

2020
NCET

**NATIONAL CONFERENCE
ON EMPIRICAL THEORIES
IN ARCHITECTURE, PLANNING AND
CONSTRUCTION MANAGEMENT**

M.C.E SOCIETY'S
**ALLANA COLLEGE OF
ARCHITECTURE, PUNE**

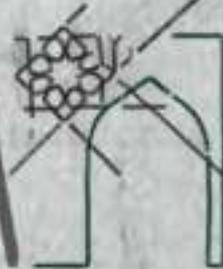
IN ASSOCIATION WITH
**COUNCIL OF ARCHITECTURE, NEW DELHI
AND
INDIAN INSTITUTE OF ARCHITECTS, PUNE CENTRE**

**e-Proceedings of
the National e-Conference
on Empirical Theories
NCET-2020**

7TH & 8TH AUGUST 2020

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ACOAA 



ALLANA COLLEGE
OF ARCHITECTURE, PUNE



Council of Architecture
NEW DELHI,
INDIA



INDIAN INSTITUTE OF
ARCHITECTS, PUNE CENTRE

e-Proceedings of the National e-Conference on Empirical Theories NCET-2020

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The National e-Conference on Empirical Theories in Architecture, Planning & Construction Management NCET-2020

INTRODUCTION

Maharashtra Cosmopolitan Education Society's Allana College of Architecture, Pune organized its 1st National Conference on Empirical Theories in “Architecture, Planning & Construction Management” NCET-2020. The conference was devoted to the idea of encouraging diverse concepts, which are more experience and opinion based, in addition to the theories already known. The attempt was to bridge the gap and integrate research with practice formally thereby enhancing the quality of Education, Architecture and Environment.

The Conference aimed at bringing together **Students of B.Arch. & M.Arch. courses from all Colleges in India, Research Scholars, Academicians and practicing Architects** along with eminent established Architects and Jury members to a forum for exchange of knowledge and ideas through paper presentations to showcase their notions, hypotheses and ideologies evolved and devised through research and practice.

Research Papers were invited on the key themes of ‘**Architecture, Design & Planning**’, ‘**Construction Management**’ and ‘**Pedagogy & Architectural Education**’ to cover an array of topics, that enables the Students, Academicians, Researchers and practicing Architects with the expertise in Architectural Design, Urban Planning, Urban Design, Conservation, Sustainable Architecture, Environmental Management, Construction Project Management, Architectural Education & allied disciplines, to publish their study in the form of Research Papers from January to March 2020.

Selection of Research Papers for Publication after initial Acceptance was based on assessment given by the Technical Review Committee, plagiarism check after minor revisions, along with submission of Authors' Declaration & Copyright Transfer and payment of necessary fees for participation at the conference.

NCET-2020 was scheduled to be held on 23rd and 24th April 2020. Due to the unprecedented COVID-19 pandemic situation in the country, the conference was postponed and conducted on **Friday & Saturday 7th & 8th August 2020** by video conference method using online application, considering the limitation of social-distancing and travel during the lock-down period.

Selection of papers for Presentation was done from those selected for publication in the Proceedings Book/ e-Book and as per merit with respect to the assessment given by the Technical Review Committee.

The Conference was conducted in the changed format of e-Conference for 2 days comprising of Day-1 including Inauguration by Guests & Key-note Speaker, Presentations of UG students' category & PG students' category; Day-2 including Welcome of Guests & Key-note Speaker, Presentations of ARP (Academician-Researcher-Practitioner) category.

The e-Conference was streamed LIVE at our official Facebook channel and the audio-video recording of the Conference is published at our official YouTube channel also after the Conference.

The free e-copy of Conference Proceedings with ISBN is published at our College website and the Print copy of Conference Proceedings Book with ISBN will be made available on request mailed to our official email-id.

This event happened to be one of the first virtual, e-Conferences conducted in the country, especially during the pandemic environment and constraints.

Team ACOA-NCET-2020 is extremely grateful to be associated with ‘**Council of Architecture, New Delhi**’ and ‘**IIA Maharashtra Chapters, Pune Centre**’ for support as **Knowledge Partner for NCET-2020**.

Team ACOA-NCET-2020

M. C. E. Society's Allana College of Architecture
2390-B, K.B. Hidayatullah Road, Azam Campus, Camp, Pune -411001

Website: www.allanaarchitecture.org
official Email-id: info@allanaarchitecture.org
official Facebook channel: **Acoa Pune**
official YouTube channel: **Allana College of Architecture Pune**

Schedule of NCET-2020

Important Dates:

- 16th Jan 2020 : Call for Papers
 20th Jan 2020 : Start of Registration
 29th Feb 2020 : Last date of Registration for submitting research paper
 29th Feb 2020 : Submission of Full Research Paper (as per first announcement brochure)

PROPOSED Schedule:

- 27th Feb 2020 : Declaration of Extension of Registration & Submission deadline
 16th March 2020 : Extension: Last date of Registration
 16th March 2020 : Extension: Submission of Full Research Paper
 17th March 2020 : NCET-Resolution-17.03.2020-Extension-LateFee
 21st March 2020 : Declaration of Acceptance of Paper (as per proposed schedule)
 4th April 2020 : Submission of Revised Paper with Fee payment receipt (as per proposed schedule)
 11th April 2020 : Submission of PPT presentation (as per proposed schedule)
23rd & 24th April 2020 : National Conference (as per proposed schedule)

REVISED Schedule:

- 14th March 2020 : Academic activity suspended (due to COVID-2019 pandemic lock-down situation)
 7th May 2020 : Declaration of Acceptance of Paper
 21st May 2020 : NCET-Resolution-21.05.2020-e-Conference-announcement
 15th July 2020 : NCET-Resolution-15.07.2020-e-Conference-FinalDates
 25th July 2020 : NCET-Resolution-25.07.2020-e-Conference-Guidelines-for-Proceedings
7th & 8th August 2020 : National e-Conference (date of conduct of NCET-2020)
 17th December 2020 : Inauguration of e-book of Proceedings of NCET-2020

CONDUCT of e-Conference NCET-2020

Conduct of e-Conference:
 Due to the video conference mode and the limitations within, the e-Conference will be conducted in 2 sessions per day for 2 days as per the following:

<p>Day 01 – 7th August 2020, Friday Duration – 9:00 am – 2:00 pm</p> <p>Session 1 – UG Panel – 9.30 am – 12.00 pm Session 2 – PG Panel – 12.00 pm – 2.00 pm</p> <p>Guests and Jury Panel for Day 1 :</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>Mrs. Abeda Inamdar VP-MCES, Pune</p> </div> <div style="width: 50%;"> <p>Prof. Durjanand Balsavar Dean- SCAD, Chennai</p> </div> <div style="width: 50%;"> <p>Ar. Prakash Deshmukh Immediate past President IIA National</p> </div> <div style="width: 50%;"> <p>Dr. Manas Manathe Faculty, MMCoA, Pune</p> </div> <div style="width: 50%;"> <p>Dr. Sachin Pore Dean – Civil Engg. DBATU</p> </div> <div style="width: 50%;"> <p>Prof. Nalini Naiknimbalkar Dean, Faculty of Arch. Vishwakarma Uni., Pune</p> </div> </div>	<p>Day 02 – 8th August 2020, Saturday Duration – 9:00 am – 2:00 pm</p> <p>Session 1 – ARP Panel – 9.30 am – 12.00 pm Session 2 – ARP Panel – 12.00 pm – 2.00 pm</p> <p>Guests and Jury Panel for Day 2 :</p> <div style="display: flex; flex-wrap: wrap;"> <div style="width: 50%;"> <p>Dr. P.A. Inamdar, President MCES, Pune</p> </div> <div style="width: 50%;"> <p>Dr. Sudhya Mahimkar Principal PICA, Mumbai</p> </div> <div style="width: 50%;"> <p>Ar. Habib Khan President COA</p> </div> <div style="width: 50%;"> <p>Prof. Lina Debnath Principal ACOA, Pune</p> </div> <div style="width: 50%;"> <p>Ar. Jayashree Deshpande, Chairperson, IIA Pune Centre</p> </div> <div style="width: 50%;"> <p>Dr. Ujjwala Chakradeo Principal SMMCA, Nagpur</p> </div> <div style="width: 50%;"> <p>Dr. Abhishek Naidu, Principal BKPSCOA, Pune</p> </div> </div>
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About the Education Society

Maharashtra Cosmopolitan Education Society (MCES), was established in the year 1948 by Late Mr. Abdul Kadir Khan and others, with an objective of providing education to the economically, educationally and socially weaker sections of the society.

The M. C. E. Society has been awarded "**Maulana Abul Kalam Azad Literacy Award**" "constituted by Maulana Azad Education Foundation, Ministry of Social Justice and Empowerment, Government of India for being one of the best Minority Educational Campus in India.

The society has set up 30 institutions imparting education to nearly 25,000 students from Preprimary to Graduate, Post Graduate and Doctorate levels in the fields of Arts, Science, Commerce, Management, Law, Education, Architecture, Computer Science, Information Technology, Pharmacy, Medicine and Dental Science under the dynamic leadership of Dr. P. A. Inamdar, President, M. C.E. Society.

About the Campus



Azam Campus is a complex of prominent educational institutions located in the heart of Pune city in the Pune Cantonment area. It is set up through the generous donation of Late Haji Gulam Mohammed Azam.

The diverse institutes are located on the huge and impressive campus of 23 acres of well-developed, green land and self-contained infrastructure in the heart of the Pune city. All the colleges are affiliated to the established and

reputed Universities, Boards and Councils, recognized by the Government of Maharashtra.

The campus has all essential facilities and amenities Assembly hall 500 capacity, other Seminar-cum-Conference halls, number of Canteens & Cafeteria for staff & students, adequate parking space, Playground and Gymnasium with National-level sport facilities, Hospital for General, Dental and Physiotherapy consultation, ATM and a Branch for banking facility, Hostels and Guest house, Prayer Halls, Green and Garden areas, Transportation, etc..

About the College

Allana College of Architecture was established in 1999 by the M.C.E. Society with donation given by Mr. Abdul Razzak Allana & Late Mr. Hussain Allana. The college is approved by the Council of Architecture New Delhi, All India Council for Technical Education, and Directorate of Technical Education Mumbai Maharashtra State.

The College has conducted multiple Architecture under-graduate and post-graduate courses since its establishment; B.Arch. course since 1999, M.Arch. (General) 2005 to 2009, M.Arch. (Construction Management) since 2010.

The College imparts education leading to five years full time B.Arch. course affiliated to Savitribai Phule. Pune University and two years full time M.Arch. (Construction Management) course affiliated to Dr. Babasaheb Ambedkar Technological University, Lonere, Maharashtra.

The college is housed in a spacious building constructed as per norms & specifications of AICTE & Council of Architecture. It has spacious, well-equipped Studios and Classrooms with audio -visual facilities, Library with over 5000 titles and a Digital library of Reference books, Computer labs with 24 hour high speed internet connection and latest soft wares required for architecture, Research Room, Art Court, Model making workshop, Carpentry Workshop and Building Materials Museum-cum-Laboratory, Construction Yard for hands-on practice of various construction techniques, free Wi-Fi access for staff and students, a Seminar-cum-Conference hall, Reprography, Students' common room and area etc.



Team ACOA-NCET-2020



Dr. P. A. Inamdar
President, MCES
Patron, NCET-2020



Mrs. Abeda Inamdar
Vice President, MCES
ACOA-CDC Chairman

MCES & ACOA-CDC Members

Dr. Latif Magdum, Hon. Secretary
Prof. Irfan Shaikh, Jt. Secretary
Prof. Muzaffar Shaikh, Treasurer
Adv. Iftekar Inamdar, Member



Prof. R. T. Ghogale
Founder Principal, ACOA
Professor Emeritus



Prof. Lina Debnath
Principal, ACOA
Convener, NCET-2020



Prof. Zoher Siamwala
Design Chair



Prof. Prashant Deshmukh
Mentor, M.Arch-CM course



Dr. Parag Narkhede
Mentor, NCET-2020



Ar. Prachi Aiyer
HoD-M.Arch-CM & Professor
Asso. Dean -Architecture, DBATU
Co-Convener, NCET-2020



Ar. Dhvani Iyer
Associate Professor
Co-Convener, NCET-2020

TECHNICAL REVIEW COMMITTEE NCET-2020



Dr. Parag Narkhede
Head of Department
BKPS CoA, Pune
 B.Arch. (1997)
 M.E. (Town Planning)
 Ph.D. (Architecture)



Dr. Abhijit Natu
Principal
BKPS CoA, Pune
 B.Arch. (1992)
 M.L.Arch.
 Ph.D. (Architecture)



Dr. Anshul Gujarathi
Founder Director
Eco-solutions, Pune
 B.Arch. (2000)
 M.Arch. (Envr. Arch.)
 Ph.D. (Architecture)



Dr. Manas Marathe
Assistant Professor
MM CoA, SPPU
 B.Arch. (2008)
 M.Arch. (Urban & Rural Planning)
 Ph.D. (Germany)



Ar. Nalini Naik Nimbalkar
Dean, Faculty of Architecture
Vishwakarma University, Pune
 B.Arch. (1990)
 M.Arch. (Const. Mgmt.)
 Ph.D. (Architecture) Student



Er. Shekhar Nagargoje
Associate Director
RICS School of Built Env.
Amity University, Mumbai
 B.E. Civil (2003)
 M.Tech. (Planning)
 Ph.D. (Built Env.) Student

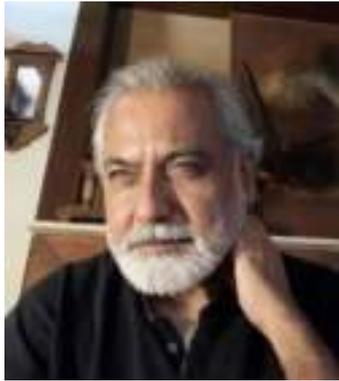


Ar. Rajeshwari Jagtap
Principal
Pravara Rural CoA, SPPU
 B.Arch. (1999),
 M.Arch. (Const. Mgmt.)



Ar. Shilpa Dhawale
Associate Professor,
Allana CoA, SPPU
 B.Arch. (1995),
 M.Arch. (Conservation),
 Ph.D. (Architecture) Student

GUEST and PANEL MEMBERS at NCET-2020



Ar. Habeeb Khan
President, COA
Chief Guest, NCET-2020



Ar. Prakash Deshmukh
Former President, IIA National
Guest of Honour, NCET-2020



Ar. Jayashree Deshpande
Chairperson, IIA, Pune Centre
Guest of Honour, NCET-2020



Prof. Durganand Balsavar
Dean - SCAD, Chennai
UG - Panel Member
Day 01, NCET-2020



Dr. Sachin Pore
Dean - Civil Engg., DBATU
PG - Panel Member
Day 01, NCET-2020



Dr. Sudnya Mahimkar
Principal, PICA, Mumbai
ARP - Panel Member
Day 02, NCET-2020



Dr. Ujwala Chakradeo
Principal, SMMCA, Nagpur
ARP - Panel Member
Day 02, NCET - 2020



Dr. P. A. Inamdar
President, M. C. E. Society

FOREWORD

I am extremely happy and proud that Allana College of Architecture is hosting its first National level conference, NCET – National Conference on Empirical Theories - 2020. The conference stands out with its objective of bringing together academicians, professionals and motivated individuals from allied fields with a wide spectrum of research aptitude spanning Architecture, Planning and Construction Management. We have always encouraged our institutes within the umbrella of MCES operating from Azam Campus - Pune to engage in activities that go beyond core academics and aim at holistic learning.

We need to break out of our routine and emerge from our shells to embrace new concepts and inevitable change. Architecture in our country is struggling to cope up with changing times and its technological demands. It has been put to a test during this pandemic and should introspect deeply to evolve new ways. Application of knowledge and practical approach to solving problems is an essential to survival and progress. My own experience as a developer in the construction industry has taught me that reasoning ability is tremendously augmented by empirical analysis of field work and not just by deliberation on pure theory. I had the opportunity to serve as President of CREDAI - Pune and have used professional platforms to support the cause of research based thinking. Evolution in any field will happen only when academicians and professionals collaborate. This conference is one such attempt to bring the community together. It shall successfully conclude with the publishing of selected papers, but more importantly it will leave participants motivated to pursue goals of academic and professional excellence. Research papers are stepping stones of systemic education.

The conference has generated a committed response with over 100 plus papers being received out of which 70 plus are selected for publishing. It has transitioned effectively into an online e-conference format and yet managed to retain that response entirely to the credit of the organizing committee. I congratulate the NCET organizing committee that is ably led by Prof. Lina Debnath - Principal of ACOA, with the dedicated support of coordinators - Prof. Prachi Aiyer and Prof. Dhvani Iyer. I also thank the esteemed panel of experts from the technical committee and presentation evaluation panel for extending their support, sharing their feedback and investing their valuable time for the conference. This is definitely an encouraging start to our efforts in the direction of integrated learning.

A handwritten signature in black ink, appearing to read 'P. A. Inamdar', written on a white background. The signature is stylized and cursive.

Compiled by Ar. Vinish Desai, Asst. Professor, ACOA using excerpts from the address speech at NCET-2020



FOREWORD

Mrs. Abeda Inamdar
Vice President, M.C.E. Society

Maharashtra Cosmopolitan Education Society (MCES) was established in the year 1948 by Late Mr. Abdul Kadir Khan and others, with an objective of providing education to the economically, educationally and socially weaker sections of the society. The M.C.E. Society is one of the oldest educational organizations in Pune and has done pioneering work in the field of education. Within a span of 15 years the M.C.E. Society from a humble beginning of 4 schools has been transformed into an excellent educational complex in the field of Arts, Science, Commerce, Computer Science, Law, Education, Pharmacy, Management Sciences, Architecture, Dental Sciences, Hospitality Studies & Information Technology.

We at Azam Campus have always tried to emphasize on the importance of research in our academic institutions. Research is nothing but searching for the truth and we need critical observation. I believe nature is the best teacher and learning, observing and analysing can lead to the development of not only the individual but the society at large. Continued experimentation in the field of research enhances knowledge and increases curiosity to go into details of the various subjects, increased scientific attitude and research aptitude. Emphasis should be on the understanding of the basic fundamentals by the young minds. This can be applied to any stream be it science, history, art, literature or engineering.

One cannot forget the importance of documentation and analysis in addition to micro-planning and micro-detailing. Such documented process, analysis and the inferences and theories should be shared and platforms such as this National e-Conference, organized by Allana College of Architecture become a medium for exchange and growth of the knowledge base. What is needed for a researcher is self-confidence, patience, honesty, perseverance and microplanning. Young minds have new ideas and think out of the box when finding solutions to problems. I truly believe that 'Readers are leaders'. It widens the windows through which we view the world. The young mind today with the help of technology is able to interact with the world with ease and becomes an important part in the growth of the industry, more so now, in the current pandemic situation. These young minds are the policy makers of tomorrow and hence we at Azam Campus, emphasize the importance of research and the interrelationship of Information Technology with all the fields, be it Environment, agriculture, economy, health etc.

Lastly, one has to realize the importance of public participation and community involvement. Industry collaboration and sponsorship for young researchers is a must so that they can have a focused mind. I urge industries to come forward for inter-collaborative relationships, be it pharmacy, information technology etc. so as to encourage the young minds to innovate and take our country to the next level of development and growth.

I congratulate Prof. Lina Debnath and her team of faculty members, for organizing this event, despite the constraints of the pandemic and look forward to many more such knowledge exchange forums in the future.

A handwritten signature in black ink, appearing to read 'Abeda Inamdar', with a horizontal line underneath.

Compiled by Ar. Dhvani Iyer, Asso. Professor, ACOA using excerpts from the address speech at NCET-2020



Prof. R. T. Ghogale
Founder Principal & Professor Emeritus, ACOA

FOREWORD

Architectural Education & Profession.

When the country received independence there were not more than two schools of Architecture in the entire country. Emergence of new schools started during sixties with Govt. & private support. Today we have hundreds of schools of Architecture in all parts of the country. It is essential to have clear realization about quality of education which can contribute effectively towards shaping of architectural profession. No single institution can transmit all possible information & knowledge in duration of course of study & make students proficient. Curriculum & duration of the course have any importance unless there is a clear policy towards faculty and methodology that changes the minds of student community which will command respect for the faculty. Studying Architecture is no longer a matter of acquiring a set of technical skills & knowledge of aesthetic alternatives. With four/five years course being adopted all over the country it will not be correct to expect students to become proficient specialist at undergraduate level. Experience shows that they barely get acquainted with a broad base course covering varied aspects of design & construction. Modern tools like computer can help physical work only. They cannot replace human capability to perceive & express skills & experiences. The entire endeavour connecting with teaching is essentially to communicate experiences of experienced to desiring & deserving students by exposing them to different situations to send my best wishes to

I take this opportunity to thank Prof. Lina Debnath & her colleagues who are involved in the preparation of National Conference on Empirical Theories in Architectural Planning & Construction.



Prof. Lina Debnath
Principal & Professor, ACOA

FOREWORD

It is a privilege to host our first National Conference on Empirical Theories. Though initially planned as a regular Conference it was converted to an e-Conference due to the COVID pandemic.

As Architects, research is an intrinsic part of our profession. Similarly, for teachers in Architecture, research is required for teaching and transferring knowledge to the students. The quality of the research work by the teachers is reflected on the quality of teaching - learning in the classroom, therefore directly benefiting the students. Students too are encouraged to conduct research for data collection as well as to find solutions for the various questions that they face. Here too, the type and amount of research done by the student is reflected in the final work produced by the students.

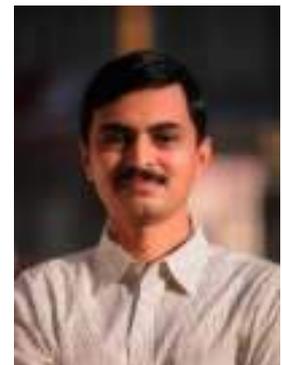
Promotion of research helps in building up the knowledge resource. Our Conference aims at promoting research among students, teachers of architecture and practitioners.

I thank the Council of Architecture and Indian Institute of Architects, Pune Centre for actively supporting us as Knowledge Partners.

I hope this Conference provides a platform for all those students, teachers and practitioners who have submitted their papers, to present their research work and share their learnings with others, similarly benefitting from the research findings of their fellow presenters.

Wish you all the best.

MESSAGE



Dr. Parag Govardhan Narkhede
Head of the Department, BKPS College of Architecture, Pune
NCET-2020 Mentor

I would like to congratulate the organizers for hosting the conference on a very relevant topic: 'Empirical Theories in Architecture, Planning & Construction Management'. It's an open-ended topic inviting a variety of professionals, together making it more interesting and inclusive. Good numbers of papers were received on various sub-themes of the conference. The papers were evaluated based on relevance and significance to the theme and research method adopted to complete the study. Most of them were written appropriately and contextually.

It was a good experience to see the participation of young as well as senior professionals and teachers in writing for the conference. Presentations of these papers in conference would surely bring forth interesting findings

contributing to the body of knowledge in the fraternity of Architecture and Planning. I would like to appreciate the sincere efforts of the committee working on preparation of conference proceedings.

It was equally interesting to work as a mentor for the conference, as a part of the technical advisory committee, to guide the team whenever and wherever necessary while preparing for the conference. I am sure the technical committee has tried its best for the same.

I sincerely thank the organizers for giving me an opportunity to contribute as a mentor and reviewer for the conference. It was really an enjoyable experience while working with the organizing committee. I wish for the great success of the conference.



MESSAGE

Ar. Zohar Siamwala

B.Arch. Mumbai University, Gold Medallist
M.Arch., MBA, Miami University, Ohio USA

Professor Design Chair, ACOA

The National Conference on Empirical Theories hosted by the Faculty of the Allana College of Architecture, Pune, is a serious attempt to bridge the gap between academia and practice. Teachers, practicing architects and student architects, though very good at elucidating their thoughts; ideas and experiences through graphics and speech rarely formalize them into a body of knowledge using the written word.

Therefore, a national conference, with such a wide variety of open-ended topics such as; architecture and planning; construction management; pedagogy and architectural education is a start to inculcate such a practice of sharing and recording this knowledge and experience. NCET will therefore promote a dialog between persons sharing similar views along with a debate for those with a contrarian viewpoint. This will fuel learning and nurture growth among the various participants and encourage them to get into the habit of writing papers in academic journals and presenting them at conferences.

I congratulate the NCET team for showing such dynamism and initiative in hosting this conference and am looking forward to participating, contributing and promoting it wholeheartedly. I am confident this national conference will be a great success and hope to see it not only as an annual feature, but with an increased footprint in India and abroad.

Subjects Taught over 30 years: Design Dissertation, Arch. Design Studios, Town Planning, Computer Aided Design, Various Electives, Building Construction Tech., Working Drawings, Services, Construction Management, High Rise Architecture, Research in Architecture, Photography etc

Chief Architect: The Archisium, (over 50 year old architecture firm in Mumbai/ Pune)
Housing, Hospitality, Religious Architecture, Educational, Industrial, Commercial, Interior Design, Landscape, Real Estate Development and Investments.



MESSAGE

Prof. Ar. Prashant Deshmukh
CMD Prashant Deshmukh Projects Pvt. Ltd.
BOS ex-Chairman -Architecture, DBATU
Member, Academic Council, DBATU
Member, Planning & Monetary, DBATU
M.Arch-Const.Mgmt. Course Mentor

Significance of Construction Management studies in Practice

At the outset I wish to congratulate Allana College of Architecture and the Council of Architecture India for conducting a Conference on **National e-Conference on Empirical Theories in Architecture, Planning and Construction Management (NCET- 2020)**.

Covering a wide range of correlated subjects concerning academics as also Professionals who wish to lead the Architectural and Construction Industry of not only India but the Globe. Over the years Allana COA has put in efforts to bridge the gap between academia and Construction Industry to produce B.Arch. & M.Arch. Students as Catalysts or Products that would suit the ever growing Construction Industry across the World!! I am sure the Conference will give lot of inputs to students with a platter of upcoming challenges of the Construction Industry along with tips to make their career in the same, here in India or Abroad.

The Construction Industry is growing at great pace with large scale projects particularly in underdeveloped and developing countries in Realty, Residential, Commercial, Industrial, Wellness Sector and Hospitals of Specialties. The Master Plans, Regional Plans are being made defining and sketching developments of at least a decade to come and with emphasis on Green and Sustainable solutions that would create a healthy environment.

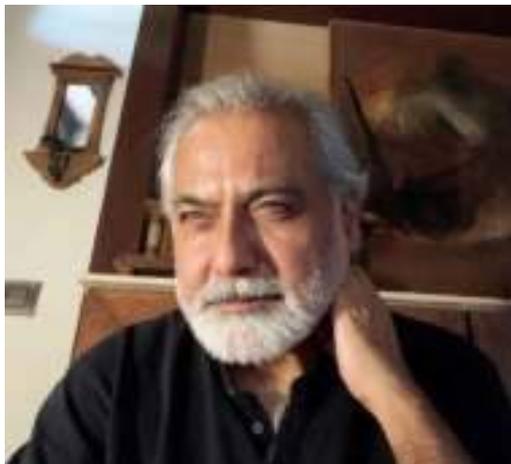
Architects and probably the Faculty members have to keep upgrading themselves with the latest skills being developed to support the development Knowledge of newer materials and Construction Technologies has become a pre-qualification for Architects and Project Managers as also various Newer software's and their upgrades is an important prequalifying Criteria for large scale projects.

AutoCAD is now replaced by ArchiCAD and Revit and BIM Tekla etc. have become lead soft wares for Design. PEBS and Precast are technologies that have to be employed while at times hybrid structures with synergy of Concrete and Steel leading to SMART designs are preferred. A wide range of Cladding materials are pouring in Long spans. Sky high Buildings have become CLIENTs' major desires. Construction Techniques and Technologies are therefore getting upgraded every single day. The Managerial Skills are therefore most looked out for in Construction Industry today. Architects with these skills would always be preferred with higher dividends as they have inherent creativity. They have to learn the techniques of Cost Time control, Administration with proper study of Risk factors in the projects and strategies to deal with them, Awareness to Safety at site and techniques to achieve zero accidents at site; in short Skills to deliver the Dream of the Client with the help of all stake holders at the BEST as never ever!!

Global PMCs like CBRE, JLL, Knight Frank Cushman Wakefield are all here now in India and our dream should be to surpass them and raise a great Global practice as Construction Project Managers.

The Conference is aimed at this effort. Let's hope this generates zeal amongst faculty and students to produce Construction Project Managers who will create History in the Construction Industry !!

All the Best !!!



MESSAGE

Ar. Habeeb Khan

*President, Council of Architecture, New Delhi
Chief Guest & Key-note Speaker, NCET-2020*

Dear Organizers of NCET-2020
Greetings from Council of Architecture....!!

It gives me immense pleasure to write this message to all the delegates and participants of National E-Conference on Empirical Theories in Architecture, Planning and Construction Management (NCET-2020) on 07th and 08th of August, 2020.

Our profession is going through the biggest challenge that it has faced in recent times. The Supreme Court judgement on the architects act and now the NEP, are going to change the face of our profession forever.

The Council is working on the judgment and its after-effects in appropriate forums. As far as the NEP is concerned I personally feel it's a very progressive policy and will immensely benefit for future generations. But this would mean radical transformation of how we have been teaching and learning since ages. We need to not only transform our pedagogical methods but also change our mindsets to adapt to the new in NEP.

The transformation has to be rapid and we need to brainstorm as to how and what would be the implications on architectural education. This is a golden opportunity for all of us in the academia to achieve what we always wanted to. We need to collectively look at how our education should be for our future generations. Fundamental issues of lateral flexibility and interdisciplinary approach to education will immensely benefit architecture. How should we incorporate this in our curriculum and syllabi is up to us.

I am sure you all will introspect, brainstorm and analyze the situation which will very soon arise out of the implementation of the NEV and use it to collective benefit of our fraternity.

I extend my sincere thanks to Professor Lina Debnath, and the Management of Allana College of architecture for organizing this conference and creating a platform for interaction and exchange of thoughts and ideas in this crucial time.

A handwritten signature in black ink, appearing to read 'Ar. Habeeb Khan'. The signature is stylized and includes a flourish at the end.

My best wishes to all of you.

Ar. Habeeb Khan
President COA



MESSAGE

Ar. Prakash Deshmukh
Associated SPACE Designers
Architecture + Urban Design
Guest of Honour, NCET-2020

I congratulate the Allana College of Architecture team and Prof. Lina Debnath, I/c Principal for taking this initiative of **National E-Conference on Empirical Theories in Architecture, Planning and Construction Management (NCET- 2020)** on the 7th & 8th of August 2020.

This is the most appropriate time for the e-Conference on the background of worldwide pandemic Covid-2019 and comprehensive changes in National Education Policy after 35 years. This is going to be a turning point in the field of architectural planning, technology, construction management and teaching contents as well as the methodology.

I hope this conference will do lot of meaningful deliberations, new ideas and creative action programme. Let us take it further for the betterment in the field of architecture.

Ar. Prakash Deshmukh
President (2012-15), Indian Institute of Architects



Ar. Jayashree Deshpande
Chairperson, IIA Pune Centre, Pune, India
Director, COA-TRC, Academic Wing of Council of Architecture, New Delhi, India
Guest of Honour, NCET-2020

MESSAGE

Continuing Education and Lifelong Learning for Architects

The profession of Architecture has become highly challenging, multi-faceted and dependent on various external considerations. The mandatory five year academic program required for attaining a recognized bachelor's degree provides the theoretical knowledge base but architects must continuously supplement this knowledge with upgrades and skills required to face challenging real life situations. The term 'continuing education' has become a part of the common vocabulary of academic and professional circles. At a basic level, continuing education can be described as a tool that helps to improve the skills and competencies of individuals so that intellectual assets develop an enduring value.

In several countries, licensing bodies, to practice within a particular profession, impose continuing education requirements on their members. Such requirements are intended to motivate professionals to expand their knowledge base and stay up-to-date on new developments. Whether it's a mandatory requirement or merely a professional's desire to expand his or her level of expertise, a continuing education in architecture certainly offers an acceptable solution to problems faced by the professional in practice and academics.

In India too, continuing education is gradually being acknowledged as a necessary concept. Architects work in an atmosphere of constantly developing technology. Practice in this evolving environment requires continual

improvement of knowledge and skills for architects to stay up-to-date with changes and developments in the profession. For the creation of a healthier, sustainable and resilient built environment, continuing education modules can be seen as capsules of knowledge that come laden with information, experience, intuition & values.

Continuing education and lifelong learning can take on two forms viz. the individual route of self-learning or the institutional arrangement for collaborative learning. Two recent events, one global and the other national, can serve to catalyze the continuing education initiative into an efficient tool to kindle a spark of resurgence.

The first event is the coronavirus pandemic which has taken the world by storm. The architecture community is at the juncture of disease and economic catastrophe. The fear of contamination controls the kind of spaces that will be accepted in near future. Modifying existing design strategies, finding newer markets for supply of materials, achieving self-sufficiency and technological progress, and facing social change are the new challenges. It is now a time of introspection for professionals, to come out of their comfort zone, analyze and evaluate their competencies, identify gaps, strengthen learning efforts and maintain the zeal to face uncertainties of the future.

The second event is the 'National Education Policy - 2020' adopted by the Govt. of India. Some key fundamental principles of the policy include multidisciplinary and holistic education, synergy in curriculum and revamping of pedagogy, creativity and critical thinking, continuous professional development of teachers and faculty, outstanding research and facilitation of true philanthropic private and community participation. The policy aims at providing support, scholarships, motivation and freedom for an equitable and inclusive education system. The array of proposed initiatives pave the path for up-gradation of the knowledge base and skills of educators, inclusion of practitioners and involvement of industry in the education process. It also motivates the setting up of institutional arrangements for collaborative lifelong learning.

Collaborative platforms: Local and national organizations, in the area of built environment, like the Indian Institute of Architects (IIA), Architects Engineers and Surveyors Association (AESAs), Builders Association of India (BAI) can play an active role in the continuing education of their members. Organizations with interests in the built environment could come together to create collaborative platforms for the sharing of knowledge amongst professionals through dialogue, discussions and debates aimed towards a better understanding of professional issues, theories and best practices.

Co-learning opportunities: There could be an effort to provide opportunities for architects to maximize their professional skills through effective learning partnerships with firms / industry and continuing education providers. Product manufacturers, business enterprises, service providers and publishing houses of trade journals and magazines in construction industry can offer a platform, for critical discourse and up-gradation of information on emerging technologies and innovative design strategies, while showcasing new materials and new markets.

Research: Educational institutions and research centers, should be encouraged to utilize their infrastructural facilities and undertake research in contextually appropriate areas to address issues related to society, location and period. For research to derive the expected result, the adopted strategies must focus towards both the problem and the solution. Architectural institutes and practitioners can collaborate to explore methods of incorporating new ideas, methods or techniques into practice and involve students to gain work experience in a symbiotic system. Hands-on workshops with expert inputs will certainly benefit the participants and revive interest in architectural topics and societal issues. Monitoring, documenting and dissemination of the educational content of such research projects would be mutually beneficial.

The virtual platform: The past emphasis on acquisition of knowledge only from books is gradually being supplemented by the acceptance of Massive Open Online Courses (MOOCs) and on-line lectures laden with rich knowledge content. A national digital database of experts, library resources and research can alleviate the problems of distance and help to bring experiences and information into virtual classrooms and webinars from across the country. Various models of collaborations can be experimented by 'mixing and matching' to suit professional and academic requirements and motivate participation in programmes for learning in virtual and physical environments across various platforms and regions.

In conclusion: Even in this period of uncertainties, opportunities are waiting to be explored. Organized effort for funding and intellectual support from various related government and non-government agencies must be initiated by professionals. Possibilities for the creation of mentorship, collaborations, co-learning facilities and digital databases at national, regional and local levels need to be explored.

We cannot direct the wind, but we can certainly adjust the sails to overcome adversity and achieve success!!



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ARTICLE

ARCHITECTS OF THE FUTURE

The notion of the architect as an artist, a model genius, has been suggested to have originated in European Renaissance. For the longest time otherwise, buildings worldwide were laid out by master builders with their construction conceived together with guilds of craftspeople. Both parties remained relatively nameless throughout the process with the creation taking precedence over its creators. Can the same be said about how we work in architecture today or have, in fact, since Modernism in recent memory?

Over the centuries following the Renaissance, the idea of a singular genius shaping buildings became institutionalized chiefly through patronage, academia and publications (aka propaganda) and the Modern and Postmodern eras further accentuated the role played by architects as one of total authority, even if this was primarily through drawings (representations of reality) and not construction itself (reality). Furthermore, architects gladly disconnected themselves from the construction process, to the extent of outsourcing it when convenient and visiting sites only occasionally. Architectural services for even the smallest of projects could now only be afforded by the very wealthy, and we continue today, to be seen as a profession primarily serving the privileged.

But that is not my complaint. In placing ourselves as the sole fountainheads of all building-related ideas, we've alienated our equals, our colleagues – engineers, a host of tradesmen and craftspeople, and other specialists who are, at times, more fundamental and indispensable to the creation of architecture than us. In celebrating our artistic ego, we have muffled soft-spoken but undeniably vital voices. It should then be no surprise that architects today are received with trepidation and questioned if absolutely necessary. Are we comfortable with this elitist aura?

In times of growing economic social disparity and accelerated environmental breakdown, domestically and internationally, architects must engage more directly with society to change this perception. The global construction industry has been singled out to contribute nearly 39% of all carbon emissions. Other shocking statistics reveal that after water, concrete is the second most used substance on earth and that if the cement industry was a country, it would be the third most polluting one in the world after China and the U.S, with India coming in fourth. These are unsettling facts for the architectural fraternity which has promoted concrete as a primary building material for over a century, feigning ignorance of its polluting properties, and even gone to the extent of shunning traditional knowledge systems of building with natural materials. Let us look at another issue, this time domestic: we know that over 65% of India's population has remained rural since 1947, with disadvantaged access to good quality built environments – be that through basic housing, schools and hospitals – and yet the architectural training we receive in urban universities does little to address that. What is perhaps worse is that we appreciate such issues rather late, which leaves us rudderless and ineffective despite harbouring good intentions.

An urgent shift in perspectives and attitudes for architects is therefore in order and I implore us, professionals and students, young and not-so-young, to firstly adopt a gentler, compassionate and cooperative attitude that is inclusive of the many voices that help shape our work. Architectural maturity expects a beautifully broad range of knowledge and experiences for which students must seek inspiration in unexpected avenues, look outside of academia to learn how to think better, build better, to seek out artisans, materials scientists, conservationists, social activists, policy makers and to actively collaborate with them. Make friends across the fence, be proactive and start early.

Secondly, while we still have the opportunity, in India especially, call upon natural building materials alongside a plethora of traditional building wisdom and innovate with both to secure its future and ours. Within this realm also lie incredible opportunities to uncover, document, showcase and adapt ways of working, thinking and making. For this, our architectural education in India, however innately international in its outlook, must also prepare us to fully engage with our many rich domestic cultures. Certainly, it is then no coincidence that these notions sit well with age-old concepts of collaboration and appreciating dignity of labour to contemporary pursuits of minimizing our carbon footprints and strengthening regional circular economies. As presumed leaders, architects must rise to the occasion and therefore champion not just sustainable and beautiful built environments but also steward symbiotic thriving communities and cultures wherever they go.

Aftab Jalia studied architecture at Allana College, Pune University, Massachusetts Institute of Technology and the University of Cambridge. He is currently Research Associate at the Centre for Natural Material Innovation, University of Cambridge where he works on devising housing solutions using engineered timber.



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ARTICLE

Hybrid Public Place: Notion of public ‘Place’ in digital era

The concept of ‘place’ is constitutional in social studies. Articulating it as ‘Sense of place’, ‘Placelessness’, ‘Place values’, ‘Place attachments’ express its integral connection with emotions of people using it. The concept gained a distinct attention in 1970’s when illustrated by humanistic geographers like Yi FU Tuan in his book *Space and Place: The Perspective of Experience* (1977) and cultural geographer Edward Relph in his book *Place and placelessness* (1976). These authors investigated the concept of *place* as more humane to its neutral counterpart *space*. When people interact with locations, endow them with value and attachments, the neutral *space* becomes a place. This coaction between humans and their environments, in turn supports the notion of place as a product of human attachments along with physical space.

The concept of place in the digital era is far much complicated. Ever since our places have been layered with the invisible networks of digital technology, our public places are hybridized. This hybridity, making the notion of *place* even more contested, now is constituent of public life in public places. How this hybridity affects the emotional engagement and collective notions of place and community? With this contestation occurring due to digitization of places, what is a new interpretation of the notion of *place*? While place is distinguished as such by the space around it, the space – a constituent notion has varied interpretations. Space, as defined by Henry Lefebvre, is a social product. (Lefebvre 1991) While describing the production of space he proposes that spaces are socially produced. Every community/ society, having its own spatial practices, produces a certain space-its own space. The space thus produced is a tool of thought and action. (Lefebvre 1991) More generally, the concept of Space is referred to as the built environments or the physical settings of a *place*. Despite many interpretations of the term, *space* now has an additional meaning in the new age of technology. With the internet and technology transcending time and time zones, two new spatial logics named as *space of flow* and *space of place* are proposed by Manuel Castells in his book *The Rise of Network Society* (1996). Space of place is described as the physical attributes of place/ location, hence is “ a locale whose form , function and meaning are self –contained within the boundaries of physical contiguity ((Castells 1996, p. 453). The space of place is physical, tangible and fixed.

Castells argues that the societies are constructed around flows- flows of capital, flows of information, flows of technology etc. These flows not only affect society but the structural domination of their logic also alters the perception, meanings and dynamics of places. (Castells 1996) The *space of flow* is a material organization of time-sharing social practices that work through flow. (Castells 1996, p. 442) For the purpose of this research, the flows of technology which are invisible layers of internet and technology are focused upon. Hence one might argue that the space of flow in this context is material organization of the virtual social practices and flow of communication through digital media and wireless communication technologies (Mobile phones, WiFi, social media). This space of flow is intangible, timeless, but not placeless. The communities that are networked virtually through social media and are linked to specific places, constitute place-based activities with well-defined social, cultural, physical and functional attributes.

One can infer that, when people interact with both- their built environments and space of flows, endow them with values, emotions, associations through the invisible layers of digital technologies, ‘hybrid places’ are produced. AND ‘Hybrid Public places’ are ensembles of people/ communities, their shared values, memories, associations, to physical spaces and Space of flows through the digital ways of engagements.

Such hybridity of digital and physical encompasses diverse tensions between tangible and intangible, time bound & timeless, real & virtual, globalized & local and so on. These duo forces are affected as the constituting digitization with respect to physical public places varies. Some places are comprehensively virtual, for example- the virtual heritage tours that despite being location-based are virtual activities that engage people with the given heritage places. Such engagements are intangible in the tangible places and range in between real-virtual. Hence these hybrid public places are more virtual than physical. On the other hand, some places are comprehensively physical, such as digital art installations and film screenings. Although these associations are established through digital media, they encompass the physical form such as screens, digital sculptures which are tangible. Hybrid public places of such sort are more physical than virtual. This array of hybridity of public places emanates experiences that are divergent in nature. The ways in which these experiences involve engaging the emplaced people in the public places are the substratum of the placemaking process in the digital age.



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ARTICLE

The Thinking Mind

Writing for me has always seemed extremely daunting, the reason for which, I am still unsure of. The same however, does not hold true, when it comes down to thinking. The mind continues to think and question, sometimes matters of consequence, sometimes not, and most of the time, absolutely unnecessary things, and one starts to wonder what does that mean, as a teacher, as a student, as an individual?

What really is thinking? The Merriam Webster dictionary quite simply puts it as '*the action of using one's mind to produce thoughts.*'^[1] And what really influences thought? It is influenced by the manipulation of our memories, psychological associations and experiences, interaction, information and 'models' of the world. We use this to create concepts, solve problems and reason and make decisions.^[2] Unknowingly, what we experience and who we are forms the basis of what we create and how we create!

The relationship of observation, thought and analysis becomes key in the generation of theories. Whether it is in the studio, the classroom, the site, the meeting or discussion or argument, over a cup of coffee or as it is these days, over text or mail or video, the interaction and the information discourse leads to the generation of syntax in the mind which should allow us to generate or create. But, then there's too much noise in and around us. What should supersede all this noise is the germ of the idea, the absolute first thought. Who puts that first thought there? How do we find it? *Feels like the plot of Inception!*

There are many folds to the study of thought, observation, critical thinking and analysis and pedagogists are forever trying to find ways of better teaching and learning design. In the *Hitchhikers Guide to the Galaxy*, by Douglas Adams, the supercomputer 'Deep Thought', designed to find *the ultimate answer to life, the universe and everything*, computes the answer as 42!^[3] A satire, no doubt, but does the philosophy have a deeper meaning to it? Could it be as simple as that? Could the answer to 'how to teach' or 'how to learn' be as simple as that?

I believe the answer lies in the understanding of how one observes, interacts, thinks and organizes the thought. It lies in the assimilation of our experiences and observations in a manner that allows us to use this information to create. It lies in recognizing the germ of the idea and as educationists, it lies in knowing how to find it and perhaps even put it in the minds of our students. It finally lies in truly acknowledging all that makes us, growing with all that continues to make us and evolving our own interpretations and derivations of the philosophy of life, the architecture and all that is in-between.

Einstein once said: '*Education is not the learning of facts, but the training of the mind to think*' and that puts things into perspective!

As an educationist, it becomes my duty to break away from the binds of the classroom walls and move towards experiential and experimental exchange of ideas and theories. Theories which lead to pure and true Architecture rather than imitation imposed by circumstances. As a student, because that's what we all really are, it becomes my duty to break away from present notions of what is supposed to be and immerse myself in the idea of what could be. As an individual, well, that's a lot tougher! The complexities of morals, ethics, values and emotions make it a lot harder to define! Is there really a formula?the search continues!

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ARTICLE

URBANIZATION AND ITS REFLECTION ON HISTORIC URBAN PRECINCTS

Urbanization is a common and inevitable occurrence everywhere, growth of cities and expansion are beneficial for the country, for many people and businesses.

The article focuses on Urbanization and its effects on Historic areas of the cities. Historic urban areas are unique and are witness to the evolution of the town, exhibit a culture, socio economical and architectural values related to the history of the town.

Economic development, Growth of the Population in the cities, lack of legal framework, rules and regulations are the reasons for the destruction of heritage in urban areas. Development of towns and cities is not certainly destructive, but the unplanned growth, poor planning, lack of awareness about the heritage values, no strict rules and regulations in the historic areas creates a problem to the tangible as well as intangible heritage. (Menon A. 2014). In India, most of the cities are historic with heritage potential and the conservation of heritage sites in the cities will be helpful to boost tourism, heritage walks and associated commercial activities. (Urban Heritage in Indian Cities, INTACH, 2015)

Pune, the famous cultural city, known for its historic architecture and cultural heritage, was for centuries under the rule of its great legendary rulers. They left their stamp on the town in the form of neighbourhoods, *Wadas*, residences, Commercial buildings (Occupational Lanes), religious buildings and public buildings. Pune had maintained the unique style and individual flavor of its urban fabric. In today's context because of Urbanization, especially in historic core areas of the town, growth and modernization are replacing the traditional character of these areas with modern designs. The historic fabric and essence of the heritage areas will be rapidly changing and losing its character.

As per the empirical analysis of the Peth area of Pune city, the change of land use from residential to commercial use, in this process, the buildings keep modified and intervening in global trends results in the loss of the built heritage settings. The streetscapes and skylines are mostly affected by these changes. Religious places with surrounding landscape spaces are encroached by heavy traffic and parking spaces have lost their character. The historical buildings in the Peth area which depicts a particular style of architecture, the brickwork, woodwork, decorative iron railings, roofing tiles, scale, proportion and height of the buildings are also affected. By considering all these factors cornering a city's-built heritage which causes the changes to be identified, and proper measures to balance the urbanization and the historical heritage settings should be undertaken. The planning authorities, local architects, stakeholders and the population of the town/city, all together, should develop appropriate measures to maintain and celebrate the beautiful fabric and flavor of their historical heritage.

Pune is famous for educational institutes and there are many Architectural colleges can develop education methodology for dealing with heritage conservation projects such as adaptive reuse of historical monuments in design studios of Architecture, heritage walks, by promoting design philosophy which supports the integrated approaches of revitalizing heritage values and develop new activities related to conservation, study of historic buildings, related values and its cultural context. Documentation of various monuments will be helpful.

The date 8 July, 2017, Old Ahmedabad was declared India's first UNESCO World Heritage City. If we want to see Pune in the list of UNESCO world heritage Cities, we need to start working on it from today. The efforts taken by all of us will be grateful to conserve, retain our respectful heritage for future generations!!



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ARTICLE

The Push and the Pull

The elementary laws of physics say, *push* and *pull* are forces acting upon an object resulting from its interaction with another object/s in an environment, whether they are in physical contact with each other or at-a-distance. The pull brings the object closer, whereas the push moves the object away; this can be directly related to the attraction and the repulsion of magnets respectively.

This phenomenon is metaphorically used to understand the social, economic and environmental scenario. The push factors make people move out of a (bad, poor) situation and pull factors make people move into a (good, healthy) situation. Thus, these factors help to interpret reasons of human behaviour, response, intervention and movement; e.g. why do people migrate, why do tourists like to visit a certain destination, why certain locations develop as urban centres, etc. [1] Such influential factors can be social, cultural, economical, political or environmental and explain the process of development.

Businesses all over the world effectively use the *push-pull* strategy for production, promotion and popularity. A product is forced into the market extensively in anticipation of trade or due to the demand of user and certainty of sale. [2] Our city's shopping malls work on push strategy. On the other hand, pharmaceutical sales are pull based and demand driven. A mixed or hybrid strategy is also conventionally used. In Administration and Management, these powerful and controlling factors, inside the environment or outside the environment, are considered as a crucial part during capacity building of the employees and overall organisational development.

Interestingly the *push* and the *pull* terminology can be applied to understand even the human mind forces; the "to do or not do" thoughts that play mental games with us. Do we not identify what pulls us towards doing something and what pushes us away from doing some other thing? Certain factors or entities in our environment affect and impel us. They either throw us out or in, draw us out or back in. External forces draw us out or throw us back in. Our own internal forces throw us out or draw us back in. The motivation, attraction, influence or our urge that bring us out of a situation can be referred to as the progressive, positive force. Usually the regressive, negative feelings of apprehension, uncertainty, resistance and reluctance bring us back into the same situation. At times, either the feelings can be so strong that other is overcome and ignored. Few simple examples can be given of the inner push of a vocalist who gets up early morning everyday to rehearse at the golden time, an artist painting for his own pleasure owing to the pull of admiration of his own creation, a person meditating for his own mental calmness, we seeing a movie for some entertainment or shopping on a day to destress ourselves in the daily buzzing life. There are times when we experience the *push* and the *pull* as equally strong feelings in our mind and they confuse us. This situation may lead us to a chaos, a muddle, a fix, a mental block, a conflict, a dilemma...! The big discussion of the brain and the mind starts, with the arguments of logic and fancy, rationale and intuition, the tussle of the right brain and the left brain. [3] Has it not happened to us before... at the time when we are going to join the graduation course, at the time when we are looking at change of place or at the time when we are about to take any important decision in life...? And that becomes the milestone decision taken which brings about a changeover or a switch or a shift in life, in a good way or a bad way.

There are not always reasons that we assess, evaluate and then finally decide. The whole process may not and does not always happen in that an analytical and discrete manner. There are just quick thoughts and we make decisions. What helps us to cross the milestone is that *push* which wins over the *pull* or vice-versa. Every experience every decision of every single person is subjective and situational. This is a very important aspect to know and identify, so as to help us understand ourselves and others around us, to give a complete picture and clear perception of how the entities that co-exist in our environment interact.

We often use the *push* & the *pull* theory in creative and analytical thinking. [4] The creative thinking and pre-design tools, including mind-mapping, brain storming, random inputs, six thinking hats, Bloom's taxonomy, lateral thinking, reverse thinking, metaphorical thinking, critical thinking, relationship matrix, SWOT analysis, ABC analysis, etc. help to enhance our senses, ability to understand and learn, all to develop the cognitive skills. Beyond this objective thinking and conscious reasoning lies the practice of creative intuition using one's own understanding instinctively. This approach is less theoretical and more empirical...!

The *push* and the *pull* are relevant to every aspect of life and environment. Let us take the present COVID-19 pandemic situation as example. At the initial stage, daily work stress accompanied by the panic of unknown epidemic was such a big *push* to keep everyone at home in safe, comfortable atmosphere. When monotony and mundaneness crept in, the urge to get out in open free atmosphere and meet people brought us out of the fear. Expectation at work, need to earn and sense of responsibility were the bigger *pull* forces. The tug-of-war of emotions continues even after five months.

Needless to mention our NCET-2020 also went through the similar jumble of things. The *push* for us has been our excitement, enthusiasm and commitment; although the eagerness, persuasion and earnestness of our Research Paper Authors and participants has been the bigger *pull* noted. We thank our participants for giving us the drive to conduct the first known National e-Conference online in the year 2020 during the strange, unprecedented times.

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ARTICLE

Importance of Inculcating Human Values in Students

Architecture Education is a professional education where the students are trained in a set of skills in a formalized approach. Students gain knowledge and learn to apply techniques, understand the concepts, principles, and methods applied in practice, attain a level of competence necessary for responsible entry into professional practice and a continued sustenance in it. Gaining expertise in skills may produce a very proficient architect but to sustain one needs to display human values in profession and daily life.

Human values guide people to take into account the human element while interacting with one another. They are strong positive feelings for the other. Positive human values result in close bonding and comfort. They are the values that permit us to live together in harmony. In other words, human values are a set of tools to manage human relations, for example, respect, acceptance, consideration, appreciation, listening, openness, affection, empathy and love towards other human beings. These values are the basic core inherent ones which help human beings to project themselves to the other. These basic values enable every human to establish relations of peace. Its understanding varies according to age (child, teen, adult), to one's education and surrounding culture. To respect someone, one must be able to appreciate some of his/her human qualities, even if one does not appreciate his/her opinions.

The five human values which are expected in all human beings, irrespective of their profession or stature are:

Right Conduct – Self-help skills (modesty, self-reliance, hygiene etc.), social skills (good behaviour, good manners, environment awareness etc.), ethical skills (courage, efficiency, initiative, punctuality etc.) and ownership.

Peace – Equality, focus, humility, optimism, patience, self-confidence, self-control, self-esteem etc.

Truth – Accuracy, fairness, honesty, justice, quest for knowledge, determination etc.

Peaceful co-existence – Psychological (benevolence, compassion, consideration, morality, forgiveness etc.) and social (brotherhood, equality, perseverance, respect for others, environmental awareness etc.)

Discipline

Human values thus are an integral part of one's personality and affect employability quotient. Many employers are inclined to hire those who have better human values. In today's world, people face a lot of problems at various levels: individuals, family, profession, society etc. Unhappiness, dissatisfaction, tension, frustration, depression even suicide and on the other hand signs of domination, violence, crime, terrorism etc. Poor health of the body, complaints, fights, inter-personal tensions, injustice and hatred, poverty, unemployment, division, discrimination, exploitation, opposition, struggle and war are commonplace. All these point at one thing- the lack and deterioration of Human Values.

Human Values and Professional Ethics degradation among youth is an alarming problem of India. Family and society play a significant role in shaping one's moral values. There is a strong bonding between the parents and children, which determines the personality of the child. Family is the basis on which values are built. The family has a great responsibility to pass on to the children the right values.

Similarly, educational institutes too are responsible in inculcating the right human values in their students which will help them later to develop and follow professional ethics. UGC has formulated guidelines for implementation of Human Values and Professional Ethics for the Higher Educational Institutes which suggests Introduction of Foundation Course on Human Values and Ethics for Undergraduate Level and Advance Course at Postgraduate level, an outreach programme for the same in the form of Workshops, assignments, participation in National Schemes like Fit India, Swachh Bharat Abhiyan etc., and promotion of Human Values in various ways. Recently higher authorities too have suggested the incorporation of Universal Human Values in Technical Education as part of the realising the aspirations of NEP 2020. Some of the renowned Higher Educational Institutes in our Country have already initiated Induction Programmes for students in Universal Human Values. Hopefully the institutes will be able to orient the young minds towards the right values and its use to develop professional ethics for self-development, to develop right worldview, to think morally right and behave in the positive way leading to self-discipline, good conduct and be a good human being and a responsible citizen of the society.

The values have been neglected not only at the social level but at the national level also. There are several factors with modern higher education which are making people literate or educated undoubtedly but on the other hand responsible for forgetting the basics or values of a good human being or a responsible citizen of the society.

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METABOLISM IN ARCHITECTURE

Development of a Sustainable and Resilient Society

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ABSTRACT

Metabolism is an avant-garde architectural style developed in Japan at the end of World War II which focuses on the relationship between the built environment and its inhabitants. It is a form of designing which emphasizes the concept of biological growth in architecture. It states that the city and its structures are living organisms that develop together to sustain one another. It is in tune with the current need of society which is human association and mobility rather than just functionality and programming. The characteristics of this style of architecture are modularity, prefabrication, adaptability, sustainability and strong core infrastructure which reduces the time of construction. It goes hand in hand with a sustainable and resilient society; sustainable in terms of its construction and material usage. The research has been studied and analysed by taking into consideration various books, articles and papers. It has been inspected thoroughly before deriving any conclusions.

KEY WORDS – *Metabolism, sustainable, resilient society, individuality, modularity, utopia, futuristic cities.*

INTRODUCTION

At the end of the World War II, Japan faced a large amount of destruction in terms of land and infrastructure. The society was in need of a transformation which would help them sustain better. During this period, a new style of architecture started emerging in Japan under the influence of architects like Arata Isozaki, Kisho Kurokawa, Kenzo Tange and many others. This avant-garde architectural style was called 'Metabolism'. It responded to the human and environmental catastrophe of the atomic bombing of Japan and the country's vulnerability to natural disasters such as earthquakes and tsunamis.^[6] Envisioning a utopia of resilience, Metabolist architects employed biological metaphors, recalled techno-scientific images and evoked the notion of an architecture that focused on vernacular forms.

When taken into account its literary meaning, Metabolism is a chemical reaction that occurs in the cells of living organisms to sustain life. On similar lines Metabolist architecture emphasized on the concept of biological and sustainable growth in society. This implies that the city as well as its structures are living organisms that develop together to sustain one another. These philosophical thoughts were put into action by the metabolist architects who discovered the inter-relationship between the human beings (living part of the society) and the structures (built part of the society).^{[3], [4], [5]}

AIM AND OBJECTIVES

The aim of this research paper is to focus on the ideologies of Metabolism and how it is the need of the time to create a sustainable and resilient society. The objectives are to understand the impact of metabolism on the society, to understand its relationship with sustainability and how it is different from other styles of architecture in terms of its human association.

UTOPIC SOCIETY

Metabolism is a vision that moves from construction to deconstruction and vice versa. It is at a course which is much different from the internationally established styles of architecture where in the main intention is functionality and programming. Metabolism is in tune with the current need of the society which is human association and mobility rather than just the basics of a working design. It is creating a utopic society with dynamic designs and reflects a constant transformation based on the human growth all around. It also has a strong Marxist influence on the resilient society implying a systematic spatial reorganisation which helps achieve a balance between the built and the unbuilt.

Due to the metabolist ways, the city became an amalgamation of 'cells'. The identity of a person in the Japanese society was no longer associated with the patriarchal family system. Every person had his/her strong individual identity. In this way, the whole of Japan was treated as ground zero. It became a site of rebirth where the society and its culture would be formed again based on political, economical and more advanced theories of planning.^[6]

METABOLISM IN ARCHITECTURE

After the various conferences held to determine the accuracy of Metabolism in today's time, Japanese architects like Arata Isozaki, Kisho Kurokawa, Kenzo Tange and many others worked to devise new and improved construction materials and techniques which would make Japan a 'Utopia' in terms of its planning and spatial organization. Some of the characteristics of this visionary style of architecture include modularity, prefabrication, adaptability, sustainability in terms of materials and a strong core infrastructure. This helped in quick and efficient construction which was the need of the time.^[3]

Talking about a few examples to support these theories and philosophies are 'The City in the Air' by Arata Isozaki in Tokyo, 'Nakagin Capsule Tower' by Kisho Kurokawa in Tokyo and 'Shizuoka Press and Broadcasting Tower' by Kenzo Tange in Tokyo. All of these structures were innovative and radical and fit the whole idea of Metabolist Architecture.

'The City in the Air' is a conceptual project of suspended capsules in the air with a cylindrical structural core. The capsules can be incorporated or removed based on the real time necessities of the residents. In Incubation process, Arata Isozaki said, "Future cities are themselves ruins. Our contemporary cities are destined to live only a fleeting moment. Give up their energy and return to inert material. All of our proposals will be buried and once again the incubation mechanism is reconstituted. That will be our Future." The project is flexible and mobile and adapts well to the society.^{[1], [3]}

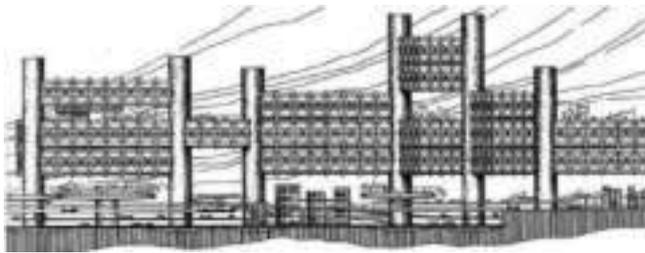


FIG-1 'City in the Air'
(<https://www.archdaily.com>)



FIG-2 3-D View of the City
(<https://www.archdaily.com>)

'Nakagin Capsule Tower' is the first capsule architecture design wherein the capsules can be plugged into the central core and removed when necessary. All the pods were manufactured and pre-assembled with the interiors in the factory. The capsules were then inserted into the shipping containers which were in turn fastened to the concrete shaft. The tower is still relevant because of the 'dynamic city' and trans-cultural aspects. [2], [4]



FIG-3 Nakagin Capsule Tower
(<https://www.archdaily.com>)



FIG-4 Detail of the plugged-in capsules
(<https://www.nationalgeographic.com>)

'The Shizuoka Press and Broadcasting Tower' materialised the metabolist ideas of Kenzo Tange to create an urban, organic and vernacular structure. It has a central shaft around which all the prefabricated capsules are plugged-in. [5]



FIG-5 Shizuoka Press and Broadcasting Tower
(<https://whereintokyo.com>)

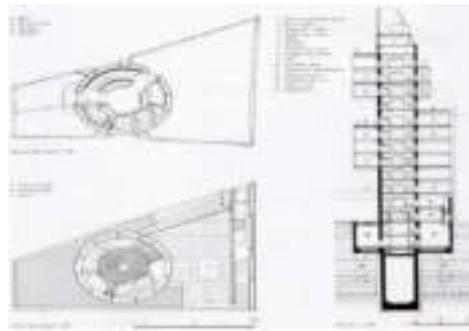


FIG-6 Plans and Sections of the Tower
(<https://www.archdaily.com>)

All the above case studies help to understand the ideas of the architects that were put into action to create structures that are living models of their theories and thought processes. They are all resilient in terms of their flexible designs and sustainable in terms of their material usage. Once destroyed or demolished these structures can go back to their material form with maximum recyclability and minimum wastage.

PROS AND CONS

Compared to other mega structures, elements can be added or taken away from these metabolist structures without disturbing the integrity of the whole structure. [6] These kind of structures promote individuality into planning as well as one's own life. A person learns to adapt to life with bare minimum facilities. Care is taken while designing every cell which makes the design and the designer very sensitive towards the culture and life of the society. They can be used based on the personal needs of a person like storage, workspace and other facilities. [6] These are very economic designs and get constructed really fast due to factory manufactured modules which just need to be installed on site. The placement of the individual units create an interesting façade treatment. It also helps save space and reduces the carbon foot-print of the building.

On the contrary, the only drawback felt is that because of independent living, the society is somewhere losing its tradition of family life. People are losing their roots and moving towards urbanism. There is no permanency to life per say.

RECOMMENDATIONS

The metabolist structures will be well suited to Pune's context especially for the Educational and IT sectors as these areas are growing rapidly and need accommodation facilities for the working people. Areas such as Hinjewadi and Pimpri Chinchwad which are the developing or developed areas of Pune, have constant commute of people on a daily basis. If they are provided with work and stay facilities nearby, a lot of their time will be saved and will improve their work quality. Also these structures can solve the problem of land scarcity in Pune as they consume very little carbon footprint. The independent units will be utilised well by the working people as their work or study space. As the units can be easily installed and removed as per requirements, they will adapt well to the working conditions where an individual can customize the unit as per his/her needs. The quick construction of the structure will also be beneficial.

CONCLUSION

The concept of Metabolism focuses on the idea that nothing is permanent and change is the solution to all the problems arising in the future. The idea initiated from Japan because the frequency of natural calamities in Japan is the maximum and unlike the Western cities where there would be at least some stone or brick remnants; the Japanese would have to rebuild from scratch. The issues of scarcity of land, housing shortage and unplanned sprawling were resolved. The metabolists addressed the fundamentals of philosophical and political reflections on the structure and essence of society and strived for better and modern living. Their designs focused on the social relationship between a controlled public system and the individuality of the user. ^{[3],[6]}

The knowledge gained is that the search for resilient and sustainable architecture is not new, just the perspective towards it has evolved with time. The use of materials, the construction techniques, the designs and the style of living have drastically changed. Thus, the buildings have to be such that they adapt to the environment well and once its time has reached, it should be able to go back to its inert state. ^{[3],[6]}

In future, architects and designers working with the sustainable principles must keep in mind all the metabolist ideologies to create utopias which are resilient, self-sufficient, eco-friendly and have the maximum human association while preserving the cultural identity, aesthetics and integrity of the society. ^[6]

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NATURAL LIGHTING THROUGH BUILDING FACADES

Case of Corporate Buildings in Pune

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ABSTRACT

Sufficient Natural Daylight in Office spaces can help to increase the productivity of inhabitants. Designing Office buildings with a focus on daylighting and bringing outdoor elements inside, one can create a sunny, productive workplace that is warm and satisfying. Facades are one of the important elements of any building which leads to an improvement in the overall performances in the buildings. Facades play a substantial role in the quality of a building. Researches have done earlier majorly focuses on the natural daylighting inside the building, but how is the productivity of inhabitants affected due to Natural Daylighting is somewhere missing from those research papers. So, this research majorly focuses on, how the productivity of inhabitants can be increased by getting enough natural light inside the workplace.

The method of this research is by doing case studies and analyzing a few parameters such as orientation, the material of the façade, façade treatment, and so on. Light quality would be measured through the luxmeter to get quantitative data. Suzlon One Earth is planned with sensitivity towards a climate that is both energy-efficient and attracts vernacular solutions. While on the other side Lohia Jain IT Park hasn't been designed sensitively, thus increasing the load on artificial lighting and air conditioning. The basic focus of this paper is to study the responses and reaction of various users towards the play of light due to façade and to analyze the possible intervention which caters to those need as well as design unconventional aesthetic façade.

KEYWORDS - Daylight, Façade, productivity, office buildings.

INTRODUCTION

Daylighting is the restricted admission of natural light, direct daylight, and diffused-skylight into a building to cut back electric lighting and saving energy. By providing a rapid relation to the dynamic and continually evolving patterns of outdoor illumination, daylighting helps produce a visually exciting and creative setting for building residents, whereas reducing the utmost quantity as one-third of total building energy prices.

The science of daylighting design isn't simply a way to give enough daylight to an occupied area, however a way to do so with none undesirable side effects. Beyond adding windows or skylights to that area, it includes carefully equalizing heat gain and loss, glare control, and variations in daylight convenience. For instance, effective daylighting designs will carefully consider the utilization of shading devices to cut glare and excess contrast within the workspace. Additionally, window size and spacing, glass selection, the reflectance of interior finishes, and therefore the location of any interior partitions must all be assessed.

Efficient daylight in offices not only improves the productivity of inhabitants but also is vital for our well-being. Well illuminated spaces with natural elements like daylight and vegetation can improve creativity and learning. Exposure to natural light can improve concentration and short-term memory, which successively leads to obvious benefits concerning performance at work. Productivity can increase by up to 20% when companies move to buildings with enhanced natural light and added to the present, absenteeism tends to fall in organizations that understand and act on the importance of daylighting.

DAYLIGHTING IN CORPORATE BUILDINGS

Data Collection & Analysis

The data collection of this research has been done in two parts. The Primary data is basically the actual field survey for readings, using a luxmeter. The secondary data includes the survey based on the feedback of the users. Both the surveys were carried out in two offices – Suzlon One Earth, Hadapsar, and Lohia Jain IT Park, Kothrud.

Case Studies:

1. Suzlon One Earth

Suzlon Energy, a world-leading wind energy corporation based in Pune India, together with the architect, pledged to make the greenest workspace in India. Living the slogan of the corporation, 'powering a greener tomorrow', the architect relied only on non-toxic and recycled resources. [1]

A million sq. Feet of ground plus 2 levels, in a 10.4-acre urban setting, achieved a LEED Platinum and Teri GRIHA 5 Star certification with 8% of its annual energy generated on-site through photovoltaic panels and windmills with a complete marginal cost of about 11%. [2]

It has become the necessity of the hour for global companies to possess sensitively designed buildings that reflect their values, concerns for the environment, and therefore the image of the new age. It involves coming up with designing buildings in India with sensitivity towards a climate that's both, energy-efficient and attracts vernacular solutions.

The workplace derives its inspiration from large Indian historical sites like Fatehpur Sikri



Image 1.1 Suzlon One Earth (mgsarchitecture.com)

and so, the Meenakshi Temple complex in Madurai. The name “One Earth” signifies recognition of the world as a singular eco-system whose resources should be managed sensibly. It also signifies the effort made to make such an environmentally responsible corporate home. [3]

- Envelope Performance Goals
- Minimal Heat Gain (40% better than ASHRAE 90.1 2007 and ECBC envelope standards)
 - 100% shaded Glazing during summer (April-October)
 - Natural Ventilation Potential in transition spaces.
 - Daylighting (>90% Daylit spaces)
 - Illuminance Levels
 - As per NBC 350 Lux average
 - Lighting Load (<0.8 W/sq. Ft for offices)
 - Suspended direct-indirect light fittings
 - Desk and furniture mounted task light



Image1.2 Internal Courtyard (mgsarchitecture.com)

All the external landscape spaces are brought into the inside on the perimeter of the building bringing fresh air, nature, and daylight into the workspace to improve the efficiency of inhabitants [4]. The central garden space boosts communication, interaction, and development amongst the 2300 colleagues and provides a spectacular aesthetic presentation for guests. Large glazed areas on North face allowing diffused light for office spaces. Aluminum louvers act as protective skin allowing daylight and cross ventilation.

Table-I Daylight Study in Suzlon One Earth

Sr. no.	Floor	Frequently Occupied Area (Sq.m)	Area with DF>2.5% (Sq.m)	% Daylighting
1.	Ground Floor	4355	3541	80.5
2.	First Floor	6480	5175	79.86
3.	Second Floor	4582	3746	81.75
4.	Third Floor	1500	1067	71.21
	Total	16957	13529	80.1

The daylight zone and prediction calculations from daylight simulation results demonstrate a minimum Daylight Factor of 2% in 75% of all space occupied for critical visual tasks. That means 75% of all regularly occupied spaces get adequate daylight, diminishing the need for artificial light and creating more natural conditions in the workspace. In order to improve productivity and have a positive psychological effect on employees 90% of spaces allow access to the view outside. [5]

It is believed that access to a window that permits adequate sunlight and an outside view is helpful to inhabitants and that it influences their satisfaction with their workspace.[6] Large glazed areas on North face allowing diffused light for office spaces. Window with vertical shades to reduce early morning and late evening sun, from the North side.

2.Lohia Jain IT Park

Table-II Daylight Study in Lohia Jain IT Park

Sr. no.	Floor	Frequently Occupied Area (Sq.m)	Area with DF>2.5% (Sq.m)	% Daylighting
1.	Ground Floor	840	670	79.76
2.	First Floor	840	675	80.35
3.	Second Floor	840	700	83.33
4.	Third Floor	840	720	85.71
5.	Fourth Floor	840	740	87.95
6.	Fifth Floor	840	740	87.95
7.	Sixth Floor	840	740	87.95
8.	Seventh Floor	840	740	87.95
	Total	6720	5725	85.2



Image 1.3 Lohia Jain IT Park (mgsarchitecture.com)

Lohia Jain IT Park is one of the commercial expansions of Lohia Jain House, situated in the Bhusari Colony. It offers spacious and elegantly designed showrooms and office space. The project is well equipped with all the amenities to facilitate the requirements of the people. The project has B2 level parking + 7 levels of offices and the IT building is of approx. 12,500 sq. M.

The daylight zone and prediction calculations from daylight simulation results demonstrate a minimum Daylight Factor of 2% in 85% of all space occupied for critical visual tasks.[7]

Table-III Comparative Analysis

Parameter	Tabletop Case Study	Tabletop Case II Study
1. Desk Illumination	Lighting zones: 1000 lux zone, 300-700 lux zone, 100-300 lux zone, 50-100 lux zone, 10-50 lux zone, 0-10 lux zone. (All up to 1000 lux)	Lighting zones: 1000 lux zone, 300-700 lux zone, 100-300 lux zone, 50-100 lux zone, 10-50 lux zone, 0-10 lux zone. (All up to 1000 lux)
2. Orientation	Longer facade of the building is orientated north-south. Other two facades were protected using balconies, buffer spaces, etc.	Longer facade of the building is orientated north-south. Other two facades were protected using balconies.
3. Climate	The climate of Pune is composite A variable landscape and seasonal vegetation noted. Temperature in summer is in the range of 32-41 °C and precipitation varies between 700-1300 mm per year.	The climate of Pune is composite A variable landscape and seasonal vegetation noted. Temperature in summer is in the range of 32-41 °C and precipitation varies between 700-1300 mm per year.
4. Natural Daylighting And Fenestration	100% double glazing being maximum provided. Fenestration designed for maximum light gain according to standards. 90% of the room surfaces with daylight and external views. High performance glazing used according to standard.	In this office more than 80% of regularly occupied spaces are double with a DF of 12.8%. floor plans is orientated from due to back of facade treatment in live spaces.
5. Window to Wall Ratio	Window to wall ratio was around 20%.	Window to wall ratio was around 30%.
7. Protection	Windows with external shades to cut off early morning and late evening sun. From North side, High Performance Glazing (i.e. exposed glass of more than four feet straight). Thus, no additional shading is necessary for these facades.	This office has very few projections, where the slab is itself extending out, which is shading the floor beneath it.

That means 85% of all regularly occupied spaces get adequate daylight, diminishing the need for artificial light and creating more natural conditions in the workspace.[8] It is believed that access to a window that allows enough daylight and an outside view is beneficial to occupants and that it affects their satisfaction with their workspace. Large glazed areas on all

four sides allow diffused light for office spaces throughout the day. Despite having more areas illuminated by daylight, having a glass façade on all four sides without any secondary protection, the glass façade not only takes in the light but also takes heat with it. Thus, increasing the load on the HVAC system of the building, which isn't sustainable.[9] Observations from the Case Study

- The perfect window to wall ratio on East and West facades is 0.3-0.4. If the ratio goes above this range, the windows must be designed carefully because the low sun angles for these orientations makes the look of their shading tremendously problematic.
- The ideal light intensity at tabletop is 200 lux. The light intensity in all types of windows studied is more than 300 lux up to a distance of 2.00m from windows. This is often quite the perfect light intensity of 200 lux and causes alarming glare on tabletops. Light intensity should be controlled to cut back glare in these spaces without disturbing daylight penetration beyond 2.0m.
- After the space of 2m from windows, light intensity suddenly starts reducing by about 50% for each 1m. This reduction can be worked on to increase daylight penetration.
- While, in the case of small windows, with reduced height (i.e., 1.35m), light (with the required intensity of 200 lux) reaches up to a maximum distance of 3.00m and, just in case of full-height windows sunlight reaches up to a maximum distance of 3.50m.
- Windows having protection on top admit lighter upto the first one meter as compared to sunken or projected type windows.

Designing narrow floor plates: The application of this strategy is slightly more complex than the others, as often site constraints dictate the building forms that are proposed. Yet, wherever the potential narrow floor plates let the daylight to flood the floor plate. Using the advantage of the learning that fenestration of height, has the ability to light the ground area of twice its height (in terms of depth). With a restricted narrow floor plate, the worries of glare are amplified, often circulation is moved to the peripheries to address this issue. Other successful arrangements are the utilization of light shelves and of fins on the external facades. While light shelves bounce visible light up towards the ceiling, which reflects it down further into the room; fins aid in adjusting the angle of solar ingress into the structure. Both of these strategies help in reducing the issue of direct glare and decreasing thermal absorption.

Wide floor plates with central dark zones: Where narrow floor plates are impossible, different approaches become possibly the new way. With wider floor plates, one of the potential solutions is to plan the darker zones in the center of the form. The dark zones can be assigned functions like lift cores, meeting rooms, toilets, and staircases. Typically, this zone used to place all the service functions in the building and areas that need lower lux levels.

Carving out courtyards: This void carving activity takes into account sunlight to in-filter into the core of the site, and thus light the internal blocks as well as the peripheral. According to the Daylighting Pattern Guide for advanced buildings by NBI (New Building Institute) -" The courtyard empowers the formation of narrow building footprints under compelled site conditions, for example, urban areas, and takes into account light and air from two sides giving the possibility for balanced daylight illumination and open the door for cross ventilation."

Low Wall to Window Ratio: This strategy can be successful in the workplace typology by understanding the internal working patterns of office space, given the requirements of work desks in the space all the sill levels can be successfully be maintained at 1100mm, this reduces the façade area that needs to be glazed and also helps in achieving a lower wall to window ratio. According to the Beijing University of Civil Engineering and Architecture, studies have proved that by increasing the sill height by 0.1m and increased lighting saving of 0.219 W/m2 on a sunny day as well as 0.225 W/m2 in a cloudy day is achieved. To additionally improve on this technique, minimum openings are planned on the east and west sides of the structure.

Orientation: For a structure to improve on daylight optimization, the structure must be oriented for solar design; this guarantees that the proposed building can enhance and benefit the most of passive and active solar strategies. According to the energy efficiency requirements in building codes, energy efficiency policies for new buildings -" Shading, the orientation of windows and openings are of major importance for the total energy balance of the buildings."- **March 2008**. This strategy is very area explicit, so in the given the Indian sub-continent, the ideal orientation is the North-South, where the long side of the block is orientated along this axis. This orientation additionally takes into account, infiltration of the best quality of daylight into the structure, if fenestrations are designed correctly.

CONCLUSION

Day-lighting concepts are evaluated according to energy saving-potential, visual aspects, and the control of solar radiation. This paper summarizes the use of daylight in buildings with climate and better working conditions for the inhabitants to increase their productivity,

design criteria, and strategies for more naturally lit office spaces. A basic finding derived from two case studies is also highlighted. Corporate buildings can take advantage of an ample amount of daylight available due to the duration of working hours in daylight. Thus, penetration of sunlight is feasible by appropriate design strategies and using light shelves with louvers during summer and winter and can help in energy optimization in artificial lighting. This paper will encourage people to incorporate natural light through various designs, methods, and materials in the building design by minimizing glare and overheating. If the incorporation of day-lighting with electric light is achieved, it can save a considerable amount of energy used during the day time in the next decades.

ACKNOWLEDGEMENT

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LIFE IN SKYSCRAPERS FUTURE OF RESIDENTIAL TOWERS

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ABSTRACT

The paper aims at clarifying the problems of living in highly dense areas where per person land availability is less than the required and how tall buildings could be a vital tool for solving the problem and could be a criterion for efficient urban development. Skyscrapers formerly known term for tall buildings are there around us for a long time now. Their use was initially limited to only in commercial sector but nowadays the new trend of Residential Skyscrapers is up now. World demographics suggest double the population in next 40 years looking at the current rate of growth being skyrocketing. Population of major cities around the world are increasing and hence there is shortage of land availability for living. In such cases where there is scarcity of plot, going higher instead of wider could be the only solution. The effective use of Skyscrapers to achieve the target of accommodation is studied here by analyzing the population growth and through current case studies which would help them develop into the future.

KEYWORDS: *Skyscraper, Slenderness ratio, Population, Land-usage, Sustainability*

INTRODUCTION

Architecture always serves a professional and a convenient way to solve various urban needs, giving more of a practical solution to it. The architecture plays an important role not just in aesthetics but also to satisfy the physical as well as social requirements of a society, where architect playing a crucial role of his responsibilities towards environment and sustainability while professionally practicing. The 20th-century city was largely the unselfconscious result of the competition between individuals and groups of people striving to maximize their own benefits as they perceive them, but there has also been much cooperative action to shape the public realm. Hence these structures were the superficial elements in shaping the future of urban development.

Tall buildings are around for a very long time and widely creating a symbol for the city. Starting off with merely as a financial hub in a city, the typology is vastly changing and making it's way more towards residential living. By building a heavy enclosure which destroys the skyline of nature to building more of a sustainable space that could enhance the quality of living spaces, Skyscrapers gets a great variety of reviews.

The Aim of the paper is to understand the problems of population growth and land availability in cities and to explain the role of Skyscrapers as one of the solution for it. This can be achieved by studying the basic data of population growth and how it is affecting the usage of land.

UNDERSTANDING THE PROBLEM

Population growth is one of the important problem the world is facing currently other than the climate change. The 21st century was the drastic movement towards this rise and according to UN, the current population of 7.6 billion as of 2020 could reach to 8.6 billion in next 10 years. This rate is still going to grow further and will have large impacts towards living. One such impact could be the availability of space for living. According to UN, 55% of current population lives in urban centres and this number is going to increase to 68% in coming years because of rural migration towards the urban places.

When both of the scenarios of population growth and rural migration taking into account, the metropolitan cities are going to be flooded be overpopulation. The availability of space per person per square metre is going to decrease and the only option would be the cutting down of trees. The amount of deforestation is going to increase in order to expand cities which are further going to cause environmental issues.

The urban fabric of some of the world's most densely packed cities such as Tokyo, Mumbai, Singapore, Shanghai, New York, etc. are constantly increasing and there needs to be some ways to control this growth of expansion in order to save nature land.

GIVING A SOLUTION

There is a need for some solutions to prevent the urban sprawl from entering nature's land. One such solution could be the Skyscrapers or tall buildings that have less foot prints and greater heights. These structures are usually governed by a ratio called slenderness ratio rather than their actual heights, this slenderness ratio is basically the ratio of width to height, in simple words how the tall skyscraper is as compared to how less the space it is occupying at the base.

Although tall buildings have been blamed for crime and mental breakdowns in urban context for overloading the public realms and often criticized as the symbol of power and prestige, there goes more than meets the eye. With the current advancements in building construction technologies, these structures not only enhance the image of the cities but also provides a sustainable solution into it in various ways. A lot of Architects have turned their heads towards a more sustainable development in a building rather than just it's appearance.

Living in tall buildings is now more towards a more sustainable environment rather than just living secluded from neighbours on each floors. With the awareness towards design, the standard of living in such spaces is increasing day by day.

THE POSSIBILITIES

In the past, the lifestyle inside a tall building was rigid with nearly same environment of each floors and no open spaces or terraces for interaction. But with current design philosophies, architects have changed the way one lives in a skyscraper. Many open spaces can be inculcated that are self-sustained and appearance is not boxy anymore but rather towards a more sculptural look.

An example of such design could be to take the concept of "chawls" in Mumbai where to understand how there is an interaction between the group of units and then to integrate same in design of spaces in a tall building. Similar to this concept and from awareness of Architects towards the design, there could be endless possibilities towards achieving a subtler Skyscraper design.

THE IMPACTS AND CONSEQUENCES

On a good note, emergence of such skyscrapers can minimise the usage of land, hence further saving the area of nature from cutting down. With the use of new advance materials, not only the construction time is reduced but also the effects of it towards environment are reduced. By providing proper sustainable measures a good amount of energy can be saved with the usage of renewable resources.

But on the contrary, there are few problems that arise once the buildings starts to reach new heights. Some of such technological and engineering problems could be in providing a proper stability to the structure, heating, cooling, ventilation, services, safety and the structural integrity from environmental impacts such as wind loads and earthquakes. Another major concern would be the safety of occupants from fires and provision of proper firefighting protection systems.

Other than these technical problems, there is one major problem of Cost. As the depletion of available land the cost of plot is growing at a faster rate. Also the new materials have a tremendous cost of making which also explains that providing sustainability comes expensive and there is not much that can be done when it comes to such price. The economy of a region surely can affect the emergence of skyscrapers and hence limit their disclosure.

CURRENT SCENARIOS – CASE STUDIES

Living in Tall buildings as residents may not be popular long back but it is growing to a large extent as the cities are limiting the plot areas for developers to build on. Probably the best example to study how tall a building can go with lowest footprint would be the 432 Park Avenue Tower in New York City. New York being one of the world's popular city in terms of business centres as well as tourism have gained a lot of popularity because of the number of skyscrapers it is holding. A complete residential type tower has a height of 426m and with the square base of only 28m side giving an incredible slenderness ratio of 1:15. The 85 storeys high building of reinforced concrete consist of 147 luxury apartments. The tower is designed to oppose the swaying of structure in case of strong wind and earthquake loads in such a way that the whole building is divided in seven vertical segments having two hollow floors without any windows, walls and interior after every 12 occupied floors. This prevents the structure from swaying due to wind vertex load and even further, a heavy tuned mass dampers are also installed on top of tower.

Another example on a similar line could be Kolkata's The 42. Kolkata being one of the world's densely packed city was surely in a need to go higher and with keeping its spread minimum. The tower is again a slender building with the slenderness ratio of around 1:13 with the height of 268m. and consist of 56 luxury apartments across 65 floors. This residential tower sets an example of better land usage in terms of its slenderness as the city of Kolkata already have the problems of land availability because of its population density.



432 Park Avenue Tower

Steinway Tower

The 42

Fig 1: Examples of tall slender skyscrapers.

CONCLUSION

Skyscrapers are there around for a long time and with emergence of new materials such as steel and concrete, their development is further growing. From the previous case studies, it is clear that the architects and developers have thought of going higher as the land availability is very less. The demand for housing is at pinnacle and the population growth is further going to push this need, hence going higher would be a helpful solution. But everything comes at a price as constructing whether vertically tall or horizontally long is going to be expensive. But also taking this into account the higher land cost also leads to taller buildings. The cost of land creates effect that raises the per floor cost of building of a given height and creates the incentive to build taller buildings to spread the land cost over a larger number of floors.

Building higher is not going to stop and with taking design considerations and factors of sustainability into account, the demand for high rise would result into a more effective solution to the major problem of population growth the world is facing. And hence these structures will slow down the expansion rates of the cities resulting into the saving of mother nature and forest areas.

RECOMMENDATIONS

A lot of research is already going on behind the development of the tall buildings. Most of it is related to how tall the structure can go keeping its stability to the maximum. Another attempt is also given to the sustainability of the structure and how well it can act towards the environment.

Considering a context of residential typology, not most of considerations are given towards the living and lifestyle of the people in it. All of such buildings are basically only a tall box having floor plates with some number of accommodation units or apartments. There is no interaction even with the apartments kept side by side. The Residential towers, even though are going to be used only for living should be designed in such a way that there can be constant interaction between people not only on same floors but also vertical interaction. This can create a better liveable space where there is constant social interchange of ideas and this will definitely result into a space people would like to live within.

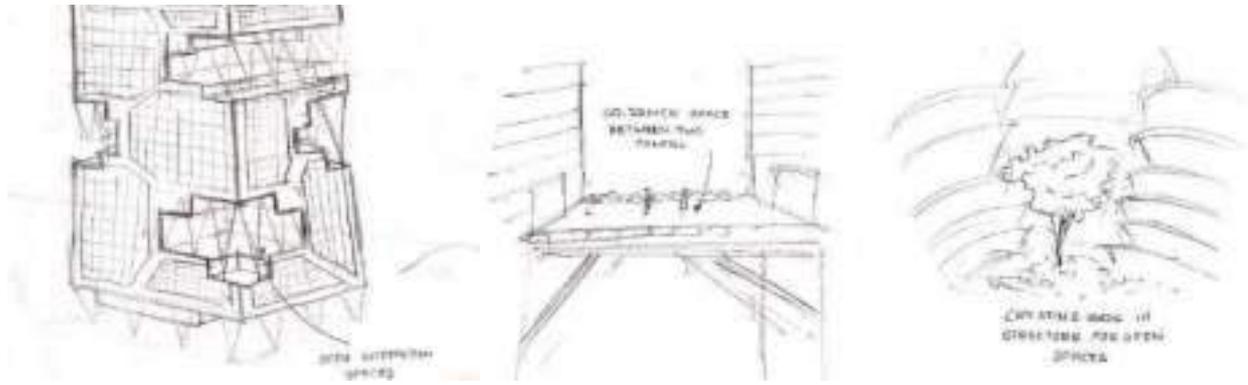


Fig 2: Conceptual sketches explaining basic interaction spaces.

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STONE QUARRIES AS A RECREATIONAL PLACE

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ABSTRACT

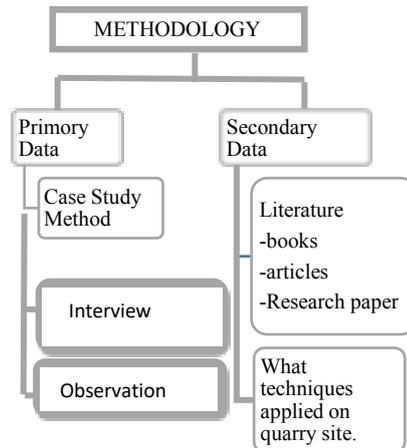
Quarrying is more in developing county for the transport and construction industry. The most of used stone quarries are waste land. It is not useful for any other purposes, if they are developed as a part of research center, garden, restaurant, amusement park, lake etc. then it is helpful to save the waste land and development of the country. The aim of the research is to study the various techniques used for the development of the quarry. The objectives are to study the various quarries sites for the purpose of developing quarry site, to study the already developed quarries sites, study the advantages and disadvantages of quarry sites and technique used for quarry site development. The methodology is followed by two ways one is primary data i.e. case-study and secondary is data collection. By using these two methods the quarry land can develop in the amusement park with lake, restaurant, research center, fountain, jogging track or walkway, gardens i.e. recreational space. The research is limited to development parameter of quarry. The expected outcome of this research is to derive guidelines for various recreational activities.

KEYWORDS - quarry, developed, helpful, techniques, recreational place.

INTRODUCTION

People and municipalities consider quarries to be unpleasant and require various subsiding methods to address problems with noise, dust, and appearance. One of the most powerful and famous examples of successful quarry restoration is Butchart Garden in Victoria, BC, Canada. Another problem is pollution of roads from trucks leaving the quarries. To control and restrain the pollution of public roads, wheel washing system is becoming more common. Generally, the water is removed by pumping while the quarry is operational, but for high inflows more complex and different approaches may be required. For example, the Coquina quarry is excavated to more than 60 feet below sea level. Water inflows increase as a quarry becomes deeper and it also becomes costly to lift the water higher during removal; this can be drawback in quarry depth. By dredging, some water-filled quarries can be worked from beneath the water. Many people and municipalities consider quarries to be unpleasant and require various subsiding methods to address problems with noise, dust, and appearance. Some quarries place wasted; no use for any purpose i.e. its main problem to identified in research. So to design or to develop stone quarry in different ways i.e. site of stone quarry site can be used a tourist place as well as public place for entertainment.

MATERIAL AND METHODOLOGY



INTERVIEW CONDUCTED ON CASE STUDY

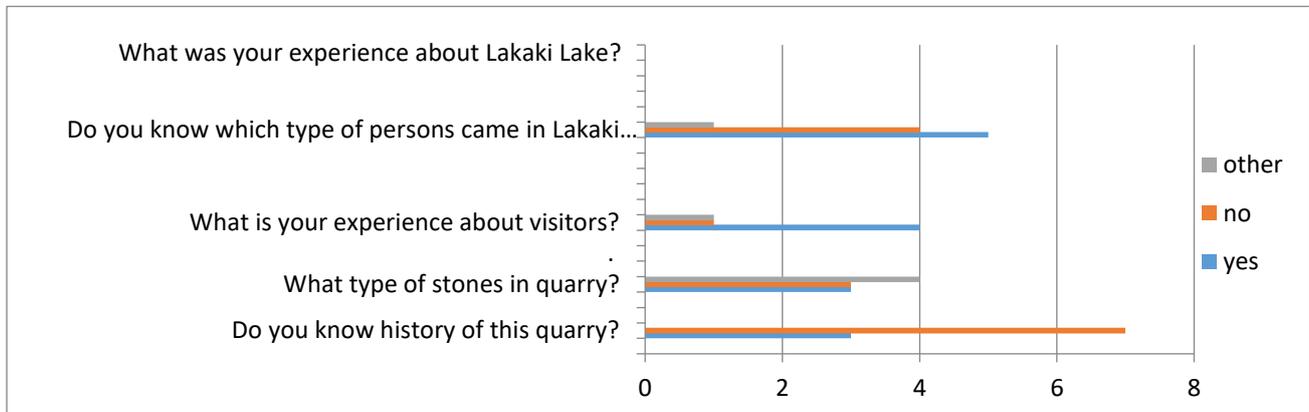




Fig.4. Plan of Lakaki Lake ^[5]



Fig.5.Before Developed Quarry ^[5]



Fig.6.After Developed Quarry ^[5]

OBSERVATIONS FROM CASE STUDY (TABLE NO. I):

PARAMETERS	RESULTS	INFERENCE
Surrounding	It is surrounded by a walkway in the form of bridge, which makes lake in random shape and sitting arrangement exactly in front of lake and landscape garden near up.	Peaceful place with accommodation of people surrounding it.
Materials	Paving stone is used for pathway for sitting wooden benches are placed. In landscape garden semi open sitting are arrange. HVSC sheet for roofing. Steel grill use for bridge.	As stones can be easily available, hence the paving done by stone material. Lake is surrounded by these stone pathways, it feels attractive and due to semi open sitting they are able to see surrounding view.
Techniques	Pitching of stone in Lakaki lake for protection, aesthetical purpose. Drilling and Blasting of rock.	Stone quarry site is fulfilled by taking drilling and blasting techniques hence waste area becomes usable area.
Use of existing stone.	The place has been enclosed by boundary which is made by existing quarry over there. Stones have been placed over there for sitting purpose.	Wall compound act as a protecting component to the quarry site.
Sitting Area	Trees trunks can be used as sitting for visitor at specific places.	To feel natural environment the trunks of tree can be use as sitting.
Vegetation	Sufficient trees and greeneries are present for natural aesthetics. ex. shrubs, trees, grass etc.	It feels cool due to vegetation.

TECHNIQUES USED IN IT:

In Lakaki lake for developing site of quarry, some techniques are used step by step



Fig.1.Excavation and Backfill ^[6]



Fig.2.Stone drilling & Cutting ^[6]

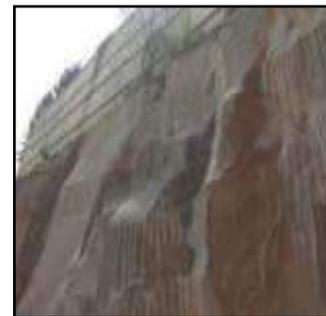


Fig.3. Pitching of Stones ^[6]

1.Excavation and Backfill:

For construction of foundation and trenches, earthquake in excavation and backfilling of soil up to minimum depth is required. Excavation and backfilling of soil is crucial part of construction process. For safety purpose, care must be taken while excavation. There might be chances of different soil layers while excavation, dewatering may be needed sometimes. These are the key points which should be kept in mind to take necessary action during excavation and backfilling.

Work scope for excavation and backfilling of soil:

- Setting out of corner benchmarks.
- Excavation to approved depth.
- Dressing of loose soil.
- Survey for top levels
- Making up to cut off level

- Constructing dewatering wells and interconnecting trenches.
- Marking boundaries of the building.
- Constructing protection bunds and drains

2. Stone Drilling & Cutting:

Drilling is a cutting process in which drill is used to cut a circular hole on flat products such as curling stone. From outside the hole (top-hammer drill) or within the hole (down-the-hole drill, DTH), the hammering action can be performed. Drifter Drills are used for horizontal drilling. In rare cases, to cut holes of non-circular cross-section, specially-shaped bits are used. A square cross-section is also possible. Some types of stone drilling

- 1) Center drilling
- 2) Deep hole drilling
 - a) Gun drilling
 - b) Trepanning
- 3) Micro drilling
- 4) Vibration drilling
- 5) Circle interpolating

3. Pitching of Stone:

Medium sized rock set into mortar exposing the stone is known as Stone Pitching. It is designed to spread the flow along the hard surface and around the protruding rock.

Functions

A slope is armoured with stone pitching. This gives a strong covering. It is smoothly drained and will withstand some water velocities. On slopes with a maximum seepage problem, in flood-prone areas or where vegetation is difficult to establish, such as in urban areas, this technique is useful. It is also useful for scour protection by rivers and on gully floors between check dams. Main advantages are stone pitching forms a strong and long-lasting method of reinforcing a slope surface and stopping gully development.

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CONCLUSION

I came to the conclusion that the site can be developed with certain parameters such as architectural elements, landscape, amusement parks, research center. Various techniques of sustainability can be used for various activities like blasting rock, drilling of quarry. Depending on the location of quarry and surrounding cities would decide the typology of building.

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ASPECTS OF SPACES AND AUTISTIC KIDS.

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ABSTRACT

Architecture is not only about aesthetics but it is more about the feeling that its users experience. The scale, colour, light, textures, landscapes, etc., are the means through which one can have a dialogue of emotional perception. The society has categorized people with mental illness separately making them isolated from the community. These children are often hidden from the public eye, or sent away to secluded facilities. In order to make them comfortable and encourage them to socialize and become independent, there is a need to create spaces which have a feel making them comfortable and thus heal them. The study tries to relate psychology of patients with spaces. Building should not just respond to physical needs but also to the emotional needs and patients who are mentally challenged/specially abled would be better to understand this. Healing cannot only be through therapies or medication but can be achieved through spaces too. The visual parameters of a space like textures, colours, natural light play an important role in learning and development of these children. The paper focuses on the impact of these parameters on the health of kids with autism in order to design spaces appropriate for patients with autism.

KEYWORDS- Autism, Spaces, sensory issues, light, colours, textures, socialization.

INTRODUCTION- Autism also known as Autism Spectrum Disorder is a condition that includes problems with communication and behaviour. They generally have a stereotypical, repetitive, restrictive pattern of interest. They suffer from qualitative impairment of social interaction, major defects in language development and other communication skills. They often have sensory issues and adds to their social delay. As per studies 1 in 68 children are diagnosed with autism.

Today, an important social issue like segregation of mentally disabled are often overlooked. In order to build a healthy community, these people have to be treated with respect. As a society we must better understand and consider the needs of people with Autism. Supporting and encouraging the patients suffering from autism, should be the priority of society.

Autism has no medication, thus therapies are only the way of healing. They often require therapies like occupational therapies, speech therapies, music therapies, behavioural interventions, co-ordinated therapies, etc. Autistic people are often highly sensitive or under responsive to sensory experiences like sound, light, colours, textures or touch. On the other hand they are even sensitive towards spaces, whether it is the type of space (indoor, semi open-or open spaces) or the scale of the space. Thus there is a need of broadening the requirements of designing spaces that are inclusive. Studying the impact of the factors of spaces would help in achieving the theories, tools and techniques to design comfortable spaces for people suffering from Autism.

The study is limited to kids suffering from Autism of age 3-15 years and the visual aspects of space that are mainly- light, colour, texture, scale of spaces, way finding and configuration of spaces..(as these are aspects that are related to sensory processing) The scope of the study is that it might help in designing suitable and appropriate spaces for patients suffering from Autism.

OBJECTIVE: The objective of the study is to find the impact of light, colours, textures on the mental health of kids with autism. To find out which colours, textures do they prefer and what kind of light is suitable for them. Also, to find out the experience of kids with autism in different spaces of different scales and the impact of configuration of different spaces on the kids with autism in order to design spaces which are suitable and comfortable for kids with autism.

METHODOLOGY : The study is initiated by surveying and interviewing teachers who teach kids with autism and paediatricians in child development. Studying 20 cases of patients suffering from autism through an audit followed by the analysis of the findings. After analysis common points in all cases are identified and mentioned followed by the inferences for the same.

The study of 20 patients of age group 3-15 years. The audit is based on the guidelines provided under the Applied Behaviour Analysis and TEACCH (Treatment and education of Autistic and related communication handicapped children). This includes sensory issues like colour, texture, sound, taste, visual impact of different objects, kinds of spaces preferred (indoor, outdoor, public spaces.) And their experiences in these various spaces.

TEACCH-Treatment And Education of Autistic And related Communication Handicapped Children.

TEACCH is a structured academics program with separate defined areas for each task such as individual work, group activities and play. It relies on mainly visual learning. It mainly helps developing skills and structure along with language development.

The teaching process addresses behavioural changes by creating appropriate environment that reduces stress, anxiety and frustration experienced by children with autism by taking into consideration characteristics like sensory processing, social relationships, resistance to change, etc.

The TEACCH works on five major principles mainly

- Physical Structure (individual's immediate surroundings).
- Consistent Schedule (using mediums like drawing and photography).
- Work Systems (activities that promote independence)
- Routine (consistency in activities).
- Visual Structures (visually based instructions).

Scale of Spaces : Kids with autism have a particular way of perceiving spaces. Architecture of a space has the potential to enhance their experience of space, increase their sense of power, build social bonds and integrate them into the society [4].

In the cases studied the parents were asked about the most preferred space by their kids. The observations are as follows:

Majority kids preferred being at home and isolated and do not like going to public places due to lack of communication skills. Some kids preferred outdoor spaces like gardens, parks and playgrounds. They generally get scared going into small confined spaces. This can be seen often while using the toilets. The kids generally have a problem using the traditional toilets which are confined. On the other hand when exposed to large spaces such as auditoriums, they get scared and feel lost.

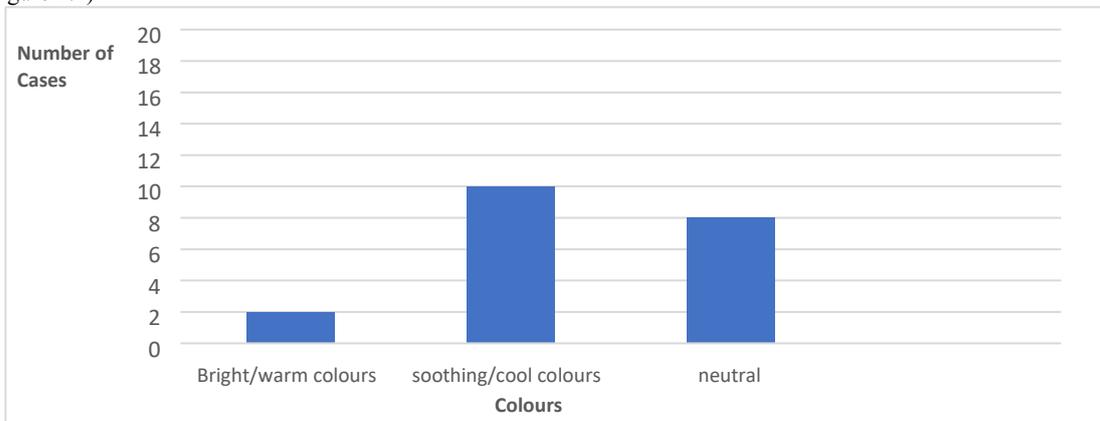
Way Finding and Configuration of spaces: It is sensible to organize spaces with clear functions based on the typical schedules of the use of the spaces. High stimulus areas must be differentiated from low stimulus areas using transition spaces like courtyards, gardens, etc. These

buffer spaces provide an opportunity for social interaction. One way circulation is advisable creating seamlessness in spaces. The spaces must have minimal disruptions and distractions.

Light: Lighting is an important aspect not only for those with visual impairments but also for those with auditory processing problem. Use of daylighting is highly advisable for kids with autism. Although the light must be glare free and silhouetting must be avoided. It has been observed that daylighting aids cognitive abilities and improved health.

Where natural light cannot be accommodated ,controllable artificial lights can be used. Mood lighting can help creating active and calm zones. However ,careful control of reflections, glares and shadows is necessary. Fluorescent lights, sub visible and lights which emit low hum and flickering lights are to be avoided as these can cause severe headaches, eyestrains and increased repetitive behaviour.

Colour: Colour has a direct influence on the mood and behaviour of these kids. According to the cases studied, the observations are as follows.(Figure 1.1)



(Figure 1.1)

Following are the effects of various colours on kids with autism. [2].

- Violet -Calms very nervous or upset person.
- Indigo- Soothing effect on eyes and nervous system.
- Blue- Peaceful and soothing. Calms the nervous system.
- Green- Helps to reduce anxiety, tension and nervous disorders.
- Pink- Soothing effect, relaxes muscles, reduces anxiety.
- Yellow-Feel nervous or tired, stimulating effect.
- Orange-Increases appetite, nervousness.
- Red – Stimulating power, hyper sensational.
- White- Soothing effect.
- Black- Feels too dark and stimulating.

Textures: Texture enhances the visual experience and the sensory impact of touch. This may vary among the children experiencing sensory processing disorder in autism. Following are the observations made in terms of textures after studying the cases. Figure (1.2) shows the observations of textures preferred.

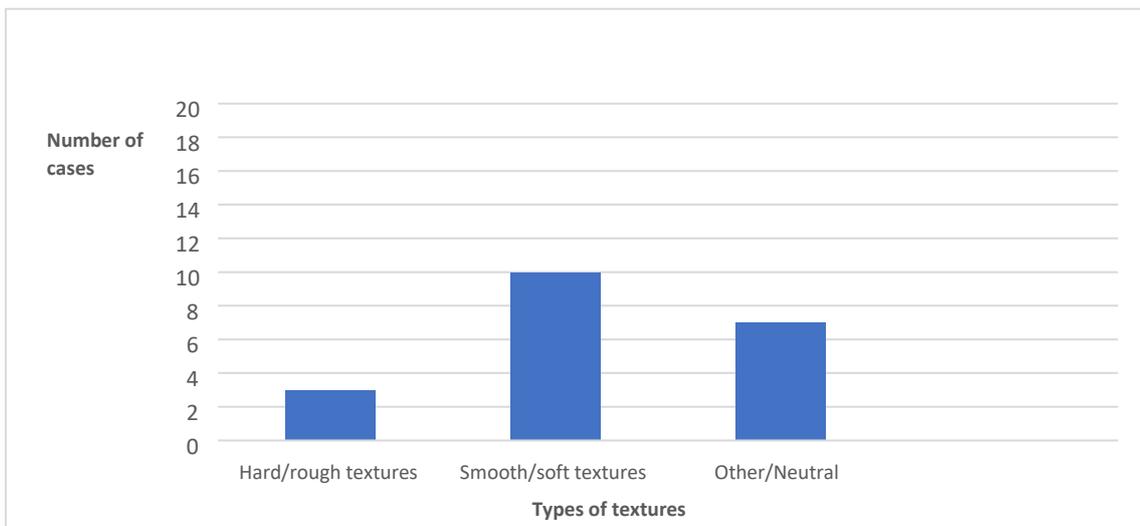


Figure (1.2)

INFERENCES: The above aspects have an impact on the kids with autism. The inferences are as following.

- **Scale of Spaces** :In case of spaces, they neither prefer confined/small spaces nor they prefer large spaces. They generally like being indoors. Rather they prefer spaces that are familiar ‘
- **Way finding and configuration of spaces:** One way circulation proves to be beneficial. The spaces should be organized based on the daily schedule of the kids. Transition/buffer spaces help in transiting from one place to another and are beneficial.
- **Light:** Natural light is advisable wherever possible but without silhouettes and glare. Fluorescent lights should be avoided.
 - **Colour:** Soothing and neutral colours are often preferred. The kids may show several tantrums when exposed to colours like red, yellow as these colours are agitating for them and this leads to violent and uncontrollable actions. Colours like green and blue have a soothing and calming effect which is necessary for kids with autism. .Tints and hues of colours that are subtle are more popular.
 - **Textures:** Soft textures are generally preferred by the kids. Other textures like glossy finishes, sticky/wet ,mushy textures have a negative and harmful impact on their behaviour.

CONCLUSIONS: The paper summarizes the several aspects of a space that have a direct or indirect impact on the health of the kids with autism not only physically but also mentally .Designing autism Friendly spaces that include proper amount of light ,easy way finding ,soothing and calming or neutral colours ,preferable textures and spaces of optimum scale can play an important role in improving their mental health. Spaces having sensory stimulations ,for example sensory gardens ,schools or spaces that can lead to socialization can help in encouraging the child’s development. Failing to consider the needs of this user group can result in behavioural incidents and social isolations. Creating spaces considering the above aspects can create a supportive and stabilized environment to create a better society to live in.

ACKNOWLEDGEMENTS:I wish to acknowledge the help provided by Prof. Sushma Parashar to guide me for conducting the research .I would like to thank Dr.Parag Narkhede Sir for his useful occasional reviews .I sincerely want to thank Dr.Jaai Joshi(Developmental Paediatrician) for allowing me study her patients and for her constant support throughout the research.

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NEED FOR REDEVELOPMENT OF GOVERNMENT COLONIES; SWARGATE POLICE COLONY.

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ABSTRACT: This research paper is discussing about the various problems faced by residents of the Government colonies with the focus on police colony. With the rising levels of urban population and an increasing share of incoming population, cities facing the problems of providing shelter. Major change has been observed in housing typology in past decades due to the change in lifestyle of society with globalization, changes in economy. This research paper includes the primary data generated through site visits, interviews and inventory format, also on secondary data like collection of News articles published by government. Government housing like police colonies were allotted in 1950 And has not been developed since last 75 years. The structure is lacking behind in all aspects such as design, Building technology and services available as compared with contemporary facilities. This report tries to find out whether the structure needs to be redeveloped or it simply needs changes and repairs. All the findings are done with the interviews and through study of news articles and by Laws. Also discuss about the procedure for redevelopment by government, compare different redevelopment Projects.

KEYWORDS: Urbanization, police colonies, shelter, problems, redevelopment, government.

AIM - To find out whether swargate police colony needs to get repaired or fully redevelop.

OBJECTIVES – a) To get primary data by interviewing the residents/ people living in the police colony of Swargate. b) To observe and analyse the study area: Swargate police colony. c) To find flaws in colonies from architectural point of view.

SCOPE - a) To study government police colony. b) to understand the present scenario of government police colony by visiting the government police colony. and interviewing the people.

LIMITATIONS - a) Lack of secondary data. b) Information was way less in the related books or on the internet, because of this topic is mostly ignored by government & ngo’s. c) Due to lack of time, Only 56 peoples were interviewed during survey instead of 30% of total tenants. d) The study focuses only on swargate police colony.

INTRODUCTION - Pune is a city witnessing heavy urbanization in several years. The city is a developing rapidly with the population of 3747217. To control and provide security to the respected population, optimum police force is required to sustain city’s need, for which service men’s & their families must be provided with healthy living shelter. A lot of changes in housing typology were observed in past decades, due to the changes in living lifestyle of human. But the Government housing like police colonies allotted in 1950 has not developed since nearly 75 years. The structure is left behind in all aspects such as design, building technology, and services, with respect to time. But now according to current housing standards the structure should adapt new ways of comfort living.

METHODOLOGY: This research aims to find out whether respected structure needs to get repaired or redeveloped completely. To achieve this aim H.I.S. (home interview survey) was under taken. From that data different motives of residents were noted down. Live case study of respected area was done to observe and analyse different aspects in architectural point of view.



Figure 1: H.I.S Result Showing types of Residence [reference- Author]

1) HOME INTERVIEW SURVEY (H.I.S.): The total no. of residence residing in the colony were 780 (approximately). Interviews of 56 people of different age groups were taken (because of limited time constraints). Three scenarios were observed from all the 56 interviews.

All 56 interviews further categorized into three sub types as follows :

FAMILY MEMBERS	M	F	C	NO. OF TOTAL FAMILIES	NO. OF ROOMS ALLOCATED TO EACH FAMILY *2
2	1	1	0	52	
3	1	1	1	46	
4	1	1	2	32	
5	1	1	3	40	
6	2	2	2	35	
TOTAL (INTERVIEWED)	780	TOTAL		205	

Figure 2: H.I.S. Result Showing types of Residence [reference- Author]

A) TYPE-1 INTERVIEW: Vandana Ruplar and others(25-35 years of age) Insufficient natural light and ventilation in the flats. No dedicated space for four wheeler parking. Lack of parking space for two wheelers. No dedicated space for children’s play area. They demand for redevelopment of the project and wish to have high rise building with at least 1 bhk flat person.

B) TYPE-2 INTERVIEW: H.P. Chavan and others (35-45 years of age) These residents are living here from about 15 years. According to them, proper parking facility is not provided. Water leakage problems faced by the residents. Cracks in walls are also a major issue. Lack of privacy for the residents. Restriction of opening new businesses in the site. Lack of space at the arrival of guests. They demand for redevelopment of the project and wish to have a high rise structure with at minimum requirement 2 bhk. flat per person.

C) TYPE-3 INTERVIEW: Rajaram Salunkhe and others (55-65 years of age) These were the residents of single storied structures (kaularu ghar). They appreciate the surrounding environment and don't want to change the feel which the space provides. They don't demand for any redevelopment of the project but wish to have repairs in the structure.



Figure 3: H.I.S. Results [reference - Author]

From figure 2, it is clear that there is more than 55 % consent for redevelopment from total number of residents. 35% of people were satisfied with repairing and minor alteration of the structure and 10% of people (majorly old age category) were surprisingly happy with the current scenario.

2) Live case study: Site visit was conducted at police colony of Swargate sector. The site consisted of 11 building blocks of G+3 structures and 10-12 ground structures (kaularu ghar). Total area is 44,308 sq.m this site comes under residential zone.



Figure 4 : site area [reference - google earth]

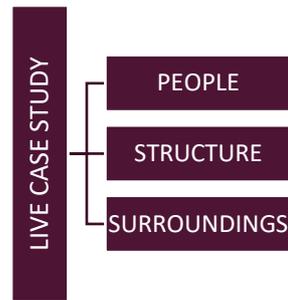


Figure 5 : categories [reference – Author]

As shown in fig.5, live case study was categorised into three main factors – PEOPLE, STRUCTURE, SURROUNDINGS.

a) Peoples – there were approximately 205 no. of families residing in the whole colony. Each family had form 2 to 6-7 members but the rooms allotted to each family was same irrespective to the no. of individuals. from H.I.S., several issues were addressed such as privacy, common toilets and lack of hygiene and much more.

Because of above issues the people were forced to live in a complex state of mind, resulting in poor mental and physical health. Overcrowding It refers to the situation in which more people and living within a single dwelling than there is space for, so that movement is restricted, privacy secluded, hygiene impossible, rest and sleep difficult. It may promote the spread of respiratory infections such as TB, Influenza and Diphtheria.

This situation must be taken on serious note because this affects directly to the day-to-day life of policemen ultimately affecting on there service.

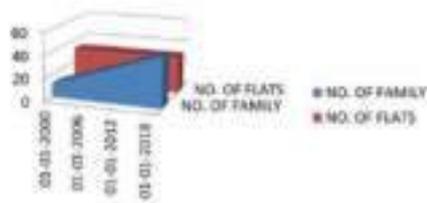


Figure 6 : Graph of ratio of flats to family [reference- Author]

b)Structures – As above survey the Government housing like police colonies allotted in 1950 has not developed since nearly 75 years. The structure lacking of basic facility's like individual toilets, proper light and ventilation. Size of rooms were too small i.e. 10x10ft.and 10x8ft. according to today's housing standards. Passages are too narrow and closed. Safety features like fire staircase, hoes rill were not provided at that time. Slabs and walls leakage problems were happens in monsoon.



Figure 7: unhygienic common toilets [reference- Author]



Figure 8: leakages in walls[reference- Author]

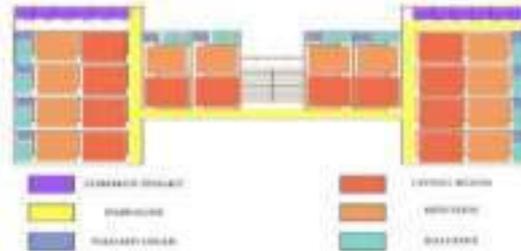


Figure 9: Tentative plan of G+3 building [reference- Author]

3) HOUSING STANDERDS :

a) Site - Elevated from its surroundings, Independent access to a street of adequate width, Away from breeding places of mosquito and flies, Away from nuisances such as dust, smoke, smell, excessive noise, and traffic. Should be in pleasant surrounding ,soil should be dry and safe for founding the structure and should be well drained.

c) Rooms - Should not be less than two, at least one of them can be closed for security ,the other may be open on one side if that side is a private courtyard. No. should be increased as per the family members.

• **Cubic Space**-at least 500 c.ft per capita preferably 1000 c.ft

Area (sq ft)	Person
110-120	2 person
90-100	one and half
70-90	One
50-70	Half (children between 1-10 years)
Under 50	Nil

Person per room

Person	Room
1	1
2	2
3	3
4	4
5	5

Figure 10: Area and Room standards [reference-3]

4) ISSUES OBSERVED: Because of lack of maintenance from government structure has been damaged in several ways. Because of that nature of respected area is polluted. Due to unorganised waste disposal, the diseases like dengue and malaria is likely to get spread. Because of lack of parking space, tenants always feels unsecured about their vehicle. And it directly affects not only on physical but also on mental and emotional health.

5) RULES FOR REDEVELOPMENT: According to new redevelopment rules, now housing societies would need consent of 51 per cent of the members only to undergo redevelopment. However, the clause is valid only for construction which is more than 30 years old. For applications which are attested by an architect or a structural engineer, the permission will be given within 24 hours. These are the basic three rules to satisfy the need of redevelopment. Government housing such as this require redevelopment but need to be in above criteria.

6) CONCLUSION: From above data it is seen that swargate police colony remained one of the neglected government housing in the pune city. From Interviews taken it is clear that more than 75% of residents consents for redevelopment or repair government authority should look into this matter. There quarters were built in 1960. The structure was designed to full fill requirement of that duration of time but currently the structure lack behind in present housing standards. The structure nearly half century old that’s why it needs to get change. But for redevelopment certain bills must be passed from various funds. This governing process requires long duration of time until then need alteration and repairs must be done.

By addressing above data, Swargate police lines fulfils all the criteria's of redevelopment. Redevelopment must be done with respect to their familiar environment, with their basic needs. Government processes like this require long duration of time for governing process. Till that required damages must be repaired and basic amenities must be provided.

By addressing the services, users and requirements this design is not applicable. New designs such as low cost housing shall be implemented and constructed in these place.

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PUBLIC ART AS AN URBAN REVITALISATION STRATEGY A CASE OF PUNE

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ABSTRACT

It is believed that great public spaces are the living rooms of the city, they impact the everyday life of the common people, and also contributing to developing communities. Public spaces from time to time need to be regenerated, many factors like changing political conditions, ideologies, some social movements and time as well as affect public space. Various strategies like provision of infrastructure, redevelopment of existing infrastructure, revitalization of the streets, squares and public spaces like markets and gardens using different techniques of placemaking like public art, seating areas and other such spaces that give an identity to the area. Pune as a city is continuously developing and its public spaces are changing too. Attempts have been made by local government bodies to revitalize the public spaces by using Public Art as the Public Revitalization strategy. This research paper attempted to study the impact of these strategies on the surroundings of the area of intervention, peoples' opinions about the same using qualitative research methodologies like interviews and observations. The research paper led to the conclusion that unless and until most of the community is included in the process of decision making for urban revitalization strategies, the citizens residing in the neighbourhood won't show the willingness to engage with the provisions made.

KEYWORDS *Urban revitalization, Revitalization strategies, Public Art, Cities, Community development.*

INTRODUCTION

It is believed that great public spaces are the living rooms of the city- a place where people come together to enjoy the city and each other (UrbanDesign.org). Throughout the history of the world, Public spaces have had great importance. Not only do they contribute towards great political movements, but they also create a breathing space for the city if designed contextually. A good public place creates a great environment for children, senior citizens as well as women, as it is occupied for most of the hours of the day.

A public space can be enhanced, rejuvenated or regenerated in various ways. It may vary according to the need of different areas. It can be done by architectural/ landscape or an art intervention. These interventions contribute to building the image of the cities, which is, its distinctiveness, sense of aesthetics and cultural aspects that define a city's appearance. Public Art contributes to the visual quality of an urban environment. It adds massive value to the social, cultural, economic as well as aesthetic value of the city. Public art contributes a lot towards the city's legibility, encouraging community pride, sense of belonging while enhancing the travel experience.

Public art can be in various forms- Paintings, Sculptures, Installations, even street performances like street plays, dances, etc. Public art should be so that, it allows humans to interact with it. Involving communities right from when the idea is conceived to its application. These efforts make the communities and the neighbourhood bond with space more, resulting in better and well-maintained public spaces. Public Art can create an emotional bond of the people with spaces. The research paper tries to analyze the public art installation in the Pune city and tries to understand citizens' opinions about the public art and whether or not it is a good strategy to rejuvenate the Public spaces. The paper also tries to state the importance of community inclusion in the process of rejuvenation of Public Spaces. Here the examples of "Swargate" and "Aundh Smart City Stretch" are considered. Users like hawkers, passers-by and residents in the neighbourhood were interviewed.



Images:

Sculpture installed on Aundh Smart City Stretch (left)

Autorickshaw as an art installation near Swargate main junction (right)

LITERATURE REVIEW

A public space refers to an area or place that is open and accessible to all people, regardless of gender, race, ethnicity, age or socio-economic level. These are public gathering spaces such as plazas, squares and parks. Connecting spaces such as sidewalks and streets are also public spaces (United Nations Educational, Scientific and Cultural Organization, n.d.). Any public space that is a non-domestic or not familial is a public space, any space where a person can freely form reasonable and political judgements is a public space, example, Coffee House (Rendell, 2006). India as a country, now, demands efforts on the availability of, and access to public spaces based upon the fact that public spaces yield benefits of greater inclusion, safety, democratic engagement and gender parity. Street activities act as "eyes on the street" that keep cities safe (Jacobs, 1961). Rejuvenation of existing inventory of public spaces is necessary. Parks, beaches, historical landmarks, places of worship, and century-old architecture are in tatters. Indian public spaces can be revived if the government addresses the four basic needs of infrastructure, hygiene, security, and accessibility (Dhar, 2018).

Public Art denotes any work of art which is designed for and sited in a space accessible to the general public, from a public square to a wall inside a building open to the public. Public art is an umbrella term which includes any work of art purchased with public funds, or which comes into the public domain. (Public Art, n.d.). Public art contributes significantly to culture-led regeneration in terms of creation of a distinctive environment in cultural quarters that allows and encourages a creative milieu as well as development and investment that improves social cohesion and enhances the quality of life for local people (Grodach, 2010). Public art reflects local identity as well as promotes the place internally (within the city) and externally (outside the city). (McCarthy, 2006)

The integration of public art in a specific context is also referred to the form as the individual or community perceives it and the acceptance or refusal the individual/community will eventually reveal. The social dimension on the art makes it popular and communicative. The art in a public space is to be liked and accepted by the majority of the Populus and not just the critics and experts, this highlights the necessity of including people and their opinions as the art placed in a public space should not make people feel that it is imposed upon them. But at the same time the decision whether or not a certain public art is to be installed in a particular space will depend on whether the group belongs to

the same neighbourhood, i.e. whether they identify emotionally with space, also whether it is going to affect their day to day activities and so on or so forth. The decision also depends upon whether the initiative of intervention is taken by local authorities or the private sector (Casanovas, 2005).

Art spaces can serve a variety of public space roles, they act as spaces of community development. Firstly, they provide a platform for meeting spaces, social gathering spaces. Secondly, the integration of public art encourages community participation as the neighbourhood residents and audiences are often involved in the same (Grodach, 2010). Art spaces if strategically planned near the commercial market establishments may also boost the local income generation as an increase in tourist footfall. At the same time it in one way or the other supports artists which contributes to individual redevelopment.

A new topography of places should be mapped that exist **between** the public and private which are on the threshold, for example, academic institutions, as they are the end and the beginning. People tend to welcome such art interventions in ephemeral spaces (Rendell, 2006). Public art interventions should also be done in places that attract a larger crowd, example, parking, plazas or and other such gathering spaces.

Pune as a home to a rich culture and heritage has started to see many such art interventions at Swargate, Aundh, Bund Garden, and many other places. The research paper will try to focus on the cogency of public art as a revitalisation strategy in Pune city within Pune Municipal Corporation limits.

METHODOLOGY

Public Spaces are a reflection of society and its culture. With urbanisation and integration of the global economy, it is essential to build an image of the city. Public art adds massive value to the social, cultural, economic and aesthetic value to a city. Indian cities have an advantage of its rich culture and heritage that can be translated to art which can result in unique images of each city. (Sogani, 2019)

Public art as an urban renewal strategy has been in discussion within many urban planners, designers and architects around the world. Its facets are now being seen in Indian cities as well. Many organisations with the local government have been active in installing art in the public spaces for the last decade and we can see paintings on the walls of academic institutions, art installations made from the waste within the city. The question of whether public art as a strategy for urban regenerations is helpful or not emerges. Thus, a study of two such cases was carried out- Swargate and Aundh Smart City Stretch.

The two cases vary from each other concerning the type of neighbourhood, people utilising it and the places around. Swargate was earlier, outside the Pune city.

The redesign of the road has made the road pedestrian-friendly for the residents. A few shopkeepers, hawkers and the residents living nearby were interviewed about the same.

Qualitative Research methodologies like interviews of people in the neighbourhood and passers-by. Observations were made of the two cases. Interviews were taken of the nearby the people like hawkers, people waiting for autorickshaws, buses and for someone to pick them up from the swargate State Transport Stand. Some people were unknowingly utilising the shoes installed near the signal as a seating.

Following are the interview questions that were asked:

- Q. Do you like art installations? Reasons for liking it or disliking it.
- Q. Has this changed the footfall in the area and impacted your business in any way?
- Q. Has it ever become any kind of a nuisance?
- Q. Do you think more such interventions should happen in the city? Why?
- Q. What kind of art would you like to see in the public spaces?
- Q. How do you engage with public art?

The two cases vary from each other for the type of neighbourhood, people utilising it and the places around. Swargate was earlier, outside the Pune city.

Interviews of 9 people were conducted out of which 5 were from Swargate and 4 were from Aundh Smart City Stretch. The age groups of the people interviewed were extensive. Thus, responses formed kind of a pattern. The questions were mostly qualitative and thus allowed people to talk more freely about how the strategy was applied.

DATA COLLECTION

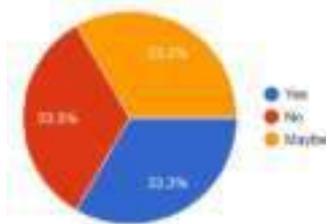


Figure 1
Source: Author

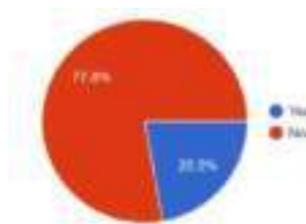
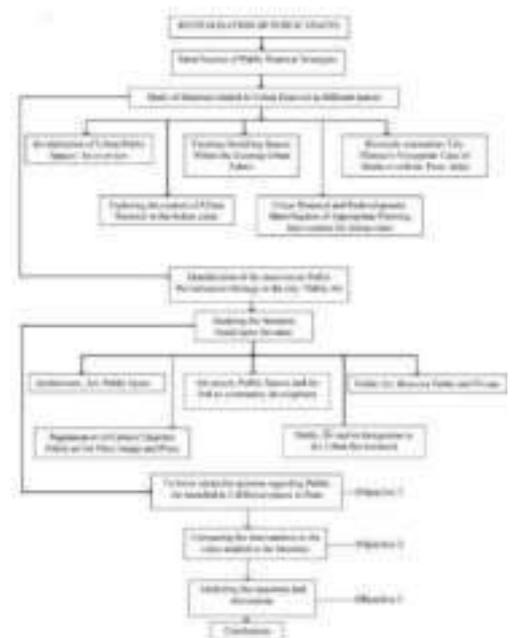


Figure 2
Source: Author



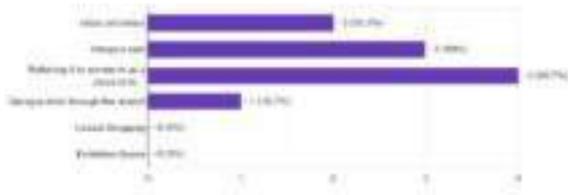
OPINIONS OF PEOPLE ABOUT PUBLIC ART

Figure 1 talks about the **opinions of people about the Public Art**, the responses were dependent upon the people and their involvement with the neighbourhood, the people being in contact regularly with the neighbourhood also saw the problems and hence had mixed opinions.

NUISANCE EXPERIENCED BECAUSE OF PUBLIC ART

The participants were also asked about the art intervention **being a nuisance** to the people in the neighbourhood case A pointed out the spaces around the art are being a nuisance because of the homeless using the spaces as their sleeping spots, while case B did not lead to any kind of a nuisance to the people in the neighbouring areas.

WAYS IN WHICH PEOPLE ENGAGE WITH THE PUBLIC ART



0,1,2,3,4 talks about the number of people engaging with the art and the space in the given ways.

Figure 3

Source: Author

Figure 3 states mostly about the involvement of people with the Public Art while most of the people referred the art to someone as a place to meet (Ola, Uber or friends) while case B also saw the art and space around it as a hangout spot and also as *khaugalli* (food street)

INFERENCES

While the interviews of the participants suggested that, the responses are highly dependent upon the kind of engagement the participant observes with a particular neighbourhood. Case A Swargate area doesn't exactly house much of residents so it doesn't show the full-time engagement of a single person with the art, which has certain limitations on the emotional attachment of the participant with the area. While Case B, i.e. Aundh has a residential development around it which makes them bond with the public space.

Also, most of the hawkers were disappointed as the decision-making procedure doesn't include their opinions and they suggested that while doing such intervention local bodies should consider giving them spaces to carry out their businesses not just making the cities look good.

An interesting fact was also observed during the interviewing process, most of the younger generation was pretty happy and open-minded about the interventions, while the more experienced and older generation considered the spaces created as waste and suggested that infrastructure like parking would have been more suitable.

CONCLUSION

The research focuses on the opinions of common people about Public Art in two different areas in the city. Interviews of the shopkeepers, hawkers and residents were taken and the conclusions suggested that due to lack of community inclusion in the urban revitalisation strategy, the strategy might lead to failure. The research tried to understand the reasons why this strategy is not as successful as the strategies in the western countries. Many more facets of the urban revitalisation strategies have been left for the future due to lack of time. The future work concerns a deeper analysis of the ways to include communities in the Urban revitalisation strategies, what kind of art can be introduced in the public spaces and how it can be made to motivate the people to engage with the Art.

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DESIGN AID/PRINCIPLES FOR BUILDING IN CONTEXT

New development in character-rich areas of India

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ABSTRACT:

Heritage (old) and development (new) presents society with an obnoxious duality whether to retain one or raze for other. These two facets of the city, heritage, that helps us to proudly celebrate our roots and new developments, that helps in, providing convenience and comfort often overlap and cause friction. A golden mean is a mutually understood and desirable middle ground for the two concerned parties. This mean facilitates the coexistence of the two in harmony. A mean between the duality of Heritage (character) and development (construction) is increasingly sought by the city for its renewal and improvement in the life of its people. A mean between the two, in the form of a set of guidelines, parameters and strategies is the aim for the paper. Understanding Character ,by mapping (activities) photographic documentation of the sample area of Kasba Peth Jaipur and Fort Kochi will provide a comprehensive idea for the character in the Indian context .The caselettes of Kasba Peth , Old Jaipur and Fort Kochi are studied and process under three bold objectives, Built fabric densification and its relations with the street, identification of dilapidated buildings that are prone to New developments and policy strategies for implementation and execution. A set of design guidelines for concerned personnel to follow that will in advertently help solve an important issue of encroachment of new developments in Heritage present areas. A contextual approach such as this will help in solving and resolving similar issues that the country's other Heritage cities and towns face.

KEYWORDS- *Character, Streets, Kasba Peth, Jaipur, Kochi, Indian heritage, Design Aid*

INTRODUCTION

'A landscape whose every rock tells a story may make difficult the creation of fresh stories' (Lynch, 1960) The quality of environment of a settlement is the outcome of natural and built environment. As a result of rapid development, the environment is constantly being degraded due to increasing population, depleting vegetation and water resources, climate change, pollution and ecological imbalance, which constitutes the natural environment. What happens within the city? How does the to be built, affect the built? (Sanghvi,2017). The paper's primordial aim is to set out a design aid that will help designers, local authorities, developers and other built environment professionals to stimulate and develop greater understanding for designing and building in areas of historic settings. And secondly, the purpose of this research paper is to explore how good design in historic settings is achieved. there is not one correct answer or approach of course, but there are ways of thinking and working which increase the likelihood of success. (Kiruthiga & Thirumaran, 2019).Clearly, the skill of the designer is at the heart of the issue so my aim is to set out an approach to design which will help to break down the design process into a series of steps involving understanding character , cultural values and designing effective solutions that are appropriate for the specific historic context being considered. the desired outcome is the high-quality design of new buildings and spaces in historic settings.

2.CASELLETES

To demonstrate the exercise, various features and aspects that help in defining the character of Kasba peth, Old Jaipur and Fort Kochi are investigated and compared in this study. These regions are particularly selected due to their historical significances in the geographical setting they lie in. Kasba Peth helps in understanding character through the lens of its activities and streetscape. Principles for understanding character of the study areas: • Urban structure • Urban grain • Density and mix • Scale • Materials and detailing.

2.1 Kasba Peth, Pune

Kasba peth is one of the oldest living 'Peth' or living residential parts in the sprawling Pune city. Being in the city's core center, Kasba peth is the prime example of an historic city centre reacting to urban and economic forces for fruition of newer developments. A delayering of Kasba peth in terms of different broad principles is presented as follows:

2.1.1. Urban structure in Kasba Peth

The Urban structure in Kasba Peth has a particularly distinct image that bestows it with its unique and warm charm. It is the organic placement of blocks, the meandering streets and the placement of building that have forms inspired by the site profile that encompass the entire urban structure present in Kasba peth.

2.1.2. Urban grain

The Urban grain in Kasbah Peth in this new age is still reminiscent of the organic pattern of street and spaces built and modified in the glorious Maratha Regime. The Urban grain closely follows a constant relationship of solid-to-void between buildings and open spaces. A cluster, here is predominantly composed of no more than 14-17 mid-sized buildings that are either zoned as commercial, residential institutional and mixed.

2.1.3. Density and Mix

Density in Kasba peth can be easily described as Residential as well as mixed use, however, this pattern varies with each particular piece of land and its use. The primary settlements that stayed in Kasba were communities of goods traders and skilled craftsman/artisans who built their living quarters cum stores in Kasba peth due to its historical proximity with the then capital of administration near Shanivar wada.

2.1.4. Scale

The surrounding scale, hierarchy and massing of the existing built form in Kasba peth can be understood through layers of Primary, secondary and tertiary streets. The scale in Primary streets of Kasba peth relates more to the Width of the street than to the height of the person. The secondary and tertiary streets derive their massing and scale from nearby buildings, particular landmarks or strategic views present in the vicinity.

2.1.5. Materials and Detailing

Historical Developments such as Bhide Wada and Kulkarni Wada are evident examples of use of indigenous materials such as basalt stone for built form construction. However due to advancement in technology and improving economies, reach became wider and more materials for construction became increasingly accessible. Combined with availability of skilled craftsmen, ornamentation and richness in detailing became evident on facades of wadas that about the primary streets of Kasba peth.



Fig 1 Illustrated Figure Ground Map of Kasba Peth, Old Jaipur and Fort Kochi at Scale 1:1250 Source (Author)

Fig 1 Helps us in understanding the Organic street pattern and the rich pattern of built form. The streetscape is vivid dotted with seamless trails of facades almost having no space in between. A no setback policy can be observed leading to increased densification around the primary streets. (Cooper, 2014)



Fig 2 Primary, Secondary and Tertiary Street Character at Kasba Peth Source (Author)



Fig 3 Primary, Secondary and Tertiary Street Character at Old Jaipur Source (Author)



Fig 4 Primary, Secondary and Tertiary Street Character at Fort Kochi Source (Author)

a. 3. COLLECTIVE UNDERSTANDING

Here, Indianness is portrayed as a Harmonious patchwork of architectural illustrations that depict the impact of the local environment and inherited culture in defining the spatial elements of the living clusters found in various parts of the studied areas.



Fig 5 The Idea of Indian Character and its values Source (Author)

(Montgomery, 1998) described the character of a place with three elements of an urban environment, namely, physical setting, meaning, and activity.

3 Conclusion

Principles (Planning)	Conclusion based on study area
Urban Structure	The new development should respond well to the existing urban structure of the area and not just associate itself to a particular style or particular building.
Urban Grain	New developments should respond and respect the existing Urban grain. A very solid grain with tall high-rises and very narrow streets for example in Mumbai, tends to have confined and closed effect than an open arrangement such as in Old Jaipur and Fort Kochi with its long streetscapes, provide a different and healthy solution.
Density and Mix	New developments in historic and character rich places should respond to the amount, nature and exiting mix of uses that particularly distinctive to that area as seen in the study areas of Kasba Peth, Old Jaipur and Fort Kochi.
Scale	New Developments should consider the surrounding scale, hierarchy and massing that the existing built form has. Sensitivity on the end of designers is far more important so not either allow the new developments to stand out or blend in using different architectural strategies such using rooflines of facades, window openings as seen in Old Jaipur to fragment the streetscape into a more humane scale.
Material and Detailing	For new developments, it is important to be sensitive to the use and appropriation of use of color, texture of materials, pattern of materials. It is also important to design their use and detailing so as to either make the development stand out or blend in.
Principles (Design)	Conclusion based on study area
Gateways	Entrance devices can have multifarious uses. As seen in Kasba peth, strategic new developments can take have dual purposes that also benefit both the entities and adds essential elements to the urban fabric.
Visual marker on street	Visual markers help in making focused streets and grants the street with characteristic of placeness.
Built projections from wall plane	Whilst adding volumetric variation to the streetscape, protrusions also become an elevated social space where people and street negotiate.
Roofscape activity	As seen in Old Jaipur, the roofscape is an open, unrestricted and free landscape that can be utilized for different purposes. To celebrate festivals, for daily or a getaway to the stars, activities on the roof provides multi-dimensionality to wall plane.
Climate	Response to the climate is a must, and every new development should consider passive ventilation strategies for efficient functioning and sustainable living.
Street Pattern	The streetscape is a vivid public realm that is owned by none but belongs to everyone. Different strategies such as orthogonal + organic or organic + linear layout of streets result in different characters of the street as well as the precinct. Great sensitivity is required to recreate condition found in the past without pastiche.
Activation of Street	The streetscape is an important element in the urban fabric and addition of activities that promote constant flux and increases social friction helps in elevating streetscape's appeal.

II. TABLE [1] Conclusion table based on study area

The conclusion drawn from the study areas of Kasba peth, Old Jaipur and Fort Kochi based on various principle are listed in the table (Fig 9) above. A combination of the principles presented above, when utilised in a highly sensitive understanding of the context will help in stitching together the old and new. Buildings dreamt and created with great clarity about past conditions, result in outcomes that are richer and well flavoured to the context. Character of a space is inherently rooted in the place and before one builds in a character rich area, the character of the area should be studied and understood. This study greatly informs the design process resulting in an outcome that is more appropriate and suitable in the context.

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A SURVEY ON PEOPLE'S OPINION ABOUT SMART CITY INITIATIVE IN AUNDH AREA

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ABSTRACT

Smart cities base their strategy towards developing cities in order to improve quality of life of the people residing in the area by the use of modernized technology and by assisting the use of spaces in urban area. There is a need to further develop smart networks in smart cities to meet the needs of the people living in these areas, hence making the smart public spaces attractive for the people becomes important. Government of India has taken a modern and innovative initiative for the betterment of the society. This paper aims to find perception about smart city initiatives of citizens residing in Aundh area of Pune city. It also aims to understand the awareness among citizens regarding such initiatives taken by the Government towards development of cities. Data was collected from a certain number of citizens residing in Aundh Area for a minimum of two years. Findings show that there were some difficulties faced by the citizens like non availability of public washrooms, traffic congestion, etc. Although they were quite satisfied with the overall execution of smart city project in this area. Data collected through interviews of shop keepers in the area and residents is analysed in the light of planning and design initiatives under smart city program.

KEYWORDS:

Smart City Initiatives, Development of cities, Users' satisfaction, City Beautification, Social Life etc.

INTRODUCTION

Smart city initiative is one of the important steps towards development of cities. A Smart city is a city which is very innovative and futuristic with respect to the infrastructure, transportation, real estate, and also market availability. Smart cities base their strategy towards developing cities in order to improve the quality of life of the people residing in the area by the use of modernized technology and also by assisting the use of spaces in urban area. The government of India has taken a modern, futuristic and innovative initiative for the betterment of the society. Watson (2015) had introduced the term Fantasy city which is similar to smart city, with regards to the concepts, various ideas about how beautifully cities can be developed.

In 2015, the Government of India proposed the National Smart City Mission for adding a new face to the urban development whereby the government of India aimed to develop 100 smart cities across the country along with making them sustainable and citizen friendly. Factually, 99 cities have been selected to be upgraded as a part of smart city development as of January 2018. According to the smart city project, public places in the proposed smart cities would be given Wi-Fi internet access. Smart city initiatives not only includes new development of a city but also redevelopment of the existing infrastructure would be part of it. Pune was one of the first twenty smart cities of India.

PUNE SMART CITY INITIATIVES

Pune had ranked second, among the 98 nominated cities, in the First round of Smart Cities competition organized by the department of Urban development of India. Pune has already implemented some of the initiatives which are as follows:

- Smart Public Bicycle Sharing
- Free Wi-Fi
- Smart Street Redesign
- Well lit streets
- Smart Place making
- Citizens Engagement
- Wide Footpaths for pedestrians
- Seating Accommodation
- Smart parking project
- Tactile paving.

Pune Smart City has implemented these projects successfully. E connectivity and Transport Hub were some of the initiatives under smart city planned by the "Smart City Development Corporation Limited" (PSCDCL) in Aundh Area. Some other proposed initiatives are as follows.

- Computerised system for transport and an IT network for the bus rapid transport system.
- Around 200 poles with close circuit cameras
- E Buses and E Rickshaws for BRT Route
- Smart Mechanized Street Sweeping
- Awareness campaign by visiting societies
- Bicycle on rent
- Pedestrian friendly roads / bicycle-friendly roads

Although there have been smart city initiatives undertaken by the government at moderate scale, there is no feedback from citizens taken to improve these initiatives through research. This research paper attempts to fill this research gap which would help urban planners, urban designers and local authorities for planning and development of smart city programs.

AIM

To study citizen's perception about smart city initiative in Aundh area.

OBJECTIVES

1. To study the level of satisfaction that the citizens feel about the initiatives in this area.
2. Understanding the initiatives taken by Government towards development of cities.
3. To know opinion of the local residents of Aundh area of Pune city about smart city initiatives.
4. To understand underlying reasons of perceived satisfaction level.

RESEARCH METHODOLOGY

Quantitative data was collected from a certain number of respondents residing in Aundh area, who lived there for minimum of two years and also from shop keepers in the area. Qualitative data was collected through interviews with the local residents and shopkeepers to understand the reasons of satisfaction/ dissatisfaction levels. Structured Questionnaire was used to collect the data.

Visual survey was done on site through photographic documentation. Study of architectural drawings was done to understand the change in streets of Aundh.

DATA COLLECTION AND ANALYSIS

The collected data was analysed by MS Excel. The Statistical tools used for the analysis include tables, graphs and charts.

- It was observed that 39% of the people felt that the space utilization of the parking v/s footpath v/s driving road was not effective.
- Public facilities like washrooms and water fountains were not easily available.
- Most of the people were satisfied with the execution of the work.
- 78% of the residents were quite satisfied with the beautification and cleanliness of roads under this initiative.
- People felt that the footpaths were crowded with hawkers during the peak hours i.e. 6-8pm causing difficulty to commute.
- 75% of the residents observed that this initiative causes traffic congestion during evenings i.e. 6-8pm.
- 60% of the people felt that this initiative is user friendly for handicapped people. The remaining 40% of the people disagree with the same.
- 74% residents observed that the safety has increased, especially for women leading to improved social life in the vicinity due to this initiative.
- 36% of the shopkeepers observed that the sale had increased in the area after this initiative. 40% of the shopkeepers felt that it remained the same whereas the remaining 24% felt that the sale had reduced.
- Most of the people were quite satisfied with the overall Smart city initiative in Aundh area.

VISUAL SURVEY:

1. The broadened footpaths have been misused by the two wheeler riders during peak hours to bypass the slow moving traffic. (Fig.1)
2. Hawkers, Neera Sellers and fruit vendors encroached the footpaths for selling their stuff. (Fig.2)
3. Raw material like paver blocks, cement, stones, ready-mix concrete and asphalt at times was just lying on the roads. (Fig.3)
4. Delay in execution of the work was not communicated to the citizens which let to dissatisfied progress of work.
5. Parking of four wheeler vehicle on cycle track should be avoided. (Fig.3)
6. Parking of Vehicle is a big time challenge as a lot of challenges are faced in conventional parking towards reducing congestion on city roads, it is extremely time-consuming which causes traffic congestion.



Fig 1



Fig 2



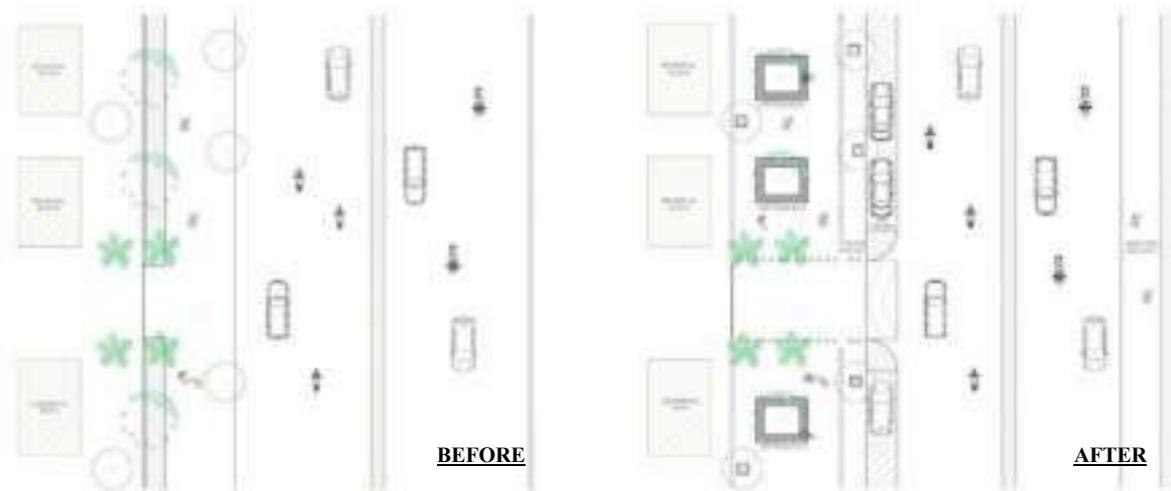
Fig 3



Fig 4

STUDY OF ARCHITECTURAL DRAWINGS

- The difference in the streets of Aundh can be clearly studied from these drawings.
- The compound walls have been pushed inside in order to widen the pedestrian pathways.
- Seating spaces and interactive spaces have been created on these pathways.



CONCLUSIONS

Smart city initiative is an important step towards improving the quality of life of all the people residing in the area by the use of modernized technology to create smart outcomes for citizens. With respect to the smart city initiatives planned for Aundh area of Pune city, although the initiatives are planned, the same are pending execution. According to the survey, it has been found that all of the respondents were aware of smart city initiatives taken by Government of India. While some people residing in Pune were satisfied with most of the initiatives taken towards smart city, others reported some issues towards various initiatives taken in this area. Smart city initiatives definitely contribute in increasing walkability of the cities. It also adds to the social safety by increasing social vigilance through enhanced social life. However, these initiatives need to take care of certain requirements of citizens such as provision of toilets, increasing walkability for differently abled people so that these initiatives become more meaningful. Through this research, challenges faced by citizen residing in Aundh area were identified and studied through visual survey in order to overcome these challenges and to make future smart city initiative successful.

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WHAT MAKES PUNE LOOK LIKE PUNE?

A study to identify architectural characters that give the city its identity and whether or not they should be a key aspect in design in today's time or the future

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ABSTRACT

Urbanization and growth of cities in terms of population and expansion of the cities is inevitable. Aided with the help of tools and machinery used in construction along with ease of transportation and availability of more sustainable as well as cheaper material, construction is becoming faster and easier. Although this is beneficial in many aspects, this is ultimately leading to the loss of the cultural identity of cities as they no longer look as they used to. This research paper aims to find out what gives the city of Pune its architectural character and cultural identity in the eyes of a few architects. The study, furthermore, tries to find out the need of the inheritances this cultural identity from old Pune to new Pune and how to do so. All this is done through questionnaires and interviews.

KEYWORDS— *Urbanization, Cultural Identity, Architectural Character, Cultural Heritage*

1 INTRODUCTION

Known for its Wadas, caves, the various colonial buildings, Pune draws attention to a vast number of tourists who come here to thrive in its culture. But slowly over the years, with changing time and technology, like all other places all around the globe, Pune too is succumbing to the loss of its original cultural heritage. This research 'What makes Pune look like Pune' is a study of salient architectural features that gave Pune its character and identity, and whether these features are as prevalent in today's age as they were a decade ago. It looks at the character of the city now and is being done to study what defines this growth or hampers it.

Cities and towns across the globe have been on a continuous expanse as a natural response to urbanization and a shift of population from rural areas to urban areas in search work etc. In this process of fulfilling the needs of the ever-growing need of the society and people and demand for construction, the construction industry has to adopt newer ways and techniques of faster, more efficient, types of construction etc... Herein, whilst making construction and newer built spaces more efficient or adhering to norms of construction and guidelines, is the character of the city undergoing major change? And is this change good or bad, necessary or unnecessary? The question also arises that are all cities beginning to look the same because of similar techniques, guidelines and rules, materials etc. that are being shared globally and the market becoming closely knit all around? If so, what's the need for elements that make a city unique, what are these elements, should they be incorporated, how can they be incorporated in design and if they aren't, why are they not being used?

The research will answer these questions to point out where exactly we as architects, are facing problems while maintaining the identity of this city, and whether it is wise to be holding on to it, or letting the growth lead us to defining the city in new ways.

2 LITERATURE REVIEW

After understanding the role of urbanization in shaping the city It talks about Americanization of the major cities like Tokyo and the process of westernization. It further differentiates the cities on the basis of its intermixture of various land uses, extensive areas of unplanned, haphazard urban development. It mentions concept like 'eye on the street' and 'highlights various other elements of the cities of Japan, both positive and negative. The second paper "A study of "Urban Heritage: Putting the past into the future" talks about the landscape approach of urban heritage which is different from the common approach of conservation of facades and materials of existing structures and new structures by justifying that 'cultural heritage management has been growing towards a more all-inclusive approach which also includes notions such as the intangible, setting and context, and urban and sustainable development, accompanied by a greater consideration of the social and economic function of (historic) cities. Then arises a need to bridge the gap between urban development and cultural heritage protection through the literary paper" A study of "Bridging the gap between urban development and cultural heritage protection". The paper establishes the need to develop systematic assessment methodologies for adequate consideration of the gap between cultural heritage management and sustainable urban development. Additionally, the paper brings the topic into relevance in today's ages by stating that 'the debate on the introduction of culture as a fourth dimension in sustainable development by both academia and practice is also having an echo at the international agenda for urban development.' A further study is done on a more local context in the paper "Effects of urbanization on historical heritage in a city in Tamil Nadu". It states with statistics that the number of metropolises in India with a million or more people has increased from 18 in 2001 to 53 in 2011 in merely 10 years, and that towns are undergoing a rapid transition due to urbanization without regard to their built heritage. It also concludes that the controlling can and should be done by the planning authorities.

3 AIM

1. To identify the different architectural features that give Pune its Cultural identity.
2. To know the presence of this identity in the present scenario of 2020 of the city.
3. To understand the requirement of the identity while designing.

4 OBJECTIVES

1. To conduct a questionnaire survey with different architects in the city.
2. To make analysis of the data thus collected

5 SCOPE AND LIMITATIONS

Analyzing of the difference in responses and gathering a substantial pool of data to draw more inferences. The sample pool consists of architects that are practicing or in the field of education. Therefore, the study is limited to architects only. The findings are within the scope of architecture as a topic.

6 METHODOLOGY

The type of research methodology used is Qualitative Research.

Primary data collection done through means of a questionnaire and interviews conducted (telephonic and table).



Figure 1: Research methodology Chart followed for identifying the critical factors that define Pune’s identity

7 DATA ANALYSIS

7.1 Pune’s salient architectural features that give it its cultural identity

TABLE 1

Historical Features	Wadas	6
	Arches	1
	Caves	1
	Temples	2
	Mandai	1
Town Planning	Open to built Ratio	1
	Compact City Planning	1
	Courtyards	2
	Staircases planning	2
Population	Population Rise	2

Table 1: Results for which architectural features the best reflect Pune’s cultural identity

7.2 Retention of Pune’s cultural identity in newer constructions

TABLE 2

Human Related	Awareness and Preference	Lack of support	1
		User Requirements	1
	Social Dynamics	Nuclear Families	1
		Privacy	1
		Social Status	1
Population	Increasing Population	2	
Architecture	Emergence of newer style	Contemporary Architecture	1
		Not in tune with the context	1
	Character	Wasteful Planning	1
		Unchecked Sprawl	1
Technological	Advancements	Faster methods	1
		Available materials	1

Table 2: Results for factors contributing to the change in Pune’s Cultural Identity

Discussion. The context being the need to develop places to meet the demand of the growing city, is not in tune with the architectural character.

7.3 Contributions to keeping the character of Pune alive

Responses

1. By bringing it up on the table of design wherever an opportunity arrives and incorporating as much as doable.
2. Urban poor housing programs, first River revitalization plan.
3. Suggested proposals, used arches.
4. Advocacy planning Posts on social media Academics Public lectures Training Government officials.
5. By visiting these spaces frequently, to attach to the ‘sense of place’.
6. Awareness, heritage walks, part of the wada culture.

Discussion. A good percentage of architects have tried to contribute to keeping the character of Pune alive but most in various forms on various platforms other than in their executed designs. They take part in spreading awareness and taking public lectures or educating the masses as well as students in turn trying to increase the sensitivity of students towards the local context of a city and its architecture.

7.4 Difficulties faced in proposing designs that preserve identity

TABLE 3

Awareness	Lack of awareness	2
	Lack of continuity of Purpose	1
Political	Political and system mechanism	1
	Corruption	1
Rules and regulation	DP rules and building codes	1
Technological	Advancements in technology	1
	Materials	1
End user	Clients needs	1
	Designer End user Civic sense	1
	Congregating like minds	1

Discussion. DP rules and building codes are making it harder to bring designs like these to reality. Technological advancements and materials availability makes it easier and optimum to construct faster and cheaper using more contemporary styles.

7.5 The importance and retention of the “sense” of a place

Responses

1. A sense of place sync’s with being at home and it can be retained by incorporating certain rules and guidelines to be practiced and approved in designing.
2. It’s a symbol of culture and identity characteristics, do he conserve.
3. The sense of a place is the change it undergoes over the years; it needn’t be constant and change is essential and part of urban growth.
4. Identify the Space and connecting to Soul.
5. Placemaking Needs to preserve and create in new proposals Retrofit in existing situation with contextual analysis.
6. Sense of a place does not come only from built form. Even roads and their typical edges create a sense of place. So, retaining any basic identifiable aspect of road network / built form can still retain the sense of place.
7. Living heritage, sense of belonging, space and place, belonging, planning also helps in retaining the proportions, open to built ratio.
8. By making it mandatory through the laws.

Discussion. The sense of a place can be retained by incorporating rules and guidelines an following them strictly, making it mandatory through laws is a suggestion and it is believed that even identifiable aspect of road networks can help in retaining it. More factors are open to built ratios. Some believe that change is welcome and the sense of the place is the change it undergoes over the years.

8 CONCLUSIONS

Wada culture which is the most commonly stated architectural feature that gives Pune its identity comes from the old part of Pune and is carried forward from historical times. In addition to this Mandai, temples and Caves are all part of Pune’s history but are still identifies as the features that give Pune Its character. Only a small number of people see Pune’s open to space ratio and built planning as a feature of its character thus highlighting the importance of Pune’s history in giving it its identity. However, despite this significance importance of the culture in shaping Pune’s Character, these elements are missing in today’s time as urbanization takes over the city. Many factors add up to this contributing to the loss of this cultural identity, such as lack of execution and implementation, changing times, materials, users and requirements, contemporary architecture, unchecked sprawl, wasteful planning, influx of people and changing social dynamics etc. This being the truth, all the architects responded that this should remain a factor while designing, especially whenever it is possible. The primary reason for this is to retain the regional context and cultural identity. This kept in mind, architects still struggle to implement this while designing or propose ideas which are eventually not implemented, due various factors like existing laws, politics, advanced technology and requirements of clients. So adversely, they contribute to keeping the character of the city alive by suggested proposals, advocacy planning, posts on social media, via academics, in public lectures, by training government officials, visiting such spaces, spreading awareness through heritage walks etc. But the sense of a place is being defined as its living heritage along with the open space ratio and planning of roads. A common suggestion is to retain the sense of place by incorporating rules and laws, making it mandatory and placemaking that preserves and creates new proposals to retrofit with existing situations.

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SUBTERRANEAN ARCHITECTURE A STEP TOWARDS LIVEABLE COMPACT CITIES IN INDIA

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ABSTRACT –

Rapid urbanization and rising needs of an ever-growing population are creating immense pressure on India's developing city fabric, especially the heritage cores of the cities which were not planned to sustain the rapid urbanization and support the unprecedented growth of the automobile industry. The increasing population has increasing infrastructural and spatial needs, which leads to Urban sprawl, a phenomenon faced by a lot of developed nations, that has become extremely prevalent in Indian cities. To tackle this scenario, a lot of countries have been exploring the subterranean dimension. The development of underground interlinked spaces in the city would mean more space available to cater to the infrastructural needs of the city, thereby opening up the congestion-free upper layer to more recreational space, and the spatial development for residential and commercial facilities. This would not only lead to more availability of space in the city but will also push the cities towards a more sustainable and efficient future expansion, eventually leading to a denser liveable city.

KEYWORDS –Urbanization, Underground, Cityscape, Urban Sprawl, Subterranean, Rehabilitation, and Hybrid.

1-GROWTH OF INDIAN CITIES

To cope up with the growth around the world post-Independence, most of India indulged in agriculture, whilst the urban part of the country was getting shaped in a radically contrasting way. The availability of cheap labour and resources invited foreign investors to India and people started moving to the cities in search of better employment opportunities and a better life. Thus, started the urbanisation of India. This radical shift towards the cities resulted in the rapid growth of cities in all directions. Since most of this growth was unprecedented, the city grew haphazardly. Unlike other countries, urban planning was a relatively growing field in India, hence the growth outpaced its planning principles and the city grew wherever the space was available.

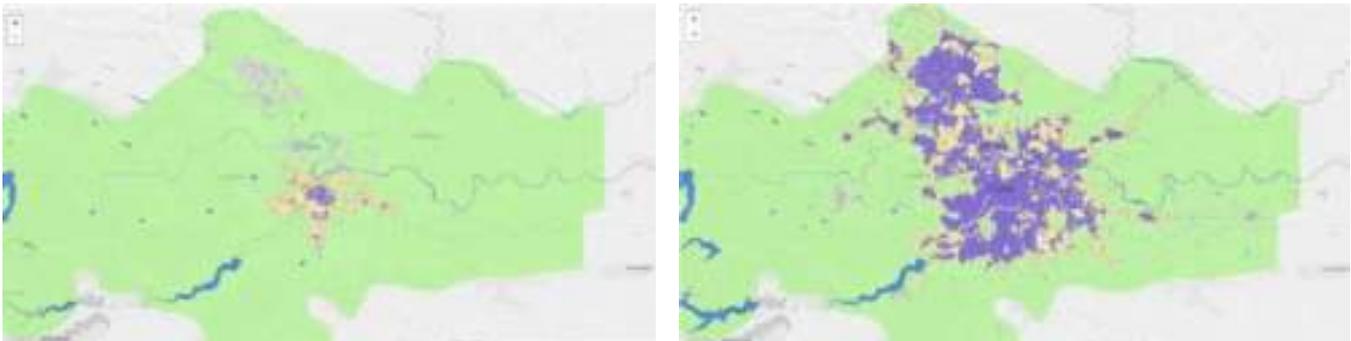


Image 1 and 2- Pune City from 1991 to 2011 (Atlas of Urban Expansion)

2-URBAN SPRAWL AND DILUTION OF CITY CORES

With the advent of the 21st century, cities became political, economical, cultural, and scientific centers of the world. A large number of city dwellers bring problems including urban sprawl. The constant influx of people from the rural to urban sector increases demand in unprecedented ways, and the city has to churn out substantial infrastructure for it. This constant migration forms a continuous cycle of development in and around the city.

Since India experienced all of this very rapidly, cities grew out of shape and started galloping over every square inch of land available around it. City cores being the epicenter of the body experienced a massive demand and were highly-priced. While the areas around the cities were relatively cheaper, it allowed people to stay away from the city chaos while remaining close to it and thus started the daily mass migration of people between suburbs and cities.

Years of development around the city opened doors for the citizens towards the suburbs, which led to considerable development on the outskirts. People's investment on the periphery of the city sucked the cities potential and diluted the value of the city centers. The center of the city is where the city bore to live. It is a direct portal to the past where the cities dawned. Just by walking through it makes you aware of the rich heritage of the core. Over the years people started moving outwards to live and the core of the city just became a district filled with commercial activities all around it. The Residential and Recreational activities around the core transformed into commercial markets, malls, and warehouses.

Urban Sprawl has resulted in:-

- 1-Loss of open green spaces and surface water bodies
- 2-Loss of flora, fauna and productive agricultural lands
- 3-Development of Car centric infrastructure and lesser pedestrian accessible zones
- 4- Unsustainable quality of living environment
- 5-No sense of specific architectural language or identity for a city
- 6- Massive pressure on existing public infrastructure
- 7- Loss of Human connect to the Heritage cores of the cities
- 8- Development of identical cityscape around the country.
- 9- Deteriorated quality of life.



Image 3, Congested core of Mumbai city (Outlook India)

3-INTERVENTIONS AROUND THE WORLD TO REDUCE SPRAWL

People around the globe have already identified the negative results that urban sprawl invites, and several strategies have been suggested to control urban sprawl, such as growth boundaries, infill development, and smart growth. Rather there is an alternative way to decrease urban sprawl, which not only reduces the sprawl but creates more space in the city – the development of underground spaces. Since ages humans have been using the subterranean spaces for religious activities, communal gathering, refugee purposes, and residential needs. It is in recent years that subterranean architecture is being widely used to cater to city needs.

To tackle the rapid urban sprawl in the early 20th century, the city of Chicago developed a series of interconnected tunnels and underground spaces consisting of pedways, subways, commercial hubs, transportation networks and parking lots to reduce the infrastructural pressure on the upper layer of the city. Helsinki in the year 2010 finished an underground city comprising of 10,000,000 m³ built underground space (parking, commercial and sports facilities, storages, stations) to create more usable spaces in the city. Similarly, the cities of Montreal, Beijing, Hong Kong, Singapore, London, and New York are some great examples of underground city development around the globe.



Image. 4. Extract of the Helsinki Underground Master Plan (Helsinki City Planning Department)



Image5. Montreal Underground Pedestrian Network (Go Montreal Tourism Guide. 2020)

India in recent years has also been indulging in the subterranean dimension. With the underground metro coming into the picture, sustainable usage of underground spaces in India is not a distant dream. Palika Bazaar in Delhi, is an epitome of a subterranean space created in the heart of the city to create more usable recreational open spaces above it.

4-USE OF UNDERGROUND SPACES TO DENSIFY THE CITY CORES AND CURB URBAN SPRAWL

Development of Suburbs on the outskirts of the core has created a “Doughnut effect” on the city, making the suburbs independent of the core. Thus, the core becomes a hollow region where a city once prevailed. A major move in regenerating the core of the city would be to infuse it with recreational and residential infrastructure. Considering the present condition of our congested cores, the future points us at the effective use of underground infrastructure to not only decongest the city, but also to build infrastructure without hampering the image of the heritage city.

By rehabilitating the existing functions underground, vacant space is created in the core of the city. These open spaces create recreational gardens and breather spaces that people need, in addition to residential and commercial projects that develop in the city. By developing the infrastructure and services required for the new projects underground, a “hybrid city network” is created, where the liveable spaces are on the ground, while the services and public infrastructure are developed below.

5-USE OF UNDERGROUND SPACES TO CATER TO THE INFRASTRUCTURAL NEEDS OF THE CITY

The principle behind this type of architecture is to determine which type of function or infrastructure will thrive underground, so that more open spaces are created on the surface layer. These spaces could be defined according to contextual requirements and implications or could also be the rehabilitation of existing infrastructure.

Functions to be built subterranean are determined as follows –

- 1-Recreational Spaces (Malls, Cultural Spaces, Theatres, Exhibition spaces)
- 2-Service Oriented (Fuel Storage, Sub stations, Power Plants and Waste water treatment plants)
- 3-Transportation Oriented (Metro, Subway, Parking and other Transportation Networks,)
- 4-Industrial Use (Warehouses and Industrial spaces)

The key to such projects would be to adapt synergy between both the upper ground and below-ground spaces. Establishing a mixed-use hybrid system of a network around the city is very crucial, and is the only way towards sustainable urban development.

It could mean having a warehouse beneath an underground parking facility with commercial development above. This leads to the effective use of limited land resources and also considerably reduces hefty commuting hours in the city. Whether it's utilizing the natural contours of a hillside or nestling under layers of soil, from culvert structures to earth berm houses, there are countless type of subterranean architecture to be explored right beneath our feet.

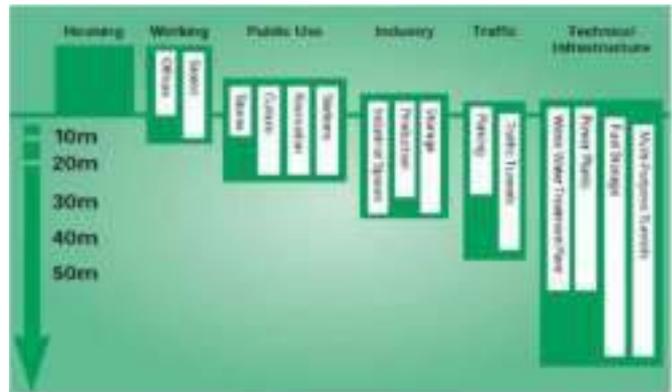


Image 6 - Feasible depths of Different Underground activities. Adapted from Ronka et al, 1998, Underground space in Land Use Planning, Tunnelling and Underground space technology Vol 13

Benefits of Subterranean Architecture

- Sustainable Urban Densification
- Effective use of land
- Preservation and Restoration of City Centres.
- Increased Productivity and Revenue in the long run.

While observing both the factors, the benefits of effective use of underground spaces go far beyond its limitations. It would be unjust to judge such projects based on economical or technological limitations since there are social, cultural, and sustainable factors that it tends to govern on a city level. If designed efficiently, this type of developmental approach will not only become a breather for the city but it can also be designed to be a commercial revenue-generating asset in the long run.

6-CONCLUDING REMARKS

The government of India is widely promoting the economic and sustainable development of smart cities across the country, and subterranean architecture should be a major consideration in this movement. The effective use of hybrid underground networks across the city would eventually lead to a much more liveable and compact city. With the advent of the underground metro project all across the country and the availability of modern technology, it can be concluded that unlike its past, India now has enough resources and a lot of potential to extensively plan and execute subterranean projects, to cater to the needs of its growing cities.

Although underground spaces have some negative effects, such as psychological and safety issues, such factors can be improved drastically by designers and operators, making the underground use an effective way of decreasing sprawl. Development of hybrid dense spaces in the city will not just magnetize people towards the centre, but also improvise with the social, cultural, communal aspect. The scope of such a development goes far beyond its economic and technical limitations, and can be a promising field of exploration.

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INVESTIGATING AN ARCHITECTS ROLE IN RURAL DEVELOPMENT: A STUDY IN THE INDIAN CONTEXT

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ABSTRACT

The purpose of this paper is to investigate an architect's role in development of rural areas. The study is conducted in an Indian context. This research paper discusses the challenges that an architect might face while working in rural areas. It explains the potentials for an architect working in rural areas. It also talks about the experiences of some Indian architects working in rural areas. The methodology adopted to complete the research was taking interviews of various architects practicing in rural areas. After talking to the architects, it was found that most of the architects are satisfied with their experience of working in rural areas. The challenges they faced were communication with the masons, transportation and hygiene. All the respondents feel that there is a lot of potential in practicing in rural areas. Furthermore, people are welcoming and respect the knowledge of the architects. There is also scope of making buildings energy efficient and sustainable. The responses received will act as a guide for new architects looking to work in rural areas. It will prepare them for the challenges they might face and also stimulate them for what awaits them while practicing in rural areas.

KEYWORDS: Rural development, Architect's role, Village, Architecture, Rural built environment, Indian Context, Village infrastructure

1.0 INTRODUCTION

A village is a clustered human settlement or a community with a population ranging from a few hundred to a thousand. Dwellings in a village are fairly close to each other and not scattered. Historically, villages were a usual form of community for societies that practised subsistence Agriculture.

According to World Bank (2005), rural development is the process of rural modernization and the monetization of the rural society leading to its transition from traditional isolation to integration with the national economy.

Rural development should aim at improving the quality of living, removal of unemployment, availability of unpolluted water and edible food, satisfactory education facilities and sanitary living conditions. Since time immemorial, India has been, still continues to be, and will remain in the foreseeable future, a land of village communities. The rural character of the economy and the need for regeneration of rural life was stressed by Mahatma Gandhi as (1936):

“India is to be found not in its few cities but in its 700,000 villages. But we town dwellers have believed that India is to be found in its towns and villagers were created to minister to our needs. We have hardly passed to inquire if those poor folks get sufficient to eat and clothe themselves with and whether they have a roof shelter for themselves from sun and rain.”

2.0 LITERATURE REVIEW

The paper “Rural Informatics in Indian governance” describes rural spaces as those that are outside the jurisdiction of municipal corporations and committees and notified town area committees. The rural-urban dimension in India continuously remained favourable to cities and towns and therefore the material blessings of the development are superior for urban individuals than for the rural masses. (Mishra, 2001)

The paper “Paradigm Shifting in Rural Development (2008)” by Anjani Singh states that, Rural development is equally involved with development of infrastructure and cottage industries, encouraging ancient crafts and industries, and providing decent low-cost homes for rural poor and also the depressed classes as with improving and remodelling the economic and social life of the rural poor.

The paper “Architect's Role in Rural Community Development” defines an architect's role as the method of conserving, improving and making the desired quality of the built surroundings under the particular condition of every community. It's the architect's responsibility that the ecological features and systems aren't adversely affected because of the changes occurring in the immediate surroundings. An architect can advise and educate native individuals on any enhancements made to their physical surroundings. An architect's role ought to be as a part of a group, collaborating in discussions with other community members (Akhimien, 2017).

In the paper “Promoting Infrastructure for Rural Transformation in India”, Keshab Das also brings to notice the fact that the population we are concerned with has very low levels of income and standards of living that their ability to pay is low. The economic opportunities for the rural poor failed to be created in a manner that would have energised the rural economy (Das, 2005).

The paper “Rural Development in Haryana” states that to provide optimum profit to the grass-root level, there is a requirement for coordination among numerous Government agencies and different establishments engaged in rural development. This can conjointly assist in minimizing the rural-urban gap in terms of basic infrastructure facilities essential for ‘Sustainable Development’ of a settlement. Moreover, the rural poor have to be compelled to participate in the development (Raheja, 2015).

While there have been past researches on how rural areas have developed over the years and how significant is an architect's role in development of rural communities, there are also published research papers on promotion of infrastructure for rural transformation and the challenges in rural development. But none of these discuss the challenges that an architect might face while working in rural areas, neither do they discuss the potentials and experiences of working in rural areas.

3.0 AIM

The aim of the research is to understand how architects can play an important role in development of rural areas and hence the country. It focuses on the probable difficulties an architect might face and the potentials for an architect working in rural areas as compared to urban areas.

4.0 OBJECTIVE

1. To identify the challenges faced by an architect working in rural areas
2. To explore the experience of architects working in rural environment
3. To understand the potentials of working in rural areas as compared to urban areas.

5.0 RESEARCH QUESTIONS

1. What are the challenges faced while working in rural areas?
2. What are the potentials of working in rural areas?
3. How is the overall experience of working in rural areas?

6.0 SCOPE AND LIMITATIONS

This research paper focuses only on architects working in rural areas. The responses of a few architects working in Central India, West India, South India and North India have been collected.

7.0 METHODOLOGY

The research is an attempt to understand the experience, challenges and potential of working in rural areas. The method followed to conduct this research was through interviews. The interviews were either telephonic or were sent through emails. The type of questions included in the questionnaire were both qualitative and quantitative. The interviews of architects working in rural areas was conducted.

The qualitative data collected included the challenges faced by individual architects, the potentials of working in rural areas and their overall experience of working in rural areas. The quantitative data included the type of work they were doing in the rural areas.

8.0 ANALYSIS

The methodology adopted for this research was taking interviews of architects either through telephonic conversations or over emails. There were seven respondents for this particular research. Out of the seven there were 42.9% women and 57.1% men. Of all the respondents 14.3% belonged to the age group 25-30, 14.3% belonged to the age group 31-36, 28.6% belonged to the age group 37-40 and 42.9% belonged to the age group 41 and above. Of the total responses received 28.6% architects are working in Northern India, 14.3% architects are working in Southern India, 14.3% architects are working in Central India, 42.9% architects are working in Western India. Out of the total responses received 100% architects are doing residential projects in rural areas, 14.3% architects are doing industrial projects in rural areas, 28.6% architects are doing commercial projects in rural areas, 28.6% architects are doing institutional projects in rural areas.

8.1 Challenges faced by the architects working in rural areas

It was revealed through the responses 42.9% architects responded stating that communication with the people in rural areas is difficult, 42.9% respondents are of the opinion that transportation is a problem that ought to be rectified, 14.3% of the architects feel that hygiene is also one of the problems that need to be addressed in rural areas. It was also revealed that suppliers and service providers are unwilling to provide services to smaller towns especially with respect to the summary and smaller requirements in terms of quantity.

8.2 Potentials of working in rural areas

The responses for this question were erratic. But all of the respondents are of the opinion that there is plenty of potential in working in rural areas. After going through all the responses received, it can be concluded that in rural areas there is less competition and comparison. The rural population is welcoming and respects the knowledge of architects and wish to see more development in their areas. Another advantage of working in rural areas is that easier construction techniques can be learnt from the local skilled labour. Also, there is plenty of scope for material exploration. There is opportunity to make the buildings sustainable and energy efficient. The primary motivation for architects should be to safeguard and adapt to the local skill. For working in rural areas, perseverance and patience is the key, making things happen for self is the most dominant factor if one wants to do justice to the profession. This can be achieved by involving and educating the client with the technicalities of the concept. The fees obtained in rural areas is comparatively low as compared to urban areas.

8.3 The experience of working in rural areas

It was revealed through the responses that most of the architects have had a satisfactory experience of working in rural areas. The responses reveal that working in rural areas is a satisfactory experience because of the opportunity to work with local craftsmen and natural materials. Problems like remote location of the site; lack of availability of materials and labour; difficulty in motivating the local craftsmen to pursue their traditional craft; mindset of rural individuals; socio-economic factors of the region and awareness of the client can make the experience of working in rural areas challenging as against working in urban areas.

9.0 DISCUSSION

The results of the research bring to light that although extremely challenging, there is plenty of potential in working in rural areas.

- The major issues faced by architects working in rural areas are transportation and communication. Other problems included that the masons do not understand the drawings, hence personal attention and more supervision is needed. Another major issue faced by architects is the unwillingness of service providers and suppliers to supply services to rural areas due to low income opportunities.
- The potentials of working in rural areas include possibility of exploration with design, use of locally available materials and traditional craft. The people respect and promote the knowledge of architects as they are eager for development in their region. There is an opportunity to learn new construction techniques that are easier as compared to the urban areas.
- The experiences of architects revealed that it is an enjoyable process even though it can be challenging sometimes. Material availability, newer construction techniques, opportunity to learn traditional crafts and use of natural materials make the experience

enriching. Whereas, problems like remote site locations, unavailability of transport and labour, mindset of rural areas can make the experience stimulating.

10.0 CONCLUSION

The research discusses how architects can assume a significant job in the advancement of rural areas. The investigation is led in an Indian setting. The research paper scrutinizes the difficulties, possibilities and encounters of different architects working in rural areas. This exploration can be utilized as a guide by architects hoping to work in rural areas. As indicated by the encounters of different architects, the local people respect the knowledge of architects and want to see more development in their region. The older people in the rural areas feel that if there is more development in their areas, relocation may stop at a specific level. Awareness of the giver and the taker, socio-economic factors of the region and mindset of rural India are the different variables that administer the experience of working in rural areas. The reactions gathered likewise showed that there are different issues, for example, communication with the local individuals, sanitation, transportation to the site, inexperience of the customers and the labour, reluctance of the service providers to supply in rural areas. The collected responses reveal that there is tremendous potential in working in rural areas. The architects bring notice to the fact that it is simpler to work in rural areas if one gets acquainted by working through some government body or NGO. Additionally, the essential inspiration ought to be to safe guard and adjust the local skills to current prerequisites. There is a great deal of scope to learn new and simpler building techniques, to investigate new materials and design utilizing locally accessible materials. Perseverance and patience are critical, getting things going for oneself is the most predominant factor if one wants to do justice to the profession, while working in rural areas.

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QUESTIONNAIRE

1. Area of work:

- 1) North India 2) South India 3) East India 4) West India 5) Central India

2. Type of work in rural areas:

- 1) Industrial 2) Residential 3) Commercial 4) Government 5) Institutional

3. Rate your overall experience of practicing in rural areas.

4. Give reasons for your rating in the above question.

5. What were the challenges faced by you while working in rural areas compared to urban areas?

- 1) Transport 2) Communication 3) Hygiene 4) Accommodation 5) Other

6. What are the potentials for an Architect for working in rural areas compared to urban areas?

ECO-SENSITIVE ZONE IN PUNE CITY: TALJAI

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ABSTRACT:

Eco-sensitive zone in a country like India has two aspects. One is government of India which is trying to protect and conserve the country's the natural heritage by declaring the eco-sensitive zones around the wildlife sanctuary and national park. On the other hand, there are the end users who tries to encroach the nature for their benefit. For e.g. who construct and build the housing projects around these areas to earn money, offering more living options for the increasing urban population. The increase of urbanization affects these green pockets. The statistical data collected from primary surveys shows the Built-unbuilt ratio, Footfall of that area (timewise), Visitors during festival time, temporary structures, affecting the animals and birds, etc.

The basic aim is to regulate certain activities around National Park and wildlife Sanctuaries so as to minimise the negative impact of such activities on the fragile eco system encompassing the protected area. In such areas mining, construction and other high-intensive activities should be restrained. At the same time these green pockets should be allowed and open the domestic needs of the native dwellers to avoid misuse and to control illegal activities that may happens in the areas like these. The balance between use and misuse or overuse of these eco-sensitive zones is the need of today's society.

KEYWORDS:

Eco-sensitive zone, lungs of the city, insensitive approach, over-use and mis-use

INTRODUCTION:

The eco-sensitive zone means the green pockets of the city. Eco-sensitive zones (ESZ) around Protected areas to prevent ecological damage caused due to developmental activities and National Parks and Wildlife Sanctuaries. Any area which surrounds a wildlife sanctuary or national park within 10kilometre radius termed as an eco-sensitive zone. The prime objective of the ESZ is to set up a kind of shock absorber for the protected area which will act as a transition zone from areas of higher protection (parks, reserves, etc.) To minimise the impact of urbanisation and other developmental activities, areas, adjacent to protected areas have been declared as Eco- sensitive Zone.

Feature of eco-sensitive zone:

- Biologically and ecologically rich
- Largely irreplaceable if destroyed
- High value to human society
- Maintain the ecological stability of area
- Conserve biological diversity

ACTIVITIES ALLOWED IN ESZ's:

Prohibited activities:

Commercial mining, saw hills, industries causing pollution (air, water, soil, noise, etc.) establishment of major hydroelectric project (HEP), commercial use of wood, Tourism activities like hot air balloons over the National Park, discharge of effluents or any solid waste or production of hazardous substances.

Regulated activities:

Felling of trees, establishment of hotels and resorts, commercial use of natural water, erection of electrical cable, drastic change of agriculture system, e.g. adoption of heavy technology, pesticides etc., widening of roads.

Permitted activities:

Ongoing agricultural or horticulture practises, rainwater harvesting, organic farming, use of renewable energy sources, adoption of green technology for all activities.

Tourism:

The tourism leaves behind garbage such as plastics bags and bottles etc. which lead to environmental degradation.

LIMITATION:

Scope of the subject is really vast if considered as PMC limits only as there are many hills and areas around such as Vetar Tekdi, ARAI, and Taljai Tekdi etc. But due to the lack of time, distances and the interactions needed with users for primary data collection; the focus of the research study was delineated to Taljai Hill only.

METHODOLOGY:

The eco-sensitive zones need to conserve because of these areas act as a shock absorber of the city. For the primary data collection, Taljai Tekdi area is chosen as a specimen. Taljai Tekdi act as the lungs of the Pune City at one time. The aim of the research is to highlight the changing scenario of the Taljai Tekdi which is shrinking in area day by day. For collecting the data, tools used were preparation of questionnaires and accordingly interviews of the users are taken at different time schedules, different periods and days. The objective behind selection of the taljai tekdi to understand the current scenario and give simple practical solutions to the issues if possible.

CASE STUDY: TALJAI TEKDI

The Western Ghats came in Eco-sensitive zones from which Taljai Hill complex, is an urban green space, is located in the heart of the city of Pune, Maharashtra. The road to this hill passes through the Shri Shivaji Maratha college campus with a picturesque mountain path, with sharp turns. Near the entrance of the forest is a temple to Taljai, a Hindu Goddess.

Above picture showing the land captured by the slums and the cricket stadium. The land pulling by the people illegally and now they are staying there for approximately 10-12 years. But because of the land pulling from green pockets it harms the birds, animals, trees also.



Fig.1
Current Situation of Taljai Tekdi
 [Source - <https://earth.google.com/web/>]

Fig.2
Current Situation of Taljai Tekdi
 [Source - <https://earth.google.com/web/>]

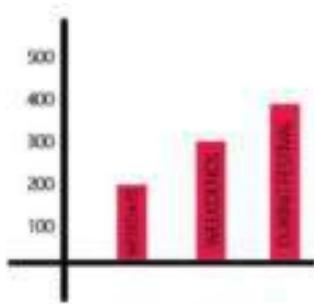


Fig.3
Count of Footfall from Interviews

The footfall of the taljai tekdi daily is approximately 100-150 and at the weekends it gets double. At the festive season like Navratri its approximately 400-500 people. The human intervention has increased since 10 years. Because of increase in number the inactive spaces in jungle they are getting disturbed. Those are the beauty of the nature which are harmed by people.

During Navratri festival so many temporary stalls are added in the existing ones. It creates more chaos. The human interventions increased and it affects the jungle area. Sometimes the waste, used glasses, paper plates, etc. might people throw in jungle. Because of these animals, birds get affected. These temporary stalls affect the climate also. Temperature of the surrounding starts rising.

No.	Name	Gender	Age	Location	Years	Timing	Frequency
1	Dattatray Ghorpade	M	44	Ambegaon Pathar	For 2 years	Evening	Weekends
2	Surekha Pawar	F	56	Parvati	More than 10 years	Morning or Evening	Daily
3	Atul Vanarse	M	47	Bibewadi	For 5 years	Evening	Weekends
4	Vila Pawar	M	56	Parvati	More than 10 years	Both	Daily
5	Vinayak	M	32	Sadashiv Peth	For 5 years	Morning	Daily
6	Satish Nipunage	M	61	Parvati	More than 10 years	Both	Daily
7	Mohankumar Bhandari	M	66	Aranyeshwar	Since than 10 years	Both	Daily
8	Asha Salvi	F	53	Dhankawadi	Since 2years	Evening	Not regular
9	Neha Deshpande	F	57	Bibewadi	Sine 2 years	Evening	Daily

USER’S OBSERVATIONS:

- People have noticed that trees have been cut down but new trees are not planted on it.
- Encroachment by slums is increasing.
- Corporation and Forest Department are Proposing new Indigenous Trees Plantation program.
- Plant more and more trees.

- High Rise Structures are obstructing the Fresh Air.

ISSUES:

1. Pollution control

Pollution level is getting increased because of the vehicular movements, human interventions, etc. In earlier days there were pleasant weather by the time it gets changed. But now a days, only in jungle area feels cool at some parts.

Recommendation:

The solution to control the air pollution is encourage the people to use cycles more and more. By adding the cycle tracks. And plant the pollution controlling trees like Neem, Peepal Tree, etc. also plant the local trees.

While selecting the species for pollution control the following are the important characteristics could be considered.

Plants should be evergreen, indigenous, ecologically compatible, low water requirement, minimum care, high absorption of pollutants, resistant pollutants, height and spread, Canopy architecture, Growth rate and habit (straight undivided trunk), Aesthetic effect (foliage, conspicuous and attractive flower colour), Pollution tolerance and dust scavenging capacity.

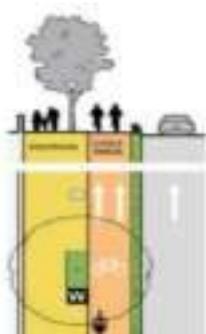


Fig.4
Cycle Track to encourage them to use cycles

[source -<https://www.itdp.in/wp-content/uploads/2014/04/07.-better-streets->]

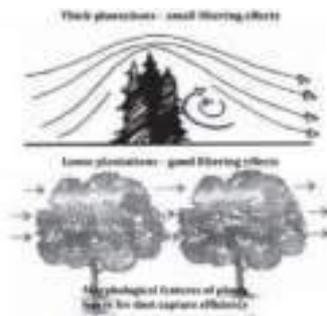


Fig.5

TYPES OF PLANTS SHOULD BE PLANTED FOR POLLUTION CONTROL

[Source - http://www.bepls.com/jan_2013/12.pdf]

TABLE-I
LIST OF POLLUTION CONTROLLING TREES

Scientific Names	Common Name
Cassia Fistula	Amaltas tree
Ficus Religiosa	Peepal Tree
Azadirachta Indica	Neem Tree
Bauhinia Variegata	Orchid Tree
Syzygium Cumini	Jamun Tree
Sapindus	Soapnut Tree
Jacaranda Mimosifolia	Blue Jacaranda

Scientific name	Common name
TABLE-II LIST OF LOCAL TREES	
Acacia catechu	Black Cutch Tree
Albizzia lebbeck	Siri's Tree
Butea monosperma	Flame of the Forest
Coccus nucifera	Coconut
Mimusops elengi	Spanish Cherry
Prosopis cineraria	Khejri Tree
Santalum album	Sandalwood
Tectona grandis	Teak
Terminalia elliptic	Indian Laurel
Ziziphus mauritiana	Indian jujube

2. Overuse of the tekdi

The current footfall of the tekdi at the weekdays is 100-150 and at the weekends are double. In the festival time it goes up to 400-500. And these people sometime use tekdi for the good purpose and sometime for the bad purpose also.

Recommendation:

So, to control the mis-use or overuse of the tekdi, limited people can visit in a day. The first come first preference can be given, at the specific time duration.

CONCLUSION:

In the recent years, so many green pockets are getting encroach by the people and their activities. This led to the deteriorating environment and affects 'the fresh air vs air pollution ratio' of the city also. To overcome these issues, conserving the green pockets becomes the need of the present period. Conservation of these areas includes increase in the pollution control trees, promoting local flora/fauna, formulating the directives for the use of these areas avoiding over use as well as mis use.

ACKNOWLEDGEMENT:

It is a great pleasure for me to undertake this project entitled- **Eco-sensitive zone in Pune city: Taljai**. I feel highly doing this project and I am and grateful to my project guide Ar. Shubhashri Upasani faculty member of SSMS college of Architecture. This project would have not completed without their enormous help and whenever I was in need, they were there behind me, and provided information regarding the same. Although this research paper has been prepared with utmost care and deep routed interest, even then I accept respondent and imperfection.

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THE SIGNIFICANCE OF DAYLIGHTING IN ROMAN CATHOLIC CHURCHES, CASE STUDY IN PUNE CITY

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ABSTRACT

The light is the symbol that can be found especially in religious buildings, through the creation of aesthetics. This connection can be found between believers and the architecture of the building. The aim of the paper is to consider how the 19th-century constructors of the Pune churches optically handled the visual space of the aisle, nave, narthex and transept, through the particular use of light. The paper is discussing upon the points of the orientation of the main axis of the churches that are correlated with astronomical paths and interaction between sunlight and church space itself. The survey will serve as an important example and also analyse other structures and architectural examples. The study focuses on how day lighting plays an important role in constructing churches. The conclusion of this study will be the principle behind the orientation of the church, which will be identified by following the path of the sun on the horizon and the church day lighting effect will be in tabular form according to time and space. This research study will help in the future for better construction techniques or designs using daylight in churches of Pune city.

KEYWORDS: Roman Catholic, luminous, Pune, orientation, aisle, narthex.

INTRODUCTION

Roman Catholicism, a Christian church that has been the decisive spiritual force in the history of Western civilization. It is one of the three major branches of Christianity. The Churches traces its history to Jesus Christ and the Apostles, in the early 30s of the Common Era. It was originated with the very beginnings of Christianity. Christianity reached India in AD 52 when Thomas the Apostle reached Muziris in Malabar Coast which is presently called the state of Kerala. The lighting in church is the most important element as it the main source of illumination and grandness of the space to obtain the peace of God. In many extensors the environmental and functional elements are integrated with both construction plan and orientation (Ivanka Stipančić-Klaić, 2015). The Natural light connects the peace of a person to the divine. The author examined the orientation of the building and its fenestration in relation to astronomical research on the timekeeping system of the church and the movement of the sun during the year and each day of the year. This paper presents a qualitative and quantitative approach to natural lighting comparing St. John Paul II Catholic Church, St Patrick's Cathedral Church, St Xavier's Cathedral Church, and St. Anthony's Catholic Church. Daylight is a combination of sunlight, skylight, and the reflected light from the facades and the ground. This will be a multiple case study method in four churches that will be considered, investigating the spatial structures and lighting in detail. The day lighting analysis will be done using a luminous meter at various spaces such as Aisle, Transept, Nave, and Narthex. The data analysis will be based on the lighting level of the various duration of time (9 am, 11-2 pm, and 3 pm) of the spaces mentioned above.

NEED FOR STUDY

This research study will help in future for better construction techniques or designs using daylight in churches of Pune city.

METHODOLOGY

As per the methodology, multiple case study methods have been used to analyze the luminous intensity of four churches. As a tool, visual observation, luminous meter application, and sun path diagram used for the analyzing sun position application.

Case 1 – St. John Paul II catholic church

It is located near Prerana Bhavan, Opp. Akshara School Survey No. 93, Tathawade Village, New, Bengaluru - Mumbai Hwy, Pune, Maharashtra 411033. It has a small entrance but the inside space is quite large. The church is purely Gothic Architecture in style. There were 2 aisles of seating (Gomes). As per the orientation of the church maximum luminous intensity is in Narthex. The luminous intensity observed there is –

TABLE-I The luminous intensity measurements of St. John Paul II catholic church

Space	9AM	11 – 2 PM	3PM
Aisle 1	40 – 50 lx	65 – 70 lx	50 – 55 lx
Aisle 2	55 – 60 lx	72 – 80 lx	60 – 65 lx
Nave	45 – 50 lx	55 – 60 lx	45 – 48 lx
Narthex	175 lx	110 – 120 lx	100 – 105 lx
Transept	60 – 65 lx	70 – 100 lx	90 – 100 lx

(Author, luminous meter application)

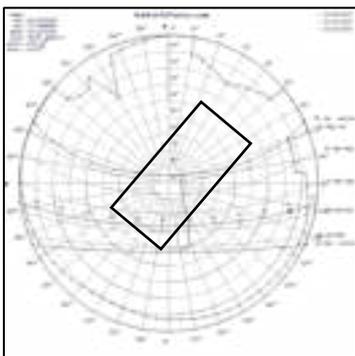


Fig.1-Sun path diagram of 9am
(Sunearthtool)

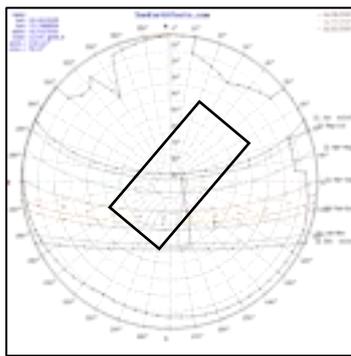


Fig.2-Sun path diagram of 12pm
(Sunearthtool)

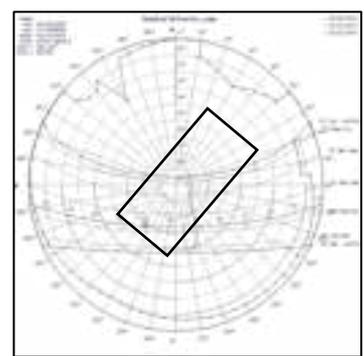


Fig.3 Sun path diagram of 3pm
(Sunearthtool)

Case 2 – St Patrick’s cathedral church

It is located at 1B, Prince of Wales Dr Rd, Ghorpadi, Pune, Maharashtra 411001. (Principal) It is located adjacent to the ‘Empress Garden’ in Pune. Built in Neo – Gothic style in the middle of the 19th century. It was adopted as 'cathedral' church when Pune was made diocese, of

which it is still the main church. It also has the highest number of parishioners of the Pune diocese. The church is purely Gothic Architecture in style. (Wikipedia). It has arches in between the seating. There are 4 aisles of seating. As per the orientation of the church maximum luminous intensity is in Aisle. The luminous intensity observed there is –

TABLE-II The luminous intensity measurements of St Patrick's Cathedral Church

Space	9AM	11 – 2 PM	3PM
Aisle 1	250 – 300 lx	650 – 700 lx	290 – 300 lx
Aisle 2	100 – 110 lx	160 – 170 lx	110 – 120 lx
Nave	60 – 65 lx	120 – 125 lx	75 – 80 lx
Narthex	25 – 30 lx	40 – 45 lx	25 – 30 lx
Transept	70 – 90 lx	110 – 180 lx	100 – 125 lx

(Author, luminous meter application)

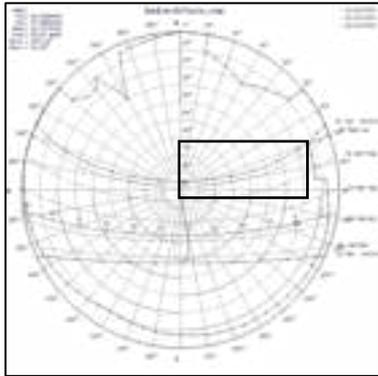


Fig.4-Sun path diagram of 9am
(Sunearthtool)

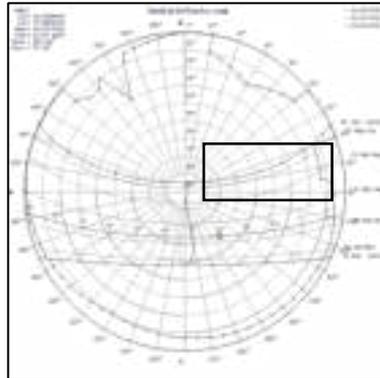


Fig.5-Sun path diagram of 12pm
(Sunearthtool)

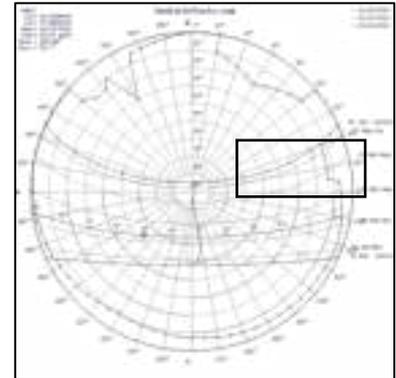


Fig.6-Sun path diagram of 3pm
(Sunearthtool)

Case 3 – St Xavier’s cathedral church

It is located at 2007, St Vincent St, Camp, Pune, Maharashtra 411001. It is over 150 years old church. The church is totally built as architectural style. It has proper transept seating inside it. The bell tower is at the south side of the church. The church is purely Gothic Architecture in style. There were 2 aisles of seating (Bookshop). As per the orientation of the church maximum luminous intensity is in Aisle. The luminous intensity observed there is –

TABLE-III The luminous intensity measurements of St Xavier’s Cathedral Church

Space	9AM	11 – 2 PM	3PM
Aisle 1	120 – 125 lx	150 – 160 lx	135 – 140 lx
Aisle 2	125 – 130 lx	130 – 135 lx	110 – 120 lx
Nave	20 – 30 lx	25 – 30 lx	15 – 20 lx
Narthex	65 – 70 lx	70 – 80 lx	60 – 65 lx
Transept	25 – 30 lx	30 – 40lx	20 – 25 lx

(Author, luminous meter application)

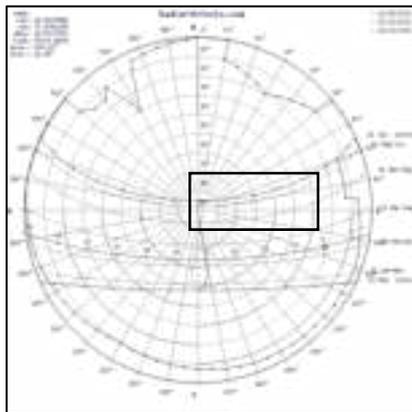


Fig.7-Sun path diagram of 9am
(Sunearthtool)

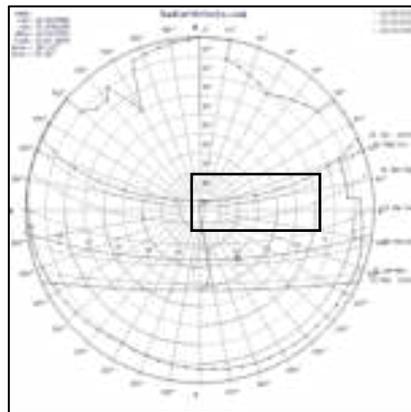


Fig.8-Sun path diagram of 12pm
(Sunearthtool)

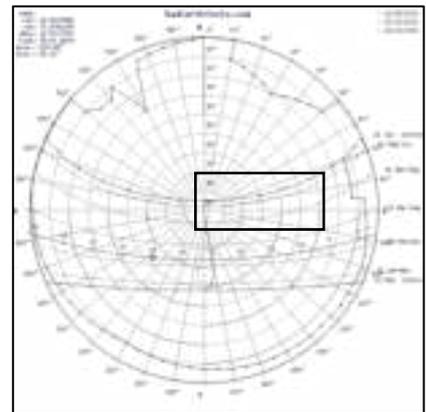


Fig.9-Sun path diagram of 3pm
(Sunearthtool)

Case 4 – St. Anthony's catholic church

It is located in model colony, Shivaji nagar, Pune, Maharashtra 411016. The church was built in 1965. There were 3 aisles of seating. It has columns in between seating which gives 3 aisles. The church is Contemporary architectural style (Principal). As per the orientation of the church maximum luminous intensity is in Narthex. The luminous intensity observed there is –

TABLE-IV The luminous intensity measurements of St Anthony’s Cathedral Church

Space	9AM	11 – 2 PM	3PM
Aisle 1	90 – 100 lx	135 – 140 lx	100 – 110 lx
Aisle 2	70 – 80 lx	80 – 85 lx	90 – 95 lx
Nave	80 – 85 lx	90 – 95 lx	95 – 100 lx
Narthex	100 – 120 lx	190 – 195 lx	150 – 155 lx
Transept	45 – 50 lx	60 – 70 lx	50 – 55 lx

(Author, luminous meter application)

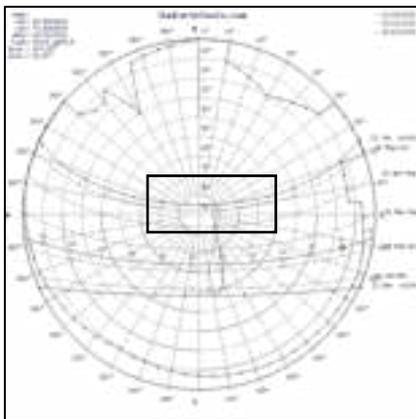


Fig.10-Sun path diagram of 9am
(Sunearthtool)

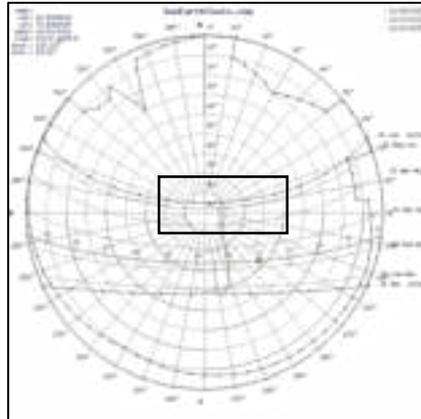


Fig.11-Sun path diagram of 12pm
(Sunearthtool)

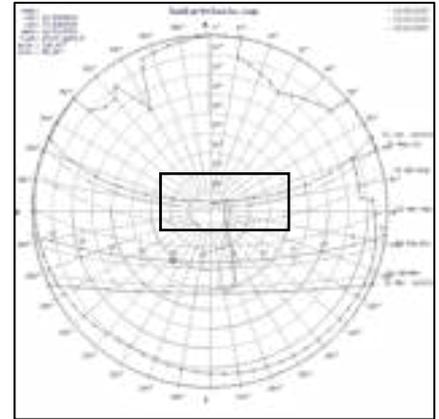


Fig.12-Sun path diagram of 3pm
(Sunearthtool)

ANALYSIS

Based on data presented, the maximum luminous intensity required is in Aisle and Narthex as per the Pune churches for the reading of the holy bible. The window positions along aisles and entrance foyer at narthex given more preference than other spaces such as nave and transept. As per the presented data, the deviation plan from true east at the St. John Paul II Catholic Church, Permet is 40°, and St Patrick's Cathedral Church, St Xavier's Cathedral Church, and St. Anthony's Catholic Church, Permet is 0°.

TABLE-V The compass measurements deviate from the true east orientation

Churches	Deviation from the true East
St. John Paul ii catholic church	40°
St Patrick's cathedral church,	0°
St Xavier's cathedral church	0°
St. Anthony's catholic church	0°

(Author, Compass application and sun earth tool)

CONCLUSION

Based on the author's survey the orientation of the churches is done in accordance with astronomical principles, following the path of the sun on the horizon. This has been a case with St. John Paul II Catholic Church, St Patrick's Cathedral Church, St Xavier's Cathedral Church, and St. Anthony's Catholic Church. The windows position and lightings applied seem to have been selected taking into consideration the quality of the interior lighting and the ability of the human presence. It should be in that direction that the light intensity should be enough for reading. Also, Narthex should be well lighted. The sun path diagram of the different intervals of time shows how the path of the sun is followed for churches. It relates the church axis to the path of the sun. It shows how the orientation of all churches is done according to the path of the sun at different intervals of time. The timings show the peak hours when the rays of the sun will be beneficial to take readings i.e., 3 sun path diagrams are considered. It is noted that the sun is more or less aligned with the openings. The windows position and lightings applied to seem to have been selected taking in consideration the quality of the interior lighting and the ability of the human presence, which is analysed by visual observation in all churches to understand how the light is entering into the church and the quantity of light required inside the churches. It also helps to understand how it is affecting the quality of the interior of the church with human presence.

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EXAMINING TOURIST INFRASTRUCTURE OF PUNE

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ABSTRACT

The globalized age of modernity is characterized by its fluidity and complexity Bauman (2010). The changes in this era has influenced the way people travel, and connect to the physical environment around them. Tourism has become one of the largest serving industries in today's time and the way a city is developed to meet a particular standard of tourism has been one of the focal points for the governments of many countries/cities. Many countries for example, Singapore, Australia, Indonesian countries etc, generate high revenue due to their increased tourism activities in the past 2 decades. India is one of the fastest developing countries in world and has worked on improving its tourism infrastructure by developing its cities. Maharashtra is the third largest state in India having 36 districts attracting thousands of tourists every year. This research paper focuses on one of Maharashtra's most developed cities, Pune and understanding its extent of tourism and infrastructure development. The objectives of this research paper are to examine what factors increase tourism within a city, to understand general standards of tourism infrastructure adopted by the government and whether Pune as a city meets those standards or not and also to gain insights on how Pune can improve its tourism infrastructure.

KEYWORDS- *Tourism, Experience, Tourist experience, Tourist infrastructure, Intangible, evaluation, Diversity, Tourist satisfaction*

1. INTRODUCTION

Tourist experience or experiences in general are argued to be subjective, intangible, continuous, and highly personal. The experiences, hence evaluated is the focus of much of the tourism experience research where experiences are defined as being within a person who is engaged with an event on an emotional, physical and spiritual level. The tourist experience is a complicated psychological process. Tourist experiences are arguably different from everyday experiences. Tourism offers complex experiences, memories, and emotions related to places, and what a person feels is her or her own subjective experience. Therefore, as the tourist experience is highly subjective, it can be interpreted only by referring to different people in different settings, time and place.

Tourism involves people traveling from one place and staying in places outside their usual environment for leisure, business or other purposes. Tourism Infrastructure demands for goods and services, and the establishments which provide similar services are considered as part of the tourism industry. Tourist infrastructure thus includes basic infrastructure components like airports, railways, roads, waterways, electricity, water supply, drainage, sewerage, solid waste disposal systems and services. Also, facilities like accommodation, restaurants, recreational facilities and shopping facilities also comes under the ambit of Tourism Infrastructure. Planning for development of Tourism Infrastructure, therefore, involves the continuous development of basic infrastructure and amenities along with all the tourism facilities in a balanced manner.

Pune is one of the most well-known tourist places in Maharashtra. The spectacular historical monuments from the Maratha period and many places of tourist interest add to the city's diversity. Shaniwar Wada, Sinhagad Fort, Osho Ashram, Dagdusheth Ganapathi, Pataleshwar Cave Temple, Rajiv Gandhi Zoological Park, Shinde Chhatra, Raja Dinkar Kelkar Museum, National War Museum, Bund Garden, Saras Baug, Parvati Hill, Aga Khan Palace, Rajgad Fort and Darshan Museum are the some of the prominent attractions in Pune. Pune is considered as the cultural capital of Maharashtra and is renowned for its cultural activities such as classical music, spirituality, theatre, sports, and literature.

3. AIM

The aim of the research paper is to understand general standards of tourist infrastructure and development and to examine whether or not Pune, as an upcoming and fast developing city meets those standards or not.

4. OBJECTIVE

The objective of the research paper is to fully understand perspectives of people coming from culturally different places and examine what Pune as a city has to offer in terms of its tourist infrastructure. Interviews of the tourists taking part in the Pune-Darshan tour, along with survey with interaction with the tours will aid in achieving better results intended for the aim of the research paper.

5. RESEARCH QUESTION

Does Pune meet the generally accepted standards of tourist infrastructure?

6. METHODOLOGY

According to Banyai and Glover (2011), it is essential to conduct an ethnographic study instead of concentrating on just one research method. An ethnographic study will help to understand the variety of responses differing from person to person on the basis of their ethnicity. Since the environment everyone lives in is different, their experience after visiting a particular would be different. Hence, the 'standards' of tourist infrastructure and development will be different for international travellers and for inter-city travellers. Thus, A variety of methods should be used to understand the experience tourists have with respect to the infrastructure they are a part of. Mixed methods are essential to explore the true meaning that the tourists assign to their individual travel experiences. Tourist experience being highly subjective and differing from person to person, age wise, nationality wise and a variety of other factors, a Quality study of the experience was done.

Tourism has become one of the leading factors the governments of today's world have been keen on improving as it has shown results in improving the overall growth of the city. Hence the number of tourists that a particular city/country attracts are important statistics in today's world. Hence, a quantitative study was also done to examine on an average the number of tourists who visit Pune.

Hence, interviewing the tourist, online survey forms and participant observation were taken up as the research methods. Thus, only the people who took part in the tour were selected as the main sample of the study.

Pune darshan tour handles various types of tourists. The tour gives an overview about Pune as a city showing its most culturally acclaimed and heritage sites. The tour is conducted all throughout the day starting at 9 am and continues till 9. Tourists are given the freedom to choose the sites they get off or on at. They can be tourists travelling internationally, tourists travelling from different cities and people within the city who take part in the tour. Thus, different types of tourists were interviewed at the end of the Pune-Darshan tour to gain a broader perspective as to how different types of people react or connect with the city's infrastructure.

The selected sample of study was divided into 3 groups:

- 1) Within- city travellers
- 2) Inter-city traveller (nationality-Indian)
- 3) International travellers

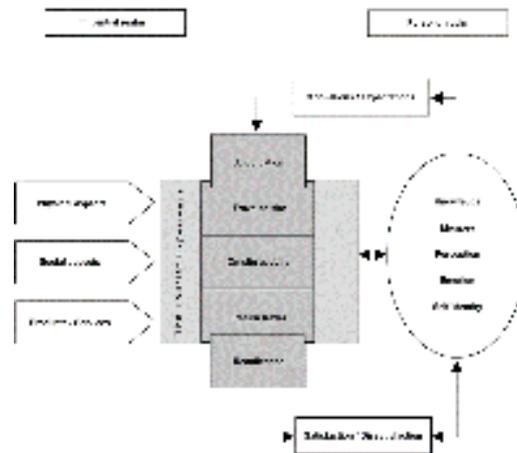


Figure 1. The tourist experience conceptual model of influences and outcomes.

7. DATA ANALYSIS:

Once the sample was selected, a total number of 22 people were interviewed at the end of the Pune-Darshan tour. Out of them 45% (10 people) were inter-city travellers, most of them travelling to Pune for the very first time, 27.2% (6 people) were international travellers and 27.25 (6 people) were travellers within Pune. Each person was asked a set of 5 questions where in they described their overall experience of the tour, gave inputs on how they would like the tour to be update or improved and also described if they faced any inconvenience during the course of the tour.



Figure 2: Pie chart showing tourist experience of the tour

50% of the tourists responded to their experience of the tour a 'Good', 31.8% of the tourists felt that their experience of the tour was satisfactory and 18.2% rated their experience as 'Very good'.

Based on their experiences of the tour, the tourists were asked what additions they would suggest to enhance the experience of the tour. The most commonly given suggestions by the tourists:

- 1) Make tour more interactive
- 2) More time at some stops to roam around the city
- 3) Updated information for the guides
- 4) Better organisation
- 5) Updated list of places to visit
- 6) Better translation skills of the guides for easy understanding
- 7) Multiple guides
- 8) Outskirts of Pune should be included
- 9) Better time management
- 10) Tour to be customizable
- 11) Better security

On the basis of responses given by the tourists, the main categories of improvement for the Pune-Darshan tour rely on regular updating of the tour and its organisation, Better interaction of the guides with the people who are a part of the tour.

The main area of improvement for the tour, on the basis of the data collected has to be Timely-updation of the tour to cope with the fast developments happening in Pune. The tourists will thus know Pune for its rich cultural and heritage as well its recent development in modern times.

The idea of tourism has been evolving over the years, thus the tourists should an entire overview of what Pune really is in terms of its infrastructure whether it be new or old.

Out of all the tourists interviewed, International tourists and inter-city in particular did not know the developed side of Pune. Pune is known widely for its 'Shaniwar wada', and it has been one of the most popular tourist destinations in Pune, but most of the people who were interviewed were completely unaware of the new developments within Pune and loved to see those sites which were the Bund garden area, Kalyani nagar, Magarpatta city and also the emerging multiplexes such as phoenix mall in Viman Nagar.

Most of the tourists liked the Pune-darshan tour when they were asked about it but had insights on how to improve the over all functioning of the tour. Since at a time there are about 30-40 people boarding the same bus and commencing the tour , most people felt the need of increasing the number of tour guides so as to further split into smaller groups as per individual convenience into groups of 5-10. Some of the international tourists actually suggested of having interpreters at all time if not guides specially in places where they stopped to shop. 80% of the travellers within Pune who took part in the tour were actually accompanying their friends or family members and actually had to stay that the Pune-Darshan tour has not been updated enough with the changing trends. Since, Pune has developed immensely in the last 10-20 years, the developed parts of Pune are not really accounted for.

Pune as a city has a lot of offer in terms of its rich culture and heritage and that, according to a lot of tourists shines through all throughout the tour. Most of the people know Pune for its huge wadas, peths, its city area, mainly the 'Shaniwar Wada' but what was lacking during the course of the tour was also including the parts of Pune that have emerged in the recent times.

8. CONCLUSIONS

Pune has seen an increased number of tourists over the years. But, most of the people who visited only knew about Pune's heritage and historic sites namely, The Shaniwar Wada, Aga Khan palace and The Kelkar museum. A very few number of people from the selected sample apart from the within Pune travellers, did not have an idea about the recent developments in the city. They discovered a new side of Pune only while travelling through the streets of Pune and were unaware of the developed parts like the Bund Garden area, Koregaon Park, Magarpatta city etc. Developing tourist infrastructure has proven to have positive impacts on the economy such as employment generation, it lead to an increased demand of local arts and crafts, and it lead to preserving historical monuments and that is why governments today spend a lot of money from their annual budgets and invest them in developing tourist infrastructure.

In conclusion, Pune has shown considerable growth in terms of its tourism infrastructure but it is not promoted enough for the wider masses to really know what Pune is about. There are various ways to promote tourism for your own city specially through digital media, creating websites, publicizing ongoing infrastructure development schemes. Pune has been a leading IT hub and an upcoming metropolitan city. Inter-city tourists fairly know the large-scale development happening in the city but to attract foreign tourists an increase their tourism, promotion of Pune and its infrastructure needs to be done with regularly updated information and timely reinforcements within the infrastructure.

9. ACKNOWLEDGMENTS

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NATURAL GEOMORPHOLOGIC WONDER (HERITAGE) SITE DEVELOPMENT - Nighoj Riverrine Potholes

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ABSTRACT

There are many natural heritage sites are present in the world, some are get developed because of their popularity and some are still lesser known, but they have a rich natural ambiance. The Nighoj Riverrine potholes are also a lesser known geomorphologic wonder this potholes are the biggest potholes in the Asia it gets recorded in the Guinness book of world record. That place has a religious, tourist and geomorphologic researching background. So there is a need of development considering with all the perspective of that region.

The importance of the natural geomorphologic heritage site, the parameters of development in such cases, the need of the development and which activities are done there in every year these are the objectives of the study.

The study is completed by the data collection and through case studies. For data collection live observation, internet, map, audio call these techniques are used and for case study two methods are used live case study and internet case study, live case study is done through the observation and taking some interviews.

Such sites are come under the government, archaeological survey in India (ASI) give some rules for development of sites like this. The sites like this are come under the UNESCO. In people mind so many wrong perspective are made for such site so for creating awareness, the development of the heritage site is necessary, it helps to increase the site potential value.

This study presents site potential of the natural geomorphologic heritage site.

KEYWORDS - Geomorphologic Site, Importance, Development, Rules, Awareness.

INTRODUCTION

A natural wonder must be a clearly defined natural site or natural monument that was not created or significantly altered by humans. Natural heritage refers to the sum total of the elements of biodiversity, including flora and fauna, ecosystems and geological structures. An important site of natural heritage or cultural heritage can be listed as a world heritage site committee of UNESCO. India has an astonishing array of natural wonders. Some are pretty well-known and undeniably spectacular, while others are less-discovered. Nighoj Riverrine Potholes are lesser-known natural wonder in India. The Nighoj Riverrine Potholes are the largest in Asia according to geologists. This archeological gigantic pot-holes, locally called as Ranjankhalage. There natural archeological gigantic potholes recorded in Guinness book of world record. Geologists indicate that formerly there was greater rainfall in this area and that the Kukadi River flowed out from the highlands with such force that scouring of the bedrock took place and resulted in the formation of these potholes. So there is need of development to make this place as a tourist attraction point.

AIM

To study the parameters and principles for development of natural geomorphologic sites.

OBJECTIVES

1. To study the importance of the natural geomorphologic heritage sites.
2. To study the need of the development.
3. To study the activities are happening there yearly.
4. To study the parameters of development in such cases.

SCOPE

Study focuses on the development of the geomorphologic site to enhance the value of site and increase the awareness in people regarding the site formation.

LIMITATIONS

Study is limited to the world famous Asia's biggest riverine potholes site in Nighoj village.

NEED OF THE TOPIC

Experts from all over the world comes Nighoj every year to study the phenomenon of their formation. [1] And there is not any development done still now regarding for the researchers, visitors, students and for deities. So there is necessity of development, to create this place tourist attractive as well as creating an environment for researchers. And also there is so many misunderstanding are made in people mind about formation of the potholes, so awareness for that is necessary. For that study of such natural geographical wonder sites is necessary.

METHODOLOGY

The study is completed by the data collection and through case studies. For data collection live observation, internet, map, audio call these techniques are used and for case study two methods are used live case study and internet case study, live case study is done through the observation and taking some interviews.

DATA COLLECTION

Study Area & their Importance

Nighoj is a village in Ahmednagar District, Maharashtra, India. It is about 90 km away from Pune and is famous for the naturally created potholes on the riverbed of the Kukadi River. [2] The potholes are been nearby between 2-3 km length and 10 m widths above 25 m in depth. Near the river basin, temple of goddess Malganga is situated. These potholes are the boundary line for two districts Ahmednagar and Pune. There is also one temple is present at Pune side near to that small guest house, marriage hall & information center is present. At the center of the Nighoj village Malganga temple and one step well is present.

Local Story & Need of Development

Long ago on one night seven sisters traveling from far off land reached this place and decided to settle here, and they made the riverrine potholes in one night. The Malganga temple is the temple of elder sister. The temple opposite (toward the village) is of second sister, there is another temple 1 km after to these temples that is for 6th sister. There is also a temple in the village of another one sister. It is also believed

that once a year a pot/plate emerges from the step well present in village. Initially it was of gold, later of some metal, now earthen. The people are following many rituals which are really dangerous superstitions. Regarding awareness and increasing research and study value of site is necessary.



Image 1 Main study area (ExTUnex Creations)

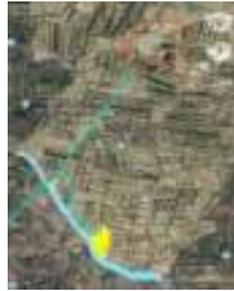


Image 2 Mapping (Bhunaksha)

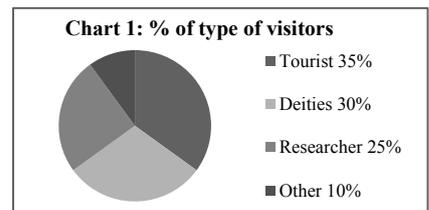


Image 3 Malganga Temple (nighoj.wordpress.com)

Table-I: Yearly Activity Schedule

Month	Activity
January-February	Less visitors are come
March-April	Festival of goddess Malganga is celebrated
May	Less visitors are come
June-July	Visiting time, more visitors are come
August-September-October	Janmashtami and Navratri celebration
November-December	Less visitors are come

Yearly Activity Schedule & % of type of Visitors



Places Near to visit

Parner Region: Padali Darya, Dhokeshwar Caves, Shahanjapur : Wind Mills, Mandohal, Ralegan Siddhi. Morachi Chincholi.

Parameters of Development

In such cases some rules are present for development to conserve that place from litter and to lose their natural value. The site development need to be done according to the ASI rules. For conservation of site construction in surrounding to 500 meters area of that natural wonder is banned. And for increase the site potential and enhancement of site importance government have some development policies. But this site is not still got developed. There local Grampanchayat authority just reserved some place for development but what development is needed to be does they don't know.

CASE STUDIES

Lonar Lake

Incredibly old at 50,000 years, the Lonar crater is the youngest and best preserved impact crater formed in basalt rock and is the only of its kind on earth. The crater was formed fifty-two thousand years ago, when a gigantic meteor crashed into the earth at an estimated speed of 90,000 km per hour. [3]

Borra Caves

Most people have never seen a real cave in their whole lives; still, those who do remain permanently fascinated by the amazing display of natural forces. The rock formations at the Borra caves (located in the Ananthagiri hills of Andhra Pradesh's Araku Valley) are proof that wonderful things can appear when water meets limestone. [3]



Image 2 Lonar Lake (natgeotraveller.in)



Image 3 Borra Caves (indiamart.com)

Table-II: Case Studies Data Collection

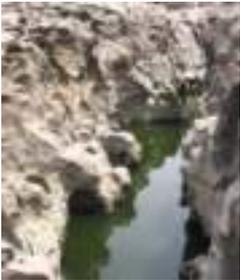
Name	Lonar Crater	Borra Caves
Study Details		
Location	Lonar, Buldhana district in Maharashtra, India.	Borra Caves, Vishakhapatnam district in Andhra Pradesh, India.
Surrounding Context	Surrounded by jungle spread with various trees & inside by a belt of bare muddy space.	Present in Ananthagiri hills of the Araku Valley. It is in the Gostani River. [4]
Geomorphologic Context	A series of small hills surrounded the basin which has an oval shape with circumference at top of about 8 km.	Various types of rocks, sediments, laterites, pediment fans, colluviums, alluvium & coastal sand are present. [4]
Existing Activity	Used for researching and many visitors are daily comes there. At ancient time they made washing soda out of that lake water.	People are come there for religious activity as well as to see the beauty of the caves. People visit the gardens, rich natural mountains, caves formation & study.
Concerns for future development	Surrounding development in between 500 meters circle is banned. Therefore redevelopment of residences work is in process now. And at current stage new research centre, planetarium, resort, information centre construction work is in process.	Now their main concern is develop the Borra caves more attractive for tourists. And they also want to provide more amenities to visitors.
Site values	It has more research oriented and religious background. It has rich flora & fauna and it also gets developed as tourist place.	Main Borra cave has religious aspects. As well as biological and archeological study value, because of rare flora and fauna.

Findings	In 2000 Lonar got ‘A’ class as tourist place. MTDC did lot of development there.	This cave is the largest cave in the world. It is developed as a tourist attraction point, so many people visits this place.
Inferences	The development in Lonar is truly well done as a researchers and visitors point of view. Lot of people are come there to study and see the natural wonder.	The people are come to visit Borra Caves, for religious purpose and to see unbelievable drained scenario is a reason of development near to Borra Caves.
Photographs	  <p>Image 4 Lonar Crater Top View (earthobservatory.nasa.gov)</p> <p>Image 5 Religious Activity (happyfeet.us)</p>	  <p>Image 8 Top of Borra Caves (google map)</p> <p>Image 9 Araku Valley (en.wikipedia.org)</p>

OBSERVATIONS & INFERENCES

Study Area

Table-III: Site Analysis of Study Area

Site analysis concerns	Nighoj Riverrine Potholes		
Location	Nighoj is a village in Ahmednagar District, Maharashtra, India.		
Surrounding Context	It is about 90Km away from Pune and is famous for the naturally created potholes on the riverbed of the Kukadi River.		
Geographical Context	Over the years, in this geographical phenomenon where the pebbles are carried by the river get locked in the cracks developed in the basalt rock riverbed.		
Hydrology	Formerly there was high rain fall in this area. The kukadi river is a main water resource of the Nighoj village.		
Topography	The main river basin is made up of potholes. The land surrounding to the potholes is little up and down basalt rock.		
Geology	The small hard pebbles vigorously swirl in these wear out areas due to flow of the water to create circular potholes shaped activities in the basalt rock over the hundreds of year.		
Values of Site	This site has a reach geographical, religious and research value. Large amount of people yearly visit this place, school trips, family trips, researchers, foreigners, deity, people from surrounding villages.		
Development Policies	10.77 hectores land is reserved there for future development regarding the site.		
Applications	Research Centre, Museum (Science Centre), Information centre, Resort.		
Photographs	 <p>Image 10 Study Area (google map)</p>	 <p>Image 11 River (flickr.com)</p>	 <p>Image 12 Researcher (Dr. Atul Jethe)</p>

CONCLUSION

This lesser known geomorphologic context has a need of development to improve their identity and for increase the value. Site need to be develop according to the ASI rules for conservation of natural beauty of site. The types of visitors are different according to month and its floating. People are coming there for religious, study, tourism and other some work purpose. To create awareness in people there is need of science centre as well as research center for researcher. The facility of the information center and accommodation is necessary to be done. It is creating a platform for study and tourism to achieve site potential.

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EXAMINING THE VISITATION OF SENIOR CITIZENS AND PEOPLE WITH DISABILITIES TO TEMPLES

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ABSTRACT -

Senior citizens and people with disabilities constitute a vital part of the population of India. It is the only age group that is neglected and not taken care for. The Indian temples lack in minimal requirements that need to be provided for the senior citizens and people with disabilities. Design plays an important role, as good as therapy in promoting well-being and functionality among elderly. This paper addresses the needs of senior citizens and people with disabilities and accessibility difficulties which they face on their visit to public space like temples and the importance of Barrier Free Environment. Senior citizens and people with disability visiting the temples were interviewed and surveyed. The main outcomes were based on the requirements and accessibility difficulties the senior citizens and people with disabilities faced. Barrier free environment supports the independent functioning of individuals so that they can get into, and participate without assistance, in everyday activities and in leisure. The main purpose of barrier free living is to integrate disabled and elderly persons fully into the society.

KEYWORDS - *senior citizens, disabled people, accessibility, Barrier-Free-Environment.*

INTRODUCTION -

This research focuses on the experience of senior citizens and individuals with disabilities visiting temples. Also explore the ways for improving architectural space quality for providing physical and psychological comfort. Old age is one of the most important phases of an individual life. It is an age where they have a lifetime of knowledge and experience. Hence, the society offered a space of respect to the old. As most of the Indian senior citizens and people with disabilities visit temples. Temple is not only a place of worship but they act as a center for intellectual and artistic life. The spacious halls of the temples were the place for recitation and listening of the folk tales, Veda's, Ramayana, Mahabharata and debates. Music and dance were the part of daily rituals in the temples. Although the temple is the hub of different religious and cultural activities and accessible to all. The very concept of access not only refers to physical access but also to intellectual, emotional cultural as well as to information access. Today accessibility for all is recognized as a basic necessity and there are attempts all over the world to ensure this.

There is a failure of society to respond to the needs of senior citizens and individuals with disabilities. Barriers and the limitations isolate and exclude senior citizens and disabled people from equal social participation. It is also important to note the impact of the obstacles which senior citizens and people with disabilities face to cultural life. As states "repeated experience to unnecessary barriers leads to frustration, anger, resignation and finally cultural exclusion". Barrier free features are now becoming fundamental to all places designed. A major step has been the PWD Act 1995 that specifies the law and the role of the state in creating access. Thus, the temples should be more accessible to senior citizens and people with disabilities with a variety of facilities and services.

LITERATURE REVIEW-

Indian temples are not only the place of worship but they are also the cradle of knowledge, art, architecture, and culture (1). Rituals, belief worship are the means of belonging or being part of the community. Thus, temples have played a very important role in the minds of the people their lifestyle and thinking. Temples are full of vitality where festivals are still celebrated with traditional pomp and pageantry, where sounds full of drum-beats, songs and prayers are still heard and where the spacious halls of the temples were the place for recitation and listening of the folk tales, Veda's, Ramayana, Mahabharata and debates. Music and dance were the part of daily rituals in the temples. Although the temple is the hub of different religious and cultural activities and accessible to all.

Interaction of the elderly with built environment is affected by the changing lives, lifestyles and physical capabilities (2). It can be claimed that people have more time to use of their home and the environment when they get older. Particular after retirement, people have the opportunity of sparing more time at home, in temples, recreational activities areas and similar kind of community facilities.

2.1 Barrier Free Environment

According to the European commission, it encourages manufacturers and service providers to produce new technologies for everyone: technologies that are suitable for the senior citizens and the people with disabilities. The origin of Design for All lies in the field of barrier free accessibility for people with disabilities and the broader notion of universal design. Barrier Free Environment is one which enables people with disabilities to move about safely and freely to use the facilities within the built environment (3). The goal of barrier free design is to provide an environment which supports the independent functioning of individuals so that they can get into can get to, and participate without assistance, in everyday activities and in leisure. The main purpose of barrier free living is to integrate disabled and elderly persons fully into the society. Accessibility is a general term used to describe the degree to which a service, or environment is available to as many people as possible. Accessibility can be viewed as the "ability to access" and benefit from some system or entity. Accessibility is often used to focus on people with disabilities or special needs and elderly people (1)

Since people get older, their health and ability status may change. To provide accessibility to older people in their living environments, the physical characteristics of built structure become important. With the purpose of providing accessibility, universal design examines how to reduce physical and social barriers in the environment. Seven principles of universal design help to create environments meeting the needs of

people with cognitive, visionary, hearing, and mobility impairments (2). Hence, universal design principles play key role in design for senior citizens and people with disabilities. Every designer should take these principles into account during the design and construction process.

AIM-

The primary aim of the research is to understand the challenges faced by the senior citizens and people with disabilities visiting temples and study the importance of Barrier-Free Environment.

OBJECTIVE-

Rituals, beliefs worship are the means of belonging or being part of the community. Thus temples have played a very important role in the minds of people, their lifestyle and thinking. The main objective of this research is to pinpoint the barriers causing problems for elders and people with disabilities visiting temples and understand the importance of Barrier-Free Environment.

SCOPE AND LIMITATIONS-

- The needs of senior citizens and people with disabilities and accessibility difficulties which they face on their visit to public space like temples.
- Accessibility and Barrier-Free Environment plays important role.
- Barrier make life more complicated. There are lots of such barriers which have to be avoided.

METHODOLOGY-

The research was carried out to understand the needs of senior citizens and people with disabilities and accessibility difficulties which they face on their visit to public space like temples.

- I. Thorough literature review was carried out to consider all the minute details and requirement of needs of senior citizens and people with disabilities and accessibility difficulties which they face on their visit to public space like temples. The due consideration was given not only to their physical needs but also social needs.
- II. Exploratory primary research was carried out by means of surveys of target of population of senior citizens and people with disabilities. This helped to gain perspective of social and personal views about the topic in questions.

FINDINGS-

The main focus of the survey carried out with the help of questionnaire is to identify the challenges that senior citizens and people with disabilities face while visiting temples. Based on the responses a comprehensive list of issues for the challenges senior citizens and people with disabilities face was prepared.

SR.NO	CATEGORIES OF ISSUES FACED WHILE VISITING TEMPLES	ISSUES
1	Due to joint pain, slow movement, problems in negotiating levels, problems in sitting, bending, climbing staircase, standing in queues.	Dexterity issues
2	Walking with some support, need of assistance	Mobility issues
3	Problems in orientation and way findings	vision
4	Cleanliness and large crowd	Surrounding issues
5	Safety while climbing staircase Safety from vehicles while crossing roads	Safety issues

Table 1 – identification of issues that senior citizens and people with disabilities face

2. Factors that need to be incorporated in temples for senior citizens and people with disabilities from the response (Table 1)-

a. Social interaction-

Provision for sitting areas for social interaction as well as relaxation.

b. Orientation / wayfinding

Easy orientation within the environment that reduces confusion/ stress and facilitates wayfinding and easy identification of circulation pathways, staircases or ramps.

c. Safety / Security

Provide an environment that ensures each person visiting temples will sustain no harm, injury or any other risks.

d. Stimulating environment

Provide a stimulating environment which is safe but challenging a way to keep the older person alert and engaged. Stimulation can result from color, visual pattern. Flowering trees and shrubs of different colors for space identification as well as aesthetic purpose

e. Accessibility

i. Barrier Free Environment is one which enables people with disabilities to move about safely and freely to use the facilities within the built environment.

ii. Senior citizens experience physical pain while walking or climbing stairs. Hence ramps should be provided for accessibility

CONCLUSION –

This research focuses on the senior citizens and the people with disabilities and intends to meet their needs. Designers generally tend to design for ordinary people, who are between the age 18 and 55, have similar anthropometrics, physiology, attitudes, behaviors, and lifestyles. However, there are other large sections of the population that need special care in the society.

It can be claimed that people have more time to use of their home and the environment when they get older. Particular after retirement, people have the opportunity of sparing more time at home, in temples, recreational activities areas and similar kind of community facilities.

The research explains the importance of Barrier-Free-Environments, a space that allows for free and safe movement, function and access for all. The goal of barrier free design is to provide an environment which supports the independent functioning of individuals so that they can get into can get to, and participate without assistance, in everyday activities and in leisure. The main purpose of barrier free living is to integrate disabled and elderly persons fully into the society.

The importance of accessibility and barrier free environments for equality of all users and their changing demands throughout their life span is the major concern of universal design. With the purpose of providing accessibility, universal design examines how to reduce physical and social barriers in the environment. Hence every designer should take into consideration the barrier free environments during the design and construction process.

In conclusion, there is a popular belief that a ramp and an elevator or lift is all that is needed to make a built space barrier-free. It must be clearly understood that barrier-free goes far beyond just a ramp and has many other necessary aspects.

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ADDRESSING ISSUES OF CONSERVATION OF URBAN HERITAGE: A CASE OF PUNE CITY

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ABSTRACT

The purpose of this study is to understand the challenges to Urban Architectural Heritage and form a basis to create strategies to overcome these issues in Pune and cities similar to Pune. The study seeks to address issues related to the preservation of Architectural Heritage and to understand the significance of the term 'Urban Architectural Heritage'. In a country with a history as rich as ours, every city has its own well-defined identity. There is no dearth of heritage monuments in our country. However, every generation creates its specific definition of heritage, which keeps on evolving. Cultural heritage in our country is a Dynamic entity. Pune is one of the oldest cities in India, with some magnificent monuments from different eras. These monuments have become synonymous with the city's identity. But this identity has never remained static. Along with monuments like the Aga Khan Palace, Pataleshwar Temple, the Shaniwar Wada, places like quaint Irani cafes and hole in the wall eateries have carved out their niche, which is now ingrained in the city's spirit. With rapid urbanization and the ever-increasing population we are losing such places. We need to find methods to protect them. The primary method employed here, to progress in this study consists of interviewing Urban Heritage and Conservation experts.

KEYWORDS

Urban heritage, Architectural heritage, Heritage conservation, Heritage, Cultural heritage, Preservation, Restoration, Rehabilitation, Revitalisation

INTRODUCTION

Heritage means the inherited civilization of predecessors. It does not end at tangible elements alone, rather it is a combination of tangible and intangible elements of the community such as thought, philosophy, religion, science, art and, architecture in society. The World Heritage Convention defines heritage as "monuments, groups of buildings, and sites."

Our comprehension of Architectural Heritage is thus clarified.

As stated by the International Council of Monuments and Sites (ICOMOS), when we talk about **Architectural Heritage** we refer to buildings or ruins, whose original value in terms of various factors such as emotion, culture, tangible, intangible, specialized or historical has been augmented of the years. We visit the places frequented by our parents and grandparents and we take them with us to the places we love to visit. The emotions attached to such places make them precious to entire generations of families. Are these not places of heritage in their way? A permanent part of the city's fabric? Ultimately, **it is those buildings without which the place in which they are located would lose its essence.**

In the past few years, we have witnessed the demolition of several venerated monuments, such as the iconic Hall of Nations in Delhi designed by Ar. Raj Rewal and the recently announced demolition of the Kala Academy in Goa designed by master architect Charles Correa. Thus, we have to delve deep within us to discover the reason for the conservation of such structures and how much they contribute to the fabric of a city. We also seek to focus on how the existence of such structures has both tangible and intangible repercussions in the long run.

ADDRESSING ISSUES OF CONSERVATION OF URBAN HERITAGE: A case of Pune city

Review of Literature

Why urban architectural heritage should be conserved. Heritage is a moral and material entity. Its preservation is not an option, rather a necessity.

The importance of restoration as an essential part of the conservation procedure cannot be overstated, regardless of its location, area, scale, or, size. It can be a solitary structure or an entire city. Its importance will not remain the same. Such spaces have to be preserved using varied techniques depending on the current condition of the building, the factors that led to its enfeeblement, its original function, and the proposed function. We must understand and pay attention to preserving the traditional urban fabric, at least in the case of heritage loss and the addition of any modern element.

<<Ancient heritage monuments and antiquities are places of learning and thus a part of our roots or heritage>> as stated by Rana P. B. Singh in Sacred scape & urban heritage in India-contestation and perspective. He studied in depth many sites across India such as Varanasi, Khajurao, and Konark to understand the clout of their architectural heritage on visitors and residents, of these places, alike. The sway of these structures on the local community is not negligible.

Heritage is ultimately the mirror of human growth and development and in this context it must be preserved. Thus we conserve cultural property not just for us, but for the benefit of our future generations and further studies.

How urban architectural heritage should be conserved. An interpretative strategy needs to be developed, communicating the importance of the intangibles of a city's cultural heritage to potential visitors alongside tangible elements of cultural heritage. The future agenda for heritage management relies on an all-inclusive approach that embraces transition and change. Century-old ideas still inspire, but the

challenge lies in practice. Assessment of the management policies and practices is needed and this becomes even more relevant in the light of the anticipated impact of climate change and urban population growth foreseen for the century. Conservation methods can include consolidation, reproduction, reconstruction, preservation, deterioration prevention, rehabilitation, and restoration.

Mr Koichiro Matsuura, the Former Director-General of UNESCO had once stated << Without the understanding and support of the public at large, without the respect and daily care of the local communities, which are the true custodians of World Heritage, no amount of funds or an army of experts will suffice in protecting the cities>>.

Aim

To understand the significance of Urban Heritage and its conservation in a developing country like India, by studying Pune city, and to relate this study to the current scenario and context.

Objective

To explore threats to Urban Architectural Heritage and formulate strategies to overcome them in Pune, by interviewing selected experts and understanding their inputs and suggestions, in their entirety.

Methodology

More in-depth knowledge about this issue was gained by concise, subjective interviews with industry experts in the fields of urban planning, Conservation, and Architectural design. A succinct questionnaire was prepared and the answers reviewed to better understand the problem and its various solutions. The following typology of experts was selected and interviewed personally.

- Interviewing experts in the field of Urban Heritage Conservation
- Interviewing educators in the field of Urban Heritage Conservation

The following questions were asked:

- What according to you is Pune’s Urban Architectural Heritage?
- How do you think the city should conserve its Urban Architectural Heritage?
- What according to you are the issues/challenges in the conservation of Urban Architectural Heritage?

In totality 10 experts were interviewed, of whom 5 were women and the remaining 5 were men. The individual responses were recorded and collated subjectively.

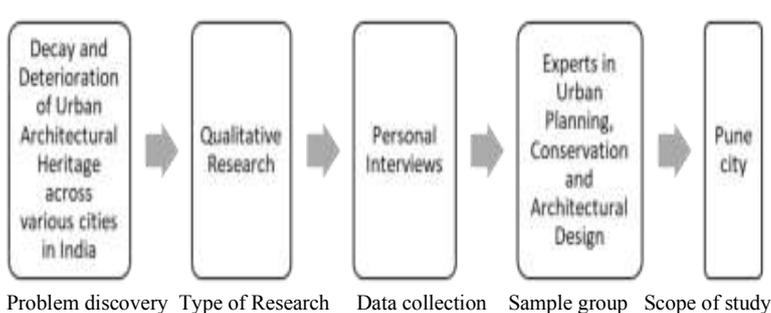


Figure 1

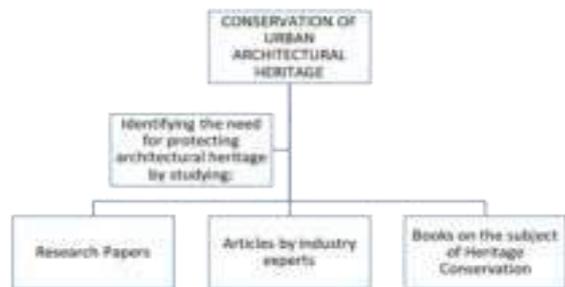
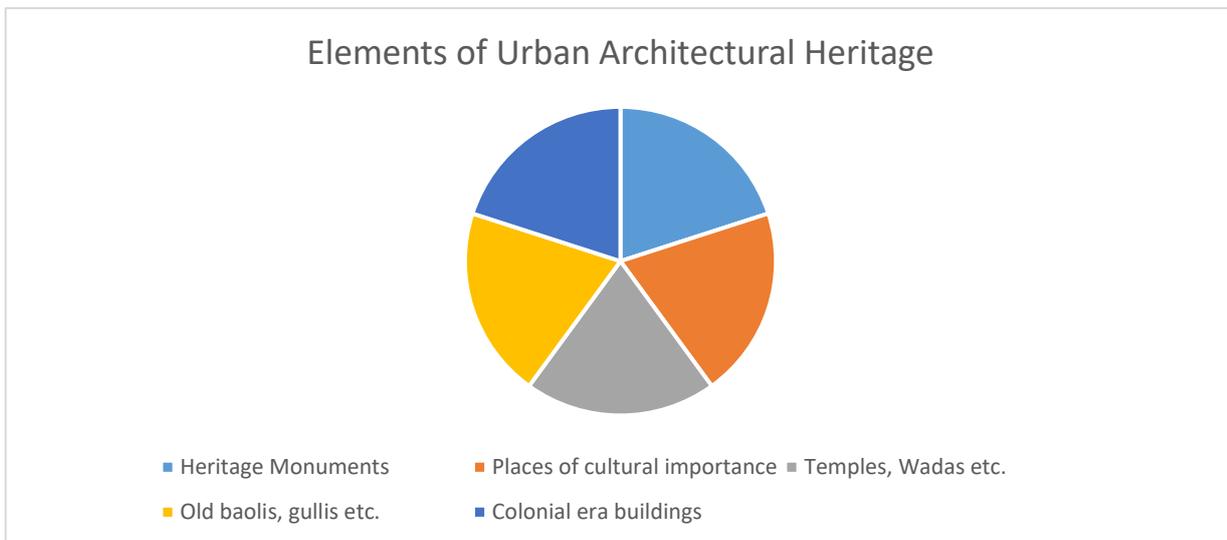


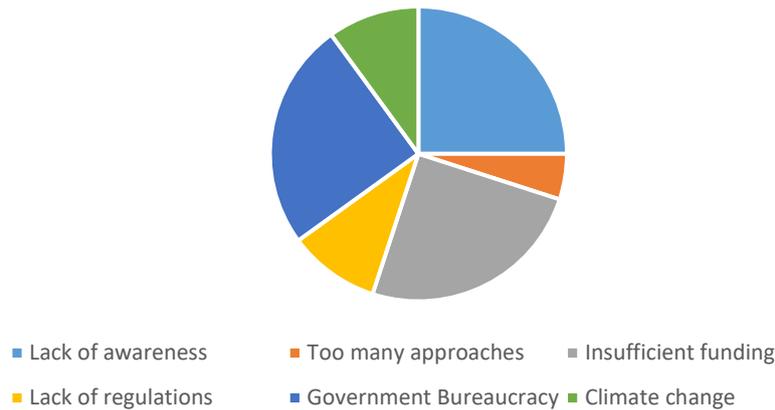
Figure 2

Analysis

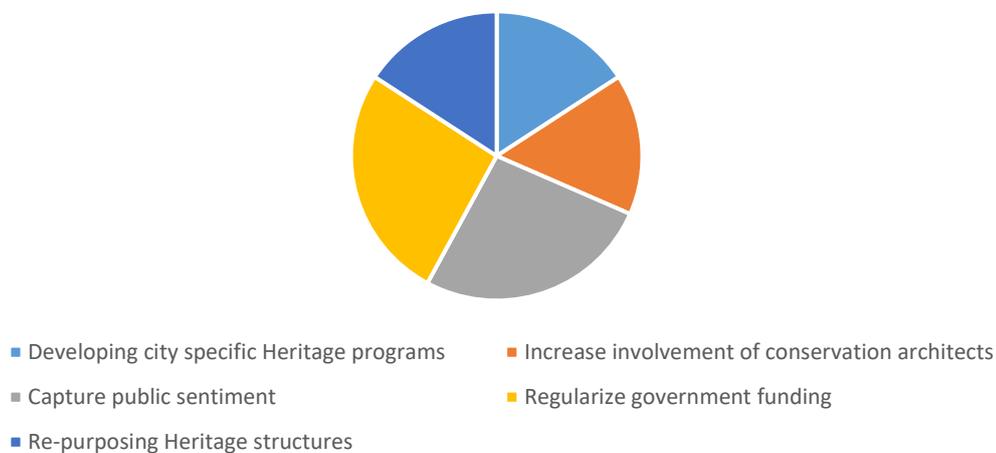
The interviews resulted in the following inferences:



Challenges in the conservation of Urban Architectural Heritage



Suggested methods to conserve Urban Architectural Heritage



CONCLUSION

Endeavours to preserve Urban Architectural Heritage are negligible compared to their contribution to the historical and architectural richness of an area. While attempts are being made, daily, these attempts are by no means sufficient for the scale of the problem we are tackling. The current world situation means we have to deal with factors such as increasing pollution levels, debilitating climate change effects, and the general callousness we have thus far exhibited. We need to highlight the importance of these spaces when preserving our heritage. It is also imperative that we increase the degree of interest and awareness from the public as well as government prerogatives.

The preservation of heritage in all its forms poses a unique problem. The issue can influence the cultural, social, and environmental values of the city in which it exists. The problem of financing is one of the most important obstacles in the way. It is necessary to cooperate with the local government bodies and NGOs to find some common ground.

The participation of people in preserving this heritage, in raising awareness and in implementing the local rules and regulations cannot be disregarded. We do not own our heritage. It is a gift bestowed upon us. Just admiring it is not our purpose. We need to pass this gift to our successors, without it being deteriorated in any way.

We must work together in unity to preserve this heritage which is the identity of our cities.

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FACTORS AFFECTING ARCHITECTURE OF AN ADMINISTRATIVE BUILDING

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ABSTRACT

The administrative building is a public building that acts as the town's representative asset. To the respective entity or authority it is a means of contact. Such buildings have tremendous significance as their architecture plays a significant role in establishing social identity at state, district or country level. These buildings would make the requisite comfort and ease inside the activities easier for the visitors. The paper is therefore focused on the analysis of the form and function of public administrative buildings in order to understand the role of administrative architecture that governs the authority's picture. This includes the analysis of important variables by evaluating various admin buildings and their results. It is measured to conclude on the singularity of the factors found. It can lead to potential modifications or existing improvements in administrative buildings.

KEYWORDS- (administrative building, organizational structure, identity of government, form & function)

INTRODUCTION

A wide range of design vocabulary is carried by administrative buildings and this design vocabulary includes factors such as location, shape, functionality, circulation, etc. They control the building's organizational structure, and describe the building's character based on the need for consideration. Such considerations are important as they help us understand how to make the building interconnect between spaces and functions. The same study shows how they are implemented inside buildings and how much priority is provided when designing these admin buildings. The comparative study shows how, in each case, they differ in meaning, materials used, and building form. Conclusion notes the importance and meaning of the variables and how they progressed as the administrative buildings changed in time and need.

CASE STUDIES AND ANALYSIS

Case 1: The District Collector Office (Ar .Sunil Patil) -It is the 'Collector Office' building of the city which is an administrative head-quarter in 2017 which is located in the hot dry climatic zone.



Image1: Site Location



Image2 : Exterior view of the building

Organizational structure: Strategic planning is based on the interconnection of all departments with a wide number of visitors being treated. Bridges and sky-walks connect all wings. The open spaces and seating areas are built to cater for tourists as a buffer. In the middle of the plaza it has heritage structure erected. Envisioned with architecture of grandness is well ventilated and well illuminated by natural light.

Character Defining Elements: The building with an urban context in mind. Its contemporary shape is achieved through the use of advanced techniques and materials and elements such as sky walks, louvered

(From:http://squareone.blog/wp-content/uploads/2017/11/DSC_5000-EDIT-2-1434x768.jpg)



Fig1 : Zoning Plan

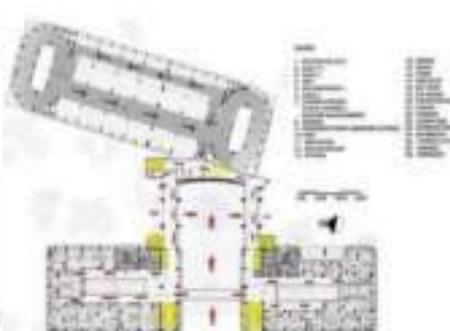


Fig2 : Horizontal Movement Pattern

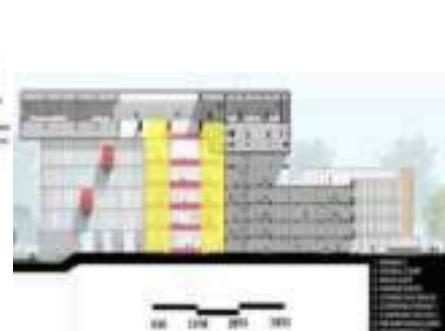


Fig 3: Vertical Movement Pattern

(From:https://images.adsttc.com/media/images/5c52/4084/284d/d1f0/e900/0058/slideshow/COLLECTOR_OFFICE_00_GROUND_FLOOR_PLAN.jpg?1548894327)

(From:<http://squareone.blog/wp-content/uploads/2017/11/AA-Section-1024x341.jpg>)

Case 2: Zilla Parishad Building (Ar. Vishwas Kulkarni) - It is located in the urban area having tropical climate in the core of the city with all the public welfare departments along with conference halls, auditorium, assembly hall. Though it is located at junction of the roads, primary entrance to the site is not clearly visible.



Image3: Site Location



Image4: Exterior view of the building

Organizational structure: The separation of the spaces according to functions in this building is worked out by separating functions according to the need for privacy. Visitors and staff are given separate cores as means of access. Functions are decoded using color codes for formal and public activities. The pattern of movement for both wings is symmetric. The U shape form provides privacy from three sides to the central space. The entrance is stepped up, and grandness. The grandness requires double height interior spaces such as waiting foyer. Within the building, the voids are created by providing inbuilt fourth-floor terraces.

Character Defining Elements: The shape of the house is symmetrical, and the upper floors are column-lifted. Inbuilt type of voids is created presenting the whole building as a single entity. Inside the building is lacking the natural light and ventilation. The two towers that come up at the corner symbolize power. The materials which are used are concrete and glass. Glass is used in the staircase towers and for the windows. Materials help to connect the facade of the building to the surrounding buildings in terms of context and aesthetic design.

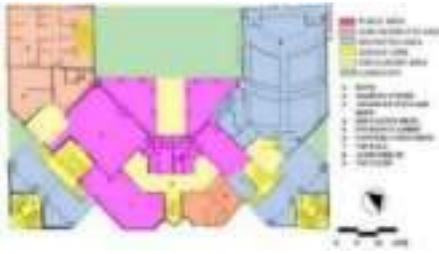


Fig 4: Zoning plan

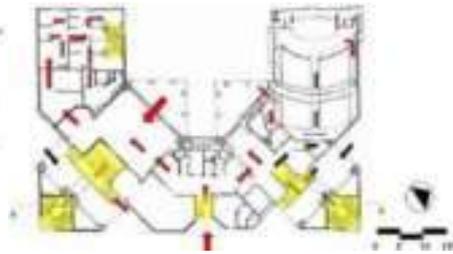


Fig 5: Horizontal movement pattern

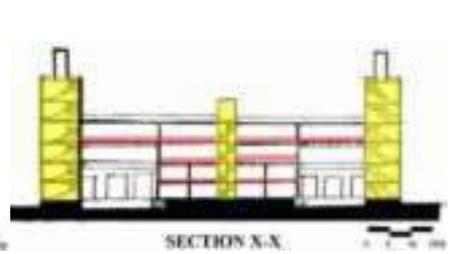


Fig 6: Vertical movement pattern

Case 3: Municipal Corporation Building (Ar. Pramod Beri) -The site is located in the suburban area. The site given was having narrow access road dividing the tight odd shaped plot area. Hence the internal road of access is widened including frontal arrival space in the road right of the way.



Image5: Exterior view from the side



Image6 : Top view of building

Organizational structure: this is a two-story lower floor building with entrances on each side for the senior staff's public and main entry. Proximity to all activities and spaces is equal, preserved by the provision of all offices in the central lobby. The upper floor contains all the appropriate offices for private formal operations. Small courtyards act as a buffer zone at each side. Employee and general public campaigns are separated by having separate means of entry. Inside the building the spaces are compact. The wings consist of 'L' shaped area of clerical staff together with curved central courtyards. The main entrance is flanked and conveys a gesture of welcome. Jetting out stepped second-level auditorium serves as a porch supervisory area for staff and a green area.

(From : Beri Pramod, 2009, Form Follows Feelings)

Character Defining Elements: The central structure is lightweight in shape. The curvilinear facade softens the frame. Within the structure the curvilinear forms and rectagulooid elements establish harmony. The type to use is that of brickwork. Exposed brickwork uses the old words in new material sense.



Fig 7: Zoning plan
(From : Beri Pramod, 2009, Form Follows Feelings)

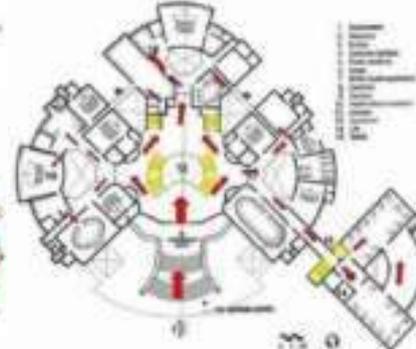


Fig 8: Horizontal movement pattern

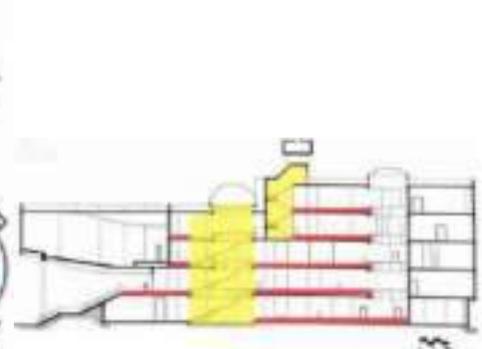


Fig 9: Vertical movement pattern (From : Beri Pramod, 2009, Form Follows Feelings)

TABLE-I : Comparative Analysis

Factors	Sub factors	Case 1	Case 2	Case 3
Organizational structure	Functionality	All the service areas, public spaces are functionally	Strong interconnection	Proximity to each functional space is equal
	Circulation	Sufficient and naturally ventilated circulatory areas are provided.	Lack of natural light in cores. No provision of universal access	Sufficient amount of light and ventilation. Provision of universal access
	Spaces	Double height spaces and monumental scale. Buffer zones or pause points are created at appropriate locations.	Double height space only at entrance, intermediate scale. Intermediate buffer zones are not sufficient.	No double height spaces or monumental scale. Small scale buffer zones are created.
Character defining elements	Form and Style	Contemporary rigid form	Variation in form i.e. use of linear, curved and chamfered edges	Curvilinear form
	Materials	Concrete, stone, galvanized iron, glass.	Concrete, glass	Bricks- exposed brickwork

Suggestive design based on study of administrative building :

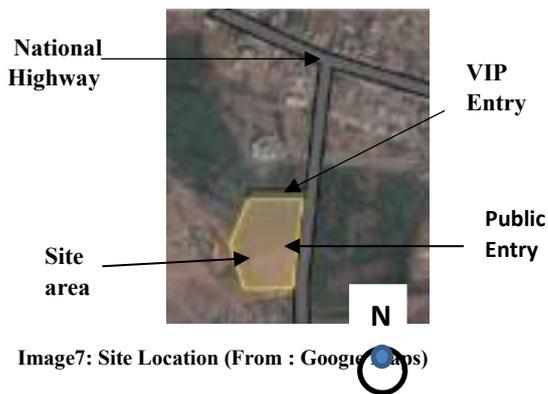


Image7: Site Location (From : Google Maps)

Town Center At Indapur

Location – Indapur (Pune) Near NH9

Site Area - 40,000 Sq.M., Climate : Hot & dry

Surroundings - Commercial and Institutional Buildings

The proposed design is an ‘Administrative Hub’ designed for Indapur town of Pune district. The site selected is located in the core of the city having ease in accessibility being nearer to the national highway. The proposed G+3 center accommodates all public welfare departments with necessary public amenities such as cafeteria, library, auditorium, etc. The segregation of public, semipublic, restricted spaces is achieved by providing all public amenities on lower floors, workspaces and offices in intermediate floors and VIP and main admin department on topmost floor. Large open spaces and intermediate landscaped sitting areas are designed to act as pause points. Voids are created within to create visual link and reduce massing.

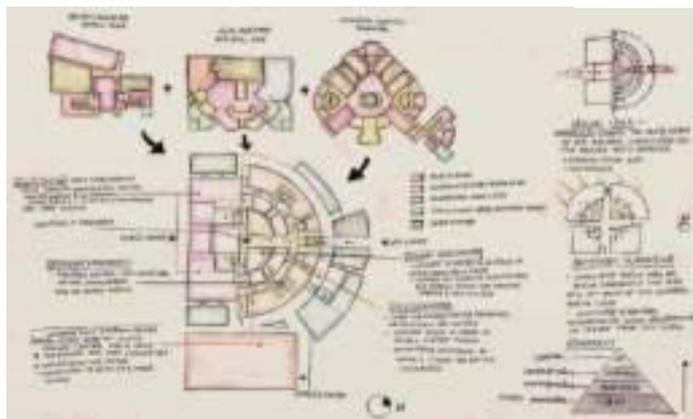


Image8 : Evolution of Concept



Image9 : Site Plan



Image 10,11,12 ; Plan, Section, Elevations



Image 13,14 : Conceptual views of building explaining massing & aesthetics

CONCLUSION

The main element in the functional building design is the operational framework that determines the connection of the building's activities with the spaces inside the building, accompanied by the general public and staff's activity flow. The structure, the esthetics, the materials were secondary aspects of the administrative building according to the structures of the administrative buildings.

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COMPARATIVE STUDY OF PLANNING AND CONSTRUCTION ASPECTS OF MODERN TEMPLES AND TRADITIONAL TEMPLES

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1. ABSTRACT

The paper presents a comparative study of traditional temples and modern temples located in Pune city. Also analyse the relationship between traditional temples and modern temples in context of architectural planning and construction strategies. The paper aimed to understand the linkage between the designing of a sacred or religious space and the experience of users in space with reference to planning and construction of the space. A survey was conducted in questionnaire form with 13 participants who visit temples, to understand the different parameters of temples. Traditionalist approaches to the architectural shaping of temples are dominant even nowadays, tradition being understood and interpreted individually. At the same time, efforts to introduce contemporary architectural expression into temple architecture have been increasing and gaining strength. Modern temples should inculcate present culture, new mode of construction along with parameters of traditional temples. These parameters could help for better construction of modern temples resulting in better construction of locality as temples have been part of community and society.

KEY WORDS

Modern temples, traditional, contemporary temples, ancient, religious space.

2. INTRODUCTION

Temples are everyday part of community and society, nodes of social interaction and symbol of peace and calm. A Hindu temple is a symbolic house, the seat and dwelling of Hindu gods. It is a structure designed to bring human beings and gods together according to Hindu faith. A temple is considered as the house of the god and a place of prayer for all peoples. A Hindu temple reflects a synthesis of arts, the ideals of dharma, beliefs, values, and the way of life cherished under Hinduism. A Hindu temple is a spiritual destination for many Hindus, as well as landmarks around which ancient arts, community celebrations and economy have flourished. Hindu temples come in many styles, are situated in diverse locations, deploy different construction methods and are adapted to different deities and regional beliefs, yet almost all of them share certain core ideas, symbolism and themes. Contemporary temples are modern and relate to present time. At present, temples are built and equipped with modern materials, structural systems, abstract forms and with reference to traditional practices and planning techniques. Ancient technique of building the temples differs from now what is being used that is contemporary or modern style. In old days temple were constructed from locally available material to reduce cost and due to material being climate responsive. Today temples are constructed with materials which are less expensive and fast to build with. While adapting to the modern techniques in building temples the essence and nature of space is lost. The change in construction technique of the temples have changed the experience one feels while his visit to the temple. This has also changed the character of a locality driven by temple, as they are being constructed same as the conventional buildings. The needs of modern temples are different from ancient temples. In old times people used to visit temples every day for learning, worshipping, rituals etc. but the temples now are more equipped and have amenities required to comfort the visit of people. People don't visit temple just for worshipping but also as a social interactive space and for activities other than praying and worshipping. The paper presents comparative study of modern and traditional temples in terms of planning, construction techniques, materials, forms and finishes, functions, accessibility, assembly configuration, interior exterior relation, scale and implantation. It aims to understand the shift of use of modern technology in temple architecture instead of traditional way of construction. The use of modern techniques in construction encouraged use of modern ways of construction in temples today. It is an attempt to find out how the progress in contemporary architecture has influenced modern temple architecture. The area of study is Pune city and area around it. The paper studied temples like Sarasbaug Ganapati Mandir, Mahalaxmi Mandir, Ram Mandir, Jain Mandir, Sadashiv peth, Mrutyunjayeshwar Mandir, Kothrud, Jangli Maharaj Mandir, Pataleshwar Mandir and Vitthal Mandir, Karvenagar.

3. LITERATURE REVIEW

The aim of temple design gradually fades because of changes in context and time. In the past, the temple was the centre of communities in India. Nowadays, going to temple is optional because the centre of communities is in commercial areas. The style of Hindu temple architecture is not only the result of the theology, spiritual ideas, and the early Hindu texts but also a result of innovation driven by regional availability of raw materials and the local climate (Michell, 1988). As a result, each traditional temple has its identity and different styles of temple architecture across nation.

Hindu temples are symmetrical with variation in square grids. (Meister, 1983). The design, the plan of Hindu temple around the sanctum or shrine follows a geometric design called Vaastu-purusha-mandala. The name is composite Sanskrit word with the three of the most important components of the plan. Mandala means circle, purusha is universal essence at the core of Hindu tradition, while vaastu means the dwelling structure (Lewandowski, 1980). Above the Vaastu-purusha-mandala is a high superstructure called the shikara in north India and vimana in South India, that stretches towards the sky (Lewandowski, 1980). The location of temples was near river or pond or near gardens.

The modern temples reflect the junction of ancient building principles and modern architecture. The great challenge of contemporary religious architecture is to conciliate the architect's intentions with the expectations and sensitivity of the community, so that the project is well-accepted and the spatial experience conceived by the architect is accomplished, making the religious experience more intense (Captivo, 2016). In contemporary sacred architecture, just like secular architecture, one can see many stylistic forms appearing simultaneously. New modernist ideas, separation of the form from the construction, sacralization of some materials and the use of new materials have created new creative possibilities (Wierzbicka, 2014). Modern sacred projects show architect's different, sometimes extreme attempts to find a language of the sacred. As a result, sacred facilities in extremely different architectural styles have been built recently. Modernist architecture opened up new opportunities for architects, without indicating one principle for solving the space of the sacrum. As many examples of modern sacred architecture show, it can fulfil its function only thanks to man who experiences it. That means that architectural space becomes alive only in its contact with man, who experiences it in contemporary culture. The role of architectural space as a spiritual shelter is of utmost importance

(Wierzbička, 2014). The imagination and symbolic meaning that architecture has besides the material dimension have an essential meaning. This is the real domain of architecture which cannot be precisely defined.

The change in time has brought change in lifestyles resulting in change in needs and facilities of a space to meet man's need. Over a period of time the versatility of our temples got degraded to mere rituals and superstitions. Previously temples were built by the rulers as a symbol of victory, wealth or by demands of people. There were only priests or brahmins organising and administrating the temple activities and functions. One of the main reasons for this sad state of affairs is the ulterior motives of Brahmins to keep the temples under their control (Ajithkumar, 2004). Today we have different administration system and worshipping department for a temple for effective functioning of temple. We need modern temples to cater to the requirements of modern times (Ajithkumar, 2004). The challenge today for architects is to rethink the place of worship in terms of our worship practice (Vosko, September, 2014). Modern temples built in modern styles should also interpret the principles of traditional temples. As regards the construction of modern temples, stylistic copies of traditional temples are absolutely predominant (Bozidar Manic, 2015). The lack of interpretation of traditional principles, planning, building techniques, symbolism, façade etc has led to failure of modernism concepts to accomplish the task of creating modern temples. Construction is often haphazard, characterised by the use of traditional architectural elements without understanding their meaning, the context in which they were created or used, adequate proportions, all of which can result in bizarre forms of architectural kitsch, which is a subject of great controversy (Bozidar Manic, 2015). Depicting principles of traditional temples in modern temples by changing the techniques of construction, planning, materials, finishes, façade has led to great difference in essence and need of the sacred space. The terms of building tradition and temple building rules-canon- are not clearly delineated. Identification of lacking parameters of traditional temples in modern temples and including those parameters in building of modern temples can reduce the controversy between them.

4. AIM

To study difference between traditional and modern temples. To understand the growth of modern temples and the linkage between people of modern times and modern temples.

5. OBJECTIVE

- To identify the difference between traditional and modern temples.
- To study the parameters of traditional temples.
- To identify the missing parameters of modern temples.

6. SCOPE AND LIMITATION

The area of study is Pune city and neighbourhood. The case studies were selected based on their year of construction and style. Eight temples, out of which 4 are traditional temples and 4 are modern temples. For in-depth understanding of topic, a survey was conducted among 13 participants who belong to age group of 40 – 70 years.

7. METHODOLOGY

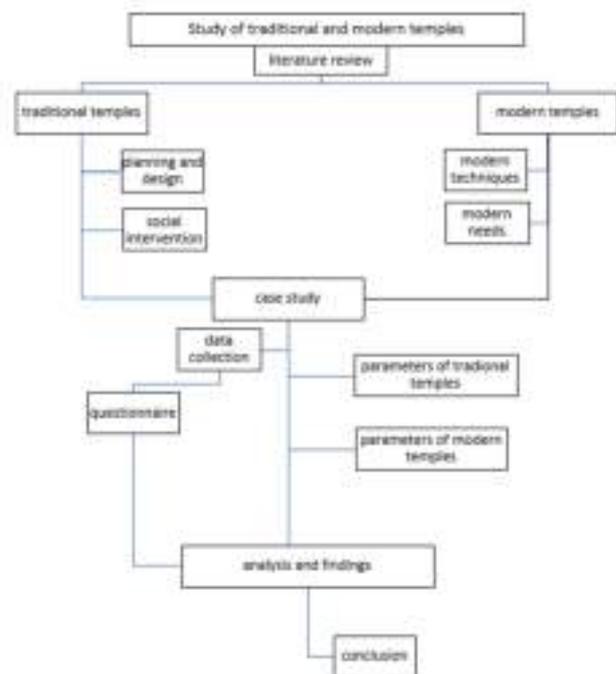
The qualitative research was carried by conducting a survey. The survey consisted of a questionnaire of 11 questions out of which 3 are multiple choice and 8 were respondents had to explain their perspective. The survey was conducted with people between age group of 40 to 70 years. The group consisted of 13 participants out of which 10 are female and 3 are male. The forms were answered by interviewing the participants and noting down their perspectives. In addition to survey, there were analysed eight temples which are traditional and modern temples. The analysis of case study was based on architectural strategies and construction techniques to identify the different parameters between them.

Survey Questionnaire

- How frequently do you visit temples?
- Which temple do you visit more?
- How is your experience of visiting an ancient temple v/s modern temple?
- Do you think modern temples are as traditional as old/ancient temples?
- What differences do you see between traditional and modern temples?
- How do you think should temples of future be?

Purpose

- Frequency of visits made by participants- to understand their association with the temple
- Type of temple visited by participants- to identify the comfort and sense of belonging with the sacred space. To learn their comfort and attachment with the sacred space.
- Experience of visiting- to understand the good or bad functioning of the space, environmental aspects of complex and the relationship between space and experience.
- Opinion on modern temples being traditional as old temples- as the modern temples are reflection of old temples with modern techniques and materials but is the feeling of reverence achieved or is sacred as old temples.
- Differences between traditional and modern temples- to identify the different parameters of temples with respect to architectural and construction planning.
- Characteristics of future temples- to include the parameters or prepare a guide for building future temples.



8. ANALYSIS AND DISCUSSIONS

RESPONSES OF 13 PARTICIPANTS ON ABOVE QUESTIONS ADDRESSED TO THEM



Fig. 1- Frequency of visits made by participants to temple.

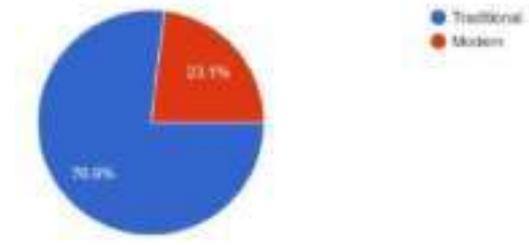


Fig. 2- Type of temple they visit.

- Experience of visiting an ancient temple v/s modern temple.

Ambience

- Modern temples are cleaner and more disciplined than ancient temples.
- Modern temples are clean
- Good and Creativity different

Form

- Older temples tend to have a sense of homeliness and tranquillity unlike modern ones which seem austere and plain
- Traditional temples depict culture, form of the town it belongs to rather than modern temples are same
- Modern temples are more aesthetic than being traditional
- Ancient temples are quite more authentic than the modern ones

Function

- In ancient temples there is feeling of peace, calm, positivity. In modern temples it feels like temple being a market place rather than worshiping place. temples build for money

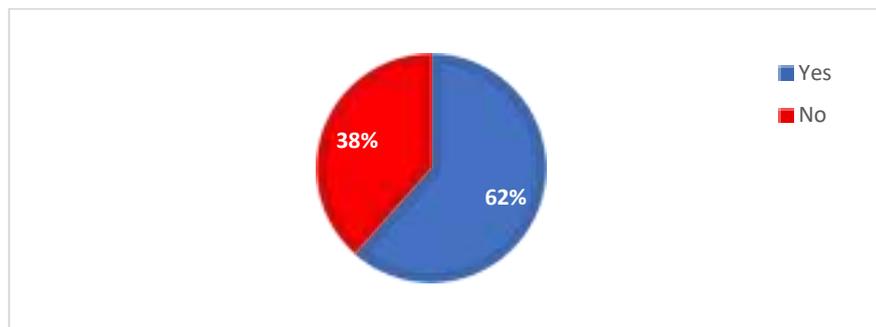


Fig. 3 -Do you think modern temples are as traditional as old/ancient temples?

- Difference between traditional and modern temples:

Form

- Huge design and ultimate carvings on ancient temples
- Structure and thinking
- In ancient temples you get to see construction techniques, delicate carvings, simplicity of deity, but in case of modern temples you see glam, dress up and only temples built for earning money.

Function

- Previous temples were meant for many social activities which are missing in modern temples.
- In modern temples Discipline is better cleanliness is maintained these temples seem to keep good financial management system
- ancient temples are more sacred. One can feel reverence which is lacked in modern temples
- Traditional temple follows ancient rituals but lack in cleanliness

Construction technique

- Difference in construction techniques hemandpathi temples are built from stone which makes them stand strong Temples built by new techniques, cement, bricks have limited life span
- The history behind ancient temples always fascinates and are welcoming. Modern temples are attractive and welcoming in terms of construction, sometimes the flashiness of those temples tend to affect the spirit of religiousness
- There is a major difference is between the level of detailing done on columns, temple walls, etc
- Traditional temples are constructed using stones, wood. which makes it feel natural, where Modern temple use artificial finishes
- The planning, aesthetics, and material
- The difference is the location of the temples.

- Characteristics of temples of future:

Form

1. The focus has to be on simplicity and the future generation should get encouraged to visit temples. Modern materials and natural materials
2. They should try to retain as much of their heritage as possible, irrespective of style/way of depiction.
3. It should be deep rooted to our traditions
4. They should be located in a place where people can worship peacefully.
5. It should be clean and should use ancient way of building and should have the space for devotees

Function

1. temples should be clean and it should be sacred space than money making platform
2. Any temple built in any style, form, etc should have reverence and be sacred
3. Temples should be run on religious faith and not having publicity stunts
4. Future temples should be of modern styles, techniques but should include purity, sacred and sculptor's creativity

TABLE 1- The following table presents analysis of the case studies based on architectural strategies:

	SHRADDHA MANDIR	SHALABHI MANDIR	RAM MANDIR	JAY MANDIR	SHRUTIKESHAVAR MANDIR	JANGLY MAJARA MANDIR	PATRESHWAR MANDIR	SITTAJI MANDIR
AREA	○○○○	○○○	○○	○○○	○○	○○○○	○○○	○○○○
PLANNING								
CONSTRUCTION TECHNIQUES	MODERN	MODERN	ANCIENT	MODERN	ANCIENT	ANCIENT	ANCIENT	MODERN
MATERIALS AND FINISHES	BCC PLASTER	BCC MARBLE	STONE WOOD	BCC MARBLE	STONE	WOOD	STONE	BCC
FORM								
FUNCTIONS								
ACCESSIBILITY								
ASSEMBLY CONFIGURATION								

9. FINDINGS AND CONCLUSIONS

- a. The architectural strategies and parameters found missing in modern temples of traditional temples are:
- b. Traditional temples are built from locally available and climate responsive materials.
- c. The form and structural system of traditional temple are cohesive.
- d. Every element of traditional temple has a story, concept, beliefs that are carved or marked to pass on to further generations.
- e. Traditional temple construction involved artists, sculptors and neighbouring people for evolution of form and style of temple.
- f. Traditional temples have depiction of the culture, historical background.
- g.

The design of a temple is a great demand for the architect, because it shelters a complex experience. The poetic/aesthetic condition of the building takes a particularly intense and decisive role in its responsiveness to its purpose - the religious practice. Including of traditional temples parameters is not just a way of reducing the difference between traditional and modern temples. Modern temples should inculcate present culture, new mode of construction along with parameters of traditional temples. Temple became sacred because the way one feel in the complex- purity, positivity, reverence, secured, conversion experience, reading of holy books or prayers actually occurring in the complex. These feelings are a result of ambience, functions, material finishes, enclosure, brightness which are achieved by efficient planning, material combination and form of complex. There is no element included without any purpose to serve or any message to deliver to people. These guides could help for better construction of modern temples resulting in better construction of locality as temples have been part of community and society.

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MULTIFUNCTIONAL FURNITURE AND SPACE SAVING INTERIOR DESIGN.

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ABSTRACT

Shelter is the basic need of human being as it saves human being from different hazards climatic conditions and wild animals. Rapid growth in population leads in increasing demand for residential apartments in urban areas which results in higher prices and smaller sizes of dwellings. To solve this issue, we need to concentrate on better space management with the help of multifunctional interior design ideas. How we reached to the multifunctional and space saving interior design. To study multifunctional furniture and space saving interior design. The basic objectives taken into consideration are cities where there is a need for multifunctional space & furniture. Also to study space saving elements both architectural and interior. The study is limited only up-to the residential typology. Primary data such as observation, internet, surfing, videos, data collection and secondary such as reference paper, human oriented design, experimental data are also taken into consideration. The demand for space is increasing and economy is also taken into consideration. Migration is taking place in most cities for the purpose of employment, education, business. This over crowdedness can be managed by efficient planning strategy which will give a specific outcome. This can be so designed that the single space can be used for multiple needs by using multifunctional furniture. This is not only feasible but also affordable and low cost.

KEY WORDS: *Multifunctional, furniture, dwellings, human oriented design, Metro-Politian.*

INTRODUCTION:

Shelter is the basic need of human being as it saves them from climatic conditions, wild animals. Rapid growth in population leads in increasing demand for residential apartments in urban areas which results in higher prices and smaller sizes of dwellings.as there is growth in population the need for space is also increasing.

Today as the population is going on increasing there is need for increasing housing demands in the cities which has an adverse impact on market prices and dwelling too. So to overcome this problem we have come to the conclusion of using multifunctional furniture which is the most ongoing concept today, which saves not only space but also cost efficient and affordable by and average income group people. A single room can be transformed to multiple activities. Furniture plays a vital role in transforming the space. Given below is a detailed information about different types of multifunctional furniture and their transformation.

PURPOSE AND USE OF SPACES:

Firstly, the purpose of structures & spaces needs to be defined. How will the space be used? A building might be commercial, industrial or residential. Structures with different purposes have very different space needs & their use will help determine how it is allocated. Some spaces might have more than one function, they might be flexible. An elementary school gym is a good example of a flexible space that can transform into a cafeteria.

NEED OF THE STUDY:

Form follows function: It is associated with the ancient architecture and design it simply means that whatever shape the building has it should function more effectively according to the need of the user. I do agree with the great architect and would follow the purpose and function of the user and not vague function. It should satisfy as well as fulfil user need and satisfaction for which the architect id being paid for.

Function follows form: The unique shape of building should be properly functionable and should satisfy the need of the userand vice versa as above.

AIM: To study the development of multifunctional furniture and space saving interior space.

OBJECTIVES: 1. To study the need for development of multifunctional space and interior.

2. To study the need for development of better space management of interior.

SCOPE: To study space saving elements both architectural and interior.

LIMITATION: To study the residential spaces interior only.

METHODOLOGY: The methodology is to collect primary data from live case study and secondary data from book case study.

PRIMARY DATA:

LIVE CASE STUDY:

OBSERVATION METHOD:

Shree impex furniture mall (Shrirampur)

LOCATION: Plot No. A-81, MIDC, Ahmednagar, Shirampur Rural, Maharashtra



Fig.1 Location



Fig.2 &3 Entrance



INTRODUCTION :

Shree impex furniture mall consists of different types of furniture, the various types available about my topic were sofa cum bed, expandable furniture such as partition, relaxing chair, hydraulic coffee table, folding dining table. Sofa cum bed can be used when there is a limited floor space and can be only used when needed. It saved a space as was foldable and used only when there is a need to use bed. A folding chair is not permanent and can be carried anywhere according to the need. It is made of wooden material with different designs which make it lightweight. A hydraulic coffee table also serves as a space saving element which is used as per the need of the user.



Fig.4 and 5 .Sofa cum bed transformation

A folding dining table is a furniture which can be used according to the need and comfort of the user. This is a drop leaf table which can be dropped down when not in use. And can be expanded when there is a need. The aesthetics are also very important in this case. This is made of wood which can be carried as per the need, mostly used for the purpose of eating. This is made of lightweight and water resistant material at the top to increase the life of the furniture and its portability.



Fig.6Folding dining table

A coffee table is a hydraulic table which can be folded and well as kept open when there is a need. It is usually placed in living rooms for the purpose of keeping newspapers, flower pots and coffee or tea when guests arrive or in a cake cutting ceremony. This acts as a more convenient and space saving elements of the interiors.



Fig.7 Transformable hydraulic coffee table.

A folding chair shown below is a wooden chair which is light in weight and can be folded flat. It can be used whenever required and doesn't fall in the category of permanent furniture. It can be carried wherever required and kept folded when not in use. It need very less space when folded and can be stored in any gap or row.



Fig. 8 Expandable teak wood chair & cushion chair

OBSERVATIONS:

The furniture used made of different material such as cushions and mostly wooden, which were easily foldable and also affordable. All the furniture was multifunctional and flexible. The versatility of the transformable furniture allowed great Multi-Function solution for every lifestyle.

SECONDARY DATA:

“The chosen literature is a combination of articles regarding small apartments along with papers about furniture and psychological articles about human needs and wellbeing. The multifunctional furniture elements used as space saving interior design, which can modify the living style of human being. (reference research paper: Small furniture need smart solutions)

MULTIFUNCTIONAL SPACE-SAVING FURNITURE:

Space-saving furniture designs is at a greater demand as the increasing population and decreasing of floor space which is though very common. A single tiny room can be used as multifunctional room such as same space can be used for living, dining and kitchen. The most important element used today is furniture as it affects the psychology as well. So it has to be comfortable according to the need and purpose of the user.

Small apartments

“According to “Byggtknisk forskrift”, TEK10, the minimum size for a one-bedroom apartment is between 7-10 square meters. Most small apartments only have one or two rooms. This means that one single room can be used for multiple activities. The multifunctional space can perform a lot many functions using multifunctional furniture. Figure below gives an example of the variety of “areas” the rooms need to accommodate. Here you have both the living room, bedroom and kitchen in the same room. Each one of these “areas” have their own specific requirements to function optimal. multipurpose spaces are very commonly used and widely accepted standards of living life. For example, sailboats and recreational vehicles have small spaces that function both as a living room, a kitchen and as a sleeping area. Multiple activities can be performed in a single space. (reference research paper: Small spaces need smart solutions: As the author says that small rooms have to be used for many purposes, I agree with same which saves spaces and can be reused as well as cost effective, many functions can togetherly managed. Same as above where there is small area we cannot afford fixed furniture but with the smart way we can deal with the situation by using multifunctional furniture as in sailboats and recreational vehicles which is also according to the need and comfort.)



Fig.9. Plan of small apartment of 30 sq.m

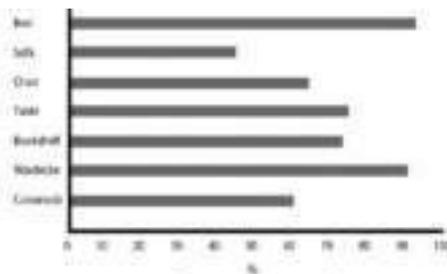


Fig.10. Main furniture in a small apartment

Furniture is customised it is according to the comfort and need of the user as well as the aesthetics plays a important role in it as it saves the space and is made for the same purpose., e.g.the height and depth of a sofa can determine how comfortable it feels.”(kristoffer Thogersen :Small spaces need smart solutions)

MULTIFUNCTIONAL FURNITURE:

The furniture which performs function according the need of the user and transforms into another one according to the need of space is called as multifunctional furniture. It can also be called as space saving furniture or resource furniture or folding furniture. There is a lot of different versions at the market. An example, the furniture illustrated in figure 12 and 14 below. One furniture can be transformed into boofshelf, chair, storage and table also.

MODULAR FURNITURE:

Modular furniture is furniture which is made up of many parts previously and when put in together gives a set of furniture which can be used as a multipurpose furniture which is according to the space and need of the user.

Modular couches is a very good example of multifunctional furniture, as it has a beautiful aesthic as well as fabrics and is customised according to the space and end user requirement within the available space.

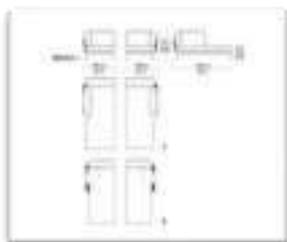


Fig.12. Example of transformable couch

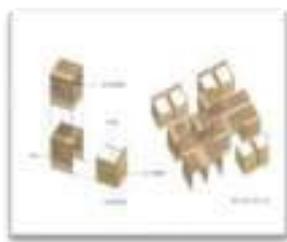


Fig.13. Example of multifunctional furniture



Fig.14 Example of multifunctional furniture

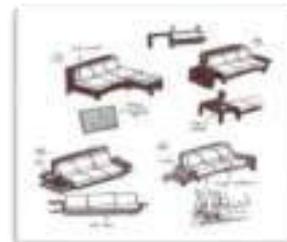


Fig.15 Example of multifunctional furniture

RESOURCE FURNITURE:

Resource furniture is a smart space saving furniture which is used by the people living in urban areas. This furniture is so designed that the users value the need for design which is low cost as well as flexible and multifunctional. This is used where there is need of space and also the furniture according to the need of the user. Resource furniture is used by most of the urban dwellers, and people residing in most of the apartments migrated for the various purposes such as education, jobs or business.

CONCLUSION:

This paper points to signify the connection between furniture and interior space and how it will benefit the people living in Metro-Politan cities to live comfortably in small area at an affordable price. It would also satisfy the need and make efficient use of floor space in the desired area.

ACKNOWLEDGEMENT:

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MECHANIZED PARKING IN REDEVELOPMENT PROJECTS- UTILITY AND OTHER ISSUES

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ABSTRACT:

Redevelopment of residential properties is being witnessed in most of the urban areas at the escalating rate in the last decade. The buildings that were constructed between 1961 and 1991 are facing aging problems such as leakages of the roof, water supply and sanitation pipes and deterioration of other building parts. The residential development that took place to accommodate then the middle-class population was mid-rise buildings having small or moderate size units and without lifts, parking and other high-end amenities. The change in space requirements over a period of time, lifestyle changes of occupants and lack of facilities such as lifts and parking and also the problems due to aging make the buildings unfit for the use of its occupants. For these reasons, buildings are redeveloped to overcome these issues. Lack of parking is one of the significant reasons for redevelopment. There is a significant change in parking norms as prescribed by current development control rules. In redevelopment projects, mechanized parking has become a standard system to cater to increased parking requirements. However, the age of original members of old apartments ranges between 65 years to 85 years or even more. This paper questions the efficacy of mechanized parking for this age group as far as the ease of use is concerned. The paper explores the actual parking requirements of original members of redeveloped apartments and how do they use mechanized parking provided by developers. A questionnaire survey of original society members is conducted in redeveloped societies to identify the issues related to mechanized parking. A visual survey is also conducted to check the occupancy and use of mechanized parking in these societies. Based on the empirical data, conclusions are drawn with regard to the use of mechanized parking and related issues.

KEYWORDS:

Residential Redevelopment, Mechanized Parking, And Parking Requirements, Etc.

INTRODUCTION:

In the last two decades with the rapid increase in cars, the need to find available parking space most efficiently and efficient car parking management has become a necessity. Also, over the decades, the parking norms have been changed, since many families are now having more than one vehicle. This is leading to the inadequacy of parking in the basement parking or ground-level parking for multi-housing projects. When the basement gets full, residents are forced to park their vehicles on the road, which compromises security and adds to congestion. As a solution, many residential societies in India are now offering multi-level car parking to residents. This helps in the effective utilization of available space and gives residents the flexibility to use the facility at any time. As the facility requires less space, it leaves a lot of open space for landscaping, creating a healthier environment for residents. Besides, it reduces the possibility of disputes over parking space.

The use of mechanized parking is a very recent development in redeveloped residential buildings to accommodate the increased requirement of parking. This study analyzes the efficiency of mechanized parking in redeveloped buildings, whether mechanized parking is useful or not to the residents of the redeveloped buildings, and what issues are these people facing while using mechanized parking.

METHODOLOGY:

This research includes both the qualitative and quantitative methods of data collection. Quantitative data is collected through a questionnaire survey. A case study method is employed to understand the efficiency of mechanized parking in redeveloped buildings using mechanized parking systems. The survey was carried out in 10 redeveloped buildings in Karvenagar and Kothrud, Pune, India, where redevelopment of these buildings is observed in the escalating rate. A minimum of 10% of residents from a single redeveloped building was interviewed to understand the parking requirements, the efficiency of use of mechanized parking, and issues faced by the residents while using the parking systems.

LITERATURE REVIEW:

In this section, the literature on the growth in the number of automobiles and the demand for parking is studied. Like most of the Indian cities, Pune is witnessing a rush in urban growth that is also accompanied by growth in private vehicle ownership. It is said that the Regional Transport Office in Pune registers almost 500 new vehicles every day. With such explosive growth in the number of automobiles, the demand for parking escalates, resulting in footpaths and available open spaces being encroached by formal or informal parking lots. [1]

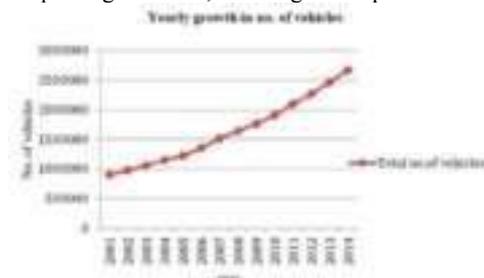


Fig. no. 1- Vehicular growth in Pune

Source: [2]

In India, more than 25 lakh automobiles are sold every year which further leads to parking problems on a daily basis. To offer some relief to vehicle owners, the Government had worked on many proposals of multi-level parking in metro cities, some of which have already been built. However, many more are required to solve the problem. [2]

In this section, the literature on types of mechanized parking available in the market is studied through the internet search engine.

Types of Automated multilevel car parking systems:

Puzzle Type: This system has more than two levels of parking. Its design has a structure that enables the use of all parking entrances and exits on the ground level. The parking pallets move left, right, upward, and downward and always have one empty slot for movements. [3]



Fig. no. 2 - Puzzle parking
(Source: www.wohrparking.in/&psig)



Fig. no. 3 - Puzzle parking
(Source: www.siegerparking.com/pit-puzzle- parking-system)

Advantages:

1. Operation is simple, no need for the parking attendants.
2. Fast retrieval time, generally 2 min.
3. Extremely safe and reliable with the safety and option of automated gates.

Disadvantages:

1. There is a greater construction cost per space.
 2. It may be a bit confusing for unfamiliar users.
 3. It requires a maintenance contract with the supplier.
- The Puzzle parking is being constructed over an area of 310 sq.m at a cost of Rs 7.55 cr.
Mostly used in residential and commercial buildings.



Elevator Type:

Fig no. 4- Elevator type parking system
(Source:www.flickr.com/photos/jag9889)

It works by lifting a car that is stored below the surface to the top by pushing the area of the driveway away to reveal the other car safely. Once the underground car is removed, the lift is lowered again!
[3]

Advantages:

1. Minimal land use. An area of 25' x 22' can park up to 72 vehicles.
2. Low noise and vibration.
3. Entry and exit are very quick and convenient.
4. Completely equipped with multiple sensors and triple safety devices.
5. Has the capability of holding cue memory when multiple patrons come to retrieve their vehicles during rush hours.

Disadvantages:

1. Required greater height, or free space for parking system installation. As there is a limit for building height, installing this system of parking would be inappropriate.
 2. There is a greater construction cost per space.
 3. It may be a bit confusing for unfamiliar users.
 4. It requires a maintenance contract with the supplier.
- Above ground level parking structures today cost 1.4 to 2.4 cr. This system is mostly used in commercial and industrial buildings.

Multi-floor type:

An automated car parking system (APS) is a mechanized system designed to minimize the area/ volume required for parking cars. Like a multi-story parking garage, an APS provides parking for cars on multi-levels stacked vertically to maximize the number of parking spaces while minimizing land usage. [3]

Stack parking system:



Fig. no. 5- Stack parking system
(Source: www.siegerparking.com)



Fig. no. 6- Stack parking system
(Source: Author)

It is a car parking system that provides non-independent parking spaces for two cars - one vehicle on the lower platform and one vehicle on the upper platform. In this parking system, access to all parking spaces is horizontal. The vehicle parked below must be removed first before the platform is lowered. To facilitate proper parking of the vehicle, the upper parking space is equipped with wheel-stop. This device should

be adjusted following the operating instructions. The parking system is operated with a key switch on the operator box mounted in front. This type of mechanized parking is mostly used in redeveloped residential buildings.

Pit parking system:



Fig. no. 7- Pit parking system
(Source: www.wohrparking.in/&psig)



Fig. no. 8 -Pit parking system
(Source: <https://weidaweldingrotator.en.made-in-china.com>)

It is a car parking system providing independent parking spaces for three cars - one vehicle on the lower platform, one vehicle on the middle platform, and one vehicle on the upper platform. The three platforms are connected mechanically and there is no relative movement in between them. All three platforms move vertically up & down together. Dimensions are following the pertaining information sheet.

In this parking system, access to all parking spaces is horizontal. Customers need to provide pit for this product for the lower car platform & middle car platform to go in and enable the upper car platform to match the ground level. To facilitate proper parking of the vehicle all the parking spaces are equipped with wheel-stops. This wheel-stop should be adjusted following the operating instructions. The parking system is operated with a key switch on the operator box mounted in front.

Mostly used in redeveloped residential buildings. [4]

Advantages:

1. Because each elevator and cart is operated independently on each level, entry and exit are quick. Retrieval time of a vehicle is less than two minutes.
2. Low noise and vibration. Entry and exits are very quick and convenient. Incorporate with a built-in turntable on each elevator.
3. Self-malfunction diagnostic control provides an excellent level of safety and reliability.
4. There is a greater sense of security.
5. It is highly feasible for extremely small sites that are unable to accommodate a conventional ramped parking structure.
6. There is no need for driving while looking for available space.
7. Emissions are greatly brought down and reduced.
8. The patrons waiting for their cars in a highly controlled environment.
9. There are fewer chances for vehicle vandalism.
10. There is a minimal staff requirement if it is used by known parkers.
11. There is an easier facade integration since there are no ramping floors or openings in exterior walls.

Disadvantages:

1. There is a greater construction cost per space (but this may be offset by the chance for lesser land costs per space and the system manufacturers say that the operating and maintenance cost will be lower as compared to a conventional ramped parking structure).
2. The use of redundant systems will result in a greater cost.
3. For unfamiliar users, it might be a bit confusing.
4. For high peak hour volume facilities, this parking system is recommended.
5. There may be a fear of breakdown (How do I get my car out?).
6. There is an uncertain building department review and approval process.
7. It requires a maintenance contract with the supplier.

The stack and pit parking is being constructed at a cost of Rs 2 lakhs.

Rotatory type:



Fig. no. 9 - Rotatory type parking
(Source: <https://cherishparking.en.made-in-china.com>)

Automated Rotary Car Parking System operates on a simple wheel mechanism that can minimize the area and/or volume required for parking cars. It is highly suitable for small and medium-sized office buildings, shops, hospitals, hotels, apartment blocks, housing estates, simply for sites where there is limited parking spaces. [3]

Advantages:

1. Space normally taken up 2 vehicles, can accommodate up to 12 vehicles within that space.
2. It does not apply to the regulations of building coverage.
3. As there is a simple one-touch operation method, there is no need for an attendant.
4. Senses where the vehicle is closer and rotates bi-directionally for fast retrieval time.
5. Extremely safe and reliable. Impossible for vehicles to fall with endless change and pallet drop prevention system.

Disadvantages:

1. But these systems have a major disadvantage of large space consumption which is successfully eliminated with the use of a rotary car parking system.
2. Moreover, the latter provides the added benefits of flexible operation without the need of an attendant and added security and least chances of vehicle damage.

The auto rotatory car parking system costs 2 lakhs/ no. This type of parking system is mostly used in commercial and industrial buildings.

Social acceptability of automated parking system

Singh (2014) studied the Social acceptability of an automated parking system in India. The observations from his empirical study pertain to the parking habits of Indian people and their relation with the social acceptability of the atomized parking system. According to him, most people prefer to just park and hurry to their homes or workspaces or any other activities they have. Especially if the user is in a rush, he or she will not like to wait for the entire process of automated mechanized parking to take place and thus will subsequently park their vehicles on the street. He points out that it is also out of the simple habit of parking on the road that people might not bother using the automated parking system. In case of system or electrical failures, the residents will prefer parking their vehicles on the ground and wouldn't want to risk it by using the automated parking system. He argues that unawareness or less information about automated parking systems especially among the drivers has contributed to the under the implementation of the automated parking system in our country. In addition, he points out that service intervals vary for automated car parking systems, depending on the type of machines used and their usage. Parking systems should be serviced at least once a year, and up to four times a year for high traffic areas or valet parking. Besides, regular cleaning is mandatory to keep the car parking system in great working order, especially with the problems posed by weather. [4]

DATA COLLECTION AND ANALYSIS:

30 respondents from 10 different redeveloped buildings were categorized into four different age groups. Almost half of the respondents using mechanized parking were mid-age population between 41 to 60 years, whereas 23% were young people and 30 % of the respondents were senior citizens.

The ratio of no. of vehicles to the parking availability provided to the residents:

Parking availability was more than the no. of cars available. This data collected reveal that in redeveloped buildings, original residents tend to purchase additional area more than that offered by the developers. As per recent DC rules of 2017, for having carpet area more than 80sq.m and less than 150sq.m, in a non-congested area, parking space for 2 car parks have to be provided. [6]The original members of redeveloped societies are senior citizens. Although their car ownership is likely to be less, they insist on the provision of car parking as a future provision for their heirs.

Parking availability in redeveloped buildings on no. of floor levels:

In recently redeveloped residential buildings, ground-level parking with double-height is widely observed. The ground level parking with double stacking or ground-level parking with double stacking and pit were observed in case study buildings.



Fig. no. 10 - Stack parking
(Source: Author)



Fig. no. 11- Puzzled parking
(Source: Author)

Type of parking observed in the case study buildings:

83% buildings had parking at ground level whereas in 13.3% building parking was provided at upper levels. The rest of the 3.7% of buildings were provided with a mechanized parking system. It is important to note that 83% of buildings were provided with double-height so that mechanized parking can be provided in the future to cater to increased parking demands.

Mechanized parking systems used in redeveloped residential building:

65.5% of buildings were provided with stack parking whereas, 34.5 % of buildings were provided with pit parking. Puzzled parking seems to be very uncommon. Only 1 building out of 10 case study buildings was provided with puzzled parking.

Types of Parking Systems	Specification
G61 Standard	It is a car parking system that provides non-independent parking spaces for two cars - one vehicle on the lower platform and one vehicle on the upper platform. The vehicle parked below must be removed first before the platform is lowered. To facilitate proper parking of the vehicle, the upper parking space is equipped with wheel-stop.[12]
<i>G63 Standard (Independent 3 level Stack)</i>	<i>It is a car parking system providing independent parking spaces for three cars - one vehicle on the lower platform, one vehicle on the middle platform, and one vehicle on the upper platform. The three platforms are connected mechanically and there is no relative movement in between them.[12]</i>
3015 (dependent 3 level Stack Parking System)	It is a car parking system providing dependent parking spaces for three cars - one vehicle on the lower platform and two vehicles on the upper platform. In this parking system, access to all parking spaces is horizontal. The vehicle parked in the lower platform must be removed first before the platform is lowered.[12]
<i>2062 (Independent Stack)</i>	<i>It is a car parking system providing independent parking spaces for two cars - one vehicle on the lower platform and one vehicle on the upper platform. The two platforms are connected mechanically and there is no relative movement in between them.[12]</i>

G63 Standard (Independent 3 level Stack) and 2062 (Independent Stack) was the most efficient parking system, where users expressed their satisfaction regarding convenience for use of the parking system.

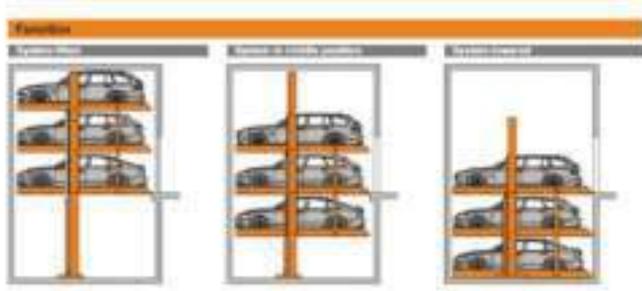


Fig. no. 12 – Stack and pit parking

(source: <https://www.klausindia.com/multi-level-car-parking/brochure-pdf/stacparking-g63standard-datasheet.pdf>)

It was also studied whether mechanized parking is user-friendly or they need the help of an operator to use mechanized parking. It was observed that the majority of the residents i.e about 76.7% of residents operated mechanized parking systems by themselves. Almost 87% of the users were comfortable using mechanized parking. The data collected also suggested that 79% of users did

not face any difficulty using mechanized parking whereas 21% of respondents expressed that they face difficulties in operating mechanized parking. Considering the frequency of use of the parking system, most of the respondents parked their car in a mechanized car parking system at least once a day, out of 29 responses 48.3 % of the respondents park their vehicle at least once a day.

In some case studies, it was found that both the bays of stack parking were in the possession of one flat owner, whereas in some case studies these stacks were in the possession of different flat owners. The flat owners in the later case faced more difficulties in parking / unparking their vehicles and were less satisfied with mechanized parking.

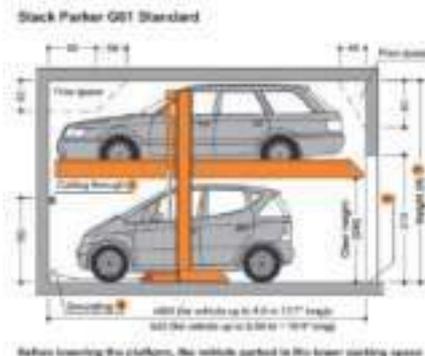


Fig. no. 13- Stack parker

(source: <https://www.klausindia.com/multi-level-car-parking/brochure-pdf/stacparking-g63standard-datasheet.pdf>)

In the case of stack and pit parking, where each bay could come to the ground floor independently, it was found to be a very efficient method and the respondents were very comfortable using this system. This system was found in the **Klaus multi parking system**, which was seen in one of the 10 case-study buildings, the respondents of this building, where very satisfied with this system, and also mentioned that it had low operating and maintenance cost, unlike the residents of the other case-study building.

Few respondents also expressed their concerns about high maintenance cost, the other important concerns raised by the residents was regarding parking and unparking in stack parking system during an emergency, as it was time-consuming. Regular maintenance was required for mechanized parking and if not provided, would cause a lot of problems. The maintenance cost of mechanized parking in these redeveloped buildings ranged from 500 Rs. – 700 Rs. Per month /flat. As the size of the bay and the height between each bay was restricted, SUV cars having greater height and size then sedan cars were unable to be parked in some of the mechanized parking. Most of the residents in redeveloped buildings, occupied their flats in past few months to a year and had 2 bays of parking, however, they had ownership of single-car only and mechanized parking is used incidentally in case of guest visiting their homes, so majority of them expressed their satisfaction in using mechanized parking, hence had no idea about the issues faced while using mechanized parking.

CONCLUSIONS:

The use of mechanized parking is becoming very common due to the efficiency of space use. However, the efficiency in use was not studied empirically. This research paper has thrown light on the efficiency of use of mechanized parking especially in the case of residential redevelopment projects where end users are mostly senior citizens, this paper reveals that the use of efficiency depends upon the type of mechanized parking. Mechanized parking such as stack or pit parking where cars can be parked/ un-parked independently was found to be the most efficient system. Also, in the dependent stack parking system, where both the stack were owned by a single flat owner, were found to be efficient in use. Developers should be sensitive towards handing over parking bays to different owners in case of a dependent system. This paper gives user feedback regarding the use efficiency of different mechanized parking systems which is useful for architects and developers in designing parking for multi-family housing.

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REUSING SHIPPING CONTAINERS AS EMERGENCY SHELTER HOMES IN FLOOD PRONE AREAS OF SOUTH INDIA

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ABSTRACT: Re-using Shipping Containers is becoming more common these days and can be seen as a useful solution for quick habitation. India being an over-populated country needs instant accommodation in the case of an emergency or disaster. This paper talks about the possibilities of using Shipping Containers as emergency shelter homes. Literature reviews are done on the up to date research about shipping containers and current flood scenarios. With an advantage of the flexibility of use, specific housing needs may be achievable.

KEYWORDS: Re-usable, speed, sustainable, temporary dwellings, shelter homes, cost-effective, floods, shipping container

1. INTRODUCTION:

Despite advanced technology, natural disasters still remains an unavoidable human hazard [1]. Huge masses of people get affected and have to relocate once the disaster hits. Thus, temporary housing plays an important role in incubating survivors until their homes are rebuilt, or to relocate entirely [2].

Out of all the temporary housing options available today, one needs to be found which can cater to a large number of people in the least time possible. This may be done by reusing Shipping Containers as Shelter Homes for post-disaster situations.

Flooding is a perennial problem. Almost every year floods cause enormous damage to the people and economy to South India. To reduce the problem, a lot of investment has been made to build embankments for protecting important areas. The records of damages due to floods state that the measures currently taken are not enough to satisfy the basic needs [3].

Thus, with the current condition of overpopulation and flooding, combined with recycling empty shipping containers, the possibility of using these shipping containers as emergency shelter homes post floods can be explored. Hence, this paper talks about the feasibility of using Shipping Containers as Shelter Homes in the flood-prone regions of South India.

2. RESEARCH GAP:

The key factor for construction in flood-prone areas is working with muddy terrain. This factor has not been mentioned in the research papers studied so far. Another factor is the socio-economic status and the mindset of the people in South India. This plays a major role in choosing shipping containers as a concept and hence, this aspect needs to be studied further in detail. In addition to this, another factor that has not been discussed so far is the practical training required for employees or skilled labour to escort victims to a safe place. Most of the employees are unaware of how to handle the situation, and thus should be briefed and made to undergo specific training.

3. AIM:

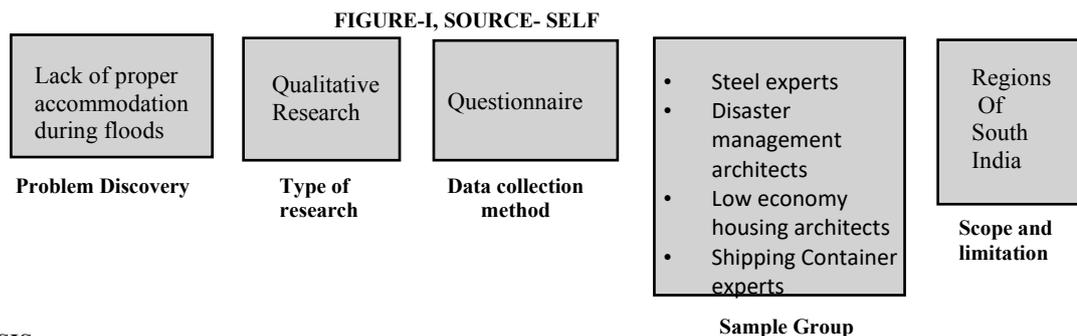
This research paper aims at checking the feasibility of re-using shipping containers as shelter homes, by studying the existing conditions, finding the best construction techniques and solving any existing problems if any.

4. METHODOLOGY:

The discussion widens in scope to analyse the qualitative aspects related to temporary dwellings [4]. Firstly, the problem was identified by finding out the current conditions of the emergency homes by the help of case studies. Next, a questionnaire was prepared and distributed to multiple architects and experts such as- Shipping Container specialists, steel experts, Sustainability experts and general architects. These architects were asked to answer the questionnaire which consisted of 4 questions-

- 1) Is there enough potential for using Shipping Containers as shelter homes? If yes, why? If no, why?
- 2) Do you know any examples of shelter homes? Where are they located?
- 3) According to you, what are the challenges of using Shipping Containers as shelter homes?
- 4) What are the important considerations to be taken while constructing or designing shelter homes using Shipping Containers?

The answers of three architects were obtained by in-person interviews and the other seven architects' answers were obtained by a telephonic interview. Each architect's answers were noted and tallied, and various significant points were brought to light.

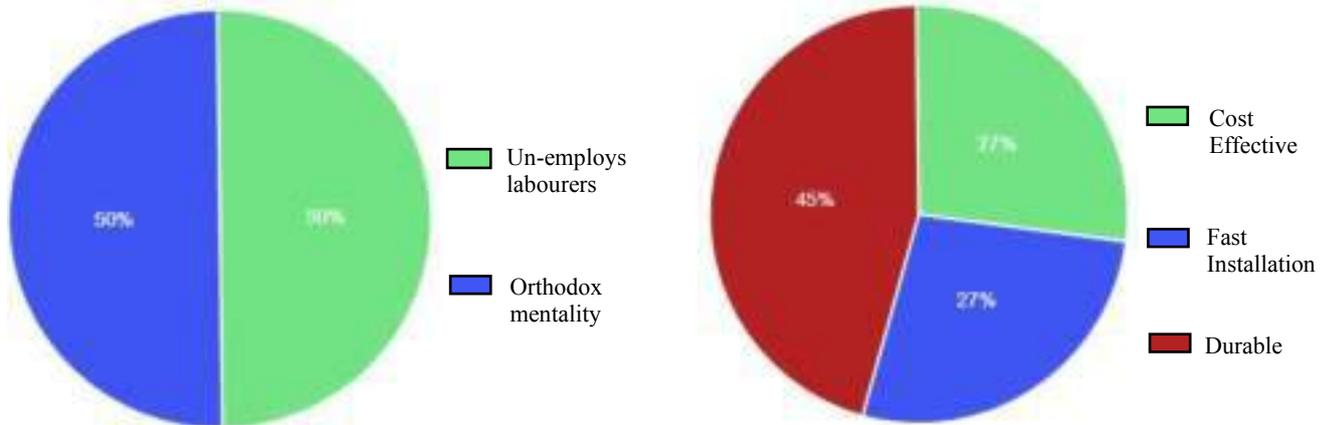


5. DATA ANALYSIS:

Based on the questionnaire made, the following responses were obtained and multiple themes could be extracted-

- 1) Is there enough potential for using Shipping Containers as shelter homes? If yes, why? If no, why? 10 responses

GRAPH-I, SOURCE- SELF

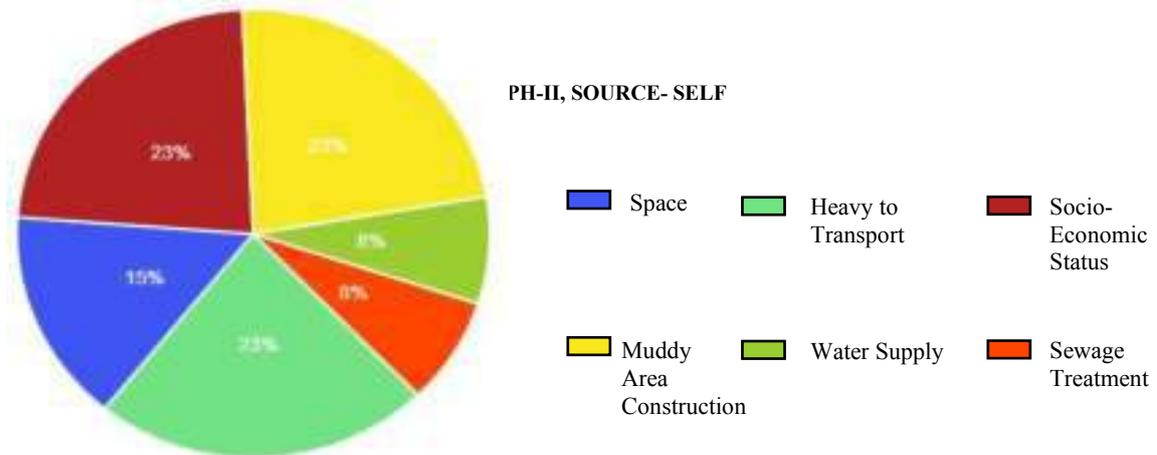


2) Do you know any examples of shelter homes? Where are they located? 10 responses

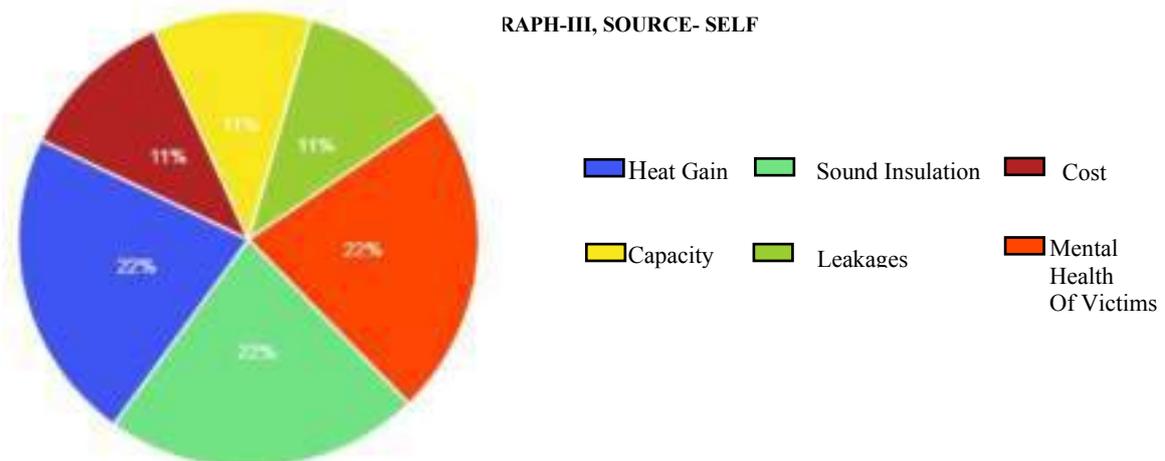
TABLE-1, SOURCE- SELF

THEME DISCOVERED	RESPONSE
Low economy use	Yes, classroom under the flyover in Thane, Mumbai
Residential Purpose	Yes, Zostel
As Shelter Homes	No

3) According to you, what are the challenges of using Shipping Containers as shelter homes? 10 responses



4) What are the important considerations to be taken while constructing Shelter Homes? 10 responses



6. DISCUSSION AND FINDINGS:

The purpose of this study was to systematically examine the social sustainability of utilising shipping containers in post-disaster applications [2]. It was found that shipping containers have multiple advantages and can be termed as a sustainable material, one which can serve as a feasible option. It shows that reusing shipping containers for building architecture, stands a chance to minimise carbon footprint and maximise affordable home solutions at the same time [5]. It was also found that this is more cost-effective as compared to other alternatives. It also has fast erection, and is a durable material. One of the interesting factors is that it allows flexibility of design. So a customisable space may be achieved as per the needs of a post-disaster space. In addition to this, it may serve as a technological advancement in India since such type of container usage is still not popular in these regions. It was also found that almost no Shelter Homes were known to exist which were made out of Shipping Containers. This can serve as a potential for trying out this new option.

But in contrast to this, there were multiple disadvantages as well. It was also found that Shipping Containers can also be tricky to use in South India due to its muddy terrain. Thus, transportation in marshy areas can be problematic. Hence, an appropriate site away from the marshy soil should be found where setting up these Shelter Homes is an easy task. Another major problem established was that people in South India were orthodox and are not ready to experiment with new design-based solutions. Also, since Shipping Containers are factory-made, it reduces the amount of labour required, which is a disadvantage to the lower economic class. Hence, provisions should be made for labourers to contribute to the setting up of these Shelter Homes. This can be done by employing them for the setting up process.

As per interviews and findings, it has been established that there are multiple factors which have to be taken into consideration while working with Shipping Containers such as, insulation, leakages, heat gain, sewage treatment, etc. Hence, there is a subsequent amount of site work which needs to be done before construction.

7. CONCLUSION:

India has witnessed many of the largest, most catastrophic floods, causing irreparable damage to people's livelihood, property, and crucial infrastructure [6]. If all these problems are addressed by sustainable and innovative solutions, Shipping Containers can be an excellent concept to work with. Considering the geography of the country and excess floodwater in the monsoon period, it may be stated that such shelters may prove as an effective tool for coping with floods. In these areas, it is seen that building embankments are not feasible options. Shipping Containers can be used as Shelter Homes as they can be erected instantly when there is a warning notice. As per the above findings, it can be stated that Shipping Containers have their pros and cons when it comes to using it in the context of South India. Hence, Disaster relief temporary housing policy needs to be developed in partnership with affected communities, with those experiencing disasters in the past contributing first-hand knowledge to enable a reconstruction response based on socially appropriate solutions [2]. This will greatly benefit future disaster survivors. Hence, from the results, it can be seen that there is scope for sustainability in certain situations, providing the design of such a project addresses the key social issues surrounding ownership, flexibility, policy planning and economic use of resources [2].

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CONTEMPORARY FORM OF TRADITIONAL MATERIAL: BRICK

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ABSTRACT: The history of brick construction is very old in Indian subcontinent. It is traditional smallest module used in construction of the structure of any scale. The traditional bricks are used for façade treatment as well as structural elements. It increases the beauty of the structure without applying any additional material or treatment like cladding. Through various permutation and combination of traditional bricks one can achieve excellent aesthetical façade treatments and create various elements like arches, twisted column, various shape of opening. The traditional touch to the modern structure can be achieved by using traditional bricks. It is vernacular construction module which is suitable for India's climate by creating cavities in the wall. Porous structure of brick help to deal with ventilation issue and reducing internal temperature. The aesthetics of façade depends on the quality of bricks used, workmanship and pointing methods. The mortar used for the construction depicts the strength of the structure. The waste formed during construction and manufacture can be reduced by using modern techniques like landscape use. This paper tries to deal with all these issues and aspects of the traditional brick in contemporary context.

KEYWORDS: façade treatment, ventilation, vernacular construction module, waste brick use.

INTRODUCTION: The contemporary form of traditional material like brick used in aesthetics. The evolution of bricks in aesthetics as per various era. The various form of bricks, its classes, materials used for manufacture, method of construction, used for different structural components. Traditional brick is majorly used in walls. But due to rapidly increasing growth of construction industry the use of various new material such as glass panels, ACC cement blocks, etc is increasing. By using this kind of materials are increasing number of issues such as ventilation issue, temperature control etc. To deal with this issues traditional bricks is good option. Innovative thinkers are also finding new ways to incorporate active sustainability into the small building elements by using traditional clay bricks. The limitation of this paper is the evaluation of aesthetic form of traditional bricks and today's aesthetic form of bricks.

METHODOLOGY: Sampling of various structure is based on importance of structure in locality, surrounding, scale of structure, unique design idea, use of traditional bricks, construction techniques, combination with RCC, etc. For this research paper 4 structures are identified based on above points and visits are done by the author to collect primary data. For understanding the use of waste bricks, various data collected from the online sources as well as book case studies and analysis is done with the help of various parameters formulated from primary and secondary data collection.

1. EVOLUTION OF BRICK STRUCTURE:



Fig. 1 - Timeline of traditional brick structure

2. TYPES OF TRADITIONAL BRICKS:

2.1 Burnt bricks: Traditional clay brick burnt in kiln.

2.2 Sun Dried Bricks: Traditional brick dried naturally.

2.3 From Waste Soil in Manufacture: brick created by combination of cement and waste soil created in manufacturing process of the brick.

3. CASESTUDY:

TABLE I

Comparative analysis of different structure

Parameters	IIM Ahmedabad	CEPT Ahmedabad	Earth Institute Auroville	IV. Nandanam School Auroville
Designed by	Ar. Louis Kahn	Ar. B.V. Doshi	-	-
Façade treatment	Circular arches & opening created	Combination of RCC & bricks.	Vault created by bricks.	Combination of RCC & bricks.
Use of brick	To create structural member	Used in non-load bearing walls.	Create various vaults & dome	In structural system
Climate response	2 to 3 degree less temp. inside the structure	1 to 2 degree less temp. inside the structure	2 to 3 degree less temp. inside the structure	2 to 3 degree less temp. inside the structure
Construction method	Load bearing	Frame structure	Both	Column & wall created by bricks
Current condition	Cracks developed in some parts	Cracks developed in some parts	Similar to new construction	Similar to new construction
Maintains	Protection of bricks from climate changes	Protection of bricks from climate changes.	Prevent from monsoon	Prevent from monsoon

4. USE OF WASTE BRICKS:

4.1 Concert hall in Poland : Architect Fernando Menis used crushed traditional red brick and white concrete to create better acoustical treatment for a concert hall in Poland. The structure is also look like a massive folded cavern rendered in origami. The multifunctional concert hall is a good example of old and new styles through its use of materials. The crushed bricks reminds the facade of the surrounding town. The white concrete adorns the outer skin of the building. The concrete hall is revealing the interior brick. The dynamic ceiling is created with the origami techniques. According to the architect partition walls can be added or removed to accommodate different sonic needs.

4.2 Crush bricks: Crushed brick can create an interesting colour to the pathway that can complement home's design and it can add unique landscape feature. The dust crated by vehicle load mixes with the dirt below the pathway, lowering level of the pathway surface and creating a muddy mess if not replaced often. The best way to use crushed brick as a pathway surface is to place it over crushed gravel.

Fig. 2 – Concert Hall Poland^[1]

Fig. 3 – Use of Crush Brick in Landscape

5. CONSTRUCTION TECHNOLOGY:

5.1 Columns: The construction of brick columns over concrete columns helps in increasing the architectural beauty. The constructed brick columns can either be round, rectangle or square or elliptical in cross-section. These can be constructed to the needful height. These columns can act as corner pillars, porch columns, boundary gate pillars or free-standing columns.

5.2 Arches: the brick arch is used in construction to span over wall openings and add aesthetics as the arch is the consummate definition of form and function.

5.3 Openings: An abstraction from the Indian perforated Jali wall historically carved of stone served as windows, providing ventilation without the need for expensive glass. Provide security and privacy while toying with light and shadow.

5.4 Roofing System: domes and vaults are created by traditional bricks. Bricks are placed side by side until a complete concentric circle of bricks is closed, to form a compressive ring. Single domes can cover rectangular, round spaces or irregular space. The radial arm makes this easy, as it shows exactly where every brick should lead in the roof should be positioned, regardless of the shape the roof is sitting on.

5.5 Façade Treatment: Among many materials that style the exteriors of homes, brick facades have a strong aesthetic value and are favourable for most Indian climatic conditions. This earthy treatment makes for an economical, low-maintenance and super-durable alternative to customary plastered surfaces.

5.6 Pointing: Bricks are placed side by side until a complete concentric circle of bricks is closed, to form a compressive ring. Single domes can cover rectangular, round spaces or irregular space. The radial arm makes this easy, as it shows exactly where every brick in the roof should be positioned, regardless of the shape the roof is sitting on.



Fig. 4 – (From Left) twisted column^[2], use of arches in Rasmacha Temple^[3], small openings created by lauri baker^[4], Maya Somaiya School Library^[5], Boys Hostel Zero Energy Design Lab^[6]

6. MAINTAINENCE, RESTORATION: Salt patches, green growth, water absorption, colour fading this are some common defects observe in brick façade. Many structure across the world with exposed brick façade has unique identity. When it is subjected to climate response and vehicular fumes, it tends to generate salt on the surface of the traditional brick which not only gives a patchy look but also indicates the signs of deterioration of existing brick work. Brick tends to open the capillary pores which impact the ingress of water and then water travels to interior part of the building spoiling the interior décor as well as strength of the structure. Exposed brick façade structure should require proper treatment at the time of installation.



Fig. 5 – Need of restoration & maintains required for brick façade^[7]

7. RESULTS:

7.1 Early period use (load bearing walls): Load bearing masonry construction is one of the oldest and most wide use construction techniques in the world.

7.2 Present use: Traditional bricks is majorly used for façade treatment.

7.3 Mortar: Mortar is a workable paste which is used to bind building blocks, fill and seal the irregular gaps between them and sometimes add decorative colours or patterns in masonry walls.

7.4 Pointing and joints: Require to protect from weather conditions like rain, fungus etc.

7.5 Wastage in construction: Every time a building is demolished, most of the waste and building material piling up consist of bricks. Collect them and stack them because you can reuse them for numerous house projects such as: Building a dog house; Build an outdoor barbeque grill; Make interesting flower pots; Use them to level your garden; Use them to build garden retaining walls.

CONCLUSION: The history of bricks is very old in Indian region. The small unit of traditional bricks plays very important role in massing of structure. Can achieve different aesthetic form by using bricks. In early period the bricks are widely used for load bearing construction and now a days is majorly used as façade treatment. The various architects use this small unit in different ways. Through this small unit we can achieve the traditional touch to the modern structure. The only drawback to use exposed brick walls or façade is first class bricks are required and labour work should be proper. The maintenance is also major factor.

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THE EFFECT OF NEIGHBOURHOOD CHARACTERISTICS AND AMENITIES ON THE PROPERTY VALUE

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ABSTRACT

Neighbourhood is a geographical unit in which there are social similarities. However, the perception of a particular neighbourhood is different for different people. The factors such as both amenities and dis-amenities are significant factors that decide house price in a particular neighbourhood. Urban residential house prices depends on two broad factors: (1) Tangible factors -characteristics of the individual houses and (2) Intangible factors -neighbourhood characteristics, surrounding environment, housing characteristics and services. The location of a property is the most obvious factor that affect the pricing of house like the centrality of location etc. The supply and demand, interest rates, property, market performance, population, sizes detonate and facilities, aesthetics are also factors that determine house price. The aim of this paper is to study the factors or key determinants that affect the value of property in a locality. In this study, the determinants such as housing characteristics, neighbourhood characteristics and amenities are considered. The study is carried out through physical observations and interviews with builders, real estate agents. On-site observations are carried out to study housing characteristics, neighbourhood characteristics and amenities in a particular area. A study area is divided into 5 distinct sub-areas with distinct neighbourhood characteristics and amenities and the impact of these factors on housing price is studied.

KEY WORDS - House Price, Hedonic Pricing Model, Neighbourhood Characteristics, Amenities, Housing Characteristics.

INTRODUCTION

House is a day to day need of a man. A house provides us with shelter or accommodation. While buying any house or a property a buyer looks at various aspects such as its location, amenities, accessibility and its price. In this papers "house" refers to the whole consisting of both the structure and the plot. House price is basically the price at which a house is sold or offered for sale. House price is dependent on a large number of factors. Price of a dwelling consists of the housing characteristics and the land on which it is build. House price study is helpful for the stakeholders or owners to take decisions to buy, sell, and invest in the property. This paper studies the factors that affect the housing prices in positive or negative ways.

LITERATURE REVIEW

Various researchers have considered different factors as a key determinants for estimating the housing price. Some researchers have considered combination of various factors. The factors such as location of a property, housing characteristics of the house building and the neighbourhood characteristics are also taken into consideration and their effect on housing price is studied. Hedonic pricing is a model that identifies price factor. According to the theory that price is determined on both internal characteristics of the good and property to be sold and even external factors / surrounding factors affecting it. HPM is used by different researchers to estimate the value of different types of commodities in market .It is widely used as pricing model in the real estate market. Many researchers have also considered location as the only element as a key determinant in the theory of hedonic pricing. Some of the researchers state that the location from the central business district as an important factor where as some of them have stated the proximity to the other employment opportunities as an extra element deciding housing price. The proximity to school, hospitals, and churches malls, convenient shopping, neighbourhood facilities etc. are also taken into consideration to study its relevance to housing price. Although some researchers have considered the proximity to commuting opportunities as a factor affecting house price in their hedonic pricing model instead of location view to parks , green spaces, rivers , sea , bridges, flyovers, gardens, income in neighbourhood, ethnic accepts etc. In the hedonic price model (HPM). Environmental characteristics or environmental quality such as air quality water quality, these pollution levels etc. is also considered as a part of neighbourhood characteristics. Other factors that are considered in the theory of hedonic model includes 1) distance to working place. 2) Hospitals 3) neighbourhood facilities 4) schools 5) shopping malls 6) view to garden / parks, etc.

Mallick and Mahalik (2014) stated that not only housing prices but also speculative prices plays an important role when housing is not just considered from consumption point view but also from asset creation point view (investment). The hedonic models are used for analysis of trends and sales comparison of housing prices etc. Abidoeye and Chan (2017) have identified 360 independent variables from 125 research articles they reviewed which used HPM to obtain housing price in market. Babawale (2011) investigated the impact of neighbourhood churches on residential property values with particular reference selected areas. The hypothesis that proximity to a church has no effect (positive or negative) on house price is tested in his study. He used a standard hedonic pricing model using a sample of 450 rented apartments (flats) across the study area. The results revealed that neighbourhood churches, particularly the large once impact negatively on the value of nearby residential properties.

Musa (April 2015) studied the impact of neighbourhood characteristics on residential property value suggesting that both neighbourhood amenities and dis-amenities play very significant role in the formation of residential housing prices. The study suggested the use of many explanatory neighbourhood variables to justifiably estimate the impact of neighbourhood characteristics on residential property prices / values. Islam (2012) estimated the impact of neighbourhood characteristics, particularly adjacent ravines, and amount of public land and incidence of crimes on house prices in the locality. Results of the paper indicated that house- hold income and adjacency to ravines positively correlated and they both independently contribute to house price. Crime variable has a negative impact on the house prices, but their impacts were negligible.

Various researchers have considered different attributes as a key determinant for defining housing price. For eg.1) based on the location of the housed 2) housing characteristics (structural) 3) neighbourhood characteristics 4) environmental marketing 5) occupancy 6) selling and financial issues that affect the housing prices .The structural aspect or housing characteristics may include attributes like floor area, no of rooms, no. Of bedrooms, age of building cost of repair & maintenance, plot size, availability of parking, basement, fire places and HVAC system, garbage etc.

The location of a residential property in a city directly affects its market price. Property values have found that group homes do not adversely affect property value. Homes can depreciate in value or increase over time depending on a variety of factors. The centrality of location will also affect homes value. The locations of property have an influence on the choice and the offer price of each residential property. The location itself is the most obvious factor that affects how much property is worth.

AIM

To study the factors that affect the value of property in a specific area.

OBJECTIVE

- To study the factors that affect the house price as such schools, hospitals, shopping malls, parks, convenient shopping.
- To study what amenities and dis amenities affect the pricing of a house.
- To study the reasons of differences in the housing prices in neighbouring areas.

METHODOLOGY

The study includes both the qualitative and quantitative methods of data collection. The quantitative data pertains to the prices of houses in different locations collected through interviews of developers and estate agents. Whereas, the qualitative data is collected through various tools including physical survey, photographic documentation, interviews with developers and estate agents. The physical survey includes site visits to the case study areas and observations of neighbourhood characteristics in terms of access roads, amenities such as hospitals, shopping malls, convenient shopping, schools and other neighbourhood facilities. These were documented through photographs. Also, the housing characteristics were observed and documented photographically. The physical planning of these areas were studied through Google maps. Finally, all these data was compiled in the form of tabulation to comparatively analyse housing prices in the study areas. This tabulations helped in understanding the impacts of neighbourhood and housing characteristics on housing prices based on which conclusions are drawn.

STUDY AREA

The stretch selected for case study was in the proximity of Sinhgad road in Pune on either sides of the road. Out of the 5 case study areas, 4 case study areas were located on either sides of Sinhgad road which is one of the important arterial roads in the city and one case study was located across the river parallel to Sinhgad road as shown in the Figure no. 1. This area was selected for study since there is much variation in rates in neighbouring areas on both the sides of the road.

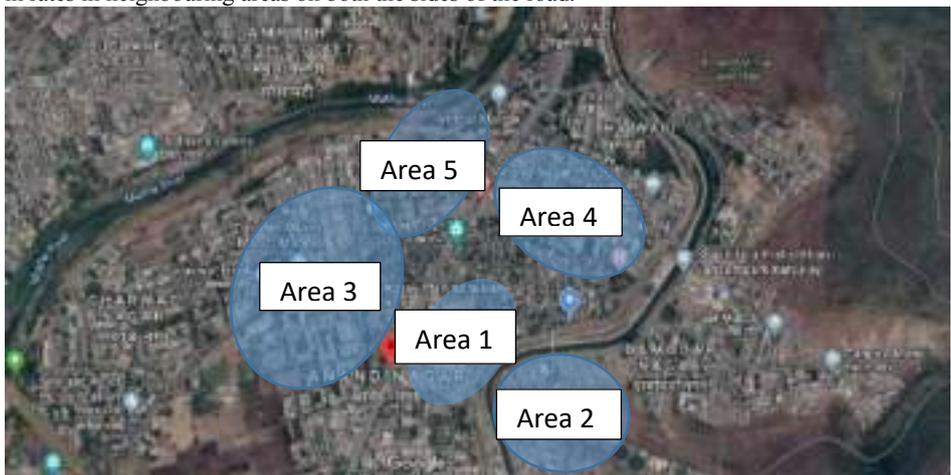


Fig no 1: Study Area

AREA 1

	<p>Area 1 selected is the Anandnagar which is located on the east side of the Sinhgad road. The area has amenities such as shopping malls, theatres, parks, open spaces, schools, and hospital in surrounding. It is a high end area. The access roads are wide, well maintained and in good condition. The socio-economic status is high. The rate of housing units ranged from 7000-8000 per SQ FT</p>
<p>Housing Characteristics Housing includes both single unit housing in the form of bungalows and multi- family housing. New buildings are also coming up in this area.</p>	

	Multi-unit Housing (G+7)	Multi-unit Housing (G+5)	Bunglows
<p>Neighbourhood Characteristics</p> <p>Access roads are in good condition. Shopping street and good social life has added to the vibrancy in the area</p>			
	Shopping street	Social life	Brand shops
<p>Amenities</p> <p>Amenities such as shopping, gymnasium, park, temple etc. are available in this area.</p>			
	Gymnasium	Parks	Temple

AREA 2

	<p>Area 2 selected is the Tukainagar which is located on the east side of the Sinhgad road. . The area has amenities such as parks, open spaces in the surrounding. It is a low lying area. The access roads are narrow and are reasonably fair condition. The socio-economic status is low. The natural setting of the area has reserved forest. However, because of the socio-economic status and housing characteristics in the vicinity the housing rate ranges from 4000-5000 per sqft.</p>		
<p>Housing Characteristics</p> <p>Mix housing characteristics are observed in this area. New buildings that are coming up are medium rise modern buildings. However, there is low lying area at the hill slope.</p>			
	Multi-unit Housing (G+7)	Multi-unit Housing (G+5)	Ground structures, G+1 Buildings, Temporary Construction.
<p>Neighbourhood Characteristics</p> <p>The locality is surrounded by hills with reserved forest. It is adjoining a water canal. Area has good natural setting.</p>			
	Forest Reservation	Canal	
<p>Amenities</p> <p>Amenities such as parks, walkways, foot over bridge on the canal are provided.</p>			
	Walking track	Park	Bridge over canal

AREA 3

	<p>Area 3 selected is the Suncity Road which is located on the west side of the Sinhgad road. The area has amenities such as parks, open spaces, hospitals, swimming pool, and cricket ground in surrounding. The access road area are wide and in good condition. The socio-economic status is medium. It is located in the proximity Mumbai-Bangalore express highway.</p>
<p>Housing Characteristics Mix housing characteristics are observed in this area. It is a mix of high modern buildings and row houses.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Multi-unit Housing (G+9)</p> </div> <div style="text-align: center;">  <p>Multi-unit Housing (G+9)</p> </div> <div style="text-align: center;">  <p>Row houses</p> </div> </div>
<p>Neighbourhood Characteristics It is characterised by proximity to highway, availability of shopping area, wide roads etc.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Proximity to Bangalore cycle Mumbai highway</p> </div> <div style="text-align: center;">  <p>Convenient shopping</p> </div> <div style="text-align: center;">  <p>Wide road with tracks</p> </div> </div>
<p>Amenities Amenities such as parks, Shopping streets and schools are provided.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Shopping streets</p> </div> <div style="text-align: center;">  <p>Park</p> </div> <div style="text-align: center;">  <p>Schools</p> </div> </div>

AREA 4

	<p>Area 4 selected is the Hingne Khurd which is located on the east side of the Sinhgad road. The area has amenities such as parks, open spaces, hospitals, walking tracks in surrounding. The access road is wide and at useable condition. It is characterised by middle class socio-economic status. It has canal flowing in surrounding. The housing rate in this area around Rs. 5000/sf</p>
<p>Housing Characteristics Mix housing characteristics are observed in this area. It is a mix of mid- rise and low rise buildings.</p>	<div style="display: flex; justify-content: space-around;"> <div style="text-align: center;">  <p>Multi-unit Housing (G+3)</p> </div> <div style="text-align: center;">  <p>Multi-unit Housing (P+4)</p> </div> <div style="text-align: center;">  <p>G+1 mixed use buildings</p> </div> </div>

<p>Neighbourhood Characteristics It is characterised by midrise buildings, lower middle class and middle middle class socio-economic strata</p>	 <p>Access road and midrise buildings</p>	 <p>Convenient shopping</p>	
<p>Amenities Amenities such as parks, convenient shopping and school are provided.</p>	 <p>Convenient Shopping</p>	 <p>Park</p>	 <p>School</p>

AREA 5

	<p>Area 5 selected is Vitthalwadi which is located on the west side of the Sinhgad road. The area has amenities such as river view, temple, shopping street, hospitals, walking tracks etc. The access road is wide and in good condition. The socio-economic status is high. It is adjacent to the primary main road. The rate in this area ranges from Rs. 8500-9000/Sft</p>		
<p>Housing Characteristics The area is characterised by high rise high end housing with modern amenities</p>	 <p>High rise Housing (P+31)</p>	 <p>High rise Housing (P+11)</p>	 <p>High rise Housing (P+15)</p>
<p>Neighbourhood Characteristics It is characterised by amenities, view to the river, wide access roads and access to convenient shopping.</p>	 <p>River view</p>	 <p>Wide roads</p>	 <p>Convenient shopping</p>
<p>Amenities Amenities such as petrol pumps, temples, shopping street, hospitals, walking tracks are available.</p>	 <p>Petrol Pump</p>	 <p>Temples</p>	

DISCUSSION

Case study area 1 is in central or developed part of the main road, it has all the amenities nearby so the rate of bungalow plots or the flats and shops is high in this area. Whereas, the housing character of Case study area 2 is good; but because of the neighbourhood characteristics the housing rate is negatively affected. Case study area 3 has many amenities as well as it is a planned area with good housing character. Therefore, housing rate is quite high in this area. Case study area 4 is organically evolved since it is earlier gaonthan area. It has fair amount of shopping, however lacks modern amenities and characterised by fairly old buildings and middle income group. Therefore, the housing price is less. Case study area 5 is recently developing area. Proper planning, provision of amenities, high end housing and natural advantage of its location including access to Sinhgad road and view to the river makes it advantageous. Therefore, it has highest housing price in the vicinity.

The increasing value of the price of a house is average of increasing in the cost of the building and value of land the house is built on. Thus, house price associates with the location, size and aesthetics of the plot or site. The amenities in the surrounding and the neighbourhood affects the value of the property.

CONCLUSION

The study reveals that the proximity to amenities and travel distance to these amenities affect the housing price to a great extent. Also, the distance from main road affect the housing prices. Housing prices decline as the distance of a property from major city road increases. This is evident from case study done in the selected areas. The socio-economic background of neighbourhood is also an important criteria in defining housing prices. Based on socio-economic background of neighbourhood, the kind of amenities get developed and they positively affect the housing prices. Therefore, the housing characteristics and neighbourhood characteristics are positively co-related and they affect the housing price. Thus, the property values in housing neighbourhood with amenities such as shopping malls, convenient shopping, parks, open spaces, schools, and hospitals, temples and view to river have higher price appreciation. The study indicates these factors positively affect the value of the property. However, it was observed that house price in one locality also differ to great extent in certain situations. Such situations may arise because of organic development in that area. Thus apart from housing and neighbourhood characteristics, these organic development situation is also an important criteria in determining the housing prices.

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TITLE OF PAPER: EVALUATING USE OF LATERITE STONE: PUNE CITY

Sub-Title: Building structure and Design form

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ABSTRACT: Green building construction is about making best use of natural resources. The building construction is growing so rapidly that there is immense need of green architectural development. Today large number of construction techniques and materials are available in construction industry but on the other hand we have cost effective, environment friendly, energy efficient building technique and material.

In current scenario, sustainable architecture cannot be completed without vernacular architecture. Hence, there is need to study vernacular architecture techniques and strategies.

Present paper highlights predominant use of laterite stone in construction industry. Comparison between laterite stone and concrete block structures has been done taking into consideration various factors such as construction cost, weathering effects. The resources required for transportation of material to construction site is one of the study aspect of data collection. The research is aimed to compare local material as sustainable building material with contemporary techniques. It focuses on in depth study of planning, aesthetic, form, materials and technologies available and its optimum utilization in sustainable architecture.

KEYWORDS: Traditional, vernacular, Climate responsive, waste laterite use, sustainability

INTRODUCTION

In today's fast growing world, many techniques have been put forth to increase efficiency and reduce cost. Also, vernacular architecture methods and techniques have their own importance resulting in higher quality, than those achieved with modern construction processes. It is essential for this architecture to retain its integrity. So the Traditional Architecture should not be disturbed, rather the contemporary architecture should be integrated well with the vernacular architecture.

In the vernacular architecture, buildings were designed to achieve human comfort by using locally available building materials and construction technology which are more climatic responsive. In the present paper, an attempt has been made to study evaluating use of laterite the sustainable building material in Pune city and its importance in building energy conservation.

Laterite is not the locally available material in Pune still its various aspects are taken into consideration and the sustainable structures are being constructed in around the city. Laterite, known as "green" or environmental friendly construction materials can be easily re-cycled, have low energy consumption. Building professionals have the responsibility to ensure that laterite used is environment friendly and sustainable. It is evident that the environment is adversely affected due to vigorous cutting of trees and random excavations made during constructions generate noise and environment pollution. Laterite has been widely known and used construction.

Materials in construction industry in various aspects of civil and building construction projects. The material is economically effective, easy to work, reduces transportation cost and also workers with prior knowledge can be employed for construction. The unique property of hardening of laterite due to oxidation on atmospheric curing can be used in traditional built forms effectively. Laterite is used in its natural form without any manufacturing process and hence is sustainable building material. Hence, lateritic structures are resistant to sound transmission, fire resistance and insect damage and provide coolness during hot weather.

LIVE CASE STUDY: KRUPACHHYA FARMHOUSE (PAUD, MULSHI)

The main aim was to study vernacular architecture features of a house. Krupachhya farmhouse on the banks of Walki river, spreading over a land of 2.5 acres (10,000 sq.m) located at village Kule, Tal Mulshi, around 35 km on the western side of Pune city was selected as study area.

Vernacular architecture principles have been used in construction of the farmhouse. The concept was Konkan architecture is used. Laterite stone called "chira" local material in Konkan is used to give natural look. The client inherits a typical "Peth" culture hence it was designed as multidimensional space at one level with natural look. The resultant design relies on material expression and is highly climatic responsive.

Architectural features of the structure

The house is constructed with laterite stone sourced from Dapoli. The stone has been kept un plastered to give rustic look of interiors. The built form has been planned around the tree such that it has become the intrinsic part of the design and acts as recreational space. An open space has been designed around the tree in form of kund with stepped seating and is surrounded by habitable spaces, the planning of the house is completely based on vastushastra. The living room to the north, the kitchen to the south and bedrooms to the west separated by passages connecting the living room and kitchen. The living room is used as buffer in such a way that it creates cross ventilation. The placement of toilets and kitchen to the south act as heat buffers. The architecture of the house was based on vastushastra and traditional architecture of Pune. The site is away from the main city still its location inherits the culture and tradition by interaction with nature and naturally occurring materials in surrounding. The character of the house is based on vastupurusha.

Site planning

The site was divided in different parts, front yard. Comprises of lawn and back yard with mango tree court forming a kund. The backyard (paras) is designed for farming work such as khurad katta for Farming work. It was designed in such a way that it was blending with the surrounding context forming its own identity.

House planning

The house planning was typical with multidimensional spaces stacked in two floors. The architect designed double height spaces and views opening into the kund. Every room was placed in such a way that it would have maximum connection with internal open spaces like veranda and kund.



Figure 5 Site plan
(archdaily.com)

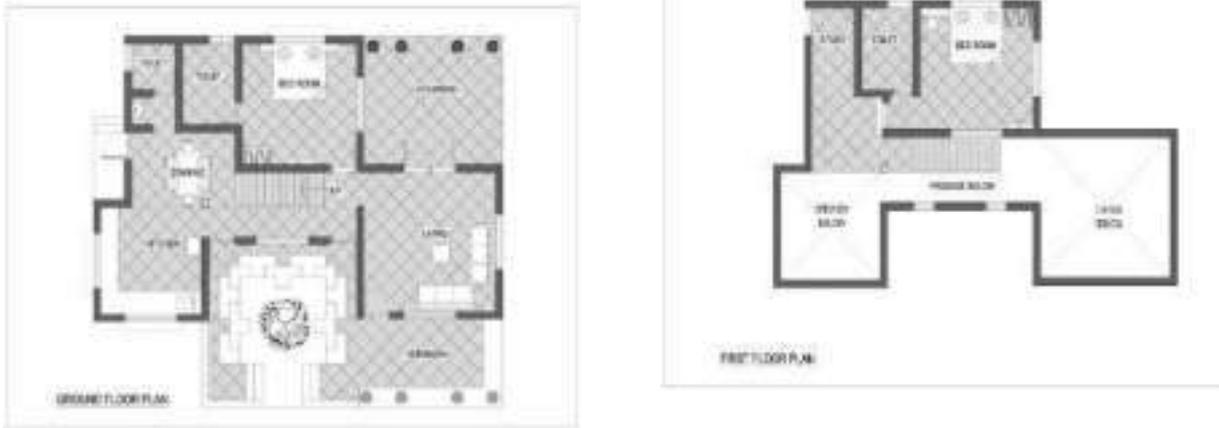


Figure 6 House plan showing internal spaces(www.archdaily.com)

Climatic responsiveness

The ground floor rooms require no artificial cooling especially the bedroom and the living room- which reduces the energy load immensely. The interiors stayed five degrees cooler in summer and warmer in winter, reducing the overall carbon footprint of the house due to use of laterite stone. Considering heavy rains in the region, sloping roofs are designed towards eastern and northern side which ultimately protected the structure from harsh heat gain from south and the west.

Aesthetics

Beauty refers to psychological comfort of the users. Taking this into consideration, architect has used Laterite stone as an aesthetically appealing element. At the entrance the columns are designed by stacking in a criss - cross manner. The beams are elevated and treated aesthetically forming angular form



Figure 7 Laterite used as aesthetics for column

Roofing

Pitched roof is used due to heavy rains. The roof fascia was designed specially highlighted by laser cut MS sheet panipatti (eaves board), painted in white enamel paint to create contrast with red laterite and double layered terracotta tiles with apex highlighted with terracotta khomb. The changing shadow patterns led to the use of glass tiles.

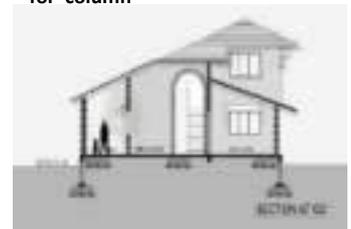


Figure 8 Section showing roofing (www.archdaily.com)

Flooring

External areas like kund and part of padwi are covered with black kadappa stone. The flooring of all rooms has been done in rough yellow Shahabad stone.



Figure 9 .External and Internal areas showing flooring

LIVE CASE STUDY: SIDDHESHWAR BUNGALOW (PUNE)

Architectural features of the structure

The house is constructed with concrete block. The house is designed in a complete modern way by using modern techniques. It is a two storey structure with spaces stacked on one another. Living room to the southeast, kitchen to the northeast and bedroom to the west.

House planning

The house planning was done by stacking spaces one on the other. Due to the placement of living room in the south east side, the harsh sunrays enter the room leading to increase in temperature of the space. The planning of the structure is so enclosed that it lacks in openness.



Figure 10 Front Elevation



Figure 11 Floor Plans

Climatic responsiveness

Due to the use of concrete block the rooms get heated up easily during hot climate. Even though, there is moderate rainfall in the city no techniques are used to save water and energy. Due to flat roof the heat gain on surface is direct so the top floor rooms heat up more than the lower one.

Aesthetics

To make the structure aesthetically appealing use of various materials such as slits, tiles, jallis are used. Painting is done to hide the look of concrete block. wooden frames have been used that highlights the openings. Railings are made from glass frames.

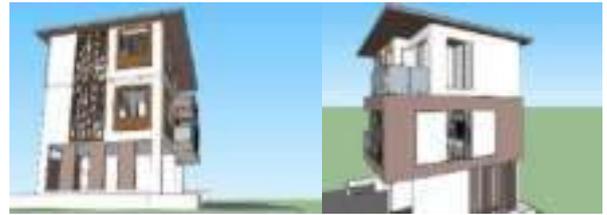


Figure 12 Jallies and slits used for aesthetic purpose

Roofing

Flat roof is used. Waterproofing is done to avoid leakage to the floors below.

Flooring

Vitrified tiles are used for flooring in balconies waterproof wooden tiles are used with nonslip versions.

Colour	Structure	Depth	Compressive strength	Water absorptivity	Specific gravity
Brownish Yellow	Vermicular	1.8 m	1.44	10.82	2.15
Whitish Yellow	Vermicular	3.0 m	1.05	13.20	1.74
Reddish Brown	Vermicular	3.0 m	2.57	11.02	2.31
Yellowish Red	Vermicular	10.8 m	1.66	13.40	1.82
Red	Mottled	6 m	1.13	13.92	1.85
Pink	Mottled	5.2 m	0.66	15.73	1.51

Table 1 Statistical Data showing physical properties of laterite

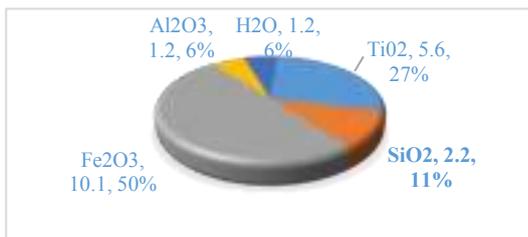


Figure 14 Chart showing chemical composition of laterite



Figure 13 laterite blocks are available in different sizes of:

390 x 190 x 190mm
490 x 190 x 190mm
590 x 190 x 190mm

Analysis:

1. The use of laterite stone is cost effective as compared to concrete block.
2. Reduces cost of plastering and painting.
3. Reduces heat within the house.
4. As porosity of laterite stone is more, it can be used for two storey load bearing structure.
5. Do not require skilled workmanship.
6. As naturally available, it can support the demand in a sustainable way.

CONCLUSION:

Sustainability is often defined as meeting the needs of the present without comprising the ability of future generations to meet their own needs. Researchers are trying to discover the benefits of using vernacular material in developing cities or small towns. Achieving greater sustainability in the field of construction through the vernacular stone is important, because it reduces the consumption of energy and resources. A home is a largest financial investment a family is likely to make but at the same time it also represents the most resource – and energy – intensive possession most people will ever own. Hence, making homes more sustainable, has a tremendous potential to contribute to the ability of future generations to meet their needs. The vernacular stone is economical, easy to work with and there is no requirement of skilled labour. The waste created due to laterite stone can be crushed into soil. Unlike concrete block, that are extensively used now – a – days create material debris that is difficult to dispose. It can be considered and applied to low cost housing construction in places of availability.

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STUDY OF RESIDENTIAL STEEL BUILDINGS WITH RESPECT TO SUSTAINABILITY ABOUT MAINTENANCE.

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ABSTRACT:

Generally, energy consumption in residential sectors is especially high in developed areas. There is great potential for energy saving in this sector. However, to achieve significant reduction in energy consumption one can use materials which are renewable, energy efficient, with innovative technologies.

Usability of steel as a material with respect to the residential buildings came to the foreground because of the rapid development in the building industry, surely it has a lot of advantages from the technological point of view, which meet all the requirements these days. But it is more important that the construction of these buildings protects the natural environment, and suits the standpoints of sustainable development and guarantees a healthy environment for the users for the whole lifespan of the building. The research focuses on maintenance of steel residential buildings. The survey was based on users of steel buildings and the experts, Architects & Engineers.

The steel as a material can be effectively used in residential sectors also like other sectors. Steel buildings are very easy to maintain with lower cost. . Though initial cost of construction is higher, steel buildings are cost effective in the long run.

KEYWORDS:

Steel building, energy efficiency, maintenance, sustainability, building technology, housing.

INTRODUCTION:

In our country there is more need of sustainable way of constructing, in the term of maintenance also. Need more use of recycling, reusing the materials and durable materials.

We are wrong to consider vehicles, factories as only polluting factors, but buildings also consumes some part of polluting or harming environment. With traditional concrete buildings are posing threat to the environment, as steel is sustainable can be used as it can be reused, recycled.

Now a day's steel is used tremendously in commercial sectors, industrial sectors, in flyovers, bridges, etc. But steel can also be used effectively in residential areas also. It has tremendous capacity of durability, also can be used effectively in low rise buildings as well as in high rise buildings. Firstly, it is sustainable material can be reused and recycled. These type of structures can be more effective to the user than concrete, etc. structures.

Steel has many desirable characteristics which can be exploited in a wide range of construction applications. It is corrosion-resistant and long-lasting, therefore steel can be maintained easily, making thinner and more durable structures possible. It presents architects with many possibilities of shape, colour and form, whilst at the same time being tough, hygienic, adaptable and recyclable.

The annual consumption of stainless steel has increased at a compound growth rate of 5% over the last 20 years in various sectors, this paper focuses on the residential sectors which can be constructed with steel material. This paper includes the maintenance needed for steel structure after the construction and steel material can be effectively used in residential sectors also like industrial and commercial sectors.

Areas of research are current technologies, experts, engineers, users of house, etc. The research is based on the case studies done, the questionnaire asked to different personalities, and the collected data, etc.

LITERATURE REVIEW:

Building maintenance is energy saving factor if done properly. Property owners all too frequently endeavor to keep maintenance expenditure to a minimum, ignoring or misunderstanding the adverse long-term effects. Neglect of maintenance has accumulative results. Buildings are too valuable assets to be neglected, they should be kept in satisfactory condition.

Steel construction's role in sustainability is that it is designed to ensure a healthy future for the sector, where businesses can operate profitably with due regard for environmental and social issues. It sets out how steel can be used to deliver more sustainable construction at the design, execution, in-use that is maintenance stage and deconstruction stages (Burgan). The sustainability of steel in various aspects, the environmental aspect, economical aspect and also various phases like construction phase, in use phase, life extension and the end life phase. The sustainability of steel structures will be evaluated in four phases in life cycle as: Design Phase, Construction Phase, Operation and Maintenance, End of Life Phase. Durability is another important factor for sustainability in operation and maintenance phase of building. Durability supplies long lasting functionality and safety for building users. The steel construction offer easy maintenance and long term production (Aksel). Maintenance phase of building is very important phase and so the maintenance.

Periodic maintenance of steel buildings depends upon the environmental zone and pollution level in which the building is located. In the humid areas, buildings should be taken much care as the moisture presents in the air breakdowns the paint. A maintenance procedure varies from building to building and depends upon building design, material specifications and access provisions. It is also necessary to ensure that the leak-proof performance of the building is not compromised. There are various steps involved in maintenance should be followed (Mehendale).

Steel structures strategies for tall buildings in terms of efficient material usage and maintenance. The stiffness-based design methodologies for determining preliminary member sizes for these structural systems were introduced and applied to a representative set of steel buildings (K.S.). Steel is perfectly suitable for tall buildings also and can be effectively used there.

AIM:

- To understand the maintenance and reusability of steel building.

OBJECTIVES:

- To study the steel residential buildings.
- To study the required maintenance after construction for steel residential structures.
- To study the sustainability factor in steel residential buildings about maintenance.

SCOPE OF WORK:

- The scope of work includes the study of maintenance of steel building, which includes visual inspection, painting, water proofing, inspection of connections etc.
- Pune city; neighborhood level.

LIMITATIONS:

- Initial cost of steel building is higher as compared to traditional reinforced concrete building.

INDEPENDENT VARIABLES:

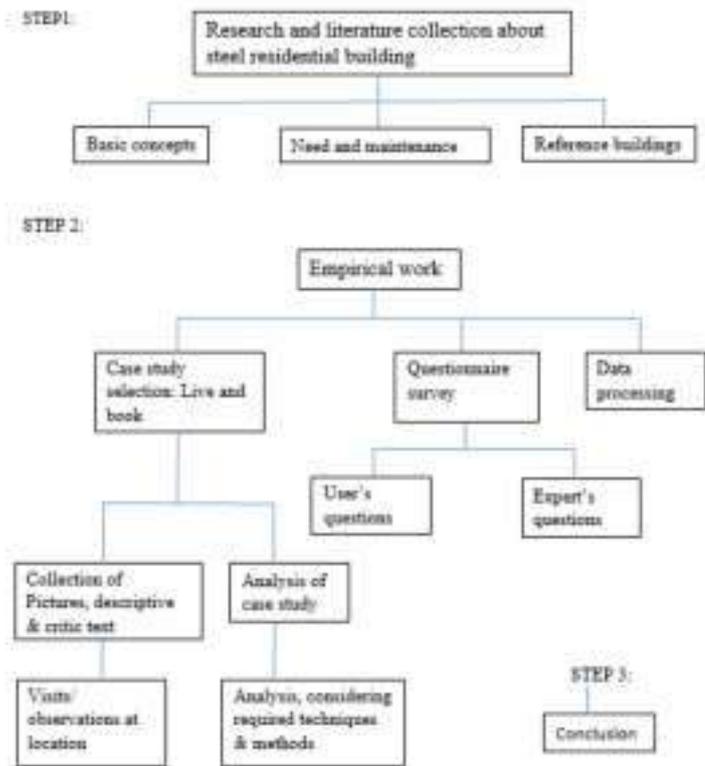
- Ignorance of public towards energy efficiency approach.

DEPENDENT VARIABLES:

- Lack of energy efficiency approach, underutilization of materials which are energy efficient.

METHODOLOGY:

Study of residential steel buildings about maintenance using data collection, questionnaire survey, case studies, Questionnaire survey done using two questionnaires one for the users of steel buildings and other one for the experts which are Architects & Engineers. Live Case study done at neighborhood level, Pune city.



A) Data and analysis:

Data collection using questionnaire survey method: various questions were asked to users of steel building house and experts and their questions were:

1. User's Questionnaire:

Questions asked to the users of steel house.(2 responses)

Q) What is your experience of living in steel structure compared to concrete structure?

- Good experience, very fast construction & ease in maintenance.
- It is good. House is easy to use and maintain.

-**Analysis:** From above responses , it is clear that steel structures also create comfortable environment to live.

Q) Do you think, steel structures are easy to maintain than concrete or masonry structures?

- Analysis:**Responses of users makes clear that, steel structures are easy to maintain than concrete or masonry structures.

Q) How often do you need to maintain your house?

- Abhyankar -After 2 years approximately.
- Ar.Athawle -After a year.

-**Analysis:**From above responses, steel structures requires periodic maintenance.

Q)What is the cost of maintenance annually?

- Abhyankar -It is very less around Rs.2000/-.
- Ar.Athawle-Around Rs.5000/-.

-**Analysis:** Steel structuresrequires less maintenance cost which is approximately below Rs.5000/- annually.

2. Expert's Questionnaire:

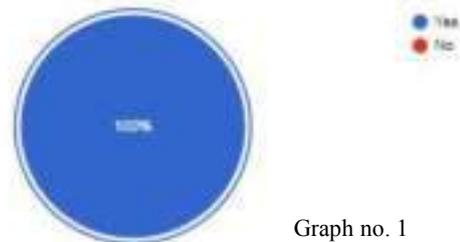
Questions asked to the experts who has skills & knowledge about steel structures.(15 responses)

Q) Do you have to rely on skilled labour for maintenance?

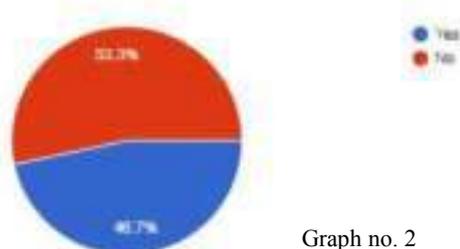
-**Analysis:** Above pie chart of experts responses shows that, one need not to rely on skilled labors and they are easily available.

Q)Why do you think, steel structures are not so frequently used for residential purpose?

- Lack of knowledge about steel structures.
- Because steel is not that very much known to people as a material.
- According to me skilled labors are not easily available thats why they are not so frequently used.
- Steel as a material requires more investment than masonry structures maybe therefore they are not frequently used.
- According to me, steel is costly as a material.
- Steel requires specific knowledge.
- According to me, it gives us some design restrictions and not gives very outstanding look.
- As steel needs more thermal protection or insulation, that's why in hot country like India it – Needs to be insulated.



Graph no. 1



Graph no. 2

-Analysis: Above responses of experts says that: it is clear that, steel structures are not frequently used because, at the time of construction more investment is needed, less knowledge is there about steel material and it requires thermal insulation. Also gives some design restrictions to construct.

B) Case studies: Case Study:1

Location of house : Dahanukar colony, Karvenagar, Pune, Maharashtra.

Name of the owner :Ar. Athwale.

Architect / designer:Ar. Athwale.

Construction year : Before10 years.



Picture no.1



Picture no.2

Maintenance after construction & reuse:

Steel is used in this three storey structure as primary material.

Maintenance required after construction is:

Required maintenance	Method
1. Painting the steel members.	Layer of metal primer & oil paints after 2 to 3years.
2. Periodical inspection of joints.	Checking of joints, member & fixing properly.



Picture no. 3

Colour coating on steel framing to prevent corrosion.

Conclusion case study:

- Steel buildings requires very less maintenance.
- Maintenance duration required is less.
- One can reuse the steel members & can get a good cost out of it.
- So steel can also be used in residential structures effectively.

Case Study:2

Case study to understand the maintenance duration, cost, need & importance in steel residential structure.

Name of house : Bourbon Lane housing.

Location of house : West London.

Name of the owner :Octavia Housing and Care.

Architect / designer:Cartwright Pickard architects and B+C Architects

Engineer of house :Campbellreith.

Construction year : Before12 years.



Picture no. 4
Three Storey structure



Picture no. 5
Steel framing of building

Maintenance after construction & reuse:

Steel is used as primary material.

Required maintenance	Method
1.Painting the steel members.	Layer of metal primer & oil paints after 5 years.
2.Periodical inspection of joints.	Checking of joints, member & fixing properly.

Conclusion of case study:

- Steel buildings requires very less maintenance
 - Steel material gives design freedom & strength to structure.
 - Maintenance duration required is less.
 - One can reuse the steel members & can get a good cost out of it.
 - So steel can also be used in residential structures effectively.
- Reference: https://www.steelconstruction.info/Bourbon_Lane_Housing_London

CONCLUSIONS:

Figure no.1

 location of steel residential buildings.

Side image of India map shows the approximate numbers and the locations of steel residential buildings, which is very less in number as compared to other countries.

From the data collected and questions asked to the users and experts, the responses clear that the reasons are lack of technology and skills, need of investment in steel buildings.

One can effectively use the steel material for residential purpose in India.

- Steel buildings are very easy to maintain with lower cost. Though initial cost of construction is higher, steel buildings are cost effective in the long run.
- There is significant time gap between the call of maintenance.
- Steel is not only used in industrial and commercial buildings but also can be effectively used in residential buildings.
- Because of higher strength of steel as a material, steel buildings can be used for high rise buildings.

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I would like to also thank the Prof.Athawale for enabling me to visit his house to observe and also for helping me to get conclusions.

SIGNIFICANCE OF GRID FORM IN ARCHITECTURE.

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ABSTRACT

The research paper is a study of the significance of Grid form in architecture.

In architecture design process execution and evaluation based on “Form Analysis”, plays an important role in achieving aesthetically and analytically stable design. Form and related elements give the designer the ability to reflect their interpretation through various means.

Under this research analysis, interpretation of architectural Grid form; will be examined under the headings of mass; space; and façade, structure. These will be concerning the applied process, relationships, organizations, and ordering principles.

KEYWORDS

Architectural Form, Grid, Elements, Order, Infusion, Uniformity.

INTRODUCTION

Form in architecture not just plays an elemental role but it influences and shapes the configuration of our design.

“Architectural form is the point of contact between mass and space ... Architectural forms, textures, materials, modulation of light and shade, color, all combine to inject a quality or spirit that articulates space. The quality of the architecture will be determined by the skill of the designer in using and relating these elements, both in the interior spaces and in the spaces around buildings”. - (Edmund N.)

Studying the reciprocal relationship between form and architecture is essential, given the intention of architecture is to provide comfort and user convenience, well built – stable structure can only be achieved by synthesis of both form and architecture.

Several aspects must be considered to analyze or design an architectural structure based on a certain form, causing it to be a cohesive study. Hence this particular research was limited to Grid Form in architecture.

AIM OF THE STUDY.

The Research aims to, ‘Examine the feasibility of executing a Grid Form in a structure based on the conceptual and constructional basis.

OBJECTIVES OF THE STUDY.

- To study basic terminologies of grid form, their advantages – disadvantages, and applications.
- To conduct a detailed analysis of the structural and conceptual methodologies of Grid form to help determine the overall feasibility based on an architectural project.
- Create a module that focuses upon Grid Form, depending upon the overall philosophy, experts and resource materials.

SCOPE OF THE STUDY.

Analysis and use of GRID FORM to create Efficient, consistent, and secured structure or layouts.

LIMITATIONS OF STUDY.

The study and analysis only focus on grid form and is limited to a single structure (building) - in the future, a similar study can be further developed for,

- a) Structure - open space relations and campus-based grid.
- b) Other types of architectural forms can also be taken into account.

1. GRID FORM

A grid can be defined as two or more intersecting sets of regularly spaced parallel lines.

It generates a geometric pattern of regularly spaced points (where the grid lines intersect) and regularly spaced fields (define by grid lines). (D. K. Ching)

Square grid: is Essential -neutral, non-hierarchical and non-directional.

1.1 Historical significance of grid form in Architecture.

“A grid is the geometric division of space into precisely measured columns, spaces, and margins.” It is unrealistic to determine which designer invented grid structures because of its continual evolution; however, key eras of development can be identified. Traces of grid in Architecture take us back to The Greek and Roman Era.

Humans have an internal desire for a **sense of proportion**, which in itself is a logical organizational approach to order.

Grid form enables the positioning of structural elements within project specified parameters.

The skeletal understructure of the grid form helps to bring a feeling of cohesiveness to visual design.

It’s organizational qualities save time while aiding different elemental **qualities**.

1.2 Formation of grid form.

A Grid is created by two, usually perpendicular sets of parallel lines that establish a regular pattern of points at their intersections. Projected into the third dimension, the grid pattern is transformed into a set of repetitive, modular units.

1.3 Advantages of a grid form.

Clarity and order – Grid brings order to a layout of structure; making it easier for visitors to find and navigate through information.

Efficiency – It allows the addition of elements to the previously designed layout.

Consistency and harmony – It leads to consistency in the layout of the overall design.

1.1 – PLAN OF OLD CITY TURIN.

Security can be simplified with a grid floor plan.



1.4 Disadvantages of a grid form.

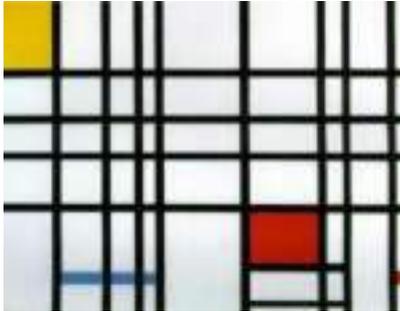
The disadvantages of grid form are few and can be overcome by some creative applications in your design.

Lack of visual attraction -

The grid setup may be plain-looking and uninteresting, with all the surfaces looking just like each other - long, straight and squared off with little visual attraction, Utilizing some of the new styles such as additive and subtractive transformation break all of the traditional rules.

1.5 Implementation grid form in architecture.

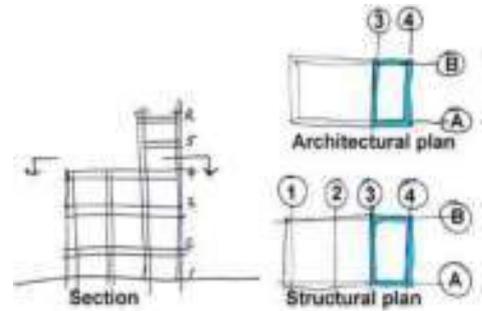
- a) Conceptual Design Grids.
- b) Planning Grids.
- c) Structural Grids.
- d) Grid system in Façade.



1.2 – DE STIJL, CONCEPT GRIDS.



1.3 –PLANNING GRIDS.



1.4 – STRUCTURAL GRIDS.

1.6 Applications of Grid Form.

1.6.1 Grids as tools for Design.

The grid is a useful device for controlling the position of building elements. Grids have been previously and presently used in all manner of layout tasks from urban design to building construction.

Its usage gives designer **control of different design elements**, making the layout task more systematic.

By determining positions of different building elements concerning a grid or to a set of grids, the designer can specify design rules that describe a typology of physical forms.

The grid-based **co-ordination** can also support a design team working on different subsystems under the same head.

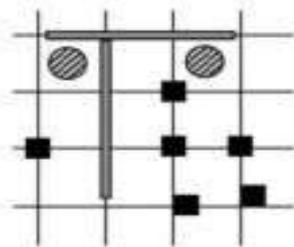
The use of grids permits the designers at the urban scale to make decisions, yet allow relative freedom at the block and lot scale for individual developers and house designers.

1.6.2 Grids in Layout Design.

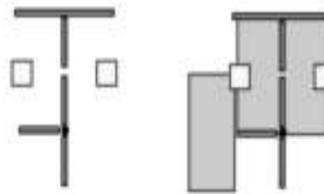
Three main concepts will emerge:

- (1) A variety of kinds of grids are used, to name a few - simple square grid, tartan grids, and rectangular grids.
- (2) Different types of grids can be grouped and used together.
- (3) Rules about element placement can be expressed in relation to a single grid or combination of grids.

In layout design a grid is mostly used as an underlay to a drawing, to organize the positions of elements. The grid-size should be chosen carefully as it is usually related to the dimensions of the spaces to be laid out or the components to be placed.



1.5 DIFFERENT ELEMENT- GRID RELATIONS.



1.6 RELATIONS BETWEEN ELEMENT CLASS AND GRID.

To use a grid as a design tool, **placing elements relative to the grid** becomes important. The simplest and most basic placement can be elements placed on nodes. However, other rules can be formulated.

1.6 shows different grid positions, assigned to different types or classes of elements. In this example, gridlines are considered as wall centrelines; concrete columns are offset on-grid crossings, and space boundaries (shown in gray) fall along grid lines.

1.7 Types of grid and their usage.

1.7.1 Rectangular grids.

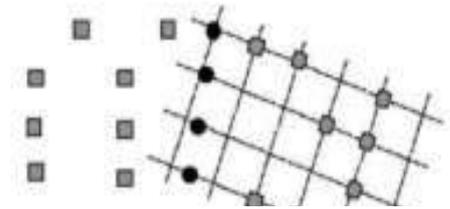
Grids need not be square always. Mostly in the landscape, building service, and structural systems, or the directionality of the design itself suggest a rectangular grid.



1.7 SHOWS RECTANGULAR GRID USED FOR POST AND BEAM TYPE CONSTRUCTION

1.7.2 Interface conditions where grids meet.

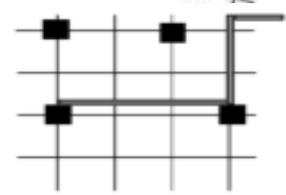
Complex designs involve different grids in different parts of a building system. When two or more grids are used, consideration of the interface condition of grids becomes important. In some cases, a special interface elements and rules are developed and followed. For example, a special, round column might be employed just to make and mark the transition of two grids at different orientations



1.8 INTERFACE GRID CONDITIONS

1.7.3 Several related grids (Offset relation).

It is useful to work with several related grids when placing different elements in a single layout. We can say that each building subsystem defines a class of elements, each denoted by a different grid. For example, we can restrict the placement of concrete columns to the crossings of one grid, and showcase partition walls to take their places on the lines of other, offset grid. In this case, the offset relation between these superimposed grids contributes to an important design decision.



1.9 RELATED GRID CONDITION.

2. CASE STUDY – VILLA SHODHAN, AHMEDABAD.

The villa Shodhan located in Ahmadabad and designed by Le Corbusier; is the culmination of Indian Culture, The client’s way of life, and Climate.

2.1 Form and shape.

The form is that of a basic cube. Volumes have been cut into Grid form the placement of brises Soleil, recessed columns on the rooftop. All the facades are different with squares concept, They work together to create an interesting Grid-based form. House grid is placed diagonally on-site to give a 3D view of the house.

2.2 Massing.

The house is derived from the basic cube. Volumes are sculpted out of the cubical grid on basis of modular scale. Due to dimensions of brises Soleil, the house almost attains a monumental scale.



1.10 – EXPRESSIVE MODEL OF VILLA.

2.3 Grid Form Analysis.

2.3.1 Grid in exterior form.

The house is derived from the basic cube grid. Building geometry is a product of subtractive, additive form in planning and structure, solid and voids in façade. The house comprised of several of the themes of Le Corbusier’s previous works and is a synthesis of previous ideas played at a higher pitch.

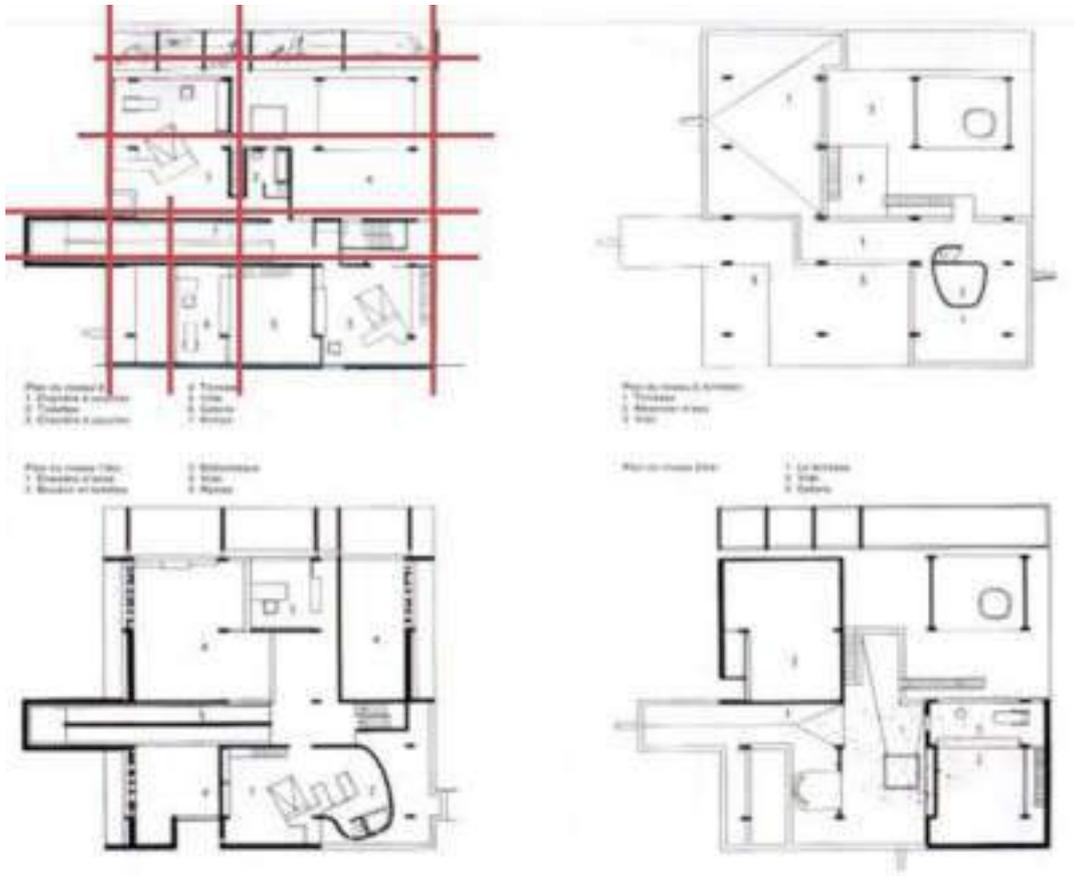
2.3.2 Grid form in Floor Plans.

This plan recalls the ingenuity of the Villa Savoye of 1929-30 at Poissy, placed herein a tropical and Indian setting, as well as in Le Corbusier’s post-1950 style.

The ground floor the plan divides the villa into the main building and single-story side containing kitchen, garage. The plans reveal an evident structural simplicity, but also, countering this, a wonderful plasticity in the handling of the rooms-in their Grid form. Different grids are infused with their dimensions. The approximately square grid plans contain an entrance salon connected by a ramp to the living room. Despite being mainly right-angled grid, sanitary areas have curved walls to break the monotony and deflect movement. Bare minimum walls (free plan) Curved walls. Grid brings order to the layout of structure; making it easier for visitors to navigate through information, it leads to consistency in the layout of overall design.



1.11 – GRID FORM IN FACADE



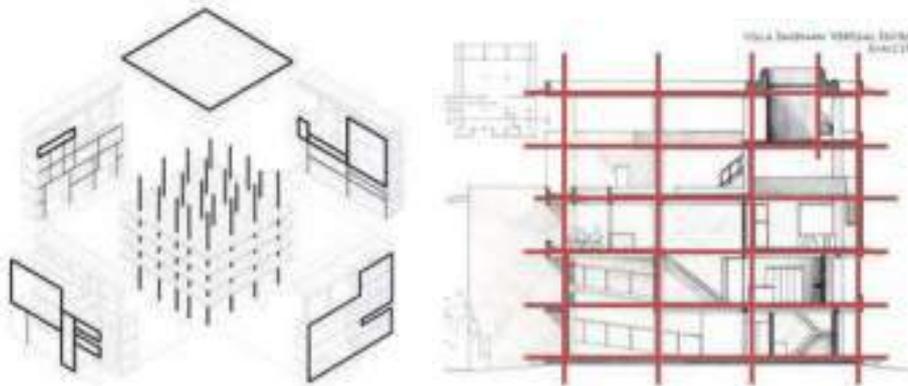
1.12 – GRID FORM IN FLOOR PLANS.

2.3.3 **Structural grid form.**

The house is derived from the basic cube grid.

Structural column grid can be seen in continuation through all the floors. This structural grid is used to organize the positions of elements even in elevation and spaces in the plan.

In this example, wall centrelines run along gridlines; concrete columns are offset on the grid crossings.



1.13 – GRID STRUCTURE ASSEMBLY.

3. **MODULE FORMULATION – KINDERGARTEN SCHOOL DESIGN.**

Following is an example of application of designed grid module for Kindergarten School Design projects.

Where two different grids of 90 degree and 45 degree are merged to formulate a repetitive model in the plans, sections and elevation.

Usage of grid has simplified the functional requirement yet two grids together enhance the visual interest.

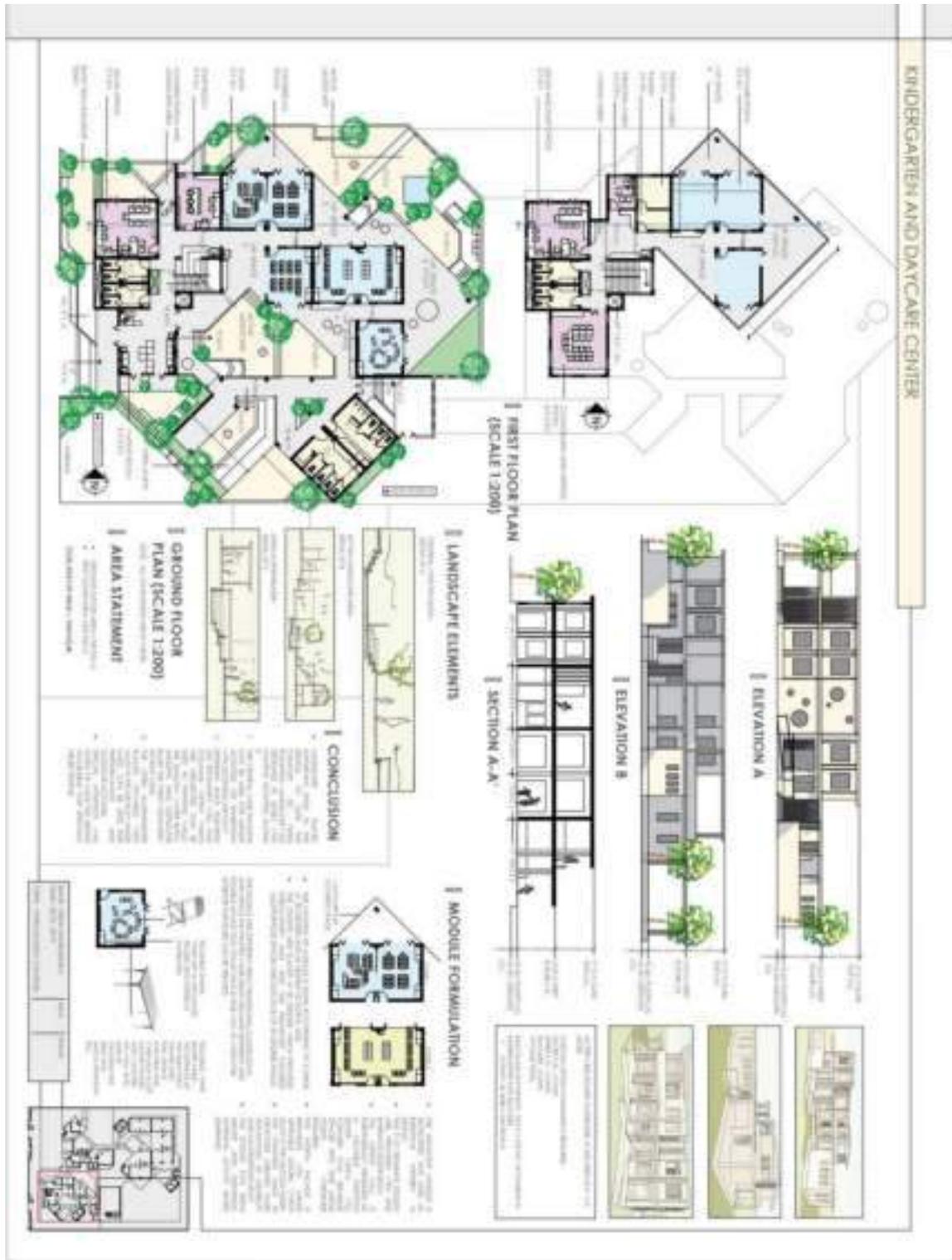
4. **CONCLUSION.**

This study evaluated the use of form, structure, and the evolution of grid structure in Architecture design. It examined traditional and non-traditional grid structures to assist in determining an effective solution for the continuation of grid form in structures.

The methodological process to develop conceptual grid structures evaluated within this thesis can encourage and guide designers to implement unique and dynamic grid structure design in their work.

The effectiveness of this study is its ability to create multiple uses of grid form that are project-specific and are conceptually linked to the design subject.

This conceptual approach to grid structure design will not only produce visually effective design but will include a properly functional and user-oriented design



5. FUTURE SCOPE.

The study and analysis part of the grid form is limited to a single structure (Building), in the future, a similar study can be further developed for structure and open space relations for campus-based grid and even in larger contexts like town planning. Further evaluation to determine the successes and failures of this study would include a quantitative analysis of the effectiveness of the grid form. Different types of structural tests and material-based studies can also be included.

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ANALYZING FACTORS, THAT LIMIT THE PERFORMANCE OF SOLAR WATER HEATER SYSTEMS, DUE TO EXECUTION INACCURACIES, IN PUNE

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ABSTRACT

Sustainability and resource management are the foundations on which the development of the future rests. The National Building Code of India Part 11, talks about integrated water management emphasizing that per capita water consumption in buildings must reduce. Ministry for New and Renewable energy (MNRE) has made installations for Solar Water Heating Systems (SWHS) in new buildings mandatory. Maharashtra state has been thereby, emphasizing about implementing the same. Solar Water Heating system installation is a proactive step towards sustainability. Yet stakeholder influence and ground conditions in India hinder the true productivity of the SWHS. The wait for hot water from showerheads is very long when SWHS is in operation, resulting in huge loss of water, an invaluable and fast depleting resource. If wastage can be reduced, consumption will automatically reduce. Hence there is an urgent need to throw light upon the inconsistencies and irregularities of the implementation of SWHS policy during execution. It is observed that there are many lacunae that prohibit the system from functioning to its 100% capacity. These are largely due to stakeholder mismanagement or cost cutting measures taken by the decision making bodies of projects. These problems are seen across the entire spectrum, from policy interpretation, to design, to material selection, to user interference. This paper intends to uncover the ground level inaccuracies that give rise to poor performance of the system in order to find the factors that negatively impact the performance of solar heaters, due to which the system fails to deliver to its maximum capacity.

KEYWORDS –Solar Water Heating Systems, execution, causes, negative impact, inadequate performance

1) INTRODUCTION

India receives solar radiation equivalent to 5000 trillion kWh/ year [1] which is far more than its annual energy requirement. Effective uses of solar products in India are not just viable but economical and sustainable solutions. One of the most widely acceptable and easily implementable solutions is Solar Water Heating Systems. The primary function of a Solar Heating System is to align with the ideology of conserving energy by removing the dependence on non-renewable or finite natural resources. The National Solar Mission of India has considered solar water heating as one of its key components in terms of policy level changes made towards building a greener India [2]. The Ministry for New and Renewable Energy, MNRE has laid down guidelines [3] by which this system needs to be incorporated in building design and these measures are the good practices that this sector should follow in order to get maximum gains from the system. Yet the result is far from what is expected. This paper examines the reasons for this by conducting field study to pinpoint problem areas.

2) LITERATURE REVIEW:

A. “Guidelines for installation of Solar Water Heating Systems in high rise buildings and multistoried flats”, MNRE [3].

This publication of MNRE prescribes approaches that are required to execute the installation of SWHS in high rise buildings. The contents are benchmarks against which case studies within this paper are compared, so as to inspect and assess if they fall in accordance or fail to do so. This is a comprehensive document that covers the design, capacity planning, location, material specification and other details, crucial in making SWHS perform efficiently. This document also covers the mitigation measures that have to be implemented in case of ground level problems arising due to climatology or site specificity. These aspects form the basis of this paper to examine if these attempts have been subsequently made in the execution. This template is used to assess criteria like approach to installation, performance of system and achieving the objective of using renewable energy.

B. “Frequently Asked Questions -Solar Water Heaters”, MNRE. [4]

This publication of MNRE has been created to answer common questions and queries about the installation of Solar Water Heaters. This clarifies to a great degree some of the grey areas that might surface while translating policy into design. This document is formulated like a checklist that includes recommendations that can be used to mitigate on-site challenges. While MNRE has extensively done the cost analysis in the implementation of SWHS, in reality, it is the cost factor that deters stakeholders from implementing the system exactly in accordance to guideline. All assumptions made in this paper are as per guidelines and FAQ document of the MNRE publication.

C. “Jawaharlal Nehru National Solar Mission, Towards Building Solar India”, Government of India [2]

In this publication issued by National Solar Mission, the Solar Water Heating Systems come under point 4.B where the mission envisages the collector grid to extend to 20 million sqm [6] till the end of the 13th plan. All applications below 80° C will be solarised [2] as per the mission’s intentions. This is an important fact for this paper because in the event that inaccuracies and inconsistencies occur, the need to rectify these can be stressed upon to prevent future or potential losses occurring like infrastructural redundancy and resource wastage.

D. “Design and Implementation of New Financing Mechanisms and Instruments for Promotion of Solar Water Heating Systems in India”, MNRE [5]

This publication issued by MNRE is a consolidated document that is an overview of the Solar Water Heater sector in India. This document gives extensive information about finance related schemes and information about costs and investments and hence is particularly relevant to this paper. Point A.1.1.1 of this document talks about the potential buyers of this technology in the coming years. According to this resource, 80% of all future installations will be in new buildings. Hence, if any discrepancies are seen in the current scenario, changes can be made in the regulatory, policy or design decisions of the future installations, to make the system more efficient.

3) METHODOLOGY

When we use showers in a scenario where hot water is provided by a Solar Water Heating System, there is always cold water in the pipeline that flows out first. There is a significant amount of time that’s taken till a steady stream of hot water starts flowing out of the showers. This water is not used for bathing and is largely wasted. As a result of which heated, treated, pumped, pressurized, white water converts into grey water once it goes down the trap. In a previously conducted research by this author, a survey was conducted to measure the wastage that incurred due to the long wait for hot water, dispelled from showers in situations where SWHS were installed. Some of the participants of that

survey reported very large quantities of wastages. These buildings were shortlisted as case studies to investigate and identify the reasons why such large amounts of losses were prevalent which would also lead to finding reasons for lack of system efficiency.

To maintain parity between case studies only high rise buildings of 11 storeys and more were considered so that similar plumbing design and SWHS specifications could be considered. The socio-economic, educational and cultural backgrounds of participants were also similar so that consumer behavioral patterns would also remain similar. The buildings chosen for case studies are spread out in the suburban areas of the city in the periphery. These areas do not receive water supply all through the day and have heavy dependence on tankers and bore wells to fulfill their daily requirements. Any wastage curbed will automatically add to the availability of resource and hence study of these buildings is very relevant. All of the buildings chosen have been built within the last decade and hence, the age of the building and technology of plumbing falls in the same time period. It was anticipated that there would be a significant number of issues where variance and non-compliance of guideline that would be reported. Hence for the purpose of case studies the scope of this paper looks at 13 specific criteria which would act as performance indicators that would help assess the buildings. The criteria have been further studied to draw conclusions as to what aspect of the system needs corrective measures. This assessment can then throw light on the causes and issues which could be identified as reasons that affect the performance level of the system negatively.

4) CASE STUDY DATA

TABLE-I: DATA OF CASE STUDIES CONDUCTED

CRITERIA	BALEWADI 1	BALEWADI 2	S. B ROAD	WAKAD	DHAYRI
Number of units	48 (4- 3bhk/ flr)	44(4- 2bhk/ flr)	15(8-3bhk/flr +1)	48(4- 2bhk/ flr)	33(4- 2bhk/ flr)
Number of bathrooms	2	1	3 *	1	1
Capacity provided	Grossly less than certified	Slightly less than certified	Capacity- individual flats	4000 liters (under)	3000 liters (under)
Frequency	All day	All day	All day	3 hrs 6 am-9 am	All day
Sustainability measures	Not provided	Not provided	Not provided	Not provided	Not provided
Pipe material	Insulated	PVC	Insulated	Insulated	-
Distance from heat source	Nearest toilet	Nearest toilet	1 Nearest/ 1 Farthest toilet	1 Nearest/ 1 Farthest toilet	Farthest toilet
Panel exposure	Shaded	Full	Full	Full	Full
Non return valves	Used	Used	Used	Used	Used
Plumbing design	Telescopic	Non -Telescopic	Non-Telescopic	Non-Telescopic	Non-Telescopic
Diameter of pipe	1", ¾", ½"	1"	¾"	1"	¾"
Solenoid valves	-	Not provided	Not provided	Not provided	Not provided
Additional heat source	Not provided	Not provided	Not provided	Not provided	Not provided

*3 separate systems provide water to separate flats and a common distribution system is not seen.

**normally the consultants/ contractors verify the capacity provided by signing a record that states the capacity provided.

5) ANALYSIS OF DATA

As seen in the table above (Table no: 1), the criteria were based on the MNRE guideline published by MNRE [3] on their website which is to be adhered to by the contractors and builders. The selected case studies data was further analyzed to find indicators that would lead to understanding reasons that contributed to the deficit in achieving maximum efficiency. Each point has been first enlisted in tabular format above and then further discussed in detail.

1. Capacity

As per MNRE specifications the minimum capacity provided should be 100 liters for 2 bedroom flats and 200 liters for 3 bedroom flats. In the cases studied it is seen that none of the five case studies fulfill this criterion. In three cases the deficit is marginal; in two cases it is substantial. As the capacity planning is not as per recommendations, all the occupants of the buildings do not receive hot water. In a survey conducted prior to this study it was noted that amounts to the tune of 45 liters at times are wasted in waiting for hot water, which ultimately is not even delivered at times, by the system. There is a gross miss-match of the certified capacity and the one observed on the various sites. This particular aspect needs a critical assessment and audit followed by periodic checks as this aspect is not stringently followed.

2. Frequency

Only two out of the five cases have a timed facility while other three are supposed to cater to the hot water needs of the building throughout the day. Normally when the facility extends all through the day, sustainability measures like solenoid valves or means to avoid overflowing of water and wastage need to be included. All three examples that provide facility all day long do not have these inclusions in the plumbing design. In one of the instances where facility is timed, flat owners have installed geysers to overcome the issue.



Image 1: Solenoid valve (Source: Author) Image 2: Thermostat (Source: Author)

3. Sustainability measures

The MNRE guideline very clearly elaborates about the sustainable methods of implementing SWHS. It talks about providing a ring main with a pump arrangement for recirculation of water for preventing wastage of water. Auxiliary hot water tanks provided in intermediate floors, individual hot water storage tanks in apartments, water meters to control consumption per flat, solenoid valves (Image:1) and thermostats (Image:2) are some of the sustainability measures suggested. None of these measures can be seen in any of the buildings studied. This is primarily due to cost factor and lack of awareness in stake holders and poor accountability.



Image 3: PPR pipes (Source: Author)

Image 4: PVC pipes (Source: Author)

4. Materials

The MNRE guideline mentions in depth about materials and fixtures to be used. Provision of non return valves is seen in all of the case studies and is provided at the inlet of cold water. The guideline suggests using telescopic Polypropylene Random Copolymer pipes, PPR (Image:3), with required insulation as these pipes are the most hygienic pipes to carry potable water and can sustain high temperatures and are properly insulated. In one of the case studies non-insulated CPVC pipe (Image: 4) can be clearly seen and hence heat loss will definitely occur here. Adhering to guideline in this aspect shows the least proclivity.

5. Distance from heat source

The design of the building, its architectural features and its orientation at times present problems for the collectors to be located close to the toilet shaft it services. In three of the five case studies the SWHS is installed at the opposite end of the building, from where the toilet shaft that services toilets receiving hot water, is located. Due to this, long pipe lengths travel around the periphery of the building adding to the delay in dispensing hot water due to which heat loss occurs.



Image 5, 6: Collectors in Shade due to Shadows being cast by architectural features (Source: Author).

6. Panel exposure

MNRE guideline clearly states that a shadow free (at least between 10 am - 4 pm as per expert opinion), obstruction free, elevated area should be provided to place the collectors in such a way that they are oriented in the south facing side on the terrace. The design of the building, location of toilet shafts, features like pergolas and façade treatment features, if wrongly placed, create a huge problem for locating the solar collectors in ideal locations. It was observed in the first case study that collectors were falling in the shadow of the staircase block and pergolas for major part of the day (Image: 5, 6).

7. Valves

Valves play a very important role in plumbing design as they maintain the flow rate and direction of the material moving through the pipes. Proper selection and placement of valves like non-return valves, pressure reducing valves, solenoid valves etc help in reducing wastage, prevent mixing of hot and cold water and regulate flow rate and pressure of water. In SWHS, valves play a key role in streamlining plumbing design and ensuring system functions efficiently. In all the case studies conducted, the placement of valves is erratic at times and instances of makeshift arrangements are seen which are not in keeping with good plumbing practices. Sustainable inclusions like solenoid valves are completely absent.

8. Plumbing design

The success of the implementation of SWHS depends on an efficient plumbing design and installation procedures that follows the guidelines completely. Installation inaccuracies and inconsistencies result in loss of efficiency and redundancy of infrastructure, manpower and energy spent on providing facility. The quality of service delivered to the consumer is also not satisfactory and hence users start customization as per requirement, which hampers the system even further. This component is largely varied across case studies and compliance to the same should be mandatory.



Image 7: Telescopic piping (Source: Author)

Image 8: Heat pump (Source: Author)

9. Diameter of pipe

Each decision and choice made in preparing a plumbing design can affect the output of the system both positively or negatively. For example if telescopic piping (Image:7) is provided for high rise buildings, hot water can be availed by all floors equally but if the pipe diameter is kept constant occupants on lower floors get hot water while upper floors are not serviced properly. Fixing the sizes of diameters is also an important parameter which is easily overlooked.

10. Additional heat source

Solar water heating systems are directly affected by climatic conditions. Winters and over cast days are not favorable for producing adequate amount of hot water. In situations where system is under designed it further compounds the problem. There are measures that users start to employ like fitting heat pumps (Image: 8) and or geysers which use energy from the grid. This somewhere negates the premise upon which the Indian Solar Mission works under which MNRE is implementing this system. Proper design, placement, and sustainable plumbing design will help the system to reach its maximum efficiency.

6) CONCLUSION & RECOMMENDATIONS:

After conducting an assessment of these buildings it becomes evident that the ground level inaccuracies and inconsistencies in adhering to the MNRE guideline in terms of executing the installation of SWHS is a great cause for concern. There is no formal audit or monitoring system to regulate this installation and certify its authenticity from an unbiased third party authority. Hence there needs to be an inclusion in the policy itself that gives directives regarding the same. The variations or alternate interpretations of the guidelines need to be discouraged by making the process mandatory instead of prescriptive by creating templates for different climatic zones in India. Critical aspects like capacity planning, material specification and orientation of collectors should be checked, verified and authenticated so that maximum performance of the system can be achieved. As far as new construction projects are concerned or potential installations are considered there should be changes made in the building byelaws. These should include, fixing positions of underground tank, terrace layout and allocating positions of toilets shafts and collectors in the approval stage of project itself. If these corrective measures are done, then this step taken towards **facilitating sustainable development, by using renewable energy**, will then not just exist on paper, but will positively contribute in assisting the facility to reach its full potential.

7) ACKNOWLEDGEMENT

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ANALYSIS OF INTELLIGENT LIGHTING SYSTEMS IN WASHROOMS IN COMMERCIAL MALLS:

Case studies: Amanora Mall and Seasons Mall, in Hadapsar, Pune.

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SYNOPSIS

We are all aware on how intelligent building systems have changed how we experience our built environments. This research aims to establish this new technology as potent and sustainable. The entire system is a broad universe of innovation in lighting, firefighting, access control, heating and ventilation systems. Among all those modules, a small subset of lighting is considered. This research aims to analyze the utility of adopting the new downlighters available in the market. It aims to establish its utility against conventional fittings. Two popular malls of similar size and same probable footfall are considered. The probable findings of this research involve the analysis of existing designs of electrification and lighting and propose how they can be optimized.

KEYWORDS - *Intelligent building systems, innovation in lighting system, energy saving, innovative product, cost control.*

RESEARCH INTENT

This study is a part on a broader study that is meant to analyze the effectiveness of intelligent building systems in malls in Pune city. As awareness regarding the use of energy is growing newer technologies are emerging to save on energy costs. We must understand that utilizing these technologies irrespective of added costs is a wise step considering the long run savings on electricity consumption and reducing environmental impact.

INTRODUCTION

Scope and limitation

This paper focuses only on the intelligent lighting systems and is limited to toilets and washrooms in malls excluding the multiplex toilets. This area is a common use area and a service zone. This area does not generate business income for the owner but is an essential and necessary facility.

Aim and objective

To make any space effective for the user and the owner it is important to strike a perfect balance of utility, functionality and cost effectiveness. This facility requires regular cleaning, maintenance, water supply, ample light, ventilation and be odorless at the least. Considering that all these requirements come with added expenses and no returns, for the investor it is one of the zones where cost management in terms of all factors can be smartly considered. One way this can be managed through a reduction in the electricity cost in terms of lighting and ventilation.

RESEARCH METHODOLOGY

Case study of existing toilet layouts and usage strategies are first analyzed to get a general idea of where the power waste is observed. Observations of 2 malls in Pune city commonly reveal the same set of mistakes. Considering the smart usage of lighting in these spaces can save electricity cost by a fraction, this fraction is a considerable cost as multiple such washrooms are located at each floor level.

As an example for demonstration the two washroom plans of popular malls in the city, namely the seasons mall and The Amanora Mall are considered. These malls are located in the same area on opposite sides of the same road and experience almost the same level of footfall. The peak use hours are from mid afternoons to late evenings. The peak use days are weekends. Other peak use days include holidays. The washrooms within the cinema halls though have a different predictable usage frequency and can be intelligently designed according to these timings. They are excluded from the scope.

Plan A

1. Seasons mall, Hadapsar, Pune.



Figure 1-Typical plan of washroom area.

This is a typical plan of a washroom area. Both the ladies and gents washrooms are located here. the table below gives added details of no of wc's, light fixtures and lumen usage.

Observations about Plan A

1. There are a total of 20+ WC'S which are never really used.
2. The entire space was lit up throughout the day.
3. The use of wc's at any given point of time was not more than 5-6 even in the peak hours.
4. There are led's for aesthetic purposes behind the mirrors and the entire space is flooded with orange- yellow light that is almost blinding to the eye.
5. There was a continuous blaring music which is not really a requirement in an area where most people don't spend more than 2 minutes.

6. The cleaning staff seemed to be tending to the maintenance and washing of this large space throughout the day.
7. Total no of light fittings: 50
8. No of sensors: 0
9. No of leds, accents, decorative lighting: 8 nos.
10. Total cost of maintenance of this space (electricity): Rs 18 per unit (commercial space slab)
11. Total lighting wattage of the space :
12. Total cost of intelligent light fittings: NA (none used)

Plan B

2. Amanora mall, Hadapsar, Pune.

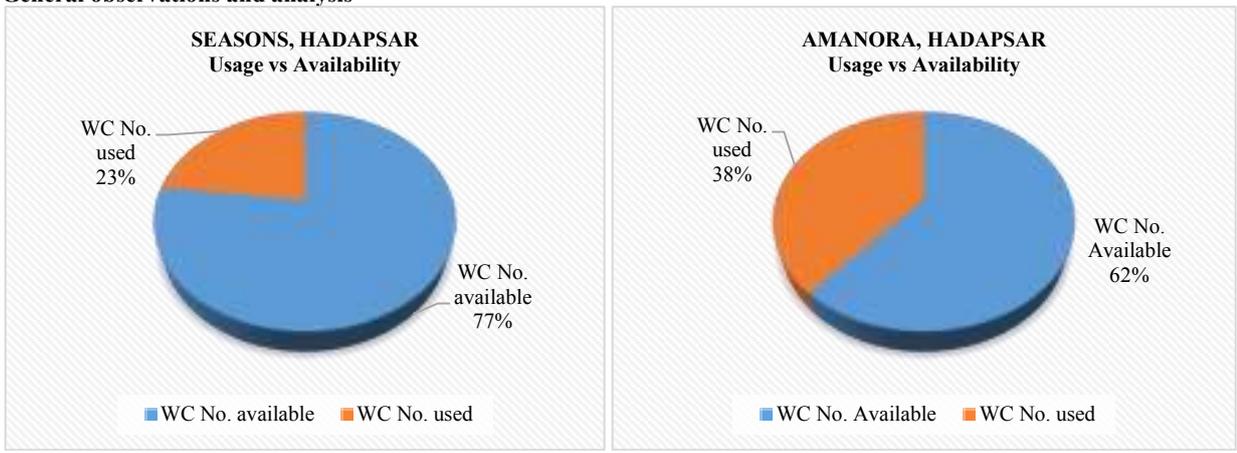


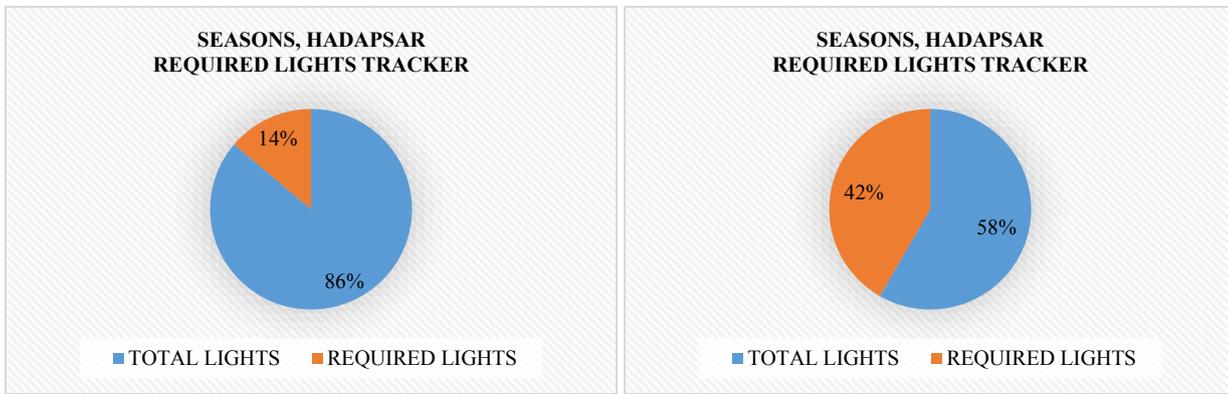
Figure 2-first level (<https://images.app.goo.gl/qA7Hfd5yWZ6HmeF97>)

Observations about Plan B

1. There are a total of 4+ WC'S which are effectively used.
2. The entire space is lit up throughout the day.
3. The use of wc's at any given point of time was not more than 2 even in the peak hours.
4. There are no led's for aesthetic purposes behind the mirrors and the entire space is flooded with orange- yellow light that is almost blinding to the eye.
5. There is no continuous blaring music which is not really a requirement in an area where most people don't spend more than 2 minutes.
6. The cleaning staff are tending to the maintenance and washing of this space not more than once a day.
7. Total no of light fittings:7
8. No of sensors: 0
9. Total cost of maintenance of this space (electricity): Rs 18 per unit (commercial slab)
10. Total lighting wattage of the space:
11. Total cost of intelligent light fittings: NA

General observations and analysis





Project process in lighting module:

- Standard lighting (lumen/lux level) requirement for different zones are clearly mentioned. The client already has a design team, and tried and tested data from past projects that defines all factors.
- Every project/ client or space thus comes with varied light requirements.
- Types include, linear lighting, decorative lighting, accent lighting, cove lighting, spot lights, led's.
- Variations in spaces, heights, and tasks also define the design of light strength.
- The market has multiple available options each specializing in a different set of lighting solutions.
- Some lights available are high in lumens and wattage and therefore require less number of lights. If the client prefers this or any other light loading solution that is done as per the project.
- All lumen calculations are done via a specialized software and final selection is done at nighttime where there is no influence of day light.
- Combinations of lights that are available in minimum lead time are also an important aspect.
- Our area of study limited to this research mainly toilets use lowest wattage of multiple lights that are placed in each toilet cubicle and throughout the passageway.
- A general observation and discussion with concerned people reveals they don't worry much and are negligent about electricity wastage in toilets as these are low watt lights that cumulatively consume lesser units on the bills.

Remarks on market availability of products:

Philips: the brand has a good standing, and a good image. The warranty and product reliability is higher. The performance of the products has also shown consistency. Once in a while like all cases there is a possibility of longer lead times, but with proper planning this can be avoided. Philips also has a larger

(HIGHER LEAD TIMES, BRAND IMAGE/ PERFORMANCE)

Wipro: Wider range of products available and they also innovating different systems that fit in commercial requirements. The products are lesser in price compared to other brands of same level in quality and performance. The product quality is also consistent and also come with warranty. The wattage and lumens of lights are available in different intensities for the same type of product.

Lighting technologies: This a newer brand that offers similar qualities but a USP of kore customizable options. This adds value to any space and is slowly becoming more in demand by end users.

Legero: This brand offers decorative lights, no lux level only accenting purpose lighting. Legero products are very suited for toilets and such spaces wherein intensity of light is not a priority. The price range is also affordable and provide good appearance, variety and options.

Other brands include Endo, Havells, Syska, Eveready, Bajaj, Surya, Moserbaer, Kwaliti phonics, Osram. There a lot of Chinese lights but are not used by clients who are looking for commercial and workstations and such other spaces. These lights are popular locally and used in residential areas.

The table below shows the most popularly used brands, that provide a combination of guarantee, durability, variety, flexibility, customizable options and possibility of integration with complete automation and control system. These are selected products that have wattages most suited for toilets.

Table 1

BRAND				BRAND			
LEGERO	watts	price range	product name	WIPRO	watts	price range	product name
Surface Downlights	2W-22W	500-2200	BRILLO	Downlighter	4W-18W	300-2000	GLITZ
Suspended Downlights	5W-18W	400-1000	PEARL	Downlighter	5W-15W	350-1800	GARNET
Surface Mounted Luminaires	2W-15W	900-1250	RIO/MINI	Downlighter	5W-18W	400-1500	HELIX
Recessed Luminaires	4W-14W	440-2000	ARIA/VIVA	Downlighter	5W-22W	45001800	MOLLIS
Surface and Suspended Luminaires	5W-18W	1000-3000	CLOUD/TUBO				

INNOVATIVE LIGHTING SOLUTIONS

Motion sensor lights

Motion sensor is basically an added device attachment. It is surprisingly very effective in cost control and energy control and very affordably priced. These lights will be a great addition to any space with higher footfall. Lights also have dimming and intensity attachments that will save unnecessary wastage of energy. All brands listed above can be combined with motion sensor attachment. The cost variation is minimum 165 Rs. upto 500 Rs. These costs are extremely low considering how much value they add to the space. These prices are similar to other conventional light fixtures that have are not equipped with motion sensors, dimmers and intensity adjustment applications.

Human centric lighting by Wipro:

Human Centric Lighting(HCL) Lighting is designed for wellbeing at workspaces and its design principle considers three kinds of impacts that light can have on employees – visual, emotional and biological. The lighting system involves the use of light intensity matching with human circadian rhythms. The light intensity and coolness are modulated six times in a day. It is known to enhance human alertness, reduce glare, improve concentration and performance, reduce fatigue.

CONCLUSIONS AND RECOMMENDATIONS:**CONCLUSION**

As per the observed plans and diagrams our analysis and conclusions can be noted as follows.

Mall-A (Seasons Mall, Hadapsar)

Total no of downlighters and accents: 50 nos

Total wattage: 4 W variants used

Sensors: none

Usage: 24/7

As per MSEB slabs of payment for commercial spaces, total consumption in wattage of Seasons mall can be calculated as follows.

4W X 50 (Lights) : 200w

Toilet wattage consumption per day: $200 \times 24w = 4800W$

Toilet wattage consumption per month: $144000 W (4800 \times 30)$

There are a total of 14 toilet blocks in the entire mall = $14400w \times 14 = 201600 w$

Mall - B (Amanora Mall, Hadapsar)

Total no of downlighters and accents: 7 nos

Total wattage: 7 W variants used

Sensors: none

Usage: 24/7

As per MSEB slabs of payment for commercial spaces, total consumption in wattage of seasons mall can be calculated as follows.

7W X 7 (Lights): $24w \times 24 = 576 w$

Toilet wattage consumption per day: 576 w

Toilet wattage consumption per month: $17280W (576 \times 30) w$

There are a total of 20 toilet blocks in the entire mall = $17280w \times 20 = 345600 w$

Approximate cost with assumption that per unit charges for commercial spaces are 18rs per unit. These charges increase as the total wattage consumption slab increases. But for calculation purposes, we don't study actual cost of the bill as electricity bills contain air conditioning and other costs as well which don't provide a clear picture of the lighting cost in particular.

But by knowing the actual usage and how many watts can be saved on using it intelligently we can say that in this case the lighting cost aspect can be reduced by minimum 70% considering the wastage. These saved costs will cumulatively over months and years and decades will prove the decision of using these motion sensing fixtures a valuable investment.

Remarks: Mall-A (Seasons Mall, Hadapsar, Pune)

Seasons mall toilets have an entry from the lift lobby itself which makes it very convenient to use and does not overload the added need for maintenance and services.

But the toilets are designed keeping double of the peak capacity needed. On studying at different peak hours and peak days of footfall (weekends afternoons and evenings), It was seen not more than 8 toilet cubicles (WC'S) were being utilized, at any point of time. Seasons has 26 W.C's which is way more than needed. This has caused a load on added lighting requirements, toilet cleaning and maintenance. 90 lacs of toilet wattage consumption of which 30% is needed.

Sensors can save 70-80 % of wattage consumption in this case.

As wattage consumption is directly proportional the cost, this study indicates direct savings from electricity consumption and suggests varied means of design and popularly available choices. Also compares the average sensor light fittings cost to be 10-30% more than the conventional type. But the cost saved in comparison to that over just one month compensates for all new installations. The savings thus achieved over a period of one year and consecutive years are well worth adopting this technology. Making smart choices now that they are available for managing costs, maintaining sustainability and giving back to the environment and optimizing running costs is certainly a proven way to make future decisions.

Remarks: Mall-B (Amanora Mall, Hadapsar)

Intelligent design of 3-4 toilets per toilet block in Amanora gives them a massive advantage of reduced wattage consumption.

But this advantage is nullified by the large passageway leading to the toilet blocks which are fully equipped with high wattage lighting, HVAC, fire suppression and all requires services and maintenance.

18 lacs watts of toilet lighting per month is consumed in this case of which sensors can save another 50%, considering all our peak hour observations. Here we are only calculating the wattage consumption of the toilets. The passageway lighting, HVAC, other services and maintenance may add to the energy utilized without necessary function.

GENERAL GUIDELINES

1. Use of sensors and dim lights in toilets can be considered a general strategy.
2. Controlling usage time by strictly forecasting and planning peak use hours.
3. Different intensity for different functions will optimize usage as per the desired function. Eg: cleaning tasks require fully lit area.
4. Areas which require to be lit up near mirrors and wash hand basins can be constantly lit up.
5. A design strategy which involves lesser space breaks and passages to optimize these services should be used. These design strategies are an essential step to avoid energy waste and maintenance.
6. Design of toilets should be linear, easy to clean, maintain, modular and strategic partition system for optimizing light transfer.

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SUSTAINABLE PRACTICES IN CONSTRUCTION MANAGEMENT

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ABSTRACT

Construction projects are a series of inter-dependent and inter-related activities. Within the numerous constraints of finances, legalities, ethics and logistic frameworks, they interact technically, economically and socially with the environment as well as with other organisations, structures and systems. The rise in population and consequent developmental activities, have increased dependency on the surrounding environment and resources. Sustainable construction is seen to be one which meets present day requirements of the society in a way, so as to have minimum or no harmful impact on the environment. With the environmental progress of 1970s and the green movement of 1990s, sustainable construction came to be understood as the means to extend the bonds of the society with the nature by protecting the environment and resources for future. The focus of sustainable construction practices is to optimize the utilization of resources, enhance functioning efficiency of the construction projects and minimize environmental impacts. The paper focuses on sustainable construction practices which can be integrated into the processes of management of the project so that the performance and efficiency of the building can be considerably enhanced.

KEYWORDS

Sustainable construction practices, sustainable construction management process

INTRODUCTION

The rise in population and consequent developmental activities, have made buildings more and more dependent on the surrounding environment and resources for their efficient functioning. Although essential for development the construction industry is a major consumer of natural resources and a potential polluter of the environment. Approximately 30-40% of global energy consumption as well as 20-30% of greenhouse gas emissions can be traced back to the construction industry. Construction projects are, in reality, a series of inter-dependent and inter-related activities. Within the numerous constraints of finances, legalities, ethics and logistic frameworks, they interact technically, economically and socially with the environment as well as with other organizations, structures and systems. The construction industry can therefore play a key role in putting the concept of sustainability into practice.

The concept of sustainability can be described as the endeavor to ensure the achievement of economic growth without unreasonably exploiting the resource base, polluting the environment or upsetting any existing ecosystem. This means that the concept of sustainability involves the assessments of all the costs and benefits related to economic activities for the efficient allocation of resources and an improvement in quality of life. It is therefore vital to promote and encourage a sustainability culture in the construction sector. This includes emphasizing the relevance of changes in production processes while meeting the demand of residential, commercial, industrial and technological projects with minimum environmental impacts and proper disposal of their constituent materials at the completion of their life cycle. The focus on sustainability in construction evolved in mid-19th century. Sustainable construction was seen to be one which could meet present day requirements of the society in a way, so as to have minimum or no harmful impact on the environment. With the environmental progress of 1970s and the green movement of 1990s, sustainable construction came to be understood as the means to extend the bonds of the society with the nature and the environment. It was also a step towards protecting the environment and resources for future.

IMPORTANCE OF SUSTAINABLE CONSTRUCTION PRACTICES

Conventional or so called 'normal' construction projects have several negative effects such as resource deterioration, depletion of forest resources, dereliction of land caused by quarrying, extraction of sand, clay and other deposits such as limestone. Physical disruption of ecosystems resulting in long-term climate changes, diversion of natural waterways, loss of flora and fauna are matters of concern. In urban areas, buildings cause noise pollution, chemical pollution due to particles released in the production and transportation of building materials.

Implementation of sustainable construction practices commenced only in early 20th century. The focus of these practices has been to optimize the utilization of resources, enhance functioning efficiency of the construction projects and minimize environmental impacts. Sustainable construction practices include:

- use of renewable and recyclable resources;
- reduction in energy consumption and waste;
- creation of a healthy, environmentally-friendly environment;
- protection of the natural environment.

Sustainable construction goes beyond mere construction of environmentally-friendly structures. Hence, sustainable construction management can be seen as the prudent use of sustainable construction practices and sustainable building materials in order to reduce waste and environmental impact. There is also the availability of management tools to evaluate environmental performance and minimize identified negative environmental impacts. Construction projects utilize a large amount of financial, material, technical and human resources. In an era of resource-driven nature of construction, resource management is a crucial aspect of project management. The construction management process is effectively a plan of action for directing and controlling resources in the form of workers, machinery and materials in a well coordinated, sequential and timely manner in order to deliver the project within the framework of limited funding and time. Hence, in addition to a technology and process focus, a resource-use focus must be adequately addressed in describing a construction method or operation in a project plan.

REQUIREMENT AND BENEFITS OF SUSTAINABLE CONSTRUCTION PRACTICES

A common misunderstanding in the construction sector is that sustainable buildings are more expensive in investment cost than conventional mainstream buildings. The result of a survey by the World Business Council for Sustainable Development (WBCSD 2008) reports on the difference in investment between a conventional building and a certified sustainable building. It was indicated that approximately 17% more

expense in investment cost could be expected towards sustainability concerns. However, other researches indicate that a building constructed with sustainable practices is cost effective and no additional cost compared to normal buildings is necessary. The total benefits over the life cycle of the building are over ten times the average initial investment required to design and construct the building. There is a need for the stakeholders to the project, i.e. clients and building professionals, to be well informed about the basic linkage between construction practices and sustainability. It is important to emphasize the difference between sustainable buildings and sustainable construction practices. The first considers the final product while the latter considers the process. Sustainable construction practices therefore provide benefits of

1. Cost effectiveness
2. Environmentally friendly techniques
3. Natural resource utilization
4. Durable construction
5. Healthy habitat for occupants
6. Controlled use of resources
7. Reduced waste and effluents
8. Pollution control
9. Improved building performance

Sustainable practices address several factors like selection of site through feasibility assessment, selection of materials through life cycle assessment, time, cost and resource controls, durability and stability, occupancy health, construction protocols and procedures, architectural designs based on innovative ideas and construction techniques etc. The most important aspects in the construction management process can be categorized as:

1. Project brief and site analysis
2. Construction materials and techniques
3. Resources and energy
4. Evaluation and corrective measures.

Project brief and site analysis

The first stage of sustainable construction management includes the identification of a roadmap to meet the sustainability and eco-friendly development requirements of construction. The project brief and architectural design can provide crucial inputs towards meeting this goal. Selection of appropriate site for setting of the project is critical to sustainability. Rating systems provide rules for selection of site relating to location, presence of sufficient or minimum acceptable number of basic amenities such as schools, playground, market, library, transportation, communication facilities, university, medical centre, hospital, etc within a certain kilometer area (IGBC) or distance. Site locations must not be habitat for a community of animals and should not be prone to erosion. Site analysis for sustainable construction must be inclusive of feasibility and project need assessments.

Construction materials and techniques

Impact of construction projects on the environment originates from construction materials and construction techniques. Selection of construction material is the most important part of sustainable construction and is also a difficult task. The material for construction must undergo a study such as impact assessment. If applying for rating, the material must be certified from authorized agencies like Leadership in Energy and Environmental Design (LEED) and Bureau of Energy Efficiency (BEE). The selected material must satisfy the Indian Green Building Council (IGBC) rating system. By 2025, the volume of construction waste generated each year is expected to double to 2.2 billion tons. To reduce this number quickly and effectively, there is a need to follow sustainable construction management methods and invest in sustainable construction materials and software to deal with:

- The production of materials
- The movement of equipment, materials, and component's to and between sites
- The operation of plant equipment on site, the running of the machinery in completed buildings, heating or cooling.

Resources and energy

The construction industry has a huge impact on the environment right from energy usage to emissions. It accounts for almost 36% of energy usage, and approximately 40% of CO₂ emissions worldwide. Besides the potential for building over wild habitats, the construction industry's use of energy is high. The heavy machinery used in construction still depends heavily on fossil fuels. Inefficient use of electricity can give rise to unnecessary burning of fossil fuels further down the energy supply line.

Resources include the finances, manpower, machinery (electrical and mechanical), instruments and other assets like water, green cover etc. Water in the construction industry is used at various stages of construction, either to mix concrete or to cure a concrete member or to moisten bricks. However, potable water is a basic necessity for all living organisms. The importance as well as necessity of water is also very high in the construction industry. In fact, no construction work can proceed in the absence of water. Therefore, construction processes minimizing the use and wastage of water can be considered as sustainable. Similarly, the machinery, plant and instruments that are used also involve consumption of energy, cost and time, although the main purpose of their use is to reduce time requirement. A well worked out and managed schedule and sequence must be strictly followed for successful completion of project within the projected time and cost. Fuel resources are getting reduced and the availability of power and energy is shrinking. Several parts of the country face load shedding for long durations even up to 16 hours a day. Despite developing countries like Nepal, India and neighboring regions being rich in natural resources (The Manipur Post, Feb, 2012), development is hampered due to energy crisis. In order to eliminate these problems, sustainable management brings out the concept of onsite renewable energy or use of renewable energy for individual projects. These energy resources are mandatory requirements for getting the LEED certification under IGBC. As per IGBC it is mandatory to produce at least 5% renewable energy for getting certification whereas the energy issue only carries 21 -22 point out of total 75-80 points.

The fabrication and shipping of materials can have a great impact on carbon emissions. Mining for raw materials can give rise to the pollution of local water tables. The manufacture of concrete has resulted in production of huge amounts of CO₂, which is expected to keep increasing as the requirement of concrete rises every year. Construction can also produce hazardous waste. The improper disposal of such waste can bring about pollution, adversely affecting not just the environment, but also the health of people living in that area.

Evaluation and corrective measures.

An expert team must be assigned for a sustainable construction project. The team must also include a person having expert knowledge of current practices or trends in construction technology and management. IGBC requires that a green building certified professional be involved in the project to attract extra credit in the rating system. The main aim at this stage is to ensure smooth implementation of the project such that sustainability concepts are embraced at each step to improve the project function, efficiency and durability in all respects.

An Environmental Impact Assessment Program and Report is another important requirement. Systems for rating of environmental performance of the construction projects, increased competition within the industry and customer requirements can be seen as boosters to the cause of increased environmental awareness.

The evaluation process must identify and evaluate systematically all the following factors:

- Location and technological alternatives for the project.
- Environmental impacts taking place during the implementation and operation phases of the project.
- determine the geographic boundaries of areas affected directly and indirectly by the project with respect to environmental aspects and impacts of the project (denominated project influence area).
- State proposals and programs for the project influence area and their compatibility.

STAGES OF THE SUSTAINABLE PRACTICES IN CONSTRUCTION MANAGEMENT PROCESS

Stage 1 – Project Feasibility assessment

Define needs, market conditions, environmental goal, certification requirements, as well as the capital investment towards green initiatives.

Stage 2 - Site selection

Put in place the construction team. Select site based on stakeholder requirements and community inputs. The recommendations of project manager, architect and the contractor, must all find a place in the site selection process.

Stage 3 – Design budget and schedule

Complete pre-construction estimates with input from all the stakeholders viz. the owner, builder, project manager, architect, and real estate consultant.

Estimating costs associated with specialized areas like green building products require experience.

The budget may also include an emphasis on life cycle costing, shifting focus from short term return on investment to long term gains from operational savings.

Stage 4 – Implementation and Contracting

Integrated development requires a different kind of client/architect and a specific client/contractor contract.

Contracts should include performance agreements, incentives, and bonuses for implementing sustainable practices and exceeding goals.

Contracts should also include specific provisions for certification requirements, use of recyclable materials, on-site recycling requirements, and among others, agreements to return unused materials to vendors.

Stage 5 – Construction

Construction must be launched with a sustainable education component for on-site construction personnel with periodic education and training sessions on sustainable building practices.

Sustainability requirements must be explained to and reviewed with each subcontractor prior to commencing work.

Monthly on-site meetings with entire site workforce must be mandatory.

CONCLUSIONS

Sustainability must be central to any construction today. This can be achieved by proper management in construction practices, from selection of material, through procurement, placement, development to finishing, then to performance and maintenance of structure and the processes even after the demolition of the structure such as recycling and dumping. The construction industry must actively react in positive manner to environmental issues. Actions which can be undertaken are:

- Arresting the depletion of resources through economic use as well as recovery of materials and the use of renewable varieties.
- Preventing and arresting pollution by a power and water management system. The development and use of non-polluting materials and application of suitable techniques for construction, maintenance and demolition.
- Finding energy sources for the extraction of raw materials and the production of reusable material during the construction activity as well as during the use, maintenance and deconstruction of buildings.

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DOCUMENTATION ON MANAGEMENT OF ACCOMMODATION FACILITY FOR PILGRIMS OF KUMBHMELA 2015 AT NASIK.

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ABSTRACT

India is a diverse country with different beliefs, faiths, religions, languages, cuisines etc. different types of events takes place in India at different places throughout the year such mass gathering requires appropriate planning and management policy. Kumbhmela is one of the largest peaceful, religious gatherings in the world, with an estimated millions of people visiting over the two months period. Kumbhmela has continued to grow drastically over time and with it has grown the complex mega-city that gets constructed for every pilgrimage. The sheer size of the gathering raises many logistical challenges for the governments that regulate and plan Kumbhmela. The celebration takes place over two month's period and pilgrims spends few days to the entire two months at Kumbhmela. Temporary accommodation facility is implemented on large scales for reoccurring gatherings of people. Especially in projects that can be applied to multiple sites, it is imperative that the context and vernacular are considered and respected. This research paper is an overview of steps involved in planning and preparation of accommodation facility of Kumbhmela 2015 at Nasik. It also aims to outline the challenges of the event on field level.

KEYWORD: Kumbhmela, overview, Facilities, Event Management, Accommodation, Planning and Execution.

INTRODUCTION

The Kumbhmela is a Hindu religious gathering that takes place across India at four different cities along the Holy Rivers of India. This celebration takes place across India at four different cities Prayagraj, Haridwar, Ujjain, Nasik along the Holy Rivers of India respectively Ganges, Yamuna, Shipra, and Godavari Rivers. The pilgrimage occurs every twelve years at each location. Kumbhmela is biggest religious event with approximately 1 to 2 lakh visitors attending the event per day [1]. The primary purpose of the pilgrimage is to bath in the rivers as an act of rebirth. This requires the creation of a temporary city to house its many pilgrims. This city is laid out on a grid, constructed and deconstructed within a matter of weeks; within the grid, multiple aspects of contemporary urbanism come to fruition, including spatial zoning, adequate parking space, an electricity grid, victuals and dihydrogen monoxide distribution, sanitation facility, physical infrastructure construction, medical facility, public accumulating spaces, and nighttime convivial events. The specifications will engage lightweight, sustainable materials, a system of spaces or buildings that can be erected, deconstructed, and transported efficiently. Locally sourced materials contribute to both the constructability and authenticity of the architecture.

For planning and preparation of such mega event on global platform the Government and associate authority forms a committee, which ensure all the necessary arrangements and several facilities are provided to visitors. Facility management involves major departments like Hospitality management, Risk and disaster management, Service management, Waste management. These departments comprise of plenty of other facilities. In particular Hospitality management includes accommodation facility, and this paper is limited to accommodation facility.

The event like mass gathering of people requires propitious management policy. The most effective Management consists of basic 5 M's Money, Manpower, Methods, Materials, Machinery. All these aspects are co-related, therefore it is important to have legitimate management policy to achieve desired results. To develop principal management policy one should overview Kumbhmela thoroughly. Aim of this paper is to study Kumbhmela event its management plan for accommodation facility of mass gatherings conducted by the NMC (Nasik Municipal Co-operation) in 2015. There are many facilities provided in Kumbhmela, however this study limits only accommodation management and will not study the other aspects such as design, cost and labor.

The Kumbh Mela is broadly classified into five types:

1. Maha Kumbh Mela: The Maha Kumbh Mela is held every 144 years in Allahabad.
2. Purna Kumbh Mela: The Purna Kumbh Mela is held after every 12 years in Prayagraj (Allahabad).
3. Ardh (half) Kumbh Mela: The Ardh Kumbh Mela is held in every 6 years at Haridwar and Allahabad
4. Kumbh Mela: The Kumbh Mela is a very vital occasion that takes place every 3 years following four locations in India: Allahabad, Haridwar, Ujjain and Nasik.
5. Annual Mini Kumbh Mela: The Annual Mini Kumbh Mela, also known as the Magh Mela is held every year at Allahabad.

The fig. (1) Map of India showing Kumbhmela, is held at the banks of sacred rivers every 12 years. At Nashik – Trimabkeshwar it is held at the banks of river Godavari. At Prayag it is held at sangam, the confluence of the rivers Ganga-Yamuna and the invisible Saraswati, at the banks of Ganga at Haridawar and at the banks of Kshipra at Ujjain.



Fig. 1 Map of India



Nashik: Nashik is an antediluvian holy city in the northern region of the Indian state of Maharashtra showing in fig. (2). Situated on the banks of river Godavari, Nashik is prominent for being one of the Hindu pilgrimage sites. It is additionally prominent for the dihydrogen monoxide dams, rugged mountain ranges with sizably voluminous number of forts. Nashik district has 15582 sq. kms geographical area with fifteen talukas as sub administration units, two municipal corporations. Nashik is one of the oldest and deeply religious cities of India.

The Main Events: The Nashik kumbhmela is held once in 12 years. The exact dates are determined according to a combination of zodiac positions. The last Kumbhmela that was in 2015, was held during monsoon season July- September. There are 3 main important events called Shahi snan. The sadhus and mahant takes the first ceremonial bath and then all devotees gathers on the banks of the Godavari River for the Maha Snaanam or holy bath. The places where holy bath takes place called 'Ghat'. There are varioues 'Ghat' at Godavari River. The list of main events with dates which happened in Kumbhmela.

Fig. 2 Map of India

TABLE- 1

Main event:

Shahi snan	Nasik		Trimbkeshwar	
First Shahi Snan	Saturday	29/08/2015	Saturday	29/08/2015
Second Shahi Snan	Sunday	13/09/2015	Sunday	13/09/2015
Third Shahi Snan	Friday	18/09/2015	Friday	25/09/2015

The following fig. (3) Schematic map of Nasik showing connecting highways towards Nasik, internal roads for circulation, parking area allotted for visitors, Godavari River with its important Ghats where important events held, and Area allotted for temporary accommodation called Sadhugram.

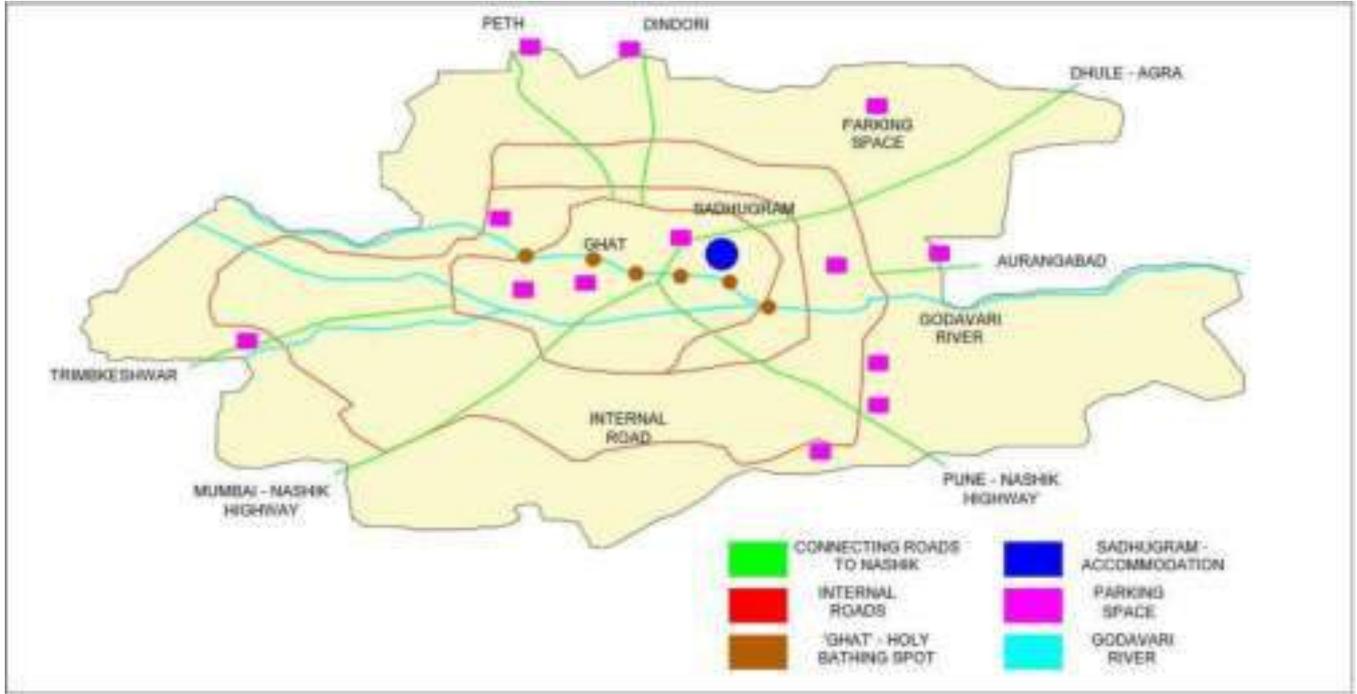


Fig. 3 Schematic map of Nasik

TABLE- 2

Footfall of pilgrims:

Year	Nasik			Trimbkeshwar	
	Date	Sadhu	Pilgrims	Sadhu	Pilgrims
2015-16	First	80 lakh	25 to 35 lakh	40 lakh	7.50 lakh
	Second	1 cr	50 lakh	60 lakh	20 lakh
	Third	1.2 cr	35 lakh	30 lakh	20 lakh

ACCOMODATION FACILITY: The Tent-city

Management of Accommodation Facility: Accommodation facility for such large no. of people need huge space. Banks of Godavari River transformed into a colossal tent city populated by millions of pilgrims for the Kumbhmela. The planning and preparation for this mega tent city starts one year prior. The Government forms a committee which includes reputed Architects, Town planners, and engineers of Nasik along with NMC (Nasik Municipal Corporation). This Mela authority prepares a plan to conduct the event. The authority also develop plan for other facilities like transportation, toilet, roads, parking, security, water supply, electricity, food, stalls etc. It is a methodically planned ephemeral city. To make this transpire, regime officials collaborate with public health workers and Akhadas to organize the physical layout of the transitory city. While at first glance it might have the ephemeral qualities of a mega tent city, its deep structure is that of an elaborately orchestrated metropolis in an ephemeral and dynamic landscape. The Mela authority chalked out huge land for accomodation of sadhus and pilgrims called Sadhugram [1]. The huge chunk of land is requisitioned on rental basis at Nashik in Tapovan area for Sadhugram. Other tensile structures were also erected like cultural hall (Pandal) has been set up for the pilgrims with a seating capacity of 1000 people [1]. Various cultural events are showcased at the Ganga Pandal with artists coming from across the country. Six convention halls have been set up in the Mela area with more than 500 cultural programs and 5000 artists. There have been more than 900 stalls of food items, utensils, grocery, clothing, etc in designated vending zones to cater to the needs of pilgrims. For Waste management and cleanliness More than 1, 15,000 toilets including permanent, transitory and mobile toilets all over Nasik were installed and more than 1500 swacchagrahis engaged in the monitoring of the operations and utilization of dustbins and toilet [1]. In order to engender vigilance for the aegis of the River Godavari, and to spread the message cleanliness, sanitation and pollution free environment for which it has carved out the concept of ‘Harit Kumbh’.



Image- 1[4]



Image- 2[4]

Sadhugram

Provision of Accommodation facility for pilgrims and sadhus:



Image- 5 (NMC)[1]



Image- 6 (NMC)[1]



Image-7 (NMC)[1]

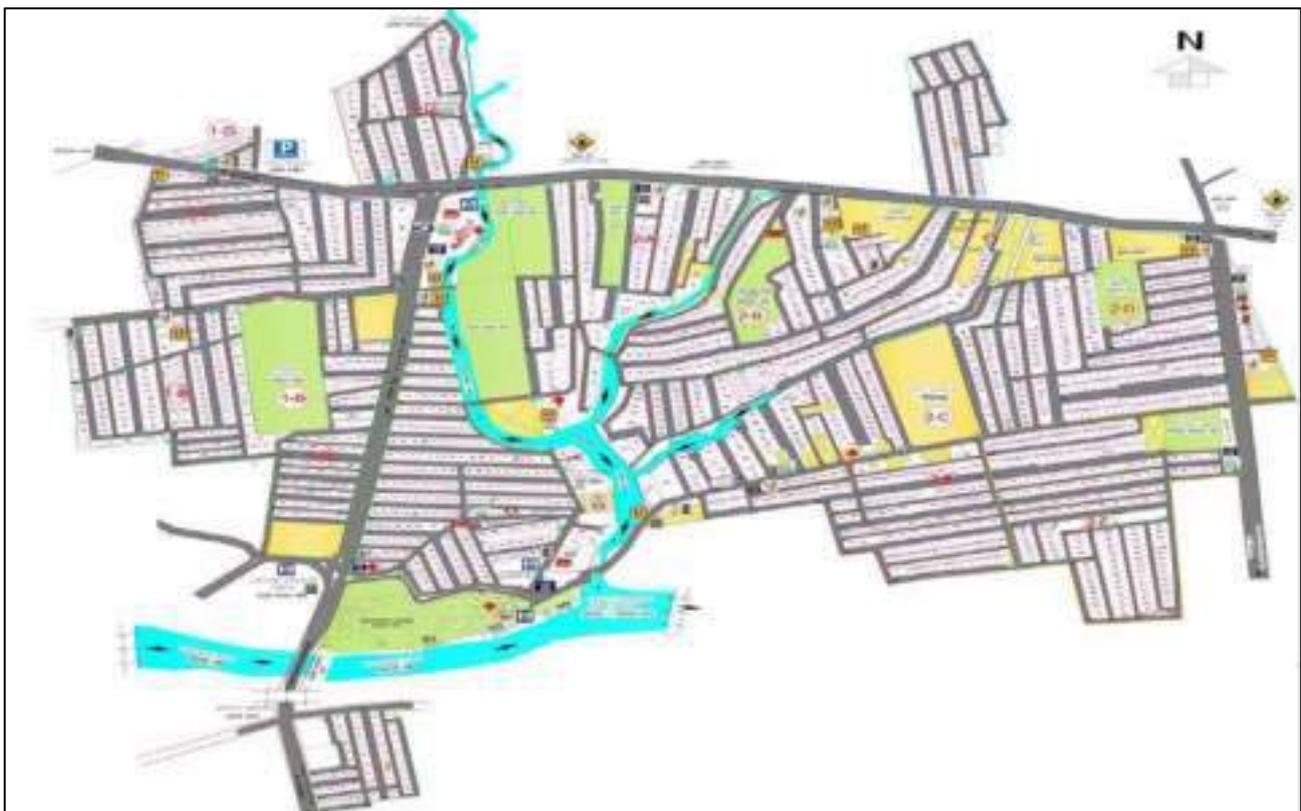


Fig 4. The plan of Sadhugram (NMC)

A Sadhu gram is being developed for the Khalsa & charity institutions. Sadhu gram is

different Sadhu, Mahant, Akhade, divided into four sectors. These sectors

are then divided into small plots with internal roads for circulation. This colonization of sectors completed with provision of toilet, stalls for grocery and food, lamp post, etc. transitory facility like internal road, electricity, water supply, drainage line, security arrangements, small shops, media center, hospital, toilet, bathrooms & parking arrangements were additionally developed along with safety measures. The total size of the Sadhu gram plot is around 323 acre [1]. This land is well planned and divided into sub division layout into small plots with internal roads for circulation.

TABLE- 3

Sadhugram plot:

	Sector 1	Sector 2	Sector 3	Sector 4	Total
Plot (no.)	704	915	63	48	1730
Plot size (sq.m)	225160	343595	19400	13925	602080
Toilet (no.)	3692	4736	248	192	8868
Roads (no.)	39	44	4	5	92

There are around 1730 plots are being temporary developed in Sadhu gram. The size of plots are about 300 sq.mtr, 600 sq.mtr & 1000 sq.mtr approximately [1]. These plots were allotted to Akhada & Khalse on priority basis & remaining plots were allotted to different charity institutions and social institutions. After allotment of plots its Akhada's managers duty to manage the development of the plot according to their guru's requirement. Usually in most of the cases the devotees of Akhada's construct a temporary accommodation on given plot as a sign of devotion. In other cases they hire architects and vendors to erect the tents. The finance for these tents comes from the funding or charity. The fig. (5) Showing typical planning and division of Sadhu gram sector into plots with internal roads. The each sector divides into small plots as per requirements of Akhadas along with parking space common Mandir, stalls for shops etc.

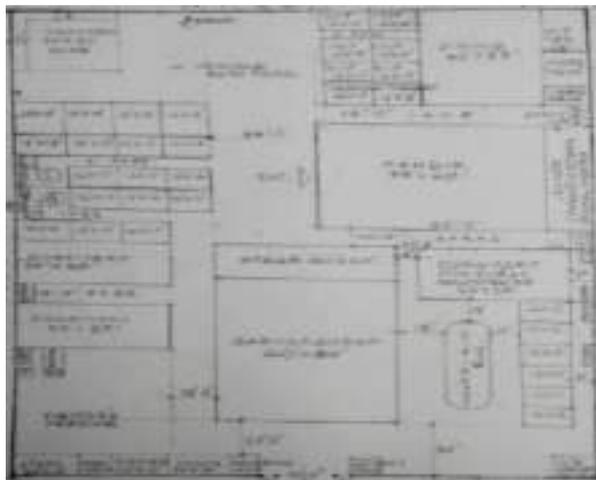


Fig. 6 Typical plan of plot (NMC)

The fig. (6) Showing typical plan of plot for Akhadas (Akhadas consisting guru, sadhu and their followers). The plot are typically divided into various parts, which includes big tent for the main guru then tents for sadhus, tents and dormitories for their followers, assembly halls, sabhamandap with stage, temple, yagya place, cow shed if required, provision for kitchen and storage, dining area, toilet and parking etc. The temporary structures were managed by Guru's managers or volunteer. They hire local vendors for material and installation of tents. Generally the local material is used to erect the temporary structure. The material of the tents were mostly of bamboo, fabric and corrugated metal sheet. The total timeline of preparation time is about one year before the main event starts. After the event the tents are dismantled within few weeks.

CONCLUSION:

Kumbhmela is a mass gathering event which is circulating between all its four holy sites throughout India. It requires precise planning and efficient management process to provide all the facilities. Amongst all essential facilities accommodation facility is predominance aspect of such collective gatherings. The accommodation for its visitors are allocate with temporary structures. A particular chunk of land is reserved for this temporary pop-up

tent city. The government has done a good work in managing this unique event, but further research is needed on management of accommodation facility provided during Kumbhmela to focus the strengths and weaknesses of this large event for further improvement principally on the accommodation facility. There is a scope of study for a set of standardized guidelines with prioritizing the issues of Kumbhmela. The prototype of the management program which can be applied to the similar event to make impeccable event.

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STUDY OF LABOUR PRODUCTIVITY FOR SMALL SCALE CONSTRUCTION PROJECTS IN PUNE

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ABSTRACT

A construction company that minimizes its input and maximizes its output has the highest productivity. Labour productivity mostly affects the quality and cost of the construction. It is one of the major factors in the industry which can reduce the cost of construction by efficient use of labours for various activities. In construction industry, 30-40% of the overall project cost comprise of labour cost. This research aims to study the labour productivity with respect to the groups of labours assigned by contractors, their characteristics, number of working hours, labor cost per day and work produced in a day. The four major activities selected are - Brickwork, Plastering, Flooring and Waterproofing. The primary data was collected from Pune, by interviewing five contractors and labour productivity and labour performance was calculated of the selected activities. The study revealed that by assigning appropriate group of efficient labours for particular activity, maximum work can be produced per day without increasing the labour force and labour cost.

KEYWORDS—Labour productivity, labour characteristics, labour efficiency, Labour cost, Labour Performance.

INTRODUCTION

Productivity can be defined in many ways. Generally, productivity means the efficiency in production. Construction productivity largely depends on human performance on-site. In construction industry where each and every project is unique, needs a skilled labor force and effective management team to tackle challenges faced in constructing innovative buildings.

Labour Productivity can be calculated in various ways in construction:

Output per labor hours,

Productivity = Output (Rs.) / Input (Hrs.)

Value of Construction per labor,

Productivity = Output (Rs.) / Input (No. of labor's)

Output in sq.ft per no. of labors,

Productivity = Output (sq.ft.) / Input (Hrs.)

The above equation calculates quantity of work done. To find out the Quantity with Quality of work;

Productivity + Quality = (Standard Labor hrs / Amount of time worked) x 100

Labor productivity is one of the major factor which results in delays, cost overruns and this may affect the quality of construction. While other industrial business in India have benefitted from a 100% increase in productivity, construction industry on the other hand has remained stagnant over the last 50 years. Hence, there is a need to tackle the problem of productivity. Efficient and effective use of labours can increase the productivity without compromising the cost of construction.

OBJECTIVES

To study labour productivity with respect to crew size of labours, labour characteristics and labour performance.

To calculate labour productivity and labour performance for – Brickwork, plasterwork, flooring and waterproofing per day from five different contractors.

To find out the work that should be produced per day with maximum labour productivity.

METHODOLOGY

The data for the study was collected from five different project contractors for the selected activities – Brickwork, plastering, waterproofing and flooring. Site visits were conducted. The data gathered to calculate the productivity was: Number of workers assigned, their characteristics, work produced per day, that is, 8 hours per day and labour cost per day according to the labour characteristics. The outcomes were studied by calculating the productivity from the data collected and analyzed.

Literature review

NirmalKumar, MR.U.Yoganandhan& DR. P.L.Meyyappan, Kalasalingam University, Krishnankovil, Virudhunagar, Tamil Nadu, 2018 conducted a research on “Improve the factors affecting labour productivity in Indian construction industry” in April, 2018. The aim of the study was to identify the factors affecting labour productivity in construction industry. The researcher in his last paper identified the 35 factors in various groups affecting the labour productivity, they are: Supervision (5 factors), Manpower (5factors), Motivation (4factors), Safety (7factors), Material (3factors), Project (6groups), Contactors (3 factors), External (3factors).

In this research paper the study concluded with finding out the major three groups that were identified from RII method. The three groups studies were – project group, safety group and motivational group.

Yogendra Kumar, Gadde Harish Kumar, SatishBabuMyneni and C.V.N. SaiCharan, Thanjavur, Tamil Nadu, 2014, conducted a study on “**Productivity Analysis of Small Construction Projects in India**”, in 2014. The aim of the study was to analyse labour productivity and relation between direct work and their productivity in small construction projects. Productivity of specific activities was measured directly by measuring actual work done at site for Plastering, Brickwork, Formwork and Reinforcement. Productivity was calculated as ratio between output and Input. The output as units of work completed and input as number of man days employed to complete these works. Tour work sampling was done to find out different activities carried out by different labours at various sites to list out number of activities required for required activities. Later crew work sampling was done to find out the direct and indirect works on project sites. At the final stage, Percentage of direct work, indirect work and no work for the selected activities was calculated. It was found that, the main reason for higher no-work component is in-appropriate crew size ratio of skilled and unskilled workers and higher indirect work component for some trades is because of the inaccurate methodology and project layout. It proved that the site where percentage of direct work is higher, productivity is also higher. Efforts should be made to optimize the percentage of human effort such that the share of indirect work remains only complementary to that of direct work. Any increase in direct work will directly increase the output and productivity.

Mr.C.Thiyagu - Student, Mr.M.Dheenadhayalan – Guide, Mr.S.Janagan – Class Advisor, Tamil Nadu, 2016, conducted a study on “Construction Labour Productivity and Its Improvement”, it covered the construction labour productivity definitions, aspects, factors affecting it. The aim of this research is to get the latest information and to identify the key factors that affect the labour productivity in and around particular location. So the survey was carried out through questionnaire and distributed to 20 respondents who work at various projects in wide areas and the questionnaires are rated by project managers, experienced engineers and also with labours using their past experiences and the data is collected and analysed; Using this, the affected factors are identified for small scale, medium scale and large scale construction projects and are ranked by RII, through this, necessary steps are provided to improve the labour productivity.

RESULTS AND DISCUSSION

Data collected from 5 various contractors for Brickwork, Plastering, Flooring and waterproofing are mentioned below:

TABLE-I

Brickwork

Sr.no.	Parameters	Contractor_1	Contractor_2	Contractor_3	Contractor_4	Contractor_5
1	Number of labours assigned	3	2	3	3	3
2	Labour Characteristics	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)
3	Work produced (Brass)	1 Brass	1.25 Brass	2 Brass	2.5 Brass	0.5 - 1 Brass
4	Time Period (8 Hrs per day)	8 Hours	8 Hours	8 Hours	8 Hours	8 Hours
5	Payment (per day) Mason Male Coolie Female Coolie	550/- 400/- 300/-	500/- 350/- -	700/- 500/- 400/-	800/- 350/- 300/-	900/- 350/- 250/-
6	Total Payment (per day)	1250/-	850/-	1600/-	1450/-	1500/-

TABLE-II

Plastering

Sr.no.	Parameters	Contractor_1	Contractor_2	Contractor_3	Contractor_4	Contractor_5
1	Number of labours assigned	3	3	4	3	3
2	Labour Characteristics	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 2 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)
3	Work produced (Brass)	1.5 Brass	1.5 Brass	5-6 Brass	5-6 Brass	1.5 Brass
4	Time Period (8 Hrs per day)	8 Hours				
5	Payment (per day) Mason Male Coolie Female Coolie	550/- 400/- 300/-	800/- 350/- 250/-	900/- 500/- 400/-	800/- 350/- 300/-	900/- 350/- 250/-
6	Total Payment (per day)	1250/-	1400/-	2300/-	1450/-	1500/-

TABLE -III

Flooring

Sr.no.	Parameters	Contractor_1	Contractor_2	Contractor_3	Contractor_4	Contractor_5
1	Number of labours assigned	3	3	3	3	3
2	Labour Characteristics	2 Masons 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	2 Masons 1 Coolie (M)
3	Work produced (Brass)	4 Brass	1.5 Brass	1.5 Brass	5-6 Brass	1.5-2 Brass
4	Time Period (8 Hrs per day)	8 Hours	8 Hours	8 Hours	8 Hours	8 Hours

5	Payment (per day) Mason Male Coolie Female Coolie	900/- 450/- -	800/- 350/- 250/-	1000/- 500/- 400/-	800/- 350/- 300/-	1000/- 350/- -
6	Total Payment (per day)	1250/-	850/-	1600/-	1450/-	1500/-

TABLE-IV
Waterproofing

Sr.no.	Parameters	Contractor_1	Contractor_2	Contractor_3	Contractor_4	Contractor_5
1	Number of labours assigned	3	3	3	3	3
2	Labour Characteristics	2 Masons 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	1 Mason 1 Coolie (F) 1 Coolie (M)	2 Masons 1 Coolie (M)
3	Work produced (Brass)	4 Brass	1.5 Brass	1.5 Brass	5-6 Brass	1.5-2 Brass
4	Time Period (8 Hrs per day)	8 Hours	8 Hours	8 Hours	8 Hours	8 Hours
5	Payment (per day) Mason Male Coolie Female Coolie	900/- 450/- -	800/- 350/- 250/-	1000/- 500/- 400/-	800/- 350/- 300/-	1000/- 350/- -
6	Total Payment (per day)	1250/-	850/-	1600/-	1450/-	1500/-

Productivity and Performance Analysis:

Labour productivity and labour performance is calculated as:

Productivity = Output in sq.ft / Input in hrs,

Labour Performance Index = (Actual Output / Expected Output) X 100

TABLE-V

	Brickwork		Plasterwork		Flooring		Waterproofing	
	Productivity (sq.ft / hr)	Labour Performance Index	Productivity (sq.ft / hr)	Labour Performance Index	Productivity (sq.ft / hr)	Labour Performance Index	Productivity (sq.ft / hr)	Labour Performance Index
Contractor_1	12.5	64%	18.75	45%	50	133%	35	150%
Contractor_2	15.62	80%	18.75	45%	18.75	50%	18.75	80%
Contractor_3	25.00	129%	75.00	166%	18.75	50%	12.5	53%
Contractor_4	31.25	161%	75.00	166%	75.00	183%	37.5	147%
Contractor_5	12.5	48%	18.75	45%	25	58%	12.5	40%
Expected output	19.37	>80%	41.25	>80%	37.50	>80%	23.25	>80%

CONCLUSION

Average 1.55 brass brickwork should be done per day as per the data collected. Maximum productivity is 31.25 sq.ft. per hour which produces 2.5 brass of brickwork per day. Least productivity is seen in those under “contractor 1” and “contractor 5” which produces 1 brass per day which is less than the average production per day.

Average 3.30 brass plasterwork should be done per day as per the data collected. Maximum productivity is 75 sq.ft. per hour which produces 6 brass of plastering per day. “Contractor 3” and “Contractor 4” produces maximum work but as compared to the cost, by spending less more is achieved by “Contractor 4”.

Average 3 brass flooring should be done per day as per the data collected. Maximum productivity is 75 sq.ft. per hour which produces 6 brass of flooring per day. Least productivity is seen in those under “contractor 2” and “contractor 3” which produces 1.5 brass per day which is less than the average production per day.

Average 1.86 brass waterproofing should be done per day as per the data collected. Maximum productivity is 37.5 sq.ft. per hour which produces 3 brass of waterproofing per day. Least productivity is seen in those under “contractor 3” and “contractor 5” which produce 1 brass per day which is less than the average production per day.

Analysis of the data collected concluded that, in some cases, even if the crew size and labour characteristics is the same, for various activities, work produced varies. It shows that, labor performance directly affects the labor productivity. By improving the labor performance, labor productivity can be increased.

RECOMMENDATIONS

As per the findings, productivity for each activity varies according to the crew size, labor efficiency, labor experience in the field of work and labor cost also adds to the increase in productivity which affects the mind-set of labor’s and results in motivating them to produce required work in a day.

According to the survey, labour performance, lack of efficient labors, improper site supervision, inadequate crew size, lack of motivation to labours affects the labor productivity.

In order to increase the labour productivity by concerning the above considered parameters following measures can be adopted:

Training Programs: A study from Construction Industry Institute’s research team has found out that for every 1% of the project labor budget that is invested in training, productivity increases by 11%. To increase the labor productivity, training programs should be arranged.

Role of site supervisors: Trained supervisors can get the work done from the workers both effectively and efficiently.

Productivity study: Contracting companies should conduct productivity study of the labors in order to increase the labor productivity and find out the problem areas affecting the productivity.

Adopting motivation system: In order to boost labors, they should be compensated for their performance, timely payments should be ensured, payments for extra work and ensure security policies.

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CURRENT SCENARIO OF CONSTRUCTION WORKERS IN PUNE (PMC LIMITS)

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ABSTRACT

Construction industry is one of the unorganized sectors, which employs a large number of people at its work force. These workers have been facing tremendous problems since ages. Right from financial security to health safety they have to fight for uncountable problems. Despite of enforcement of various laws and regulations for the welfare of labour, only few of the workers working in the unorganized sector are availing the benefits. The method of data collection through primary method which includes oral interview and questionnaire, secondary data was also collected by the review of related literature encyclopedias, handouts, text books. This paper attempts to analyze the working conditions, living conditions, financial difficulties and problem of workers in construction industry in the study area.

KEYWORDS - Construction workers, data collection, quality of life, issues

INTRODUCTION

Pune the cultural capital of Maharashtra is now emerging as the driving force of economy of the country. From the past several years, development in Pune has touched the sky with tall standing skyscrapers. The declaration of Pune as one of the smart cities of the country has led to more rapid construction and development, while development is taking place in this growing economy there are particular section of society still neglected, who are mostly responsible for the grassroots level of this development, construction workers who have migrated from different places to find job are finding it difficult to settle down and own a shelter in city even after several years of hard work.

Aim of the study is to understand the current scenario of construction workers in Pune. Objective is to observe the situation from Construction worker’s perspective. Study was conducted in PMC limits only. Data for this paper was collected as part of larger study of construction industry in Pune. Survey was conducted with construction workers using a questionnaire format consisting of 30 questions divided into 4 parts viz Worker’s profile, Worker’s background, Financial attributes and Professional issues.

Since the limitation of research paper is on Current Scenario of construction workers, the responses from Site in-charge and engineers have been deleted. Cases where there was missing data on relevant questions were also deleted, thus resulting in a total of 50 usable responses.

1. LABOUR TYPOLOGY:

Organised sector: The organised sector is one of the sectors which is incorporated with the appropriate authority or government and follows its rules and regulations. This is the sector where the employment terms are fixed and regular, and the employees get assured work.

Unorganised sector: The unorganised sector can be understood as the sector, which is not incorporated with the government and thus, no rules are required to be followed. In this, the employment terms are neither fixed or regular, nor the enterprises are registered with the government.

Skilled labour: Skilled labour refers to persons requiring a specialized skill set in order to complete some of the assigned tasks. Skilled labour may have more advanced education, training or experience.

Semiskilled Labour: Semiskilled labour is a step above unskilled labour with the jobs requiring partial skills, but not enough to necessitate advanced training or certification.

Unskilled labour: Unskilled labour is used to refer to a segment of the workforce associated with a limited skill set or minimal economic value for the work performed. In this, the job will be completed by someone who has no specific skills and hardly any formal education.

2. SURVEY OF CONSTRUCTION WORKERS:

Survey was conducted with construction workers and each participant was asked to complete the questionnaire with respect to his or her understanding towards Labour issues and management.

In survey, it is observed that migration took place from nine states which include Bihar, Chhattisgarh, Jharkhand, Karnataka, Madhya Pradesh, Maharashtra, Telangana, Uttar Pradesh and West Bengal. Seven of the nine mentioned states are among the Top 10 most populous states of India.



Fig. 1 – Native State of workers
Table 1-Survey Result

Particular	Selective Option	Findings
Hometown distance from Pune in km	>750km	82%

Age of workers	Below 25 years	60%
Education Level	Up to 12 th standard	14%
Family members at native place	>7members	50%
Members earning in family	1-2	62%
Profession of worker's father	Farmer	72%
Labour typology	Unskilled, Skilled	48%, 40%
Awareness regarding MWA of the respective profession	No	76%
Average wages/day in Rupees	<500Rs	64%
Average workdays/month	>20days	96%
Awareness regarding BOCW Scheme	No	88%
Are you a registered worker	No	94%
Rough life situations forced in the construction industry	Yes	84%
Site preference	Big sites, Small sites	98%, 60%
Work preference	Work for one contractor	76%

I. Workers Profile

- 40% workers come from 2 states of Bihar and Uttar Pradesh only.
- 82% workers are more than 750kms away from their home town. They migrated to Pune for search of work opportunities as majority of workers have no work in their native places.

Psychological aspects

- 68% workers are living alone; others are with families with at least 5 members in the family.
- 50% workers have no relatives in Pune. Others have at least one known relative who is either working with them or working somewhere else in the city that is in touch with each other.
- Feeling of loneliness acting as a burden on workers. Rough patches of early life struggle are always there in their mind.

Question: Basic amenities at labour camps/work sites

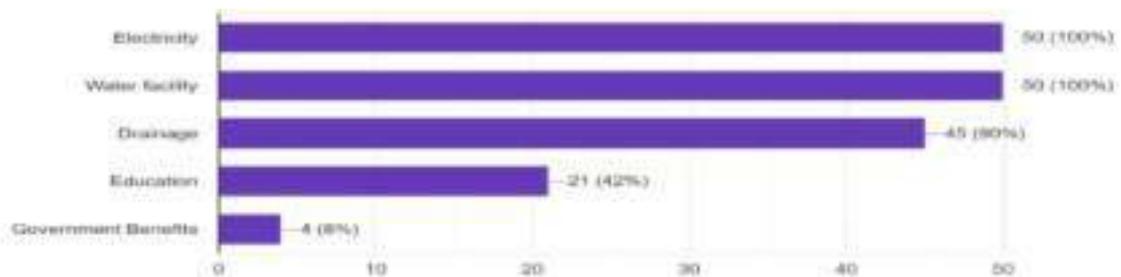


Fig. 2 – Availability of various facilities

- All workers have basic amenities like electricity and water. Provision for children's education is not up to the mark.
- Provision for children's education is not up to the mark.
- 92% workers are missing government facilities; workers from Maharashtra are getting some benefit of the government schemes.
- 42% workers are unhappy with their current life scenario and 10% feel that they are living a dream life. Others are optimistic that life will change for them if they keep the hard work going.
- Most of the workers are not happy with their life situations. They have rough past, vulnerable present with no future security.

II. Worker's background

- 50% workers hail from big families with at least 7 members in their native house.
- 72% workers belong from an agricultural background, majority of them have less than 2 acres of land. Another 14% workers are following their family traditional profession of construction worker, shows family background throw people in this field.
- Lack of education means automatic choice of construction field, it is observed in survey that only 14% workers have completed their schooling and 40% workers have studied between 0-5 standards, which include people who never went to school.

Question: Do you think rough life situations in early part of your life; force you to become construction worker?

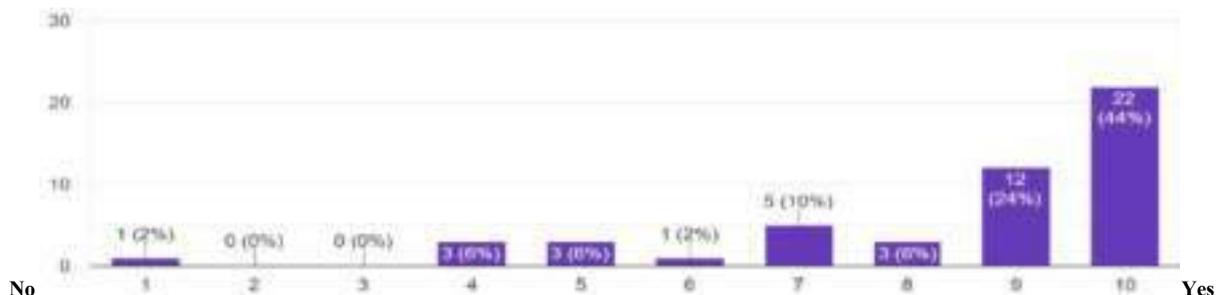


Fig. 3 – Survey results for struggle in worker's life

- 84% workers think that they have been forced into construction industry due to their rough life situations in early part of their life.
- Poverty, father's demise, disease at home, less education, less opportunities, agricultural background and big families are few of the many reasons which force them to join the construction force.

- (iii) Initially they start working as a labour near their house but due to lack of opportunities they have migrated to Pune. Only 2% people became workers with their will as they wanted to.

III. Financial Attributes

- (i) 64% workers are working under Rs.500/day, which seems less especially surviving in Pune with large families.
- (ii) Majority of the workers are getting same wage rate since several years. They are also not paid during sickness. 62% of the workers belong to families where only 1 or 2 persons are earning.

Question: Getting wages on time?



Fig. 4 – Survey results - Wages on time

- (i) Majority of the workers are getting wages on time. 72% workers are satisfied with getting wages on time.
- (ii) 68% workers want a major hike in their wages, as inflation rate is going high; surviving in city is just another struggle for such people. 3/4th workers are not even aware about the minimum wages of their respective professions.

IV. Professional side of workers

- (i) In survey it is found that 48% workers are unskilled and performing the work which require less skill and training such as helper.
- (ii) 60% workers are below the age of 25, majority of the force is new to the field as 42% workers have experience ranging between 0-5years. 88% workers are unaware of BOCW scheme. 94% workers are unregistered and not getting government benefits.
- (iii) Workers are not paid for holidays. Moreover, no relaxation is given during sickness. Almost every worker is working at least 20 days a month, which affects them mentally and physically. 54% workers stay away from their hometown for more than 9 months in a year. It shows the mental pressure they are bearing for such a long period, especially new workers.

Question: Work performed other than “Construction Worker”

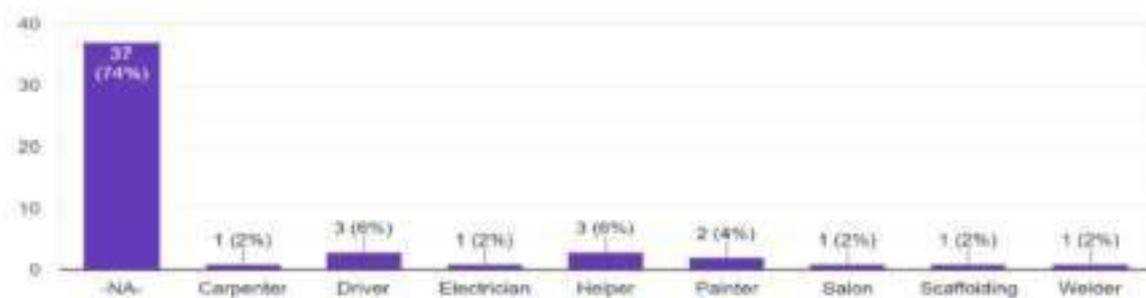


Fig. 5 – Additional skill set of workers

- (i) 74% workers are one dimensional and having no other skill.
- (ii) In many occasions when there is no work, they have no option other than to remain idle.
- (iii) Only 26% workers have multi skills which they utilize to make money in those occasional breaks. Some of them are driver, electrician helper, painter, salon and welder.

Question: Safety Provisions on site

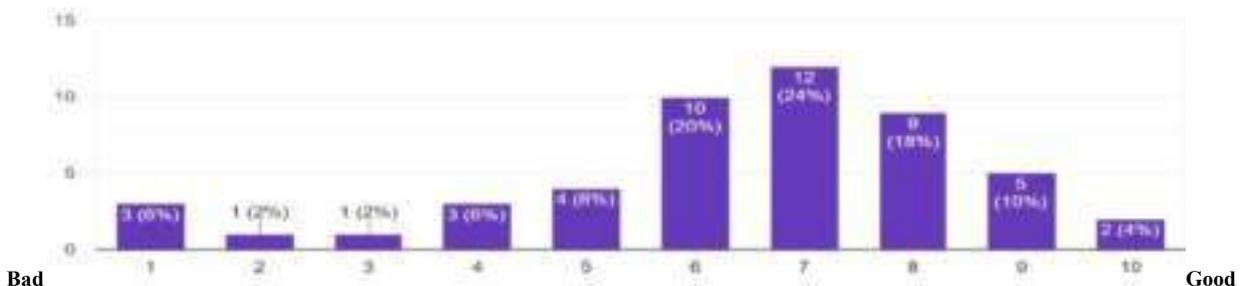


Fig. 6 – Survey results for safety provisions

- (i) More than 50% workers feel satisfied with safety provisions on site.
- (ii) Majority of them had helmets, safety belts, but missing other measures like medical kit on site.
- (iii) According to site engineers, companies are providing safety equipments but workers are not using them on regular basis. They wear the equipments during inspection. According to workers, utilizing equipments on duty badly affect their work efficiency.

82% workers are happy with their superiors and no major exploitation is reported on any site. 98% of the workforce wants to work on big sites as it guarantees regular payment, employment, work environment comfort, common friends. 76% workers want to work for contractor because they are getting wages, employment on regular basis. Whenever there is work deficiency on present site, they can be shifted to other site which is controlled by same contractor. No one wants to stand at labour collection point and wait for someone to pick them up. Others want to start their own business but most of them either have financial difficulties or are lacking in experience. Majority of such workers are below 24 in age, but they have the vision which can improve their lives.

3. CONDITION OF LABOUR

Organized and Unorganized Settlements

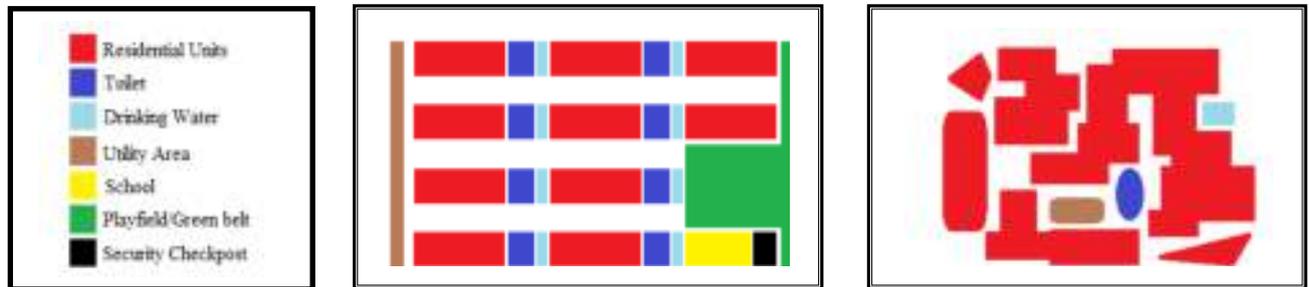


Fig. 7 - Settlement Planning

Living Conditions

- (i) Being a construction worker in India is a tough job, as labourers are considered as 2nd class citizens and higher economical groups do not want to mix-up with them. They have no respect in their own society and are always employed in low class works.
- (ii) 94% of labour force in Pune is unorganized and their future is not secured because there is no job guarantee for next day. They work at low wages, work overtime without getting paid.
- (iii) They belong to poor families, have the fear of losing job and can't speak for themselves. They are prone to exploitation. Most of the workers are migrated and have no particular place to live. They shifted to slums, where living conditions are worst.
- (iv) They may have basic amenities in the big construction companies but they are missing the facilities if they are working on small sites. Such things travels with every migrated labour, wherever they go they found themselves in such devastating lifestyle.
- (v) They have to live in temporary shelters, have to share toilets, bathroom. Many of the slums even don't have such facilities at all.

Working Conditions

- (i) In the current study of working conditions, construction workers have indicated their day to day conditions at workplace. Majority of respondent (54%) said no risk to their life at workplace. Majority of the workers are staying at sites and few at labour camps which are not far from site but they have to travel too far for work if their contractor shift them to other site.
- (ii) Regarding clean water availability at work place, majority said (67%) it's unavailable but 33% said opposite to that.
- (iii) Workers are running after work. In search of work, they have to change location on regular basis which disturbs their whole routine. Changing locations become more difficult to those labourers which are travelling with their families.
- (iv) Getting good work conditions are almost impossible in construction industry. Labourers coming from different regions and communities make it difficult to develop a sense of belief among them. Bad safety measures degrade work conditions at site.
- (v) Due to migration in different cities, they do not remain registered with particular city. After migration, their entitlement gets vanished from that city and it remains only in case if they are registered. Many times, labourers remain unregistered and they have no legal entitlement and can't claim anything in case of injury. They miss all the regular benefits from government.

4. CONCLUSION:

The plight of the labourers is not in livable condition, they have to start working at minimal wages which merely meet their daily needs. Living conditions are extremely poor; they built up their accommodation places in the areas of construction. Their safety has been compromised if they are working in small scale construction sites. The life of laborers' is always at risk. They may not have fixed working hours and always work hard day and night for a small sum. Their children are deprived of any education which forces their children to take labour profession in future. There is no doubt, Pune is growing at a rapid pace and is very ahead in race of development but the real development should be the happiness index of people. Workers who construct the city with their own hands, ends up without a roof above their head. Those who built the city block by block are the most neglected in the process. The findings from the survey clear match up with the current scenario of the plight of the construction workers, in Pune (PMC Limits). While the condition of the worker's in industry is very much deplorable. Neither the law nor the contractors are showing mercy to this socially and economically poor segment of the population.

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Planning of Warehouse with Respect Today Requirement of Market

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ABSTRACT

This research paper is about planning of Warehouse with respect to the requirement of market and industry today. Warehouse provides space for storage of goods and it is planned for various business services as well. Warehouse is a building constructed with appropriate provision for long free span structure enclosing large free space for storage of non-/consumable, non-/perishable goods. The research will suggest how to plan a warehouse along with the design of structure, light, ventilation and layout well suited for feasibility and maintenance purpose. The research aims at finding out the best suitable design and construction technology for Warehouse typology of project.

KEYWORDS – Warehouse, Types of Warehouse, Typology of Warehouse

INTRODUCTION

Pune is city of different business hub; most business needs some type of storage space to maintain availability of goods for business continuity and serve market demand which is vital for business to perform. To design effective and efficient warehouse we need to understand and analyze business needs for the design of warehouse layout and framework. Warehouse provides proper environment for storing goods and material that require storage also based on material type certain criteria needs to be met based on material type. Designed to accommodate the loads of materials and associated handling equipment's. While designing warehouse we have to concentrate on important parameter which is Design, layout, structure material, lighting, ventilation and storage layout flooring based on what is the target material/goods which will be stored in that warehouse.

TYPES OF GOODS STORE IN A WAREHOUSE

Consumable and Non-Consumable

Perishable and Non-Perishable

TABLE I.

Consumable	Non-Consumable
Consumables goods are those which can be consumed or item and goods with a limited life span	Non consumable goods are those with higher life expectancy which means they can last for long time until any natural deterioration take place
For example: Paper, Pen, File, Folder, Ink, Food, Drinks	For example: Furniture, Machine equipment.

TABLE II.

Perishable	Non-Perishable
Perishable product are products which will decay and get spoiled if it is not refrigerate or kept in freezer.	Non-perishable product are the ones with long shelf life and does not require refrigeration.
For example: Dairy Product, meat, fish	For example: Rice, Grains, Packed Foods

TPOLOGY OF WAREHOUSE

Warehouse has different typology it depended on functions and ownership

DISTRIBUTION WAREHOUSE- Distribution warehouse is the warehouse in which products are collected from supplier/manufacturer and delivered to various customers/whole sellers, it is used when stock is in large quantity which are stocked in these warehouses which are further dispatched to their zone/retail store. Storage in these warehouses is done on temporary bases it is a type of supply chain process where product is received from supplier and then shipped to customer. In distribution warehouse storage can be done by multiple companies these warehouses are important part of supply chain.

PRODUCTION WAREHOUSE- The aim of Production Warehouse is to fulfill the demand of raw materials finished or semi-finished goods, it is mainly built near the manufacturing site to hold the raw materials so that production runs continuously without shortage of raw materials.

CONTRACT WAREHOUSE- This type of warehouse is rented for a particular time period with agreement of contract. All the processes of warehouse which are shipping, receiving for them storage is done on contract basis. These services can be customized based on requirement. Contract can be done for long term and short term based on scope of agreement space is guaranteed.

TYPE OF WAREHOUSE

Private Warehouse- This warehouse is owned and governed by single company giving company total control on warehouse process. Private warehouse is cost effective when it is used for long term and provides better monitoring on resources also, company gets intangible benefits and tax exemption.

Public Warehouse- This type of warehouse is owned and governed by third party. Public warehouse can be rented for personal and business purposes. Public warehouse is very good to be leased for short term needs, anyone can use these warehouses by payment of rent to start their business. To operate this type of warehouse government license is required. Government rules and regulation are followed for this type of warehouse. Public warehouses are usually used by exporters, manufactures, importers, wholesalers, and government agencies.

Co-Operative Warehouse- This type of warehouses owned and managed by cooperative society these warehouse store goods of society member on nominal rate. These types of warehouse are only built to help their respective society not for profit purpose.

Bonded Warehouse-This type of warehouse store goods for which custom duties are required to be paid, these warehouses give facilities to store goods for extended time. This type of warehouse is good for importers as they keep items which are duty-free, these warehouses are owned and managed by both private and government sectors. Bonded warehouses need to procure license form government to operate them.

Cold Storage Warehouse-This warehouse is designed to store frozen products. Many types of products are stored which need special facilities like humidity-controlled, specific environment and freezer etc.

Government Warehouse- This warehouses owned and managed by government only. These warehouses are provided at reasonable rate for rent to companies, if the company is unable to pay rent government will take away the goods as penalty. All government and private sector can rent government warehouse.

NEED OF WAREHOUSE

Continuous Production –Raw materials need to be stored for continuous supply chain management to store raw material for production use or managed supply chain warehouse is used.

Large Scale Production –Manufacturing companies need to take care of present demand and future demand into consideration they have to manufactured the product in large quantity and this huge quantity has to be stored in place with protection.

Price Stabilization –Sufficient stock in warehouses should be maintained to keep goods price in check. If the goods are in shortage the price will increased, and if the good are in bulk the price will decrease to maintain the price stability warehouse is need.

Quick Supply –Industrial and agricultural goods are often produced in specific areas and then sent throughout the country. These goods need to be stored near where they are consumed so there is not a delay getting them to the consumers.

Seasonal Demand – Goods are only demanded seasonally such as warm clothing during the winter. Storage allows these goods to be produced during the year so they are ready when they are needed.

Seasonal Production –This is when the seasonal commodities are harvested at set times of the year but is purchased and consumed throughout the year. Storage allows these commodities to be supplied when needed.

FUNCTION OF WAREHOUSES-

- Storage of goods
- Protection of goods
- Financing
- Processing
- Grading and Branding
- Transportations

Warehouses 4 Basic Functions in Supply Chain

1.Replenishment and Accumulation of Materials2. Product Mixing

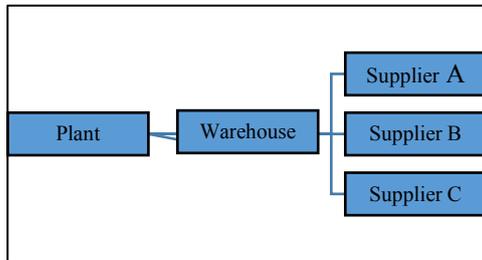


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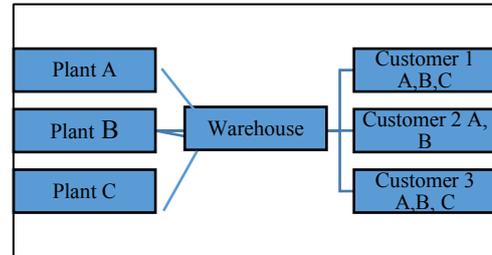


Image Number 2.

3.Consolidation4. Breakbulk

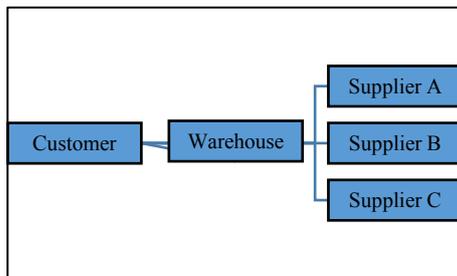


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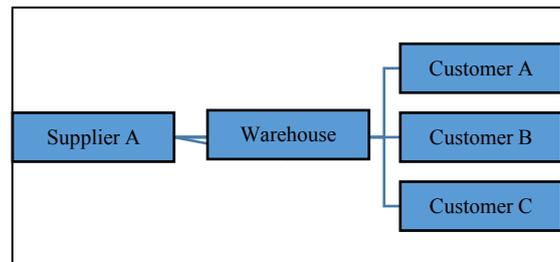


Image Number 4.

TO DESIGN A WAREHOUSE FOLLOWING FACTORS SHOULD BE TAKEN INTO CONSIDERDATION

1. LAYOUT DESIGN-Warehouse operations are the key factor for business to run smooth but while construction of warehouse planning and design stages are neglected. Following are some points which should be taken into consideration.

Product- Warehouse designing is done taking into consideration product or type of material which is to be stored. Factor such as product size, dimension, unit to be stored and material should be considered while designing warehouse.

Space-While designing warehouse maximum space utilization should be done. Ensure vertical space and horizontal space is fully utilizes.

Equipment-Taken into consideration while designing the warehouse that there should be proper space and circulation area for equipment to be stored and operate.

Materials Flow- Planning and designing of warehouse should ensure smooth and hassle-free movement of material. Provision such as easy access to loading and unloading area and also quantity of raw material consumed and new raw material should be maintained.

Personnel-Manpower required for functions of warehouse correct skill set people should be mixed and also provision for proper place to work following health and safety regulation should be made.

2. FLOORING-while designing a warehouse flooring is one of the important aspects to be thought about. Flooring should be designed to withstand heavy loads.in warehouse static load distributed under pillars of rack. Considering all these factors suitable flooring which can withstand and evenly transfer load downwards to provide stability and strength to floor surface, also floor level should be kept into account to make warehouse function properly. Flooring joint should be properly bonded joint bolts should be built with complete alignment. Flooring should be fire resistant, durable and resistant to wear and tear.

3. TYPE OF STORAGE

While design a warehouse it should consideration that warehouse should be functional and organized which can be done only when storage system is proper there are different type of storage system

TABLE III.

S.NO	TYPE	
1.	Static Shelving	This type of storage system is fixed in one place used to storage lightweight materials it is very common storage system
2.	Mobile Shelving	These storage systems are similar to static system it can be adjustable these system storages more materials in less space they are designs as level tracks have compact storage they can mounted on top or built on floor
3.	Pallet Racking	This storage system is commonly used for storage and movement of material generally made of wood metal and plastic. They are different types

4. SUPER STRUCTURE

Super structure system and roof should be able to handle temperature variation-engineered metal roofing system can be used roof should be with gentle stone which protects wall dock drive area exterior drive area should have drainage system on both side of dock door to avoid water clogging .mechanized durable dock lever should be considered for reduced operation cost, time and increase safety. Interior paint finish should be taken in to consideration such as yellow for wall, column should be highlighted in different colour which can be easily visible. Exterior paint should be heat and water resistant. Regular maintained and cleanness should be maintained to increase structure life.

SLIGHT AND VENTILATION

Warehouse building light and ventilation should be proper. There should be maximum day light for that there should be a large span window, skylight there should be proper lighting system proper air rotation system for lighting fibre glass window should made. To maintain quality air in a warehouse there should be a proper ventilation. Occupational Safety and Health Administration (OSHA) has set standard air quality standards which is mandatory by OSHA to follow will design a warehouse .Remove hot air during day time while opening windows and using industrial fans which help to remove hot air to keep air flow movement if ventilation system is not good it lead to health problem to worker To avoid all these, we need to focus on good ventilation system.

PLANNING A WAREHOUSE

Warehouse design is directly impact on business, while planning the warehouse various factor should be consider that how maximum space can be used how to make store for more storage and what type of equipment is need for make work more fast and efficiency so planning the warehouse there are some point to be consideration

1.SCHEMATIC LAYOUT

While constructing a new warehouse first a schematic layout of space should be created with proper planning of different shelves and equipment. The aim to create this layout is to create space for efficient working space and achieve business goals. Measurement should be taken accurate while designing which minimum dimension error and wastage of space while planning the warehouse schematic layout help to identify proper space for office storage space of installation of equipment and proper entrance and exit which help in proper material flow.

2.PLANNING WITH MORE SPACE UTILIZATION

Warehouse should have maximum utilized space for that these factor should be take into consideration that create productive zone and workflow areas while planning stage, create warehouse storage area provide enough space for storage with working space for that use grid system for planning of warehouse while planning the warehouse these space should receiving area, unpacking area, packing area, shipping area, dead stock area, warehouse office, storage area should planned.

3.UNDERSTANDING STORAGE SYSTEM AND EQUIPMENT

While planning the warehouse it should know the key units for efficient design. Space management can be done based on the equipment to be used and which type of storage system has be installed space such as lift duct, and other service duct depending upon the type of warehouse should be planned .every activity in warehouse that is equipment and storage need proper space .there should be a proper space management for receiving goods, packing and shipping.

4. USE MORE WORK FLOW STRATEGIES

After planning the layout, the next step work flow. Work flow should have safety measures first, safety these measures should be first concern so Occupational Safety and Health Administration (OHSA) publication offer detailed planning your warehouse safety initiatives. Safe zone is applying in every part of a warehouse that is production zone warehouse layout and work flow space.

Throughflow In this clear distinction of operation goods flow is done without crossing information exchanges between the employees is complicated it is a long movement flow

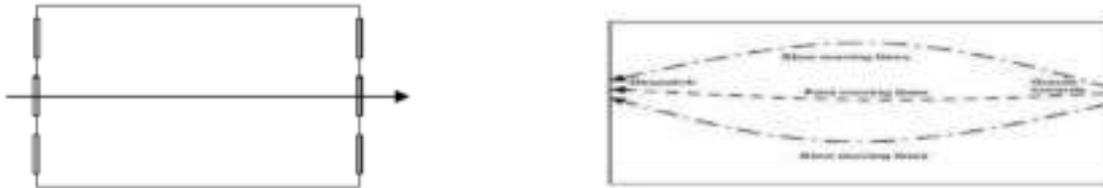


Image Number 5, 6. Throughflow (<https://www.vkok.ee/logontrain/wpcontent/uploads/2014/03/Riga-2-july-2014.pdf>).

U-Flow-This type of work flow is more flexible and cross direction operation can be done this type of work flow has better control on inventories.

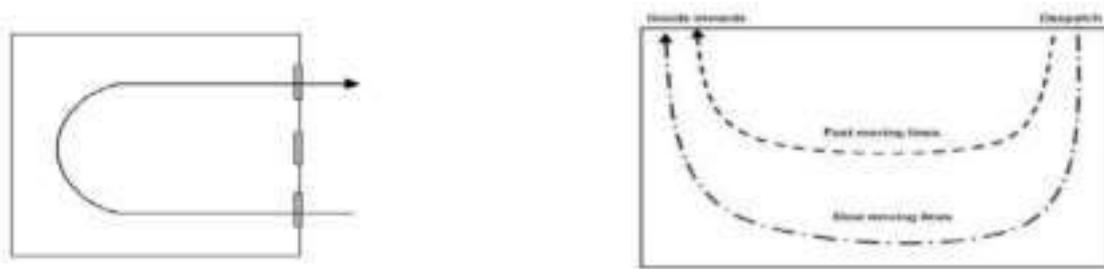


Image Number 7,8. – U-Flow (<https://www.vkok.ee/logontrain/wpcontent/uploads/2014/03/Riga-2-july-2014.pdf>).

5. TEST TRAFFIC FLOW PLAN

The last step is to test traffic flow plan .this is to perform work function in planned layout by taking boxes or equipment and performed a dry run to test design of warehouse.it is to make sure free movement of goods in all direction with on hindrance. Dummy run of complete warehouse management life cycle is conducted on floor to validate design efficiency or flaws if any

CONCLUSION

By this research I conclude that warehouse should be constructed with proper planning. While designing warehouse we need to focus on target item/good type and determine suitable warehouse type for that respective item/good. Designing should be done with efficient space management and with current and future demand in mind, adhering to all statutory laws and guidelines. Also, while planning efficient use of natural lighting, space management, safety regulation and efficiencies should be taken into consideration.

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REVIEW ON JUST-IN-TIME TECHNIQUE FOR MATERIAL MANAGEMENT IN CONSTRUCTION INDUSTRY

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Abstract

In every construction project material plays a crucial role as the material cost is above 50% of the total project cost. Unnecessary material storage leads to deteriorating quality of materials and increase in the cost of inventory. In order to avoid this, efforts should be taken to reduce material cost by applying effective material management techniques. Material management has various functions like estimation of material requirement, procurement, inventory control, storage, disposal of extra material and wastages. Material procurement or delays, both can affect time, cost, and quality. The process is known to provide right material at right place at right time and in best quantity so as to control the cost and ensure quality of project. So it's important to achieve this by using material management technique. The construction industries are trying to adopt techniques to avoid dead investments in material inventories. Just-In-Time (JIT) system is one of the initiatives that focuses on reduction by elimination of non-value added activities. This research paper is a review of JIT technique which demonstrates an example, considering a specific material requirement and stages of procurement. The paper shall be an effort to address the salient features with its merits and demerits.

Keywords – JIT, material management, procurement, cost, time

Introduction

Materials management is an important factor in project management. The key to success of any construction project is the effective material management process which has evolved and revised with respect to the over growing complexity of projects. Materials constitute major part of cost component for construction industry. The total cost incurred in construction project depends upon the type of project and the extent of mechanization and plant used. Poor materials management is one of the major problems in delaying construction projects. Ensuring a timely flow of materials is an important part of material management. Procuring materials is critical, as any materials surpluses or shortages will delay the project and put it at risk. This then affects the maintenance of a continuous flow of materials for execution, thus affecting the overall project.

Construction industry is the largest economic expenditure in India. Due to increasing competition the construction industries are forced to adopt new techniques to face challenges in construction industry. In last two or three decades all over the world, the construction environment has experienced more changes and has become one of the important element in creating the value added contents for the products and services.[1][2] The traditional approach to material has been used in industry which also has created lot of problem to construction industry itself.[3] To overcome this problem the underlying concept of JIT is used to smoothen the material management process through efficient handling and to eliminate waste with maximum value achieved.

Overview of Just-in-time concept

JIT concept originated in the early 1950's and was developed by Taichi Ohno, the chief developer of the Toyota Production System and his fellow workers at Toyota who realized that excess inventory stocks created cost and production problem. The Toyota production system targeted cost reduction and productivity improvement by elimination of several wastes such as excessive inventory and workforce. JIT was initially applied in manufacturing companies which helped to accomplish better product quality, hindrance and employee motivation, also improved workers' involvement and their commitment towards the organization. JIT also helped to reduce lead time, set-up times, defects, costs, factory overheads, inventories and storage space.

JIT is a controlling procurement process through developing a structured plan that must be followed in order to reach best capabilities. JIT can also be specified as producing the necessary units, with the required quality, in the necessary quantities, at the safe moment. It means that company can handle and distribute the resources easily using its own money. By using JIT principle one can maintain quality of the entire project and increase the efficiency of the labors. JIT principle says that inventories are less important and should be considered as waste. Conceptually, JIT is a strategy that incorporates challenging low cost expectation, less inventory storage, less space requirement for material stock, high quality and delivery dependability.



Fig No.1 Just-in-time

Research Methodology

The study began with a literature review of JIT philosophy and JIT in construction industry, with the goal of proposing the appropriate recommendations for the potential implementation of JIT, along with an example of quantitative analysis considering a primary construction material i.e. cement for a project. Semi-structured interviews and questionnaire survey were also the methodologies conducted to carry out the objectives of the research.

JIT Implementation in construction industry

- The main goal of JIT materials management system in construction project is to optimize materials delivery timing
- To minimize inventory quantities
- Protection of Inventory or storage on site from deficiencies such as theft, damage, and weather
- The implementation of JIT in construction sector requires commitment from staff and crew involved in the construction
- The successful implementation of JIT depends on versatility of the vendors, the reliability of the customers, complete management and dedication of the employees as well as teamwork
- Implementing of JIT concept results in efficiency, viability and social benefits

JIT Implementation steps

Material Calculation: Monthly target for each material is calculated as per the schedule activity. **ABC Analysis:** ABC Analysis was performed in order to select major materials for JIT application. **Material selection:** For JIT application material for different activity is selected. **Vendor Selection:** One of the important factors of JIT process is Vendor selection. 5 criteria's for evaluating the vendors are cost, quality, and providing document in time, service and cooperation. Based on the material vendors are primarily shortlisted. **Material procurement plan:** JIT calls for material procurement when needed, procurement plan is developed based on the productivity of equipment. **Equipment productivity calculation:** calculating or measuring the work done and compared to its standard, calculating the overall load/productivity

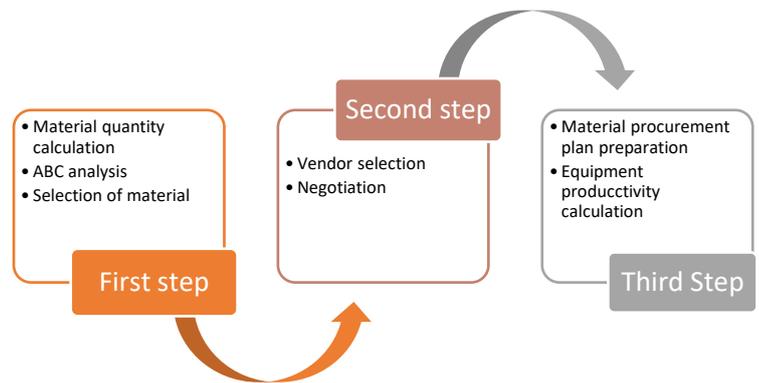


Fig No.2 JIT Implementation steps

Prerequisites of JIT

- Perfect quantity estimates
- Procurement process schedule setup
- MSP schedule properly planned with detail construction activities and their material requirements
- Effective supply chain management
- Organizational setup required
- Consolidating supplier relationship
- Preferring nearby supplier
- Peoples' involvement
- Requires continuous improvements

Significance of JIT technique in construction industry

- Effective management technique which determines the success or failure of any project
- Manages flow of materials, components, tools and associated information regarding ongoing project
- Effective on all entities contained in supply chain management

JIT endeavors to accomplish smooth generation by giving, the right materials, in the right quantity and quality, just at the time of execution, and by assuring that the materials are delivered to the site on the actual day of use or a day earlier. JIT aims to educate contractors about the advantages of disposing of waste. Excess could be considered a loss that results in zero-value and thus should be minimized. Having a surplus of materials on the site which cannot be used in other construction projects would increase the direct costs of the project and increase waste. JIT technique could be capable of lessen numerous elements such as overhead cost, manufacturing costs, rectification works so that it will lead to improvement in quality. Therefore, it's very important for everyone involved in construction project to understand the objective, the fundamental of JIT method and his or her roles in order to ensure a successful implementation of JIT system. [4]

Constraints in implementing JIT technique

- Poor labor skills and insufficient training
- JIT includes set ups of visits, shipments and receipts
- JIT depends on participation and trust between individuals, specialists, supervisors, providers, clients and so on
- Lack of project management experience
- Poor organization setup
- The JIT framework must work effectively and worker must carry out their activity right
- Unstable construction material prices and poor material management

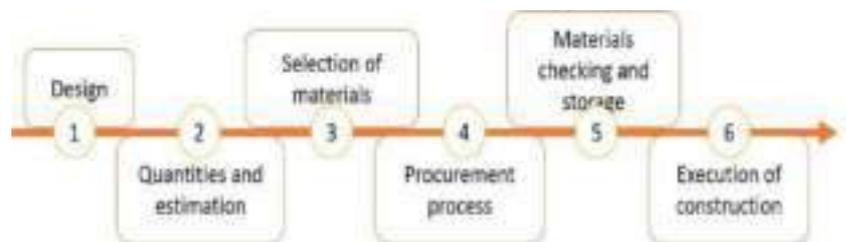


Fig No.3 Just-in-time Diagram

Example of a bungalow – Data collection and Analysis

The goal of material management is to ensure that the materials are available at their point of use when needed, hence efficient procurement of material represents a major role in successful completion of the project. Whereas material delivery delays have negative impact on the project. The study focuses on primary construction material such as cement used for constructing a 1500 sq.ft bungalow, it showcases the activity schedule (tab no.1) and the total requirement per activity and its usage.

Table No. 1 Cement requirement schedule

CEMENT REQUIREMENT SCHEDULE FOR 1500 sq.ft. BUNGALOW										
ACTIVITY	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG		
RCC			100	300 bags, 50% (% of total cement consumption)						
Brick work		23.3		23.3	70 bags, 11.6%					
Plaster				50	50	100 bags, 16.6%				
Flooring					60	60	120 bags, 20%			
Finishes						5		10 bags, 1.8%		
Activity Codes	A	B	C	D	E	F	G	Total =600bags		
Cement Usages	33.3%	20.6%	3.9%	12.2%	18.3%	10.8%	0.8%			
Quantity	200 bg	123.3 bg	23.3 bg	73.3 bg	110 bg	65 bg	5 bg			

By studying the chart shown in table no.4 the project requires total 600 bags of cement for construction.

Out of which different activities have different requirements. It clearly shows the consumption of cement for particular activity and heads towards the further need of cement bags. By quantifying the cement with respect to the requirement and procuring it accordingly clearly address the use of JIT principle. This helps in adopting JIT technique which can be used in procurement of other materials in the similar manner. Procurement is a vital starting point in the JIT process. If the site avails storage of the required cement bags then it helps to deliver the exact quantity of bags to the workmen avoiding overruns, damage or any kind of wastage. Also giving justice to JIT concept, right quantity at right time and assuring quality.

Table no.5 demonstrates the activity color codes and the overlapping activities and their total consumption of cement bags. Quantitative analysis performed to demonstrate the JIT technique and can be used even for other materials. Tracking and monitoring assists in assessing effective and efficient use of different materials for the necessary construction operation and achieving productivity. JIT can also be applied in demolition projects where waste materials can be transported directly to demanders through means of transportation generated from the project. Hence making things done 'first time right' is another principle of the JIT concept.

Supplier and Subcontractor relationship factors - The procurement of suppliers and subcontractors is a vital starting point in the JIT process. Following considerations need to be considered for long term relationship with supplier and subcontractor. The following problems are critical until implementation begins:

Long term supplier relationships: Develop a localized supply chain with fewer sources of supply and then establish relationships and partnerships among them with best suppliers. This will generate confidence and consistency such that the products required can be distributed at the right time and in the correct quantities. More frequent distributions of limited quantities of standard quality construction materials need to be ensured. Long term subcontractor relationships: Set minimum acceptable standard of quality for all subcontractors. The establishment of multi-functional teams would suggest teamwork and communication between subcontractors.

Table No.5 Cement usage chart

CODES	COLOR CODE	ACTIVITY	CEMENT USAGE PER ACTIVITY (%)
A		RCC	33.3%
B		RCC + Brick work	20.6%
C		Brick work	3.9%
D		Brick work + Plaster	12.2%
E		Plaster + Flooring	18.3%
F		Flooring + Finishes	10.8%
G		Finishes	0.8%
			100%

Merits and Demerits of JIT

MERITS	DEMERITS
Reduction in inventory costs	Initial investments are more
Minimizes storage spaces	Industry related problems may affect
Reduction in the order to payment timeline	Vast experience in project management
Saves cost on handling equipment	Unforeseen issues
Improving quality of construction materials	Labor productivity and labor costs
Completing work on ahead of schedule	Sensitive to transportation issues
Improving relations with suppliers	High level of culture and internal communication required

Improving tidiness on site	Minimal storage increases the risk of unpredicted demands
Lead time reductions reduce planning complexity	Loss of individual autonomy
Problems are highlighted quicker	
Completing work ahead of schedule	

Conclusions

Material procurement in construction site plays an important role in the life cycle of construction project and needs to be managed properly. To improve the material management process and improve project schedule reliability, technique such as JIT can be culturally adopted by the construction industry. JIT approach in can provide cost savings, reduce overall costs, optimize timing of material delivery with proper use and increase productivity. It is also useful for urban construction, because transport loads on traffic are reduced. This reduces or eliminates the storage space demands on the construction site and can be the only solution in case of space limitations. Implementation of JIT is supplier based. For an effective materials-management system, good vendor selection is essential which leads the successful completion of a project.

From the above example we conclude that use of JIT technique can improve the material procurement process and efficient material consumption without wasting and eventually will improve project's productivity and work flow, thus shortening the project durations. By using JIT principle, we can maintain quality of the entire project and increase efficiency of the workers. This paper is an initiation to bring the awareness about the technique and encourage the construction industry professionals for employing it.

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RESEARCH ON PROJECT MANAGEMENT FOR CONSTRUCTION OF RESIDENTIAL BUILDING (G+3) IN

“SUSTAINABLE FERROCRETE CONSTRUCTION TECHNOLOGY”.

SUBTITLE : FERROCRETE TECHNOLOGY-PROJECT MANAGEMENT OF SUSTAINABLE RESILIENT TECHNOLOGY FOR FUTURE...

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ABSTRACT:

With Demand of Faster pace and Ease of Construction for Rapid Growth and Requirement of affordable Housing for Masses in Cities of Developing Countries, Construction Industry is frequently opting for Faster pace and Ease of Construction systems overlooking the Environmental issues and crisis.

Environmental crisis give a Wakeup call for implementing Sustainable Construction Techniques .

Designers, Architects and Builders are constantly seeking Sustainable Construction Techniques which can cater to the huge Demand of Masse for Housing which is one of the Primary needs of Humankind.

Construction in Ferrocete Technology is one of the most Popular, Simple and Humble Sustainable Construction Technology accepted and practiced by Ace Architects, Designers and Contractors for its High level of Flexibility in Form, Lightweight, Popularly termed” Slim Building Technique”, Earthquake resistance, Cost effectiveness, Good Performance, Resilience, Preventing Water Crisis , Space saving and Sustainable attributes.

One of the ways of making this highly functional Labour Intensive technique for both of its Tangible and non-Tangible Benefits to become more popular in Construction Industry and reach the Masses is to increase the pace of construction by organizing this Resilient Futuristic Construction Technique in Project Management Knowledge Areas.

Ferrocete Technology gives solutions to most of the challenges going to be faced by the Construction Industry in Future and hence is an Sustainable and Resilient Construction Technology. By implementing this Sustainable Resilient Construction Technique in Project Management Knowledge Areas, clear understanding of Requirements and implementation will be achieved ,hence making implementation of Construction in Ferrocete Technology Faster.

As Construction Technique and concern for Environment are co-related, it becomes important to arrange for making such Sustainable construction Technique more User Friendly, which can add value to the quality of good Environment.

This Paper looks into the study of Project Management for Residential Structure(G+3) constructed in Sustainable Ferrocete Technology in Pune Region.

Key Words : Ferrocete Technology, Project Management Knowledge Area, Labour Intensive, Sustainable, Resilient.

INTRODUCTION:

In today’s fast pace world, Construction Industry is constantly exploring Sustainable Construction Techniques which can be Resilient to upcoming challenges in Construction Industry.

Need for Speed and Ease of construction overpowers Critical and Important Environmental issues. Ferrocete Technology is a well established, Proven Sustainable Technique of Construction which is Resilient in every way. Architects and Designers have explored the potential of this versatile Construction Technique for Building various aesthetically pleasing Structures for strength of this Technique of immense flexibility along with structural strength. The Simplicity of execution of this Sustainable construction Technology can become a

Resource in itself for strengthening GDP of Nation. By Proper understanding of Prevalent Project Management Tools available as mentioned in PMBOK, and organizing the Construction in Ferrocete Technology in the right Disciple and Direction, smooth and faster implementation of Construction in Ferrocete Technology can be achieved.

India is a Country rich in Human Resources and with by guiding Perception and Intelligence of Labour and by incentivizing labours , faster pace of Construction can be achieved in construction in Ferrocete Construction Technology.

By Understanding profound Benefits of Ferrocete Construction Technology and arranging it in disciple of **Project Management**

Knowledge Areas(PMBOK), implementation of this Sustainable Resilient Technology at Mass Scale can be Enabled and help masses getting aware of this “**People centric**” Sustainable Construction Technology.

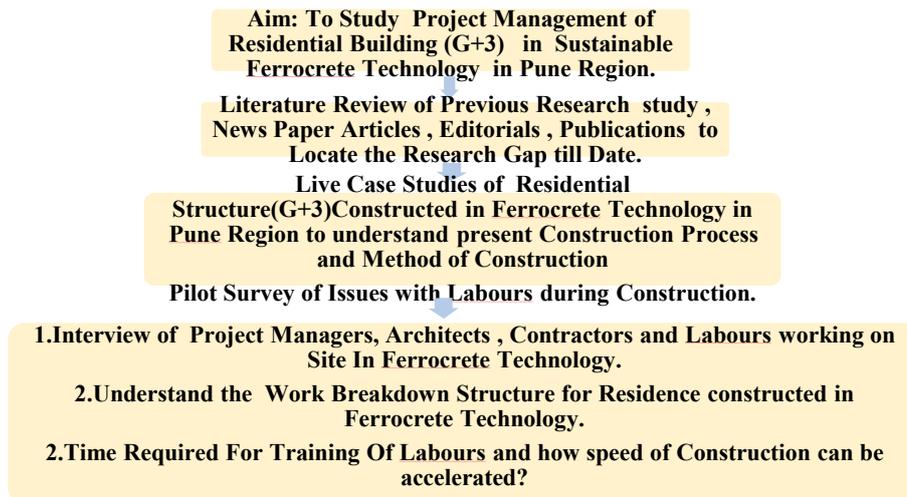
AIM: To Study Project Management for Residential Structure (G+3)built in Sustainable Ferrocete Construction Technology in Pune Region.

Objective:

- To Understand Prevalent Project Management Knowledge Areas and Tools used by Project Managers for Construction, mentioned in PMBOK .and Organize Ferrocete Construction Technique in these Knowledge Areas.
- To clearly understand the Construction Process, Needs, Requirements and hurdles faced during construction Process During Construction of Residential Building in Ferrocete Construction Technology.
- To understand the Work Breakdown Structure to help in getting absolute clarity of Requirement of Labour and Materials.

Scope and Limitation:

To understand Project Management of Residential Building(G+3) done in Sustainable Ferrocete Technology in **Pune** Region .

Fig-1: Methodology of Research- Self Study.**NEED FOR RESEARCH IN TODAY'S CONTEXT:**

Need for Speed and Ease of construction overpowers Environmental issues, which is a major concern for the developing world. Systematic Project Management of Sustainable Construction Technology like Ferrocete Technology , in Project Management Knowledge areas is **the need of the hour.**

Addressing Effective Construction Management becomes important element and powerful tool in implementation of this Sustainable Construction technology as:

- Construction in Ferrocete technology is **Labour Intensive** and mostly generic.
- Speed of Construction in Ferrocete Technique gets affected due to mismanagement of labours and availability of Trained team.

LITERATURE REVIEW:**1 .Ferro Cement as a Cost Effective Alternative to RCC. ⁽ⁱⁱ⁾**

The Author attempts to promote extensive use of Ferro cement components as an alternative to conventional concrete components for application in low-rise housing by doing a comparative study of cost analysis of Ferro cement and R.C.C.²

Findings: Ferrocete Technology, is one of the Best alternative for Cost effective low cost affordable Housing.

2.Review Paper on Ferrocement in Construction ⁽ⁱⁱⁱ⁾

Authors concluded from this study how ferrocement is better than conventional types RCC, PCC etc and perform good against lateral displacement, fire resistant ,economically without required any skilled worker. On other hand ferrocement is a good alternate material depends upon location of application.

Findings: Ferrocement specifically doesn't required any skilled worker .

3.A Review of Impact on Labour Management in Construction Industry. ^(iv)

Authors Mention that Improving production efficiency is one the biggest challenge in the construction industry. The productivity of any project relies mainly on labour force as labour play an integral part in the success of the project. Proper management of labours increases the productivity along with this the project is completed on time with optimum cost. The study mainly focuses on the various factors or parameters related to labours that have a great impact on the project productivity.

Findings: Labour Management is Important for success of any Project.

4.Study and Cost Analysis of Ferrocement Panel for Affordable Housing ^(v)

Most developing countries are faced with problems of low standards of living, poverty, environmental degradation and housing shortage. Ferrocement technology has been established as environmentally friendly affordable cost technology. Ferrocement is a type of slim wall reinforced concrete technology.

Findings: Ferrocement Technology gives solution to many Urban Housing issues.

Background Study:

- a) Ferrocement News:A news Article which gives updates on Latest workshops conducted on Ferrocete Technology ,Information and Latest Updates on Ongoing work done in Ferrocete Technology.
- b) Working on Site for Construction of Residential Building done in Ferrocete Construction Technology.
- c) Working and communicating with Ace Project Managers.
- d) Communicating with active members of Ferrocement Society Of India.
- e) Teaching Ferrocete Technology in Academics and regular visit with students on Ongoing construction sites working in Ferrocete Technology.

DRAWBACKS IN PRESENT CONTEXT:

- Most of the construction work done in Ferrocete Technology is Generic in Nature.
- Work on Site is Highly Dependent on Verbal instructions and explanations. Formal Site work record not organized and not available.
- No formal Professional Training given to Labours. No clarity of overall picture given to labours ,hence the labours take more time to understand and execute the details.

Methodology Of Construction: ⁽ⁱ⁾

1) Basic Methodology of forming Ferrocement members A ferrocement structure is formed by fabricating the mesh reinforcement to the shape and size of the structure first and then mortared and cured. Method of forming a ferrocement element is : 1) Welding skeletal steel framework. A skeleton of steel bars is welded to the exact geometrical shape and size of the structure. This provides a rigid framework of the exact shape and size with correct line and level.

2) Tying mesh reinforcement tightly over it to form cage. Weld mesh and fine wire chicken .

mesh is tied over this welded skeleton by stretching and tying technique. 'Tightly tying meshes' is the key point in ferrocement construction.

3) Impregnating the mesh cage with rich cement mortar, finishing and curing. The stiff cement mortar is filled in the mesh layers by press fill method. In press fill method, the mortar is to be pressed inside the meshes from both the sides. All these steps in construction are to be followed in sequence. On large size constructions, one can work simultaneously on all the three operations

Figure 2: Case Studies and Interviews.....(Self Study)

Sr.No:		Case Study-1	Case Study-2	Interview-1	Interview-2
1.	Name of Project	"ARUNODAYA" Deccan Gymkhana, Pune	"SAHAYOGA" Ashoknagar, Pune	Er.Prakash Nagnath	Er.P.P.Lele.
2.	Architect	Ar. Girish Doshi	Ar. Girish Doshi	Er. Prakash Nagnath	Secretary, Ferrocement Society of India.
3.	Year of Construction	1998-1999	2001-2002	Experience 28 years in Construction Works	Experience 35 years in Construction Works
4.	Total Number of Labors in Team for Project	18-20 labours	12-15 labors	15-20 labors	10-15 labors
5.	Total Number of women Labors in Team for Project	4-5	3-4	4-5	3-4
6.	Initial Training Period for Labors for Ferrocement Technology	15 -20 days	15 days	Approx. 15 days	Approx. 15 days
7.	Team Retained?	Yes	Yes	Yes	Yes
8.	Age group of workers	18 to 67 years	18 to 72 years	18 to 60 years	18 to 55 years.

Role of Team Members in Organised Management for Ferrocement Construction Technology:**1.Role of Designer/ Architect:**

- To provide Precise Drawings with detailed stencilled layout for Generic Design
- To provide Drawings well in Time with details explained properly to the Contractor and supervisor.
- To give a clear picture of the Final Design to be executed to the Client, Structural Designer, Contractor, Supervisor and Labours. Site Visits at regular intervals to check quality of Materials and Work Executed resolve doubts in case of generic requirements.
- Estimation of Total Cost of Project.

2.Role of Structural Designer:

- To look into minimal apt usage of steel members and keep a check on quality of materials used.

3.Role of Contractor and Supervisors:

- To understand the Requirement of Design and Drawing in absolute clarity with the designer/Architect.
- To guide the team of Labours, Train Labours and explain the Drawings and Technique in complete understanding of project.
- Day to day Requirement for Materials, Record of Materials Consumed, Requirements of Labours, Maintaining Site Reports etc.

Knowledge Areas of Project Management.....(According to PMBOK)^(vii)

- 1) Project Integration Management
- 2) Project Scope Management
- 3) Project Time Management
- 4) Project Cost Management
- 5) Project Quality Management
- 6) Project Human Resources Management
- 7) Project Communications Management
- 8) Project Risk Management
- 9) Project Procurement Management
- 10) Project Stakeholder Management

The knowledge area contains the tasks that withhold the overall project together and integrates the project into a unified whole. This knowledge area touches the five phases of the project –

Initiation, Planning, Execution, Monitoring and Controlling, and Closing. Starting from scheduling tasks, purchasing tasks, replacing team members, addressing risks, and rescheduling tasks everything is covered under this particular phase.^(vii)

Comparative Analysis :FIG:3

SR No	ISSUES CONCERNING LABORS	LABORS WORKING IN CONVENTIONAL SYSTEMS (R.C.C, MIVAN)	LABORS WORKING IN FERROCRETE TECHNOLOGY	FINDINGS
1.	Initial Training Required	Minimal.	Yes. Intense Training Required	One time Investment for Training but benefit of technology in longer term.
2.	Requirement of Skilled Labour.	Already skilled labour required for specific job	Any labour ready to work can be trained.	More number of people can get employment easily.
3.	Risk involved during construction Process ² .	Higher	Minimal	Less Risk involved in Ferrocete construction. Hence Safe.
4.	Range of Age group	18 years to 50years	18 years to 75years	More range of age group of labours can be employed as the work is easier in Ferrocete construction.
5.	Health facility/Insurances Provided.	Yes.	Yes.	Minimal expenditure on Health facilities as the Construction Technique is easy and safe.
6.	Food ,Shelter provision	Yes(optional)	Yes.	
7.	Wages Paid	Mostly daily	Mostly fortnightly or Turnkey or lump sum	Good supervision required during Turnkey payment.
8.	Percentage of women labour (w.r.t male labours who can be employed)	50 % to 60%	30% to 70%	More women labours can be employed as the work is easier in ferrocete.

FERROCRETE CONSTRUCTION TECHNOLOGY IN PROJECT MANAGEMENT KNOWLEDGE AREAS. RESIDENTIAL BUILDING (G+3)

1. Project Integration Management: To Develop Project Charter, Develop Project Management Plan, Direct and Manage Project Work, Monitor and Control Project work, Integrate Change Control, Close Project.

Team Required: Architect, Structural Designer, Contractor, Supervisor.

2. Project Scope Management:

The Project Scope Management includes six processes:

- Plan Scope Management: Scope of the Project-Residential Structure (G+3)
- Collect Requirements: Requirements of Clients, Contractors(Inventory), Supervisor ,Labors.
- Define Scope: Scope of Work done by every agency.
- Create WBS:
- Create WBS from Foundation to Terrace level(All floors under construction)
- Validate Scope:
- Clearly define scope of every team member.

3. Project Time Management

- Preparing schedule as per work breakdown structure.
- Estimating time required for every work .(Tying of Reinforcement bars, wire mesh ,chicken Mesh.
- The Time management processes deal with:
 - Defining activities-
 - Tying of Reinforcement, Tying of Wire mesh, Tying of Chicken mesh, Applying of concrete from both sides, Water proofing wherever required.
 - Estimating the durations of activities-By executed Site Work Study.
 - Scheduling activities –
 - Preparing Weekly/Monthly Gantt Chart.
 - Ensuring adherence to the schedule-
 - Foreseeing the possible time lapse due to non-availability of Material, Labor issues, Site conditions, Finance available for construction activities etc.
 - Outsourcing of construction elements off site and saving time of construction on Site.
 - Approaching companies who can manufacture elements of Buildings as per design suggested.

4. Project Cost Management: By understanding Tangential and non-Tangential cost Benefits of the construction technique and also making the end user understand the cost effectiveness of construction in Ferrocete technology.

By doing comparative analysis of Convention construction Techniques like R. C. C, MIVAN, Brick work etc Time Management plays a major role and good Labour Management during construction process will achieve more cost effectiveness and save overall cost of the Project as work is Labour Intensive.

- 5. Project Quality Management : Plan quality management:** Procuring good quality steel , wire mesh, chicken mesh (Rust Free and Treated)
Manage Quality: By using good quality materials , Supervising the work done on site on regular basis Presence of Supervisor during application of concrete is a must.
Control Quality : By regular Supervision and quality checks as per specification mentioned in the drawings. Crack free finishing to be achieved.
- 6. Project Human Resources Management:** Labour/people (Trained labour)
 Equipment(For Tying of Reinforcement Bars, Wire mesh, Chicken mesh), Finishing , waterproofing
 Facilities : For Labours like: Medical Facilities , Shelter, Safety, Insurance etc
- 7. Project Communications Management:** The Designer / Architect , Contractor, Supervisor should be on same page in Every stage of Construction.
- 8. Project Risk Management:** As there is minimal involvement of Machinery, and no heavy equipments involved during construction in Ferrocete Technology, Risk Involved During Construction Is Minimal.
- 9. Project Procurement Management :** Basic Material-Chicken Mesh, Wire Mesh, etc are easily available in Local Market. Procurement can be done as per estimation and Phasing of work to be done.
- 10. Project Stakeholder Management :** Team of Architect, Builder, Client as investors.

CONCLUSIONS:

Work Breakdown Structure(WBS) – (per 100sq. Ft) in Ferrocete Construction, (Above Fifth Level)
 Terrace Slab Level

Sl.No	Type of Work	Mode of Measurement	Material Required			No. of Labour Required	Contact Time with Designer	Training Time Required for Labour.
			Cem.	Wire mesh	Chicken mesh			
1	Tying of Reinforcement bars for Columns (Spiral) (Considering 1.0M Height/Paraset wall)							
2	Placing of Concrete in columns.							
3	Shuttering for Terrace Slab							
4	Placing of Hollow blocks for Terrace Slab for staircase work.							
5	Laying Reinforcement for Terrace Slab							

1. Speed on Construction , which is a major challenge in Ferrocete Construction Technology can be increased by proper Labor Management on Site
2. Outsourcing of Certain Ferrocete Building elements, modular members to companies manufacturing these members off site can save time of construction on site and speed up the construction of the G+3 Residential structures.
3. By arranging the whole Process of construction of Residence done in Ferrocete construction Technology, in Project Management Knowledge Areas, faster pace of construction can be achieved by getting absolute clarity of overall work to be done.
4. Saving of Time of Construction can help in further reducing the cost of overall project.

PROPOSED RECORD SHEET FOR REFERENCE FOR REQUIREMENTS:
Fig:4 (GIVING ABSOLUTE CLARITY OF MATERIAL REQUIREMENT, LABOUR REQUIREMENT AND TIME CONSUMED)

PROPOSAL AND RECOMMENDATIONS:

- Preparation of Work Breakdown Structure.(Preferably Phase-wise)
- Phase out the work and assign trained Labour for specific work accordingly.
- Prepare the list of Inventory required for Construction in Ferrocete Technology.
- Estimation of Tentative Cost of the Project Including Overheads.
- Preparing Schedule of Time Required as per Work Breakdown Structure.
- Preparation of Gantt Chart for determining tentative time required for completion of Project.
- The step-by-step CPM system helps to identify critical and non-critical tasks from projects' start to completion and prevents temporary risks. By using Critical Path Method (CPM) as an algorithm for planning, managing and analyzing the timing of a project, faster pace of construction can be achieved

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SOIL AND PLANTATION MANAGEMENT FOR LANDSCAPING OF RESIDENTIAL PROJECTS IN AND AROUND PUNE (Site area 10 - 40 Acre)

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ABSTRACT:

Pune has seen a rise in number of residential projects over last decade due to rapid increase in population. People prefer to stay in residential projects where amenities for daily recreation are provided. Landscape is one of such amenities; in fact it's one of the unique selling points of such residential projects. Though aesthetically pleasing views of landscape generate very much interest among buyers, it may not involve landscape consultant at all at the beginning stage. On the other hand, cost spent on landscape is marginally less as compared to the construction cost, thus sheer negligence is observed during planning and execution of landscape works. Soil and plant material are the two important resources of a landscape project. Since both these resources are extremely precious, its preservation is must. In Pune region good quality soil is available at many construction sites, but it is not preserved till the end of construction. Shortcomings in planning and irregularities in execution causes soil pollution and damage to plants. In addition to this proper planning for procurement of soil and plant is not done many of the times, which causes delays in execution. Execution of Landscape work is generally carried out in different phases, during a time span of 3-4 years as per the requirement. Since time is not a constraint landscape development occurs in an unplanned way, without desired quality of soil and plants and desired quality of workmanship. Landscape of residential projects may appear aesthetical but it lacks sustainability. In order to add sustainability to a residential landscape project pre execution planning and best suitable construction practices during execution are must. This research paper aims to evolve a schematic plan for management of soil and plant material, based on factual onsite data.

KEYWORDS: Landscape, residential, Soil pollution, Plant material, sustainability, management

INTRODUCTION:

Pune city which was once titled as Pensioners paradise and educational hub, has acquired its new status as, I.T. Industry Hub in last decade. This new found status caused a rapid migration of people in Pune and surrounding region from across India. Since 2005 Pune observed an increasing demand for Residential projects, which has been met by mince of large scale residential projects as well as townships. Most of these projects are located in fringe areas of Pune due to, Hugh area requirement. These projects are mostly developed for middle income groups and higher income groups. Such projects demand high end amenities as well as recreational areas in terms of landscape. Landscape component is restricted to *10 % of total plot area and its quality is determined by design brief and environmental norms.

Development of landscape happens in different phases. Soil and plant material is required in all phases. Since the cost spent on landscaping is very less as compared to total construction cost, negligence during handling of soil and plants as well as wastage is observed. Overall development of landscape construction occurs along with the execution of construction activities. Since actual installation of plant material is done at the end of project, area reserved for landscaping is constantly exposed to construction activities. It affects the quality of soil. Due to lack of coordination between agencies, wastage of material, damage of precious natural resource viz. soil and plants happens. Suitability of soil, manure and plants needs to be investigated in order to make it more sustainable. This research paper aims to study causes of Soil pollution as well as causes of damage to plant material due to negligence in execution of landscape projects, and its ill effects on soil and plants. It also aims to evolve schematic plan for management of soil and plant material. This paper contains data collected through interviews and questioners, presented in a tabular form, in order to derive an empirical conclusion in the form of schematic flow chart.

1 DESIGN BRIEF FOR LANDSCAPING OF RESIDENTIAL PROJECTS



Image 1-View of landscape project

(Source - <https://images.search.yahoo.com>)

- 1) Almost similar design brief for projects located at different locations irrespective of its cultural and social context.
- 2) Hardscape consists off paved areas, water bodies, Seating etc. Execution of hardscape areas happens along with Execution of building.
- 3) Softscape consists of all the plant material. Execution of softscape takes place along with finishing stage of project.
- 4) Cost spent on landscaping is negligible thus negligence observed during execution of landscape project.
- 5) Involvement of live plant material and its future maintenance both are challenging factors.

2 IMPORTANT NATURAL MATERIALS FOR LANDSCAPE PROJECT

For any landscape project soil, water and plants are the three main natural materials. Soil is the most precious resource easily available on site. Soil excavation is first labour intensive activity during construction, by means of which natural soil is procured. Imported soil is fertile soil, obtained from river beds and can be excavated and transported except four months of rainy season. It involves transportation cost. Trees and existing vegetation takes years to grow and represent ecosystem in that area. Plants imported from nursery require years to attain maturity and need fertile soil and water for desired growth. If already matured plants are procured they are costly. Plantation requires portable water for growth at specific intervals according to climate. **Thus material management is must for residential landscape projects since it's a significant typology in terms of numbers.**

*As per Pune Municipal Corporations bylaws 10% area of plot is used for landscape development as an open space.

3 SOIL MANAGEMENT

3.1 Types of soils available around Pune and its impact on plant growth

Healthy soil acts as a medium for plant growth. Unfortunately during construction of buildings and execution of Landscape construction, the quality of existing soil gets damaged which in turn causes altered plant growth. In Pune district mainly three types of soils, viz. black-fertile, brown and red mixed type of soil are found. Due to lack of availability of space, residential projects are developed around fringe areas of Pune where previous land use was farming. Mostly black cotton soil and brown soil with coarse grains is found in most of the project sites. Black cotton soils forms a clot around root ball thus it needs to be altered by mixing red soil. On the other hand brown soil can be used as it is by allowing use of red soil only for certain area. In addition to this soil medium contains one third proportion of manure. Different plant material requires different types of soil.e.g.Lawns need more impervious type of soil for better drainage whereas trees and shrubs needs lesser impervious soil. **Thus use of existing soil as a medium for plants can cut down on cost spent for landscape.**

3.2 Soil procurement

General practice pertaining to soil procurement in Residential projects is to remove top soil up to a depth of (25-45 cm) and replace it with imported soils from riverbeds. This imported soil may not match with the quality of original soil and causes layering of soil which affects effective drainage. Imported soil is a very fine quality soil found near river beds and takes years to form, thus exploitation of such a precious resource should be totally avoided. In addition to this meeting with the required amount of imported soil is difficult in four months of rainy season which may cause delay or use of unsuitable soil for project.

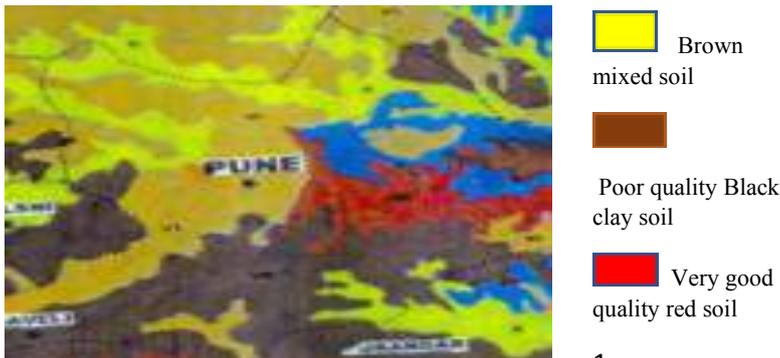


Image 2-Soil map of Pune (Source: Krishi.Maharashtra.gov.in),



Image 3 - view of construction site (Source: clicked by Author)

3.3 Advantages of topsoil preservation

- 1) Quality of soil is same throughout the site.
- 2) As per the known fertility status of soil plant material can be decided.
- 3) Natural drainage is promoted and unnecessary importation of soil can be stopped.

3.4 Causes of mishandling of soil:

- 1) During excavation of buildings soil is removed and excess soil than storage capacity is sent to landfills.
- 2) Excavated soil is stacked on open areas surrounded by construction activities get contaminated by spillage of cement material, steel, wooden particles etc.
- 3) Construction activities which further involve use of cement for e.g. plastering if done in rainy season causes mixing of cement in rain water. This can lead to soil pollution.
- 4) Excessive compaction of soil due to heavy vehicular movement.
- 5) Use of open areas surrounding buildings for stacking of soil.
- 6) Use of construction machinery such as concrete mixer on random site areas.
- 7) Plastic and non-degradable garbage thrown surrounding labour camps.
- 8) Stacking of construction material like sand, bricks, steel bars on ground.
- 9) Dumping of construction waste.

4 PLANT MATERIALS

4.1 Design intent and suitability of plant material

Landscape design of residential projects is based on mostly aesthetical value. Landscape component is essential for residential projects for successful marketing of project. Even before start of project flats are sold on the basis of showcasing landscape views. This approach leads to selection of such plants which have bright colors, flowers, good shape. Sometimes hardscape component is more than soft scape component ignoring environmental norms. In many projects landscape garden is developed on podium slabs which restrict use of big trees with deep roots in plantation. Plants near dead walls or redundant areas are neglected during maintenance. Parking areas and areas near compound wall lack shady trees as while designing this structures provision for deep root growth not considered. Similar plant material is found for different projects throughout the region irrespective of its locational context, soil type and availability of water. All this factors should be considered for plantation planning.

4.2 Procurement of plant material:

- 4.2.1 Tree: Some projects have existing matured trees. A Plan to conserve such trees is beneficial. In case of absence of trees they can be procured from nursery.
- 4.2.2. Shrubs and ground covers: The required quantity is more as well as need of material at different stages of project. They need great protection. Thus procured from nursery. They are required at the start and end of project.

4.2.3 Lawn: Required in big quantity at the finishing stage of project. Procurement of lawn is totally dependent on choice of lawn. Ideal way to procure the plants of suitable height, quality and health is growing them in a nursery on site in proper care using construction period effectively. That helps them to acclimatize with surroundings. In that case proper nursery management plan for watering and desired growth as per site requirement can be prepared. This reduces the cost. This method is useful for trees and shrubs as full grown trees are costly and in case of shrubs quantity is more. For lawns installation of ready lawn becomes costlier. Instead of that lawn planted by dibbling method is economical.

4.3 TABLE 1 CAUSES OF DAMAGE TO THE PLANT MATERIAL DURING VARIOUS STAGES OF PROJECT

Sr no	Image	Project stage
4.3.1		Planning 1) Negligence towards landscape planning. 2) Existing trees cut down. 3) Plantation design not done considering water availability on site 4) Unsuitable soil used as a medium for plant material. 5) Inappropriate location for plants. 6) Decisions regarding site levels done in absence of Landscape consultant. 7) While doing paving and cementing around trees sufficient area for root growth not left. 8) Faulty design of flower beds and sunken slabs restrict plant growth. 9) Unsuitable plant material
4.3.2		Execution 1) While construction activity area surrounding existing trees not protected. 2) Roots Of existing trees get damaged while excavation. 3) Lack of co-ordination between service consultant and landscape consultant. 4) Newly planted Trees not supported by means of sticks causes tilting. 5) Plants procured from nursery lay on site till plantation without care. 6) Existing soil and procured soil not mixed well especially for lawn causes ineffective drainage. 7) Spillage of construction material such as cement, paint acid on plants. 8) Bad quality water used for irrigation.
4.3.3		Maintenance 1) Lack of co-ordination between execution team and Maintenance team. 2) Availability of less water than the requirement. 3) Manual watering either in less or more quantity. 4) Failure of stp system causes fewer water supplies. 5) Skilled Gardner is not appointed. 6) Maintenance team unaware about cutting and pruning requirement of plant. 7) Interference of end users.

Image 4, 5, and 6- Various stages of Residential landscape projects (source: clicked by Author)

5 CONCLUSION AND RECOMMENDATIONS

5.1 TABLE 2 - CONCLUSIONS AND RECOMMENDATIONS FOR SOIL AND PLANTS DURING DIFFERENT PHASES OF PROJECT

Location		Near site office	Boundary /Road Plantation	Main open space
Material				
	5.1 .1 Soil	soil availability and site conditions 1) Required quantity of soil is less. 2) Existing soil can be used.	1) Fertile soil is required. But generally on site soil used. 2) Manure is used to increase fertility.	1) Existing Top soil covered with good quality imported soil. 2) Required quantity is large. 3) Impervious soil required for lawn
	Recommendations for Desired Quality	1) Topsoil should be used as less quantity required. 2) Fencing are required for protection of soil and plants.	1) Fertile soil should be used till depth of 900 m for tree growth. 2) Area surrounding tree needs to be covered to avoid soil pollution.	1) Space for landscape development needs to be fenced & kept free of construction activity 2) Top soil should be stacked. 3) Imported soil should be Procured on time to avoid delay.
5.1.2 Plant Material	plant material	Plants Imported from nursery due to lack of space	If not available on site, trees are procured from nursery and grown on site.	Plants Imported from nursery or procured from site nursery. Native trees not planted.
	Design intent	Temporary aesthetical value	Shade/ compliance of norms	Active and passive landscape.
	Recommendations for Desired Quality	1) Replant able, sturdy shrubs are ideal at this location. 2) Should be stacked in semi shade till installation. 3) Maintenance should be done till the completion of project. 3) Lawn should not be planted at such places.	1) Trees should be of at least 3 to 4years old to sustain further. 2) Native and fruit bearing trees should be planted. 3) Needs to be protected with supports and during construction. 4) Regular watering and maintenance is required.	1) Plantation should start ideally once the services are installed and finishing is done. 2) Plantation should be done by skilled labour. 3) Vary of lawn should be chosen as per availability of water on site. 4) Ideally should be maintained by execution team for first 3 months.

Image 7, 8, and 9 –Various phases of residential landscape project (source: clicked by Author)

5.2. Recommendation for soil management : A soil sourcing plan (SSP) should be prepared on each construction site, to use existing soil effectively, without much wastage, SSP should include, 1) the areas and types of topsoil and subsoil to be stripped, Route for unloading, Storage area.

2) Method for stripping, stacking and relaying for existing soil, and alteration.

5.3 Recommendations to avoid soil pollution during construction:

Site management plan (SMP) is highly recommended, demarcating different areas on site as per function such as,

- 1) Proposed building footprint and adjoining construction area.
- 2) Area for machines and tools such as RMC plant, bar bending etc.
- 3) Storage area for material
- 4) Area for labour camp.
- 6) Area for vehicular movement.
- 7) Construction activities involving use of cement should be avoided during rainy season to avoid mixing of cement with rainwater and soil.

5.4 Recommendations for soil and plantation management during planning and execution

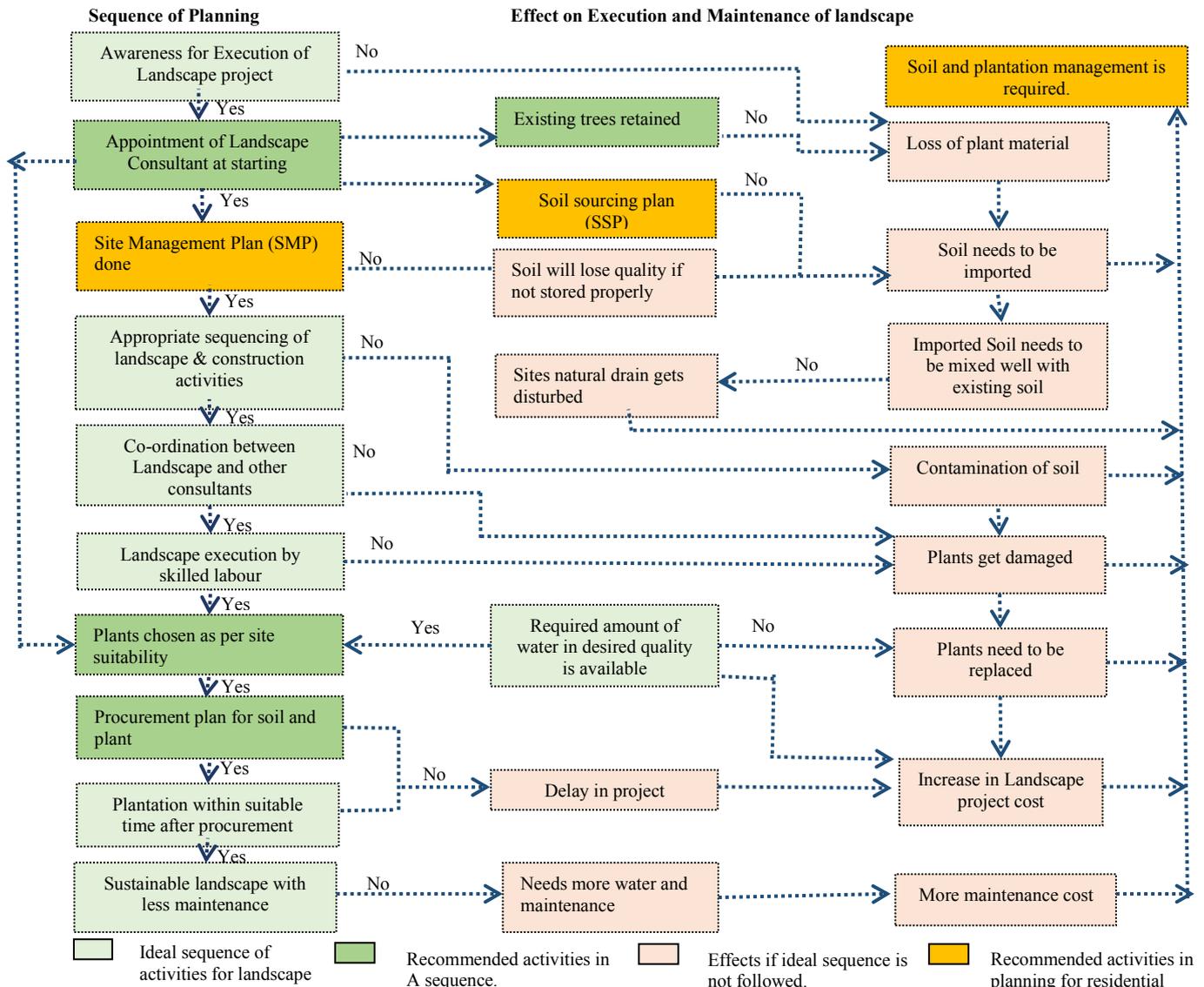


Fig.1 a systematic approach flow chart for execution of landscape project. (Source: Author)

5.5 Summaries of recommendations from systematic approach flow chart.

- 1) Landscape consultant should be appointed at the start of project.
- 2) Zoning for site management should be done.
- 3) Plants should be chosen as per site suitability and plantation should be avoided in month of April and May in case of insufficient water.
- 4) Existing soil and plants should be retained and preserved during construction.
- 5) Procurement plan for imported soil and plants should be made in advance as per execution schedule to avoid delays.
- 6) Source of water should be identified at the beginning.

5.6 General sustainable practices recommended.

- 1) Instead of dumping construction waste viz broken pieces of bricks, bats, blocks, excess soil etc. in landfills, it can be used as filling material below lawn mounds
- 2) Leafy material from existing/Planted trees can be collected in compost pits for producing manure.
- 3) Native, fruit bearing trees and edible landscape can be incorporated at certain parts of project.

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IMPACT OF USAGE OF BATHROOM PODS IN HIGH RISE OR MASS RESIDENTIAL HOUSING PROJECTS

Sub Title: Review & evaluation of bathroom* construction systems in contemporary India.

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ABSTRACT

In this growing fast world need of “off-site” construction is gaining popularity among the developers, provided it is ‘cost effective’ & ‘less time consuming’ compared to conventional construction. Bathroom pods are mainly used in Commercial and Industrial projects. The main objective of this paper is to reduce the timeline of the high rise or mass residential projects by using high quality bathroom pods resulting in speeding up of cast in situ construction process. It aims to set new standards & help architects, engineers, construction managers & building owners to address the potential issues found in traditional & conventional bathrooms. It also aims at making the work area in conventional construction more organised, by avoiding conflicts in scheduling work among multiple agencies. Based on the findings of case studies done by the author the conclusion of this research paper is drawn. Other sources of information include e-mails, questionnaire and personal interviews of concerned stake holders. The scope of this paper is restricted only to high rise or mass residential projects in Mumbai & Pune region where majority of the bathrooms are standardised.

KEYWORDS: Bathroom pods, off-site construction, high rise or mass residential projects, POD technology, volumetric modules, time efficiency

INTRODUCTION: *‘Bathrooms are usually challenging to build, costly & time consuming, due to too many trades working in a confined space’ [1]*

It has been observed that most of the projects are delayed due to poor sequencing of onsite construction work. During construction on site the desired quality of the bathrooms is not achieved & use of unskilled labour, inferior material and inadequate supervision may lead to leakages & other defects. This results in delays, theft & damage to each other’s work, relating to a “Not me” attitude observed on site. Costs over-runs & delayed occupancy also affect all the stake holders.

The need to write this paper was felt, so as to resolve all these issues and find an alternative suitable solution in Indian scenario especially in Mumbai & Pune region. This can be achieved by implementing POD technology & to set new standards which has already being utilised in some of the developed countries like USA, Australia, China, Japan & UK. Employing volumetric modules as bathrooms are means of efficient and effective construction for highly serviced areas in HR buildings. Recent developments in structurally integrated volumetric pod concepts have seen the ability to be configured to provide alternative architectural solutions in architecture. Now that Rera is introduced delay in projects adversely affect the various stake holders and the time has come to examine the technology & accept the acute need of different concept.

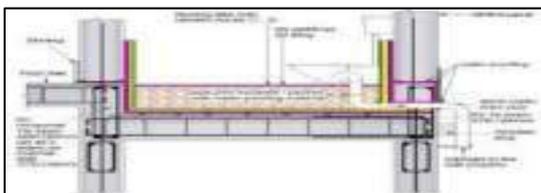
Aim of this research paper is to achieve time efficiency & high quality by setting new standards in bathroom constructions by using POD technology. A bathroom pod completed in a factory capitalizes on the ability to move product in controlled manufacturing condition & on tight inventory control complying with the project schedules, error proof joint systems & mechanical fastenings. Provides safe delivery (careful) & strategically with respect to site constraints. Helps in organising the work area & manufactures the ability to research & implement aesthetic functional innovations to better improved quality of Pods.

The objective of this paper is purely to produce high quality product with cost effective, less time consuming & high production resulting in speeding up of cast- in- situ construction process. Restricted to high-rise residential or mass residential projects up to 25 floors in Mumbai & Pune region, having standardized bathrooms, Minimum 200 nos. per project & at least 50 nos. per type are suggested for effective costing of pods. Maximised efficiency of bathroom size should not exceed 3m x 2.3m as trailer size considered is 8’ x 20’ i.e. 2.4 m x 6.66 m for logistics [2]. For ease of crane to lift one full stack of bathroom pod on site, maximum weight of the pod should be restricted between 1.5T- 2T [3].

Intent of this paper is to reduce effective overall construction time line of the project by using *non load bearing pods*. Also to facilitate offsite operations like cost predictability, higher quality, resolving skilled labour shortage, enhancing labour skills, reducing safety risks for workers, reducing material wastage & controlling noise & air pollution on site.

In this research paper, case studies were done to determine the cause of delay in cast-in-situ bathroom constructions along with leakages & maintenance issues on site after occupancy. Formulation from recent and previous researches related to use of benefits of bathroom pods, along with comparative study of merits & demerits of other methods of bathroom construction like traditional, conventional & non-conventional were carried out. Survey through personal interviews, mails & questionnaire with the manufacturers of pods, consultants & other stake holders were adopted. The findings were confirmed that better quality can be achieved through use of bathroom pods.

Classification of bathrooms used in contemporary India.



Sunken slab with brick bat coba: (Traditional method)

The purpose of the sunken slab is to conceal all the drainage lines below the floor, care has to be taken to avoid leakage problems. After the plumbing pipes are laid, waterproofing is done by brick bat coba. In case of leakages the bricks retain the soiled water. In case of Eastern Water Closet (EWC), the depth of sunken slab is 200mm and 400 mm in case of Orissa pan.

Fig.1- Brick bat water proofing (Source) hicarewaterproofing.com.

Under slung plumbing: (Conventional method)

Here the toilet slab is built at the same level of adjacent slabs. Sleeves or holes are punctured wherever plumbing pipes have to pass through the slab & pipes are clamped to the bottom of the slab. It is concealed by false ceiling from below. A door trap is provided in the false ceiling for maintenance. Without disturbing the structure(as in the case of sunken slab) the entire plumbing can also be replaced if any leaks are observed which will drip onto the false ceiling below & can be easily identified & repaired



Fig.2- Leaking ceiling images, shutterstock.com



Fig.3- Leaking ceiling images, shutterstock.com

Use of HDPE pipes: (Non – conventional method)

In non-conventional method, use of High-Density Polyethylene pipes is done instead of other pipes like LDPE or PVC. Single pipe is used to carry down the soiled water, hence known as ‘Single stack system’. Many fitting & joining options are available there, so no flame is used for joining

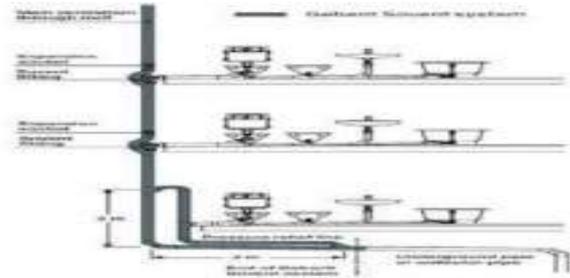


Fig.4- Drainage of bathroom system, researchgate.net

Use of Non-load bearing pods: - (New system)

Bathroom pods have efficient assembly line style construction which ensures accuracy, precision, consistency & speed. It comprises of a floor base frame, all walls & a ceiling and are then fully tested and fitted with all of the required architectural fixtures and fittings. All plumbing & electrical services are pre-installed & fully tested & leak proofed in the factory. Pods undergo stringent quality control, testing & auditing for quality inspection. Once at their final position hook up connections are made by using flexible connections to the already provided source points on the dry wall exterior of the units. An easy & quick process of installation involves plugging of electricity & water connections. By adjusting the screw jack pedestals or using different shims, the requested bathroom floor level or threshold is reached.



Fig.5- Bathroom pods, alibaba.com

- Available in both Lightweight Concrete and Superlight galvanized steel frame solution.
- After completion of the project, defect rectification required by bathroom trades is greatly reduced. This allows the trades to move on to other projects.
- For the developer, the use of prefab bathrooms often assists with getting the project to market quickly, providing a better return on investment (ROI).
- For the owner, on-going maintenance is significantly reduced.

Note: Any direct contact between the pod unit underside and building structure or construction site surface is strictly forbidden. Always transport only one bathroom at a time with the forklift. Never stack one bathroom on the other. Avoid diagonal pull of the straps [4].

Logistics & procurement: Water transport is the cheapest means of transport, suggested wherever possible. While transporting and when exposed to onsite elements for protection, bathrooms are wrapped in heat shrink wrap. Semi-trailers or B-doubles are used for transportation to site at a predetermined time to fit in with site programming. **Example:** “On a project in Brisbane with over 600 bathrooms, crane Cycle time was around three minutes per bathroom. Pod’s unique lift system ensures crane time is kept to a minimum, and can reduce crane time by up to 10 minutes per bathroom when compared with other systems.”[5]. For economic transportation minimum 4 to 5 pods should be transported at a time. Pods are crane lifted & landed on a cantilever deck from where they are hoisted by using a forklift. To minimise site time pod manufacturers provide specialised handling equipment. In India acceptable economical distance is 50km to 175km. [6]

Materials used in the construction of the bathroom in contemporary India are:

Table 1

Sr.no	Sunken slab with BBC	Under slung plumbing	Plumbing with HDPE	Bathroom pod (Non-load bearing)
1.	Bricks, sand, cement, crush sand & water for walls	Bricks, sand, cement, crush sand & water for walls	Bricks, sand, cement, crush sand & water for walls	Light weight galvanized steel, cold form steel, fermacell, rock wool, concrete composite panels, plaster board & epoxy grouts, aluminium floor
2.	Bricks, sand, cement, crush sand, water and chemicals for waterproofing	Chemicals for waterproofing	Chemicals for waterproofing	Bituminous sheet based water proofing membrane. Steel membrane with joint welding.
3.	Tiles & cement for tiling work	Tiles & cement for tiling work	Tiles & cement for tiling work	Tiles & chemical cement for tiling work
4.	CL,AC,GI, PVC, UPVC, CPVC & brass	AC,GI, PVC, UPVC, CPVC & brass	HDPE pipes & fittings	HDPE pipes & fittings

Merits & Demerits of toilets with different types of plumbing methods used in contemporary India

Table 2

Sr.no	Sunken slab with BBC	Under slung plumbing	Plumbing with HDPE	Bathroom pod
1.	Pipes are concealed inside the slab	Pipes are not concealed inside the slab	Several advantages over LDPE and PVC.	Most of the Bathroom defects lists are eliminated
2.	BBC & Chemical WP	Chemical WP	Chemical WP	Membrane WP
3.	Repairs to sunken toilet are inconvenient troublesome & time consuming.	Leakages can be easily identified & repaired. But troublesome & unhygienic for the occupants residing below as maintenance is done from their BR.	Resistance to corrosion, tuberculation, deposits & chemicals. Leakages minimised	Most of the needs of multiple trades on construction sites are organised
4.	Costing & dead load of brick bat coba is increased	Costing & dead load of brick bat coba is reduced	--	Costing & dead load of BBC & int. walls is reduced
5.	High maintenance as	Low maintenance	Easy & very low maintenance	Minimised maintenance
6.	Low quality supervision	Low quality supervision	Medium quality supervision	High quality supervision
7.	Neither recyclable & eco-friendly material	Neither recyclable & eco-friendly material	Recyclable & eco-friendly material	Great from a sustainability perspective
8.	Longer time required for construction on site so work cannot be speed up	Less time required as compared to sunken toilets on site so work can speed up	Higher softening point so easy to speed installations & fabrication on site	Less time, cost predictability, higher quality, resolving skilled labour shortage,
9.	Increases safety risks for workers on site. Increases noise & air pollution.	Increases safety risks for workers on site. Increases noise & air pollution.	Increases safety risks for workers on site. Increases noise & air pollution.	Reduces safety risks for workers & controls noise & air pollution on site
10.	Total wastage on site is around 7% to 10% of the materials used	Total wastage on site is around 7% to 10% of the materials used	Total wastage on site is around 7% of the materials used	Total wastage in production can be less than 1% of the materials used
11.	Fixtures & fittings need to be stored on site which increases the risk of theft & damage	Fixtures & fittings need to be stored on site which increases the risk of theft & damage	Low scrap value, so avoids thefts, only fixtures & fittings stored on site increases the risk of theft & damage	Fixtures & fittings don't need to be stored on site which reduces the risk of theft & risk of damage
12.	Cementing material or solutions used for joining	If pvc pipes are used then flame may be required for joining	Many fitting & joining options, no flame is used for joining	Many fitting & joining options, no flame is used
13.	Dependency on weather	Dependency on weather	Dependency on weather	No dependency on weather
14.	--	Sound of above bathroom in use disturbs the occupant of the bathroom below	--	--

Evaluation of the bathroom systems in contemporary India:

Table 3

Sr.no	Description	Traditional BBC	Conventional Slung	Non-conventional HDPE Plumbing	New system PODS
	Case study done	10 nos.	10 nos.	10 nos.	5 nos.
1.	Material procurement	2-8 days	2-8 days	2-8 days	4 - 10 days
2.	Pre site execution stage	-	-	-	8 - 10 days
3.	Site construction Time**	20- 30 days	18- 24 days	18- 21 days	3 days [7]
4.	Cost	C	-10% C	20% C	10-12% C- locally 25% C- imported
5.	Quality a) Leakage b) finishes	20 % Good	15 % Good	8 % Good	0 % Excellent
6.	Weight on slab	Heavy	Medium	Medium	Low
7.	Labour intensive on site	High	High	High	Low
8.	Availability of material	Sometimes problematic	Sometimes problematic	Sometimes problematic	No problem
9.	Water required for curing	High	Medium	Medium	No
10.	Maintenance	High	Medium	Low	No
11.	Transportation	Low	Low	Medium	Heavy
12.	Machinery	Light	Light	Light	Heavy
13.	Warranty	No	No	No	10 years

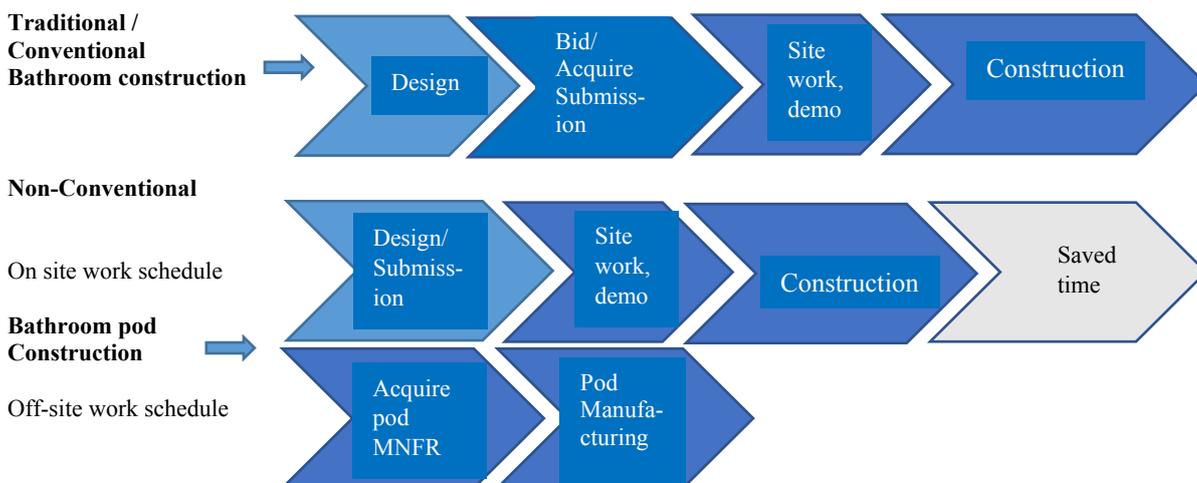
** constructing three walls, plastering, water proofing, tiling, plumbing, electrical, painting, fixtures & fittings, sanitary ware etc.

CONCLUSION

Based on site observations and findings through case studies, the toilet leakage problems are more prevalent through major & minor structural or non-structural cracks, pipe sleeves leakages & poor workmanship of waterproofing. Prototyping of bathrooms provides a peace of mind about what the final result will look like. As a result bathroom pods are extremely attractive option for large scale construction

projects such as high rise or mass residential buildings. Capital cost may not be less than conventional construction bathrooms but savings in construction time, material waste & improved quality means earlier income streams from on-going project.

Diagram showing process comparison for comparative analysis study between conventional bathrooms & bathroom pods to show actual reduction in time of bathroom constructions



40% reduction in time of bathroom constructions is achieved by use of bathroom pods [8]. It is rare that modular construction techniques do not interface with more traditional methods of construction. This alone often gives rise to interface and tolerance issues that could, if not considered at the early design stages, led to lost productive time on site and contribute to additional costs.

Following results are achieved from the findings from the questionnaire formed by the author

Table 4

Sr.no	Quality	Convenience	Cost	Time
1.	With streamlined project management the efficiency is maximised	Less site management & co-ordination	Less recruitment & accommodation	Reduction in overall timeline of project
2.	Due to skilled labour, high standard of finish & functionality is achieved	Relying on a single source saves construction managers, owners, and architects time and money.	Elimination of theft & breakages	Timely project completion to comply with Rera rules in India
3.	Made to order hence no design limitations		Less site supervision	Schedule optimization
4.	Live testing prior to installation		Higher cost of material	
5.	Reduce damages		Less material wastage	
6.	Excellent fire resistance			
7.	Excellent acoustic insulation rating			

To conclude, the rise of off-site construction is gaining popularity, but it is still lower than the desired figures expected by the industry. By widely displaying the impact that new off-site technology can have into the wider world, by showing companies who have profited most successfully from the sector. We need to share, we need to spread, and we need to display the glowing benefits of the off-site industry to the wider masses involved in construction, thus impacting its growth for the better.

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BEHAVIOUR BASED SAFETY APPROACH FOR FIRE SAFETY IN HIGH RISE RESIDENTIAL BUILDINGS – Case Study of Pune

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ABSTRACT

Behavioural based safety (BBS) is a popular approach in occupational health and safety management to achieve maximum safety in any workplace. BBS programs enable the organisation to rectify existing issues and reinforce a safety environment by finding the root cause of the behaviour of the workers. Fire safety is one of the major concerns in high rise residential buildings due to their complex composition as well as the occupants with varied backgrounds. The losses due to fire are two-fold, one caused by actual intensity of fire and the other enhanced by the behavioural issues of the occupants while confronting fire hazard. Rules and regulations only provide a general guideline for making a building fire safe. Yet its actual application in every project demands conscious efforts of the planners and managers. Fire risk is identified as the 5th highest risk in India hence ensuring fire safety calls for the evaluation and research of new approaches to fill in the gaps between the law and the implementation to reduce the fire accidents in the country. This paper aims to study the BBS approach and also discuss the applicability of the method and its perception in fire safety perspective. The scope of study is limited to high rise residential buildings in Pune. The study of BBS and the human behaviour in fire is done through literature study. Case studies of buildings (live and book), fire incidences and user's survey are done to pinpoint the problems in implementation of fire safety measures. Fire safety measures are present in most of the high-rise buildings due to provisions in fire safety law. The analysis done shows that BBS approach can surely improve the effectiveness of the fire fighting measures in the fire hazard.

KEYWORDS- *Fire safety, high rise, residential buildings, behaviour-based safety(BBS), human behaviour, stakeholders*

1. INTRODUCTION

Fire safety is one of the major concerns in high rise buildings. Performance of a building against fire is determined by behaviour of the occupants, building features and fire safety measures installed in a building. In India, high rise buildings are attaining great new heights. In metropolitan cities like Mumbai, Delhi more than 30 floors are in occupation phase.[1],[2] The latest Development Control Rules of Pune is allowing the development to attain heights above 100 m. National crime record bureau in its report, published in 2018, mentioned that fire accidents predominantly happen in residential areas with greater instances of fatality than injury.[3] More than 1000 incidences on an average in a year do happen in Pune itself as per records generated from Pune fire brigade. Hence fire safety management needs a review and research in approaches to improve fire safety. A safety culture in any organisation imparts better business opportunities and hence it is taken care very meticulously by the management. Most of the accidents taking place in any organisation are due to unsafe behaviour patterns of the employees. Behaviour based safety approach focusses on behaviour of the employees, finding faults and providing solutions for intervention. Fire incidences directly affect the occupants of a building in disastrous ways. High rise buildings need special attention in fire safety because there is a significant increase in fire load and time required to evacuate the building due to occupancy load. Evacuation of people, suppression of fire and moving to safe place and wait for rescue are the basic strategies adopted in fire safety. This paper tries to evaluate and foster the need of the BBS approach to provide fire safety measures to improve their effectiveness. Putting off fires, prevention of occurrence of fires and reducing the loss of property and life in a fire hazard lie primarily in the occupant's hands. The conscious study of behavioural issues in fire hazard can help in designing fire safety measures in a building efficiently.

2. BEHAVIOUR BASED SAFETY APPROACH

BBS can be defined as a process which aims to encourage or discourage employees to behave in a proper manner to prevent the accidents at workplace. In this approach, observations are made to list down the behaviour of employees and these observations are sorted into categories which produce positive or negative consequences. The strategy is formulated in the end and measures are proposed that will encourage or discourage certain behaviour in consultation with the management and workers.

2.1 Aspects of Human behaviour [4],[5]

Aspects of Human behaviour considered as baseline of this approach are-

- Behaviour is the way, people act, which is observable and measurable.
- When the chances of getting hurt are too low, people tend to take risks.
- Whenever the behaviour has advantages, people tend to do that though it is unsafe.
- When the SAFE way is easy, then people tend to adapt to that way.
- If people clearly understand the consequences of their behaviour they behave safely.
- People often act according to their perception of risks and rewards rather than according to rules and regulations.

2.2 Observable and Underlying behaviour [4],[5]

Observable Behaviour is associated with people actually doing the physical activities in the plant, control rooms and offices etc. Underlying Behaviour is related to conditions and work processes that may be "root causes" of observable behaviour. These can include how well facilities or systems are designed for people's use, clarity in the management's expectations of following procedures, the effectiveness of the risk assessments in understanding and managing hazards/risks.

2.3 ABC model [4],[6]

BBS use ABC model which elaborates why people do what they do.

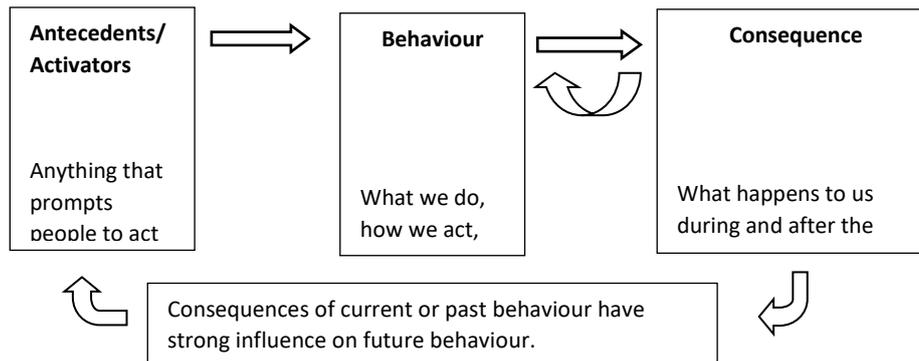


Fig. No.-1 Flow chart of ABC model (Source-Author)

3. FIRE SAFETY IN HIGH RISE RESIDENTIAL BUILDINGS AT A GLANCE

High rise buildings have increased fire load due to a greater number of floors. Rapid growth of fire can be observed in a short span of time due to stack effect, complexity of services. The consequences of fire are multifold- life and property losses due to actual burning, life losses due to suffocation, stampede and overcrowding, property losses due to fire suppressing measures. Evacuation of people becomes very critical due to increased occupant load, less time available as fire growth rate is unpredictable, more time required by fire fighters to reach the spot due to the verticality of the building. Especially in residential towers, backgrounds of end users are totally varying. Mixed population of elderly, young, adults and children adds to the complexity of approaching fire safety.

4. CURRENT APPROACH OF FIRE SAFETY IN HIGH RISE RESIDENTIAL BUILDINGS

Installation of fire suppression measures and furnishing no objection certificate from the Fire Department is made mandatory by Maharashtra Fire Prevention And Life Safety Measures Act 2006. Fire safety has been addressed in National Building Code 2016 and Development Control Rules by providing guidelines for Fire Prevention, Life Safety and Fire Suppression, covering all relevant elements of the building. Hence fire safety measures are getting implemented in all high-rise buildings. Interviews with officials of fire department established the fact that though the law and systems are in place they often get calls for fire rescue from residential buildings. Compared to Pune, Mumbai has already been having several high-rise residential buildings in use. News headlines and articles indicate that fire safety in Mumbai of these buildings is becoming crucial and a matter of concern. These observations give directives towards the ineffectiveness of the systems in place.

5. BBS APPROACH AND ITS APPLICATION IN FIRE SAFETY

Fire ignition, its spread, amount of losses either property or life are closely related to the behaviour of the occupants of the building. The occupant's approach towards fire safety decides its effects on the building. To keep users of the building safe in occupation phase, all preventive actions are taken in pre-occupation phase. Maintenance of the services is totally in occupants' hands who are totally unknown in pre-occupation phase. BBS approach finds the root cause of unsafe behaviour to take corrective actions. As stated above in 2.3 ABC Model, antecedents (activators) and consequences influence the behaviour of people. Activators in fire safety may be fear of life, carelessness, social background of end users. Consequences may be past fire experiences or any rebates and rewards. Secondly, underlying behaviour which includes the designing of facilities and services is many times the root cause of behaviour. Hence the consultants with their planning can direct the end users to behave safely during the hazard by keeping the losses to the minimum. While designing and providing fire safety measures, if the designers consider the behaviour of the occupants, in case of fire hazard, the efficiency of the system can be improved.

6. IMPORTANT FACTS ABOUT BEHAVIOUR OF PEOPLE IN A FIRE HAZARD [7],[8]

Many researches are done in behaviour of occupants in case of evacuation in fire hazard. Important findings are-

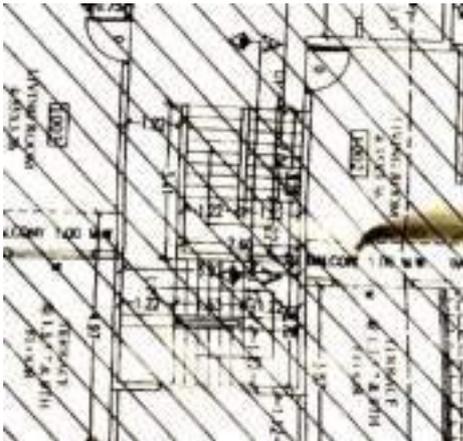
- The perception of danger determines the reaction to the impending danger through sight, smell and smoke.
- People tend to follow familiar route in case of a disaster.
- People tend to be caught in the smoke that spreads around during an attempt made at escaping.
- Parameters that guide in finding the way out are visual access, the degree of architectural differentiation, the use of directional signs and signage indicating numbers and plan configuration.
- Small groups merge into large group while escaping.
- Performance of occupants in case of emergency evacuation is largely dependent on others' behaviour.
- Inadequate ventilation develops fear in the occupants caught in fire making them to behave unsafe.
- The actual time of evacuation is also more than designed due to behavioural issues of the occupants such as few follow rules, varying individual reactions towards fire that include inclination to fight, warn, or wait.
- People tend to follow a clear path though it is longer.

7. CASE STUDIES

Case studies from different parts of Pune are carried out to analyse the aptness of preventive measures with reference to behavioural issues. Only three elements such as means of egress, fire alarm and detection system, exit signages are elaborated amongst those which are directly related to human behaviour.

1. **Staircase**-Minimum 2 staircases are mandatory by law. The fire staircase needs to be enclosed and either pressurized or well ventilated depending upon the height of the building.

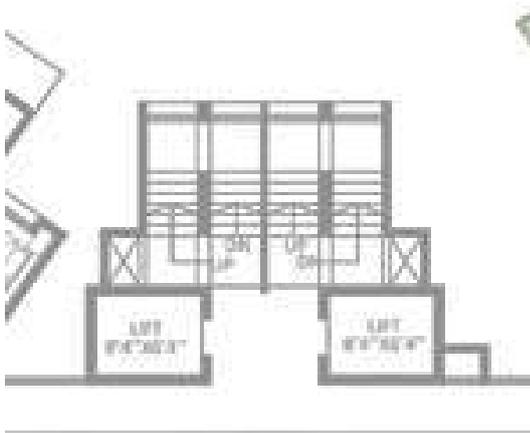
Case study 1



Two staircases are present but abutting each other. Not a single staircase is enclosed.

Fig.No.2- Plan and Picture of staircases in first case study (Source-Author)

Case study 2



Two staircases are present abutting each other and one is enclosed with fire door and pressurized.

Fig.No.3- Plan and Picture of staircases in second case study (Source-Author)

Analysis-

- In the above cases the fire staircase is identified.
 - Considering behaviour of the occupants, these will not serve the purpose of fire staircase of safe evacuation.
 - In first case, not a single staircase is enclosed hence it may not remain safe.
 - In second case, all the occupants will use the pressurised safe staircase, is not guaranteed as both the staircases are abutting.
 - Fire exit is through unenclosed lift lobby hence if lift catches fire exit will be inaccessible. Thus, accessibility of staircase is not thought of in case of hazard.
2. **Fire detection and alarm system**- The provision is found in all case studies. In 4 out of 5 case studies this was not either working or maintained.
 3. **Exit signages and escape plans** are rarely observed put up in place and no visual differentiation is provided to find the exit.

6. QUESTIONNAIRE SURVEY

A questionnaire survey was carried out to map the behaviour of the general users of residential buildings and to help in analysing the case studies. The form was circulated amongst 100 people above 16 years of age and including a random sample of male and female residents of different societies. Total 94 responses were recorded. Important findings of users' survey are-

1. Almost 40% of the users don't expect fire in their house as well as building.,
2. 78% have not experienced the fire hazard hence totally unaware of the gravity of hazard.
3. 36% people think that the residents are responsible for the property or life loss in case of fire.
4. Most of the people know the importance and location of refuge area.
5. Most (average 60%) are aware of the fire fighting systems installed in their building and know about fire exits etc. But they do not know how to use those.
6. 76.6% say that they did not take part in fire drills and do not show interest in maintenance of the firefighting system.

7. 65% people say that they were never guided about fire safety while undertaking interior decoration projects of their houses.

7. COMPARISON OF THE FINDINGS OF CASE STUDIES AND SURVEY WITH THE BEHAVIOURAL FACTS

1. If fire detection and alarm system is not working, then perception of fire will take fairly longer time increasing more life losses or injuries.
2. Users are not aware of the consequences of fire hazard as they least expect fire and not experienced one, hence they are least interested in maintaining the systems.
3. Exit passage or fire exit is not differentiated through architectural interventions hence users may find difficulty in finding the way in case of hazard.
4. Fire staircases need to be free and clear as people follow clear paths in case of emergency. Also, accessibility of fire staircase in the fire incidence has not been thought of while providing in plan.

8. CONCLUSIONS

The case studies and survey give the root cause of behaviour of the users in or before hazard. The consultants can think on these before providing fire safety measures in a building. The comparison shows that the provisions are in place but may not be useful in case of hazard. Both the staircases should be placed apart from each other to guarantee the use in fire hazard. The accessibility of either of them should be planned through an obvious path. The entry door of the staircase, if placed in a way that it stands out, it will catch attention of the occupants during escape. Signages directing the evacuation path should be used as additional entity and the plans made should guide the occupants to take the desired path. Only one element is considered in this paper to check the applicability of BBS approach in fire safety. If we carefully analyse the rule and regulations, many provide the guidelines of solutions for behavioural issues of the occupants. But the designers have to think cautiously while applying and implementing those in the particular project. If we apply behavioural knowledge in planning of fire safety, we can definitely improve the efficiency of them in fire hazard. The stakeholders - architect, builder, fire consultant together can create the environment in a building in such a way that the unknown occupants will follow their guidelines of the fire safety. Required fire safety measures, though passive or active, have to be planned from designing phase of the building to get them woven inseparably in the overall building fabric.

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A REVIEW OF CONVENTIONAL RIGID & FLEXIBLE PAVING MATERIALS FOR SUSTAINABLE URBAN ROAD CONSTRUCTION AT NASHIK, MAHARASHTRA, INDIA

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ABSTRACT:

The development and maintenance of urban road infrastructure systems is an integral part of modern city expansion processes. With the rise in awareness of environmental issues and diminishing natural resources, the focus of infrastructure construction industry is shifting towards eco-friendly materials and technologies. Rehabilitation of urban roads involves construction of rigid or flexible pavements depending upon its existing typology of pavement. This research paper shall be a review of conventional sustainable rigid and flexible pavement materials. A comparative analysis of materials such as, Plain Bitumen, Plastic in Hot Bituminous Mix, Reclaimed Asphalt Pavement (RAP), Pavement Quality Concrete (PQC) and Ground Granulated Blast Furnace Slag (GGBFS) in Ordinary Portland Cement shall be done with respect to the construction management principles. The comparison matrix shall be derived from the existing literature review and suitable case studies. The research would culminate to encourage the use of Waste Plastic in Hot Bitumen Mix and Ground Granulated Blast Furnace Slag (GGBFS) in Ordinary Portland Cement as sustainable flexible and rigid pavement materials respectively.

KEY WORDS: Sustainability, rigid, flexible, pavements, bitumen, concrete

INTRODUCTION:

Urban roads are a part of urban infrastructure. These roads are required for both intra-city and intercity movement and render much higher level of service compared to Rural Roads, State Highways and National Highways. The planning, development and maintenance of urban roads are often a challenge to the engineers.[1] Nashik is one of the emerging cities in Maharashtra. The road network of the city have been developed rapidly due to its social, cultural, industrial and mythological importance. From the current road conditions, it can be seen that these urban roads will require maintenance from time to time.

The road pavements are broadly classified in two types: rigid and flexible pavements. Generally, for the maintenance of rigid pavements Pavement Quality Concrete (PQC) is used and for flexible pavements, plain bituminous mix is overlaid. These materials consume a remarkable amount of energy during the production, construction, operational and the end of life phase. If the maintenance of roads is done using appropriate sustainable materials it shall: reduce the costs, reduce the emissions and reduce the consumption of raw materials thus preserving the resources for the future generations.

The aim of this study would be to review the sustainable rigid and flexible pavement materials which can be opted with regards to maintenance of major urban roads (12 m wide) in Nashik. The research is carried out with the objective to lay down a comparative matrix of materials (plain bitumen, waste plastic in hot bituminous mix, reclaimed asphalt pavement, PQC, GGBFS) with respect to the construction management principles and ultimately recommend the most sustainable material.

ROAD PAVEMENT MATERIALS:

Road Pavement:

A road pavement is a structure consisting of superimposed layers of processed material above the natural soil sub-grade, whose primary function is to distribute the applied vehicles load to the sub-grade.[2] Considering the vehicle distribution, for 12 m wide four lane single carriageway roads, the design of the pavement should be based on 40 % of the total number of commercial vehicles in both directions.[3] The road pavements are broadly classified in two types namely, flexible and rigid pavements.

Types of Road Pavements:

1. **Flexible Pavement:** A flexible pavement can be defined as a pavement layer comprising of a mixture of aggregates and bitumen, heated and mixed properly and then laid and compacted on a bed of granular layer. The surface course may consist of one or more bituminous Hot Mix Asphalt (HMA) layers. These pavements have negligible flexure strength and hence undergo deformation under the action of loads.[4]

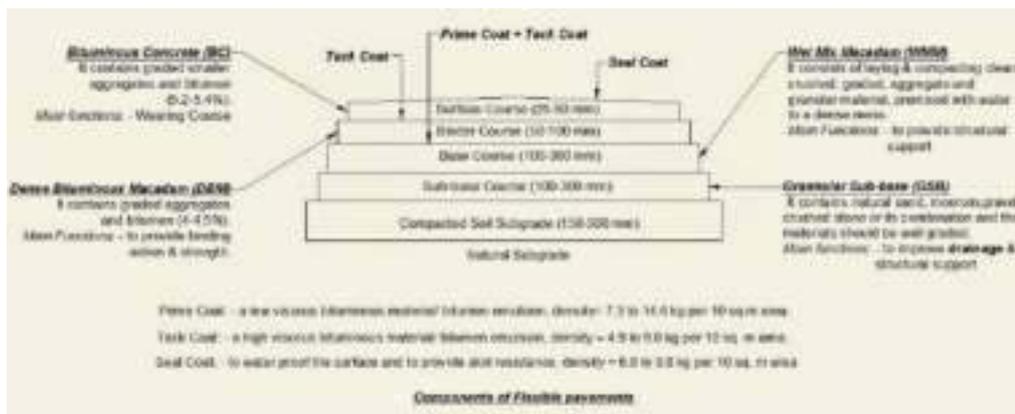


Fig. 1: Components of Flexible Pavement (Source: [14])

Flexible Road Pavement Materials:

1.1.1 **Plain Bitumen:** Bitumen is a viscous liquid, semisolid or solid material, color varying from black to dark brown having adhesive properties consisting of hydrocarbons which is derived from distillation of petroleum crude or natural asphalt and soluble in carbon disulphide.[5]

1.1.2 **Plastic in Hot Bituminous Mix:** Plastic roads mainly use plastic carry-bags, disposable cups and LDPE bottles that are collected from garbage dumps. When mixed with hot bitumen, plastics melt to form an oily coat over the aggregate and the mixture is laid on the road surface like a normal tar road. Waste plastic at 6-8% of weight of



Fig 2: Bituminous Pavement Road (Source: [15])

bitumen can be used. Each kilometer of road with an average width requires over two tons of poly-blend. It shall help to reduce non-biodegradable waste.[6], [7]

1.1.3 Reclaimed Asphalt Pavement (RAP): Reclaimed asphalt pavement (RAP) is generated when asphalt pavements are removed for reconstruction, resurfacing, or utility work.[8] RAP is an admixture which can be added to bitumen. It replaces bitumen by 15 to 20%. If RAP is old, an additional additive is required. Usage of RAP is feasible only if there is a hot mix plant near the site. There are essentially two types of recycling technologies i.e. (1) In-place and (2) In-plant each having two variants, (1) Cold and (2) Hot. The choice of which method to adopt for recycling would depend upon economic, environmental and the capability (of producing the mix, meeting the design requirements) factors.[9]

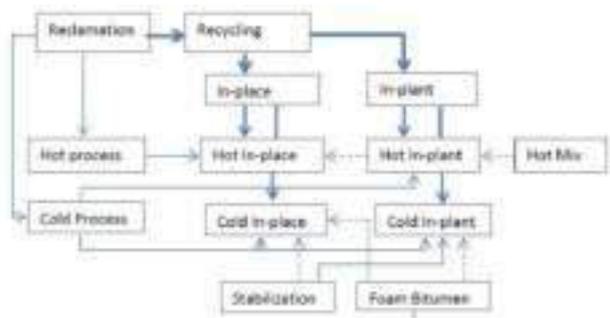


Fig 3: Overview of Reclamation & Recycling (Source: [16])

2. Rigid Pavements: Rigid pavements are those which possess noteworthy flexural strength or flexural rigidity and are made of Portland cement concrete either plain, reinforced or pre-stressed concrete.[10] Components of rigid pavements:

- i. Prepared soil subgrade
- ii. Granular sub-base (GSB) or drainage layer
- iii. Base course / DLC (Dry Lean Concrete)
- iv. Cement Concrete pavement slab using PQC (Pavement Quality Concrete) [11]

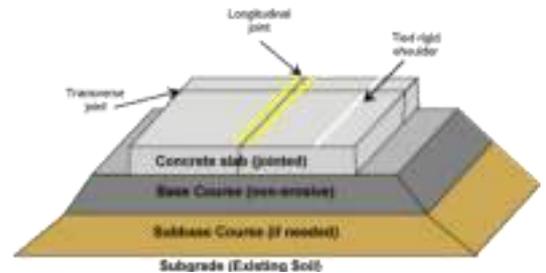


Fig 4: Schematic section of typical rigid pavements (Source: [17])

2.1 Rigid Pavement Materials:

2.1.1 Pavement Quality Concrete (PQC): Pavement Quality Concrete (PQC) is cement concrete made with large size aggregates in accordance with IRC specifications and laid over a dry lean concrete sub-base. Ordinary Portland cement (IS 269), Portland Pozzolana Cement (IS 459) & Portland Slag Cement (IS 1489) can be used for PQC. [12]

2.1.2 Ground Granulated Blast Furnace Slag (GGBFS) in Ordinary Portland Cement: Portland Slag cement is manufactured by either inter-grinding the Portland cement clinker, Gypsum and granulated slag or blending the ground granulated blast furnace slag (GGBFS) with Ordinary Portland cement by means of mechanical blenders. Slag cement is manufactured as per IS 455 – 1989 and quantity of slag added shall be in the range of 25% to 70%. The granulated slag if further grinded to a fine powder to make Ground Granulated Blast Furnace Slag which is a supplementary cementations material.[13] Use of Ground Granulated Blast Furnace Slag as an additive to Ordinary Portland Cement is mentioned in IS 456 : 2000 Plain & Reinforced Concrete – Code of Practice.



Fig 5: PQC Road (Source: [18])

Comparative Analysis of Flexible & Rigid Pavement Materials:

The comparison of materials is done with respect to the principles of construction management.

TABLE 1: Comparison of Flexible Pavement Materials

SR. NO.		PLAIN BITUMEN	PLASTIC IN HOT BITUMINOUS MIX	RECLAIMED ASPHALT PAVEMENT (RAP)	INFERENCES
PRE-CONSTRUCTION PHASE:					
1	Layer & Thickness	Surface Course 25 – 50 mm	Surface Course 25 – 50 mm	Surface Course 25 – 50 mm	Same for all the 3 materials
2	Raw Materials	Graded Aggregate, Bitumen, Filler, Cement Lime/Stone Dust, Water	Bitumen, Aggregate, Filler, Waste Plastic, Water	Bitumen, Aggregate, Filler, RAP, Water	Bitumen is the common base material
3	Equipment Required	Boilers, Sprayers/ Distributor, Hot Mix Plants, Truck/Dumper, Mechanical Pavers/Finishers, Rollers	Zhatak Machine, Agglomeration Machine, Boilers, Sprayers/ Distributor, Hot Mix Plants, Truck/Dumper, Mechanical Pavers/Finishers, Rollers	Central processing facilities for crushing, screening & stockpiling RAP Boilers, Sprayers/ Distributor, Hot Mix Plants, Truck/Dumper, Mechanical Pavers/Finishers, Rollers	Equipment required for laying are the same for all the 3 materials Equipment required for making the premix differs
4	Procurement Management	Bitumen is a waste product of petroleum, readily available Premix of the mentioned raw materials is transported to site	Waste plastic can be procured from Municipal Solid Waste, Segregated & Cleaned by SHG and then shredded using agglomeration machine	Generated when asphalt pavements are removed for reconstruction, resurfacing or utility work. Cold milling operations Full-depth pavement demolition Bituminous plant waste	Considering the admixtures, processing the waste plastic is convenient for all kind of locations
5	Human Resources Required	QC Engineer, Project Manager, Works Manager, Lab Technician, Surveyor	Municipal Solid Waste Contractor, Self Help Groups (SHG), QC Engineer, Project Manager, Works Manager, Lab Technician, Surveyor	Recycling plant in-charge, QC Engineer, Project Manager, Works Manager, Lab Technician, Surveyor	Few extra human resources required for Waste Plastic in Bitumen and RAP

6	Risks Associated	Improper surface preparation, mixing at undesired temperatures etc. could reduce the life of the road	Unspecified plastic & improper mixing could generate harmful gases	Choice of the suitable recycling option Improper material quality can affect the design mix Plant capabilities Logistics of operation	Proper planning of strategies to mitigate the risk associated with each of the materials is recommended
CONSTRUCTION PHASE:					
7	Storage of Raw Materials	The plant mixed material is transported to site via dipper and then covered to prevent loss of heat & moisture.	The plant mixed material is transported to site via dipper and then covered to prevent loss of heat & moisture.	The collected RAP is segregated as per sizes and stored in piles. The plant mixed material is transported to site via dipper and then covered to prevent loss of heat & moisture.	Proper storage of segregated RAP can be a challenge
8	Process of Laying	Surface Preparation Application of Tuck Coat Preparation & placing of premix Rolling Quality Control Finishing Open to traffic	Collection of waste plastic Cleaning & Shredding Heating of aggregate Injecting waste plastic Add bitumen Plastic Waste Coated Aggregate is mixed with hot bitumen for 15 sec Transport to site Laying on site Rolling, finishing Open to traffic	<u>Cold in-plant recycling:</u> Collection & segregation of RAP Measured quantities of RBM & fresh aggregates are cold fed into a twin shaft pug mill Injection of bitumen Mixing & blending of all the ingredients Transport to site Paving & compacting	The process of laying all the 3 materials is the same. The process of making the premix differs.
9	Time (per km lane)	1 to 2 days	1 to 2 days	1 to 2 days	Same for all the 3 materials Timeline differs for pre-construction activities
10	Cost (per km lane)	Rs. 25 to 30 lakhs (Rs. 6.5 to 8 lakhs/sq. km.)	Rs. 18 to 20 lakhs (Rs. 4.8 to 5.5 lakhs/sq. km.)	Rs. 22 to 25 lakhs (Rs. 5.8 to 6.7 lakhs/sq. km)	Construction of roads using waste plastic in bitumen is economical
11	Life / Maintenance	5 years	15 years	7 – 10 years	Waste Plastic in Bitumen gives better resistance to wear & tear
12	Sustainability	The worn out Bitumen Pavement can be re-processed and used as an admixture in new Bitumen works known as Reclaimed Asphalt Pavement (RAP).	Proper optimization of otherwise unused plastic waste RAP can also be used as an admixture	Proper optimization of otherwise unused pavement debris Reduces the consumption of the depleting natural resources	Waste Plastic in Bitumen can be recommended as a sustainable material

*RBM: Recycled Bituminous Materials

TABLE 2: Comparison of Rigid Pavement Materials

SR. NO.		PAVEMENT QUALITY CONCRETE (PQC)	GROUND GRANULATED BLAST FURNACE SLAG (GGBFS) IN ORDINARY PORTLAND CEMENT	INFERENCES
PRE-CONSTRUCTION PHASE:				
1	Layer & Thickness	Concrete Slab (Surface Course) 150 – 300 mm	Concrete Slab (Surface Course) 150 – 300 mm	Same for both the materials
2	Raw Materials	Cement, Chemical admixtures, Silica fumes, Aggregate, Water, Steel, Joint sealing compound	GGBFS, OPC, Chemical admixtures, Silica fumes, Aggregate, Water, Steel, Joint sealing compound	GGBFS can replace OPC from 30% to 50% by weight of concrete.
4	Equipment Required	Batching Plant Tipper Sensor Pavers Dumpers having hydraulic jack Joint cutting machine Dowel bar inserter Texturing & Curing Machine	Batching Plant Tipper Sensor Pavers Dumpers having hydraulic jack Joint cutting machine Dowel bar inserter Texturing & Curing Machine	Use of GGBFS will not require any new equipment
5	Procurement Management	Tenders are floated by NHAI / PWD / Govt. of Maharashtra with required specifications. The selected bidder procures the materials once the contract is awarded.	Slag is the industrial by-product of the steel industry. Leading cement companies like JSW Cement, Jagdamba etc. manufacture GGBFS cement.	Both the materials are readily available as per the requirement.
6	Human Resources Required	QC Engineer, Project Manager, Works Manager, Lab Technician, Surveyor	QC Engineer, Project Manager, Works Manager, Lab Technician, Surveyor	Same for both the materials
7	Risks Associated	Bad weather, bleeding of water etc.	Adulterated concrete, improper surface of laying etc.	Quality control checks are necessary as and when required
CONSTRUCTION PHASE:				
8	Storage of Raw Materials	Aggregate – stock piled at sufficient distance Cement – vertical silos Water – covered tanks All batching of materials shall be by weight.	Aggregate – stock piled at sufficient distance Cement – vertical silos Water – covered tanks All batching of materials shall be by weight.	Same technique for both the materials

9	Process of Laying	Locate the Batching Plant Mixing, Hauling Placing of concrete & steel Compacting, Finishing, Texturing Curing, Removal of Forms Sealing of Joint Grooves Opening to traffic	Locate the Batching Plant Mixing, Hauling Placing of concrete & steel Compacting, Finishing, Texturing Curing, Removal of Forms Sealing of Joint Grooves Opening to traffic	Same technique for both the materials
10	Time (per km lane)	28 days including curing	28 days including curing	Same time required for construction for both the materials
11	Cost (per km lane)	Rs. 12 – 15 crores (Rs. 3.2 – 4 crores / sq. km.)	Rs. 12 – 15 crores (Rs. 3.2 – 4 crores / sq. km.)	Cost of laying both the materials will almost be the same because the difference in cost of cement & GGBFS is only 1 Rs/kg
12	Life / Maintenance	18 years	20 years	The wear & tear resistance of GGBFS is longer than PQC
13	Sustainability	15 - 20% cement can be replaced by Coal Combustion Products (ex. Fly Ash, Bottom Ash, Boiler Slag etc.)	Reduction in CO ₂ emission, conservation of natural resources, life cycle cost, enhanced engineering properties, cost economy, low energy consumption etc.	Replacing up to 50% of OPC with GGBFS makes the formulated Portland Slag Cement an eco-friendly material

Sustainability Aspects of Pavement Materials:

Behavior of the material during each of its stage of life plays a crucial role in determining the sustainability of that material. Each color depicts a quantitative marking range out of 10.

TABLE 3: Sustainability of Pavement Materials

Life Cycle Activities	Plain Bitumen	Waste Plastic in Bitumen	RAP	PQC	GGBFS in OPC
Extraction of Raw Materials					
Material Production					
Transportation					
Construction					
Maintenance					
Operational Phase					
End of Life Phase					

	Not sustainable 0 – 2.5		Less sustainable 2.5 – 5		More sustainable 5 – 7.5		Most sustainable 7.5 – 10
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CONCLUSION:

This research gives a pallet of the conventional materials currently used in the industry. A fair review of each of these materials shall help the concerned personnel to select the most sustainable material one can use as a road pavement. An evaluation based on technical, environmental and economic factors indicated that Waste Plastic in Hot Bituminous Mix for flexible pavements and Ground Granulated Blast Furnace Slag (GGBFS) in Ordinary Portland Cement for rigid pavements have significant potential aspects to replace conventional materials for various applications in rehabilitation of urban road construction. Thus, a further scientific research is recommended before the specified waste materials are finally approved as an alternative road construction and rehabilitation material. These materials are not extensively in use due to lack of awareness about them, but their usage can be envisaged in the near future.

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Feasibility of Including Water Recycle Plant - A Case Study for an Existing Residential Project at Solapur

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Abstract

Water scarcity is a common problem in most of the cities in Maharashtra, especially in the South and North Maharashtra. Solapur is one of the cities located in the South West of Maharashtra. The city sees a very low and random rainfall every year. This causes a lesser water availability and subsequently, lesser water supply by the corporation. In this research paper, the difference between water supply and water demand for the existing residential project in Solapur is studied. The water shortage issue is studied using water recycled from waste water generated by the existing residential project. Different water recycling methods are discussed and the use of the root zone system is evaluated. The appropriate water recycling method is proposed for the implementation to reduce water shortage issue throughout the year and to make the existing residential project sustainable with respect to water supply.

Keywords

Water Recycle, Water Consumption, Water Supply, Solapur, Rainfall, Waste Water Management

I. INTRODUCTION

To become happy or satisfied in the life, the human being consumes things, places and even people for socialization. Thus, we, as human beings, have different needs to fulfill at different stages of life. Food, clothes and shelter are identified as basic needs of the human beings. However, there are other things such as water, air etc. which cannot be denied as essential needs. The way we require clean air for breathing, the water has also got equal importance for living. Water is used for day to day activities such as bathing, washing clothes, cooking etc. and everyone around us requires water for daily consumption.

In civilized places, people live in a well-constructed houses. Well-constructed houses mean well planned houses that are designed and constructed according to the needs of the people expected to live there. In this paper, we are discussing about an existing residential project and the focus is to meet their need for water or water demand throughout the year. One of the major sources of water for the project is the rainfall. However, if the rainfall is not adequate to meet the water demand, one has to find other means to cater to the desired demand. Accordingly, an existing project from Solapur city is selected for the study purpose.

This work focuses on checking and verification of the following points.

- Whether the existing residential project can be adapted to water recycle system and which method is suitable for the existing project
- Whether inserting and including a recycle system is possible, efficient, useful and beneficial
- Whether the layout and building infrastructure changes are possible

The cost of water recycle plant (if feasible) is out of the scope of this case study.

II. EXISTING RESIDENTIAL PROJECT SELECTED AS A PILOT PROJECT

For this work, an existing residential project is considered. This project is located at the Solapur city in Maharashtra state as shown in Figure 1. The area of the plot of the project is 2629.07 sq. m. This existing residential project was completed in 2014. This project (or apartment) has two wings, namely A and B. Wing A and wing B have P+6 storied. Wing A has 36 units and wing B has 24 units. Thus, there are 60 units in total. Out of total units, 12 units are of 1 BHK configuration and remaining 48 units are of 2 BHK configuration. There is no existing water recycling plant.

III. NEED FOR A WATER RECYCLING SYSTEM

The primary question to be addressed is that whether the existing residential project needs a water recycling system. To answer this question, one should know the water demand, water supply and water balance of the residential project.

As stated in section 2, there are total 60 units in the said residential project. Assuming that there are four people residing in each flat or unit on an average, irrespective of the configuration, total number of people residing in the apartments of residential project is 240 (=4 x 60 units). The average water consumption by a person per day [1] in the Indian city is 135 LPD² as given in Table 1. The total water demand for units (from the 240 people residing in 60 units), total fresh water demand and total recycle water demand for the residential project is given in Table 2. The water demand considered the water consumption by the people and the society. It is assumed that in the units, the recycle water can be used for flushing only. Rest all usages, in the units, require fresh water. Also, the water consumption of the society is assumed to be 10% of the total water consumption of the units. For the society, the ratio of fresh water to recycle water is assumed to be 1:3. Thus, the total water demand of the project is 35,640 LPD.

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² LPD – Litres Per Day



Figure 1: Project site location map

Table 1: Average water consumption per day per person [1]

Sr. No.	1	2	3	4	5	6	7	
Use	Drinking	Cooking	Bathing	Washing of clothes	Washing of utensils	Cleaning of houses	Flushing	Total
Consumptions (LPD)	5	5	55	20	10	10	30	135

Table 2: Water demand in LPD

Total units	Total water demand for units	Fresh water demand for units	Recycle water demand for units	Water demand for society	Fresh water demand for society	Recycle water demand for society	Total fresh water demand	Total recycle water demand
60	32,400	25,200	7,200	3,240	810	2,430	26,010	9,630

This apartment (project) has three SMC³ water connections and two bore wells. The apartment⁴ has an overhead water tank of 30,000 liters capacity and an underground tank of 50,000 liters capacity. In the month from July to March, the water demand is managed by water supply from SMC and water from bore well. However, in the month from April to June, two water tankers are required currently to meet the water demand everyday as given in Table 3.

Table 3: Water supply sources

Period	Water supply from SMC		Bore well	Tanker ⁵
	Liters	Frequency	LPD	LPD
July-March	60,000	Once in four days	20,640	-
April- June	40,000	Once in a week	9,930	20,000

The water balance or shortage in LPD for the months from July to March and from April to June is shown in Figure 2 (a) and 2 (b) respectively. Presently, this shortage is addressed by using bore well water in the months from July to March and using bore well water as well as water tankers in the months from April to June as given in Table 3. Water shortage or scarcity results in the purchase of a costly water tanker during summer days (April to June) which increases the maintenance cost as well as compromises the quality of water.

Thus, there is a need for a water recycling system to this apartment to cater to water balance or shortage. The maximum recycle water demand is 9,630 LPD. If a water recycling system of 10,000 LPD is designed and installed, there will be a reduction in bore well water consumption by 10,000 LPD in the months from July to March, and the apartment will require one tanker (of 10,000 liter capacity) less everyday that can save Rs 2000 per day in the months from April to June.

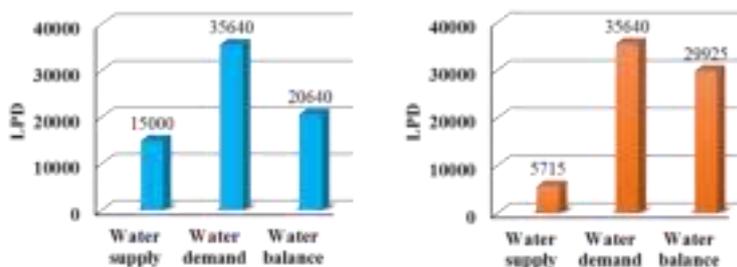


Figure 2: Water Balance (a) July To March, (b) April To June

³ SMC – Solapur Municipal Corporation

⁴ The Fire water tank capacity (40,000 litres) is not considered for the study as the water stored in the fire water tank may not be utilised on the regular basis.

⁵ Each water tank of capacity 10,000 litres costs Rs 2,000.

IV. FEASIBILITY OF WATER RECYCLING SYSTEM – QUANTITY OF WATER PERSPECTIVE

Waste water is mainly the used water. In residential area, waste water is generated from kitchen, sinks, bath area, washing machines and toilet. It contains substances like human waste, food, scraps, oils, soaps and detergents. This used water can be recycled which will make an additional source of water supply. The three types of waste water in residential areas are the kitchen out flow, gray water and black water. Kitchen out-flow is used water from kitchen sink and washing of utensils. It is about 10-15% of the total usage. Gray water is used water that comes from bathing, washing of clothes, bathroom sinks and washing machine. It is 50-60% of the total usage. Black water is used water which comes from the toilet and it is 30-40% of total usage.

Gray water generation = 85 % of used fresh water (26,010 LPD) = 22,108 LPD

Black water generation = 95 % of used recycled water (9,630 LPD) = 9,148 LPD

The apartment generates enough waste water that can be recycled using a water recycling system to meet the water consumption of 10,000 LPD. Hence, the existing project can be adapted to a water recycling system.

V. SUITABLE METHODS FOR WATER RECYCLING SYSTEM IN EXISTING RESIDENTIAL PROJECT

There are different wastewater management methods such as rain water harvesting, roof top harvesting, ground water recharge and water recycling. However, most of them depend upon rainfall. Since the amount of rainfall is negligible in Solapur city, water recycling method is the most suitable method for waste water management in the existing residential project.

Three water recycling systems are considered for this study, namely, sewage treatment plant (STP), reed bed system and the root zone system.

Electrocoagulation-based STP [2] system is a wastewater treatment technology, in which wastewater is recycled by passing the electricity and reusing the water for non-potable purpose, such as toilet flushing, vehicle (two or four wheeler) washing, gardening and society cleaning. This method can be used for recycling gray as well as black water. The system does not require chemical or biological medium for treatment. It is a costly solution as compared to other methods.

The reed bed system [3] is a natural method in which wastewater passes through the root zone of the reed where it undergoes treatment. Types of reed beds are horizontal flow reed bed and vertical flow reed bed. The vertical flow system is more effective. The reed bed system requires regular maintenance.

The root zone system [4] is a natural water recycling method in which water flows as per the slope of the ground. Hence, there is no need of any external energy. The water from one chamber flows into the other chamber due to the ground slope. The water is passed through the layer of soil, sand and pebbles as shown in Figure 3. The semi aquatic plants supply oxygen to the bacteria in the soil, at their root zone, that helps to break down the organic compound from the gray water which leads to clean water. It requires low maintenance and its has low operating cost.

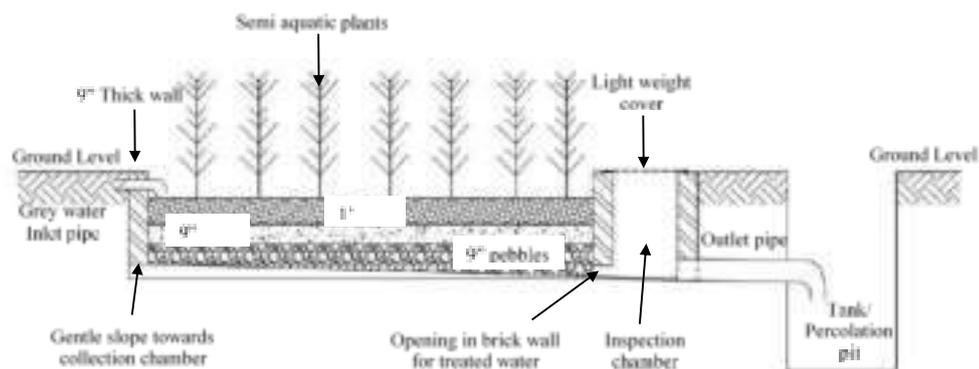


Figure 3: Root zone system [5]

Black water contains organic matter which contains pathogens that causes diseases. Hence, black water is not considered in this project for waste water recycling. For gray water recycling, the root zone method is suitable considering its low maintenance and low operating cost and is proposed for the existing residential project.

VI. FEASIBILITY OF WATER RECYCLING SYSTEM – EFFECTIVENESS AND IMPLEMENTATION PERSPECTIVE

The root zone system requires approximately 2.5 sq. ft. area for treating water at a rate of 50 LPD [6]. Although, the gray water generated in this residential project is 22,108 LPD, only 10,000 LPD of recycled water is required. Vipat V, *et. al.* [5] has shown that the efficiency of the root zone system lies in the range of 65% to 90%. Thus, the residential project requires treatment of 11,111 LPD to 15,385 LPD water considering the efficiency of the system at 90% and 65% respectively. To treat this amount of water, it requires an area of 555 to 770 sq. ft. within the plot. The site plan of the existing residential project is shown in Figure 4. Wing A and wing B are adjacent to each other. There are two roads facing front (towards 18 m wide road - South side) and rear side (towards 9 m wide road - North side) of the plot. There is a compound wall on the East and West side of the plot. It is possible to allocate 700 sq. ft. of area (in total) adjacent to the compound wall. This area is marked with hatch lines as shown in Figure 4 and can be used for installing the root zone system without affecting the usage of open area for two wheeler parking. It should be noted that the ground floor has only facility for parking that makes implementation of root zone system simple. Thus, it is feasible to introduce a root zone system within the available plot area.

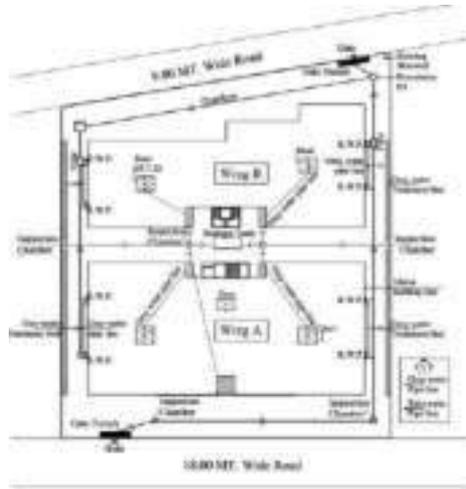


Figure 4: Feasibility plan for existing residential project

The existing residential building has separate pipelines of toilet, bath and kitchen. Presently, the gray and black water goes into the sewage line. To implement the water recycling system, the gray water needs to be diverted from bathroom and kitchen to the gray water treatment bed. It is easy to divert gray water by adding PVC elbow pipe and flexible pipe at the end of the existing pipe. The inspection chambers, filter tank and treated water storage tank can be constructed under the ground in the setback area of the plot. The treated water storage tank is proposed to be placed in the space available between the two wings. There will be only one storage tank in the parking floor. Additionally, a storage tank (precast water tank of 7,500 liters capacity) is proposed to be provided on the terrace of each wing. A separate pipeline need to be provided between the precast water tank and individual flats for flushing. These pipelines should have proper nomenclature for easy identification of treated water line. To improve the water level of bore well, rain water can be used by providing gate trench at both the gates inside the plot. The slope of the ground around the building need to be modified such that the rain water passes through gate trench. The water from roof can also be diverted to the percolation pit (Figure 4). This water is proposed to be collected in the percolation pit near the existing bore well in the North East corner so that water gets absorbed in the soil. This will ensure that the more quantity of water will be available from the bore well.

VII. CONCLUSION

In this research work, an existing residential project was studied for the need of installing the water recycling system. Accordingly, an analysis of water supply, water demand and water balance was presented. It was found that water recycling system of 10,000 LPD capacity can save usage of 10,000 LPD water usage from bore well during July to March period and the cost of a water tanker (with 10,00 LPD) can be saved during April to June period. Out of the different water recycling methods, root zone system was proposed considering its low maintenance and operational cost. Feasibility study of the root zone system in terms of quantity of waste water generated, quantity of treated water required, the effectiveness of the system and its implementation was presented. With its efficiency from 65% to 90%, 700 sq. ft. of area was identified along the compound wall of the site. A common storage tank was proposed between the two wings on the parking floor. Two precast water tanks, one each on the roof of each wing of 7,500 liters capacity is proposed. A separate pipeline needs to be put between the precast water tank and individual flat for flushing purpose. The proposed solution ensures sustainable water supply to the existing residential project throughout the year.

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REVIEWING THE RERA CLAUSES TO STUDY THE IMPACT ON RERA REGISTERED PROJECT WITH RESPECT TO TIMELINE

Housing projects located on the outskirts areas of Pune region

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ABSTRACT

Maha Real Estate Regulatory Act (RERA) came into force on 1st July 2017. RERA was formed to bring transparency, accountability and efficiency in this sector with the rights and duties of both buyers and developers being clearly defined. Individual states established state level regulatory authorities in a phased manner. RERA covers both existing and new projects. The act contains total 92 sections. Authority also holds the rights for registering, monitoring and regulating housing projects. The paper aims to study and understand RERA clauses with respect to the time period and the impact of time period of registration on projects through case studies. Objective of this paper is to understand Study factors considered for declaring project deadline. Reasons for extension, Market suitability, RERA registration finished date and occupancy date. Impact on ongoing and new projects registered to RERA. Methodology adopted by studying document Real Estate Regulatory (Regulation & Development) Act 2016. Data collection, case studies analysis and findings.

Key words: RERA registration; impact; project; time period; MAHARERA

INTRODUCTION

Real Estate is the 2nd largest industry after agriculture. Before introduction of RERA limited Acts were present like Maharashtra Ownership Flats (Regulation of the Promotion of Construction, sale, management and Transfer) Act, 1963, Maharashtra Apartment Ownership Act, 1970 and Consumer Act 1986. Till 2015 no single window regulatory authority existed. The bill was passed on 10th March 2016 by the Rajya Sabha. The RERA Act was effective on and from 1st May 2016. During this time, Out of 92 sections, 52 were notified. All the other provisions were effective on and from 1st May 2017. The act contains total 92 sections out of which 4, 5, 6 and 7 sections are related to timeline of the project. Real Estate Regulation and Development act changed the unstable and unregulated real estate sector. The act is useful for all stakeholders of the project. "An Act established the Real Estate Regulatory Authority for regulation and promotion of the Real Estate sector and to increase safety and confidence for the transactions in construction sector" [1]. The act protected the interest of consumers in real estate sector. The act came into force to fill up the gaps between the various stakeholders associated in a real estate transaction. There was a lack of proper regulatory framework. "RERA is the revision to form the framework for construction project Management" [2]

Before RERA was implemented buyers faced the following problems like project delay, high rate of interest charged on late payment, multiple bookings for same property, price escalation, shoddy construction, lack of timely judicial remedy and funds collected from the buyers were utilized for other projects resulting in cancellation of the projects. Even developers faced problems like delay in permissions and late payments by buyers. Act came into force to bring all the stakeholders of the project on single platform regarding the rules, regulations and duties to be followed. It helped in protecting the buyer and boosted the real estate investments.

Purpose of research paper is to study RERA clauses related to timeline of project and to make aware and understand stakeholders of the project about impact of delays and to work out the timeline of the project beforehand to control the delays.

The paper aims to study and understand RERA clauses with respect to the time period and the impact of time period of registration on projects through case studies. Due to RERA developers are bonded to the stated timeline of the project. Objective of this paper is to understand and Study factors considered for declaring project deadline. Reasons for extending the completion date. Market suitability for deciding project finished date. Understand the finished RERA registered time period with respect to the execution of the project, RERA registration date with respect to the construction stage of the project and RERA registration finished date with respect to the occupancy date. Impact on ongoing projects registered to RERA and new projects registered to RERA. Methodology adopted by studying the document Real Estate (Regulation & Development) Act 2016. Analysis of data collected and statement of findings through case studies of the affordable housing projects from outskirts areas of Pune region.

Scope and limitation of research paper are as follows- as the extent of RERA act is wide and contains total 92 sections and applies to both residential and commercial projects having proposed land area above 500 sqm within state, limitation for research paper is to study residential housing projects from outskirts of Pune region

Note- If the deadline is not met developer is liable for penalty. It also includes offences, penalties and adjudication under section 59-72 in case of any failure.

"How will RERA, 2017 impact Indian real estate industry in the long by Anubhav Pandey stated the problems faced by consumers before RERA was the Long term delays up to 3-5 years, in handing over of units. Mentioned protection from the RERA act that the developer must complete the project before the completion date mentioned in the Agreement and hand over the project to the home buyers, in case of delay, the developers are required to pay compensation to the buyer of the units, for the period of delay" [3] "Study on impact of RERA and GST on construction sector by Nivedita S Karnawat1 Asst. Prof. Harshita Ambre2 concluded that the project completion burden will be crucial; it is possible that the developer may transfer this risk to contractor and hence the liquidated damages clause would become more effective" [4] "Impact of Real Estate Regulation and Development Act (RERA) on India's Real Estate Sector by Somdutta P. Patil1, Prof. Ashish P. Waghmare2 studied the scope of the real estate Regulation and development act and its impact new and ongoing projects and concluded that advantages of RERA as timely delivery of flats and builders had to change their design and estimates and other services which he is going to provide" [5] "Delays in Construction Projects: Causes, Effects and Impacts of RERA by 1Akshaykumar P. Udasi, 2Milind M. Darade studied the major causes of construction delays and concluded the Effects of delay: Schedule Overrun or Time Overrun. Time is the significant project outcome which decides the standard of any project. If the project not completed within the specified time, there is no use of setting the time scale restrictions, which will seriously affect each and every other outcome. Delay in one activity impacts the other as they are interlinked and dependent on each other. If the project is completed as per schedule, the project review meetings can be conducted at regular time basis. Clauses included in Real estate regulatory act which will reduce delays in construction projects-Written affidavit- along with all the required documents, the promoter has to give a declaration, supported by an affidavit stating the time period within which the project or the specific phase will get completed. Ongoing projects affected by the RERA are at closure stage" [6]

Criteria for selection of case study

Construction Technology-RCC footing, foundation, column, beam and slab, brickwork, plastering and painting

Area1BHK (40-60sqm), 2BHK (60-75sqm)

1BHK with Bath (2.2 to 2.5 sqm), WC (1 sqm)

2BHK with Bath (2.2 to 2.5 sqm), WC (1 sqm) and attached Toilet (2.5 sqm)
 Height-G+3 to G+7
 Terrace- 2.5 to 7sqm
 Balcony- 2 to 3.5sqm

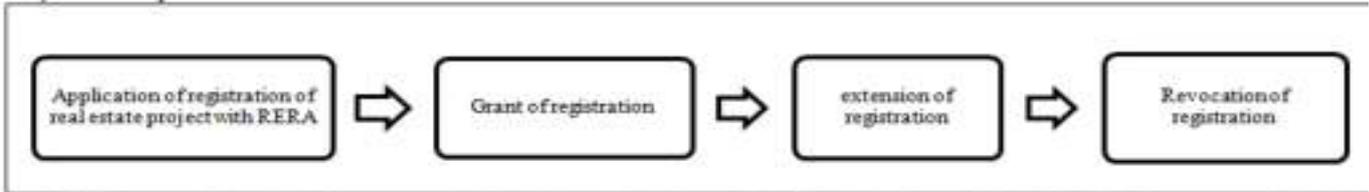


Figure 1-RERA process flow chart with respect to timeline of the project (Source- "Real Estate Regulatory (Regulation & Development) Act 2016")

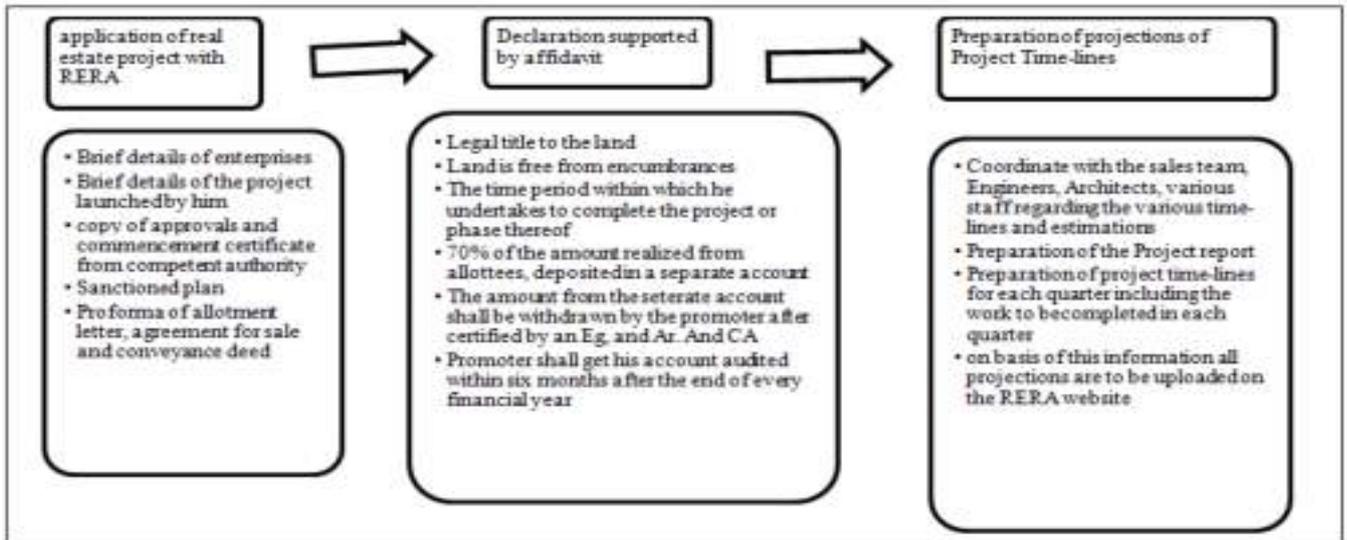


Figure 2-Registration of real estate project with respect of registration time period (Source-"THE REAL ESTATE (REGULATION AND DEVELOPMENT) ACT, 2016 AND RULES 2017, MahaRERA")

Impact of RERA on timeline (clauses)

- Section 4- Application for registration of real estate project- subsection 2** enclose the following documents along with application- I declaration supported by an affidavit stating – C the time period within which promoter undertakes to complete the project or phase thereof.
- Validity period of registration-** "The period declared by the promoter at the time of registration of project shall define validity period of registration." [7]
- Section 5- Grant of registration- Subsection 3** the registration granted shall be valid for a period declared by the promoter.
- Section 6- Extension of registration-** registration granted may be extended by the authority on an application made by promoter under reasonable circumstances and shall not exceed a period of one year
- Section 7- Revocation of registration-**in case of unfair practice or on receipt of complaint or in case of default by promoter may revoke the registration with 30 days prior notice

Source- "THE REAL ESTATE (REGULATION AND DEVELOPMENT) ACT, 2016"

Advantages and disadvantages of timeline clause

Advantages-

- Its benefitted to all stakeholders of project
- Completion of project within specific time period
- Broader perspective related to scheduling specifying the work progress, project report, estimations and cash flow of project
- Peace of mind for all stakeholders
- Concentration and timely completion of one project

Disadvantages-

- Initial time and cost of project is increased
- Scheduling, preparing reports, quarterly audits are repetitive process which may take time
- Cost overrun may happen due to more resources used for completion of project due to time bound

Mainly 3 possibilities for project completion with respect to RERA registration

- Project may complete within specified time period
- Project may complete before completion of RERA registration period or
- Project may complete with extension period required for completion

Possible reason for extension

External Factors

- Effects of unforeseen subsurface and changing ground condition (e.g. Soil, high water table) factors
- Delay in obtaining permits from municipality
- Weather, rain effects on construction activities
- Changes in government regulations and laws
- Litigation

RERA Related

- The time consumed in obtaining all approvals

2. Delay due to re-work of specification area
3. Delay obtaining completion certificate" [5]

Construction related

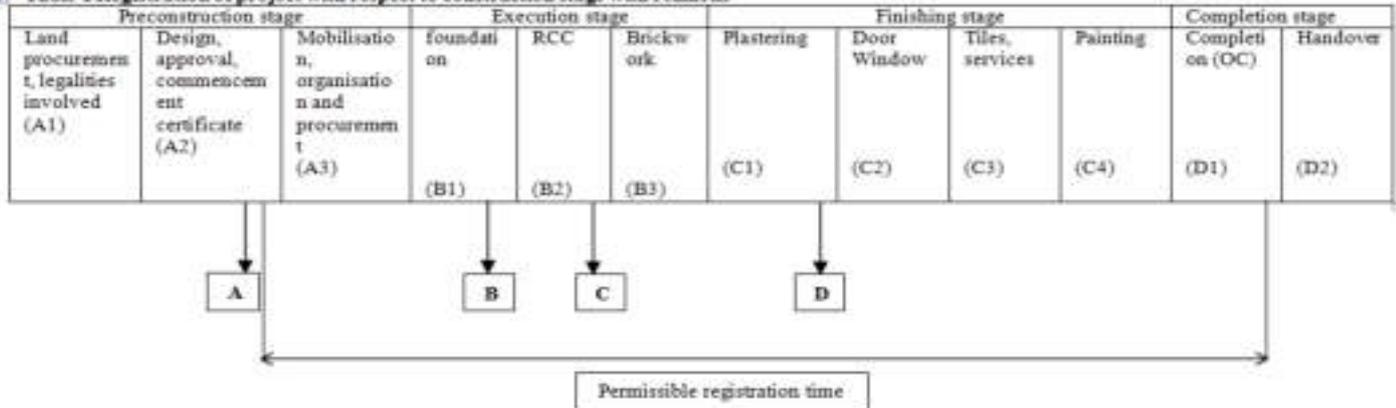
1. Due to additional FSI and extension
2. Change of preferences for execution of work

Methodology

To study and understand the factors considered for RERA registration time period of project through following points

1. Complete RERA registered time period with respect to the execution of the project
2. RERA registration date with respect to the construction stage of the project
3. RERA registration finished date with respect to the occupancy certificate

Table-I Registration of project with respect to construction stage with remarks



Permissible registration time is from issue of commencement certificate till the time of the occupancy certificate

Impact of registration at particular stage of construction

- A. Early sale and marketing of project will start
- B. For capital and investment purpose and approval of loan and disbursement of loan
- C. to start the sale after sample flat is ready
- D. Late sale and marketing of the project due to the well management of funds, project will run smoothly and on time

Requirements for registering to RERA

1. Commencement Certificate by Competent authority along with project details, declaration supported by affidavit by the promoter.
2. Required necessary permissions, approval, drawings before registration to RERA

Implications of RERA completion or closure

1. Closure of separate account (Escrow A/C), after receiving the Occupancy Certificate by the competent authority. Remaining sale of the project will continue after completion of RERA registration.
 - a. Occupancy Certificate can be obtained before RERA finish date or with RERA finish date
 - b. In some cases if litigations are there Occupancy Certificate can be obtained after RERA finish date
2. After completion of RERA registration if necessary promoter has to attend the matters related to the customer for particular project

Table-II Case study

Description of housing project	Blossom (P+11)	Sai Vihar (P+4)	Palmetest	Arbano	Onkar Meadows	Kalp Homes	Pranam	Pratham.	Madhupu shpa (P+7)	Krishnaka Residential
Location of project	Wagholi Tal. - Haveli,	Lavale, Tal. - Mulshi	Wagholi	Wagholi	Wagholi,	Chakan	Talegaon Dhamdhare	Tal. - Shirur	Pirangut	Dehu road
Plot Area SQM (Scale)	9200 (High)	1700 (Small)	24462 B/up-2492 (Small)	6598 (Med)	925 (Small)	1500 (Small)	8000 (High)	8541 (High)	6400 (Med)	6100 (Med)
Date of commencement of project	Aug 2015	Mar 2017		May 2016	Ist commencement March 2017 IInd commencement Jan2018	Mar 2018	July 2016	Aug 2016	Mar 2015	Jan 2018
Date of issue of registration	Aug 2017	Aug 2017	Mar 2018	Aug 2017	Aug 2017	Nov 2017	Aug 2017	Aug 2017	Aug 2017	Apr 2018 (B1)
Construction stage @ registration time	B2	B2	Execution of wing 4 yet to start	B2	B2	B2	B1	B2	B2	B2
Date of occupancy/handover after completion	Nov. 2019				June 2018	Feb 2019		Mar 2018	April 2019 For 'B' Bldg	
Date on which	June 2020	Dec 2021	Dec 2021	June 2020	June 2018	Dec 2018	Mar 2020	Dec 2017	June 2019	June 2021

registration finishes										
Date of extension of registration with period of extension			June 2021				Dec 2020	May 2018	June 2020	
Reason for finished date with respect to completion						Legal Issues				
Reason for extension			Approval and external factors				Construction and FSI addition		Construction and external factor	

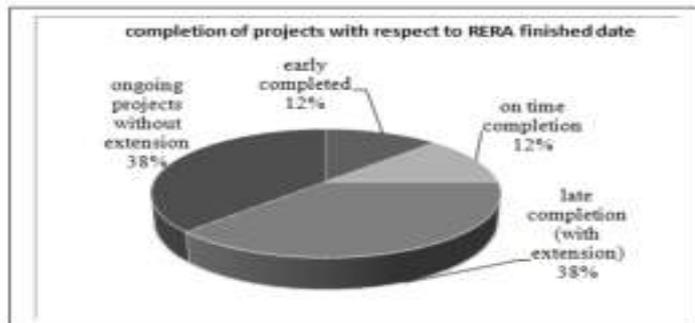


Figure III- showing completion of the projects with notified respect to the RERA registered time period

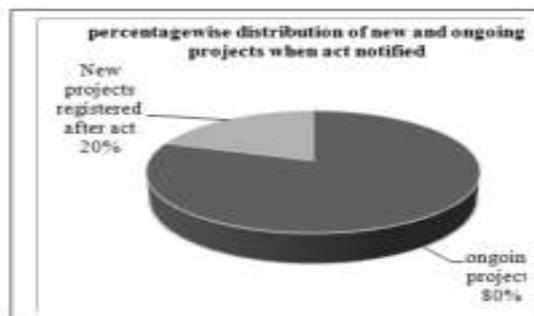


Figure IV- showing % of new and ongoing projects when act notified

Findings of 10 case study projects from outskirts of Pune region -

- Completed projects 50% and constructionwise ongoing projects 50%
- Completion of projects with respect to RERA finished date
 - Early finished projects- 12%
 - On time finished projects- 12%
 - Late completed projects with extension- 38%
 - Ongoing projects without extension- 38%
- Reasons for completion with extension was change of priorities related to the construction, approval delay, FSI addition
- Due to litigations one project received OC after RERA registration finish date
- Last date for registration was mentioned by the authority for Ongoing projects when act notified

Conclusion-

- Ontime and early finished projects are less as compare to the projects completed with extension
- Projects which are finished with extension were ongoing projects when act notified, suddenly project has to follow change in policies, procedures, schedule and budget
- Projects finished before and ontime were due to preplanning which helped in maintaining the customer and promoter relationship

Inferences-

- Ontime or early finished projects with respect to the RERA finished date will benefit from sell and marketing point of view, will benefit customer by early possession and hence saving in rent paid by customer. there is confidence gain in market
- RERA registration period worked out by preplanning, considering execution stages and by maintaining delay buffer time of about 6 months to avoid extension process and extra charges incurred for extension
- Its mandatory to get OC before RERA finished date as occupancy date or RERA finished date is mentioned in agreement of sale, in case of any delays or penalties agreement of sale holds a legal document as proof
- Buffer time of early completion can be utilized for new projects to start early
- Impact of timeline on project- less litigations, no penalties, fair practice

Recommendations-

- Every activity in a project is interlinked with other and will delay the other activity will have impact on other activities so its beneficial to preplan, execute accordingly, monitor, involve all stakeholders and schedule intermediate meetings
- Well managed project can reduce time overrun and eventually cost overrun
- Delays other than force majeure can be avoided, hence extensions can be avoided
- RERA registration finish time can be decided after considering extension time, to avoid extension process and charges
- Penalties, disputes can be avoided if project is completed within stipulated time period,

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RE-CONNECT WITH NATURE

The first step for sustainable living.

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ABSTRACT

Our cause for concern today are the many environmental impacts we are facing, like temperature rise, climate change, floods etc, which are a direct result of the ever increasing population and their way of living. When we analyse this situation, from grass root level, we find a severe disconnect between Man and Nature. If we browse through our history, we understand man's evolution from caves, i.e prehistoric times, to highrise dwellings, in current times. In simpler terms, his journey where he lived in and amidst nature to his moving up and away from nature.

Different measures are required to be taken, on different scales, to mitigate these environmental concerns. 'Sustainability' means the ability to sustain for the longest, is the key to manage, mitigate and prevent these environmental concerns. This can happen when the inter dependency of Man and Nature is in balance with each other. To achieve this balance, the connection between them has to be reinstated, for Man to understand ways in which he can adapt a new lifestyle, wherein Nature plays an equally important part.

This research primarily focuses on the hypothesis that " As we have started living in high rise buildings, the more disconnected we are with the nature."

In response to catering the needs of this growing population, we provide housing units, which are high rise. This is unavoidable. But can we also give these units some of their deserving share of nature, for them to reconnect with nature again.

This study focuses on sustainable landscape interventions to make this re -connection happen again, from a single dwelling unit scale to a residential colony scale.

KEYWORDS : Sustainability, Terrace Gardens, Kitchen Gardens, Balcony Gardens, open spaces.

INTRODUCTION:

1. Today we are facing many environmental issues like, Global warming, Climate change, Floods, Droughts etc., the gravity of which is very strongly felt today as the aftermath of these issues causes a lot of pain to us. Everyone today wants that peaceful balance restored between Man and Nature. But, to regain that balance, we have to change, change our lifestyle, change our habits and manners, change the way we look and treat Nature.
2. If we look at any village scenario, the connection between Man and Nature is very strong. A house made up of locally available material, which opens up into a frontyard and a backyard. Front yard, the main gathering space, is coated with cow dung, enabling small insects to survive within them, which in turn allows birds to come and feed on them. A house with a live fence, i.e. fence made up of shrubs, which allows small animals to pass through it, keeping their corridors intact. The backyard is mostly used for growing vegetables or as a Kitchen garden. The dung of domesticated animals is used as a manure to grow these vegetables. There is a very thin line between indoors and outdoors This inter-dependency on each other for sustenance makes it a stronger sustainable module. This module is somewhat absent in cities. We have houses in a building. Buildings which are multi storied to high rise. As we move up from ground level, our association with it starts reducing. Our front yards are converted to terraces, with a definite space. Backyards are converted into balconies. The experience of Nature as a 'whole' starts getting fragmented. It is the call of the current times to inculcate this sustenance module in a city life, to secure our future, to restore that peaceful balance between Man and Nature.

AIM :

3. The aim of this study is to identify sustainable landscape interventions to make the connection between Man and Nature happen again, from a single dwelling unit scale to a residential colony scale.

CONTENT:

4. To address our aim, this study is undertaken in two parts,
 - a) **Hypothesis:** This part deals with the hypothesis, "As we have started living in high rise buildings, the more disconnected we are with the nature." Surveys were taken to prove this hypothesis correct and also identify issues associated with it.
 - b) **Solution:** This part deals with addressing those issues by identifying landscape intervention areas and giving guidelines to achieve a better sustainable module in a city life.

HYPOTHESIS:

5. It was important to study and analyse the present scenario, to understand this disconnect with Nature. For the same, we took a survey of people, of varied age groups. Most game changer questions, which led us to get the most clear picture of present scenario, were the following,
 - a. What is your age?
 - b. What floor of building do you stay?
 - c. Do you have your own Garden? If no, what is your reason?
 - d. Have you ever plucked flowers / fruits directly from a tree?
 - e. When was the last time you planted a plant?
 - f. Do you go to your terrace/ balcony / window to see trees, birds, sunrise, sunset or any scenic view ?
 - g. How often do you do that?
 - h. Do you see Birds in your vicinity? Which birds?
 - i. How often you visit public parks?
 - j. Memories from childhood with your association with Nature?
6. The Analysis of the answers to these questions, led to very interesting findings.

- a) Out of all the people who took the survey, 75% lived in a Residential Apartment, out of which 30% lived above 4th floor, 43% lived in upto G+3 and 25% lived in Bungalows.
- b) Now out of all the people who lived above 4th floor, 70% had ONLY balconies as their connecting space between indoor and outdoor.
- c) Around only 55% of the people had plucked a flower, fruit from a tree.
- d) This is alarming, because it contained people mainly from Age group 40-60 and above. The younger generation is devoid of this experience.
- e) Another alarming observation which came forward was, 50% of the people have not planted any tree / shrub in past one year.
- f) Almost 10% of the people have not planted a tree in almost 5-8 years.
- g) 46% of the people who took the survey, did not have their own Gardens.
- h) When further analysed the reason of the same,
 - 64% people said 'no space'
 - 26% people said 'cannot maintain'
 - 10% people said 'no time'.

That starkly highlighted the point, that if we provide 'space' and give 'maintainance assistance', we might get better results in bridging the disconnect.

- i) The bird species observed were very common, like sparrows, crows, pigeons, koyal, bharadwaj, parrots.
 - j) Almost 55% of people had their own society garden. But again the issue highlighted was only 35% went there daily, 25% went there weekly and rest rarely went there.
 - k) In simple terms, people accessing the common open space of a residential colony on a daily basis was only 35% of the total occupancy.
 - l) When asked about how many visit public parks, 60% said rarely or once in 6 months. This was again an alarming situation highlighting the disconnect between Nature and Man.
 - m) So, When further analysed, we came to the following conclusions,
 - People having their own Garden, rarely visits public parks.
 - People having their own Colony garden, rarely visit public parks.
 - But People without their own colony/society garden (45%) also rarely visit parks. This becomes a cause for our concern, again highlighting the major disconnect between Man and Nature.
 - n) When we asked people what was their association with Nature from childhood, which they miss today, we primarily got the following answers,
 - working in their kitchen gardens.
 - playing on trees and plucking fruits.
 - watering and planting plants
 - having lunch and snacks beneath trees
 - having swings on trees.

Very small things, but very important as they tie us to Nature.
7. This Survey helped us prove the disconnect between Man and Nature, which is most prominently seen today, which needs to be bridged on a priority basis.
 8. The survey suggests that there are open spaces existing at all scales at the urban level which could be developed in a sensitive manner considering the creation, up gradation and restoration of the natural habitats. The need is to create and identify small pockets of natural habitats within our urban areas. This could be achieved by enhancing the existing ones and creating new ones at various scales of residential complexes, eg. Bungalows, housing complex, etc.

SOLUTION: IDENTIFYING LANDSCAPE INTERVENTION AREAS AND GUIDELINES

9. The survey told us a lot of things which are missing in our life, which were important to make that Man Nature connect. For us to bring those back, we need to identify spaces which are a part of our everyday life, for us to experience Nature in our day to day life.
10. There are open spaces of various scales in our residential areas, from the front yard, back yard to the balconies, terraces; etc. These could be converted into small habitats which have a good diversity of flora and fauna. Plants provide food and home for insects, birds, mammals etc. the more diverse the vegetation, the more diverse the fauna will be.
11. Guidelines could be given for developing such niches after a survey of a particular region, with respect to its climate, temperature, moisture conditions, wind, existing flora and fauna, etc. E.g. For a housing complex there could be guidelines given to develop the open areas like common open spaces between buildings, terraces for individual dwelling units, balconies, podium gardens, building terraces.
12. An initial survey of the climatic factors, existing habitats, areas in shade and shadow, will help us suggest the typology of species of shrubs, trees, etc. preferably native that could be grown and the species of fauna they would attract. These gardens could be a good mix of vegetable plants, fruit plants, flowering plants, medicinal plants. This could also act as a connect, joining the dots, making it a 'whole' experience.
13. Spaces identified are from a single residential unit, to a residential building, to a residential complex.

A. Single Residential Unit -Today we have various dwelling units ranging from 1BHK to 4BHK to more lavish flats. We mostly follow a typical module of design where we have balconies and terraces as an outdoor substitute. Depending on the hierarchy of the unit,i.e. 1BHK, 2BHK etc the no. of balconies and terraces vary.

- (a) **Balcony** - Balconies are used for many purposes.

(aa)Balcony attached to a Kitchen: Balconies are generally small in size, especially their length. One can grow their choice of kitchen plants in this balcony. Different ways to incorporate the same in a congested space could be seen in the photographs below.



Fig-1: Balcony Garden(Pinterest- Urban oasis)



Fig-2: Window Garden (Pinterest- window herb garden)



Fig-3: Balcony farming (Pinterest- balcony farming)



Fig-4 :Indoor Vegetable Gardening (Pinterest- indoor vegetable garden)

Above photographs show us how we can incorporate nature, though on a miniscule scale, through windows, balconies, railings and can be a gateway to our connection with nature. By opting to grow Kitchen plants, or edible plants we get a hands-on experience in growing our own veggies, taking us back to our roots, to strengthen the Man-Nature connection.

(bb)Balcony attached to a Bedroom or Living Room - These balconies are mostly used as a small sitout area to have your morning or evening tea, or to have a nice talk with your close ones, or even to spend some ‘me’ time, or to sit and work peacefully and quietly. Different and interesting ways to inculcate this with greens is shown through the following photographs.



Fig-5: Green vertical&horizontal surfaces (Pinterest- balcony garden)



Fig-6: Naturalised balcony (Pinterest- balcony garden)

These small spaces act as lungs for that individual units, catering to the varied experiences, like sunrise, sunset, rains, clouds, birds, which are sometimes lost in our mundane life. If treated correctly, could be windows, in the literal sense, to our lost experiences of childhood.

(b) Terraces:

Terraces are also used for multiple purposes like accommodating a small family gathering, also as a space for meditation and exercise, kid’s playing space etc.If we do so many of our activities here, it is very important to deal with it sensitively, making it an ideal place to reconnect with nature.



Fig-7: Outdoor Gathering space (Pinterest- Terrace garden)



Fig-8: Roof farming (Pinterest- Rooftop garden)

A terrace when covered with big shrubs, or small trees, on all sides, imparts a feeling of sitting beneath a tree. The fragrance and colours of flowers make it an attractive place for the birds and insects to come, making it a very lively outdoor.

Roof farming is proving a very good example where a terrace is partly used for growing vegetables, and partly used as a sitout. One can pluck fruits and flowers directly from a tree. Can eat veggies grown from their own garden. It enriches the overall quality of the space and experience manifolds.

B. Residential Building:

i. **Terraces of Buildings:** It holds the potential to cater to the needs of open spaces for a lot of people. It could be converted as a small park for that building, where kids to senior citizens both visit on a daily basis. It can also act as a big farming space where daily veggies are grown which cater to the building's needs. It might prove a very promising answer to our need of open spaces catering to the ever increasing population. If made mandatory for all high rise, multi storied buildings, it would suffice as a great open space for the inhabitants of that locality.



Fig-9: Terrace farming (Pinterest- Rooftop garden)

ii. **Podiums as Open Spaces:** Podiums are another big open spaces which acts as the lungs for that community. Podium Gardens act as urban parks for the community, an interaction space for the people of all ages. In times to come, with a lot of population density, these big spaces are going to be lifesavers. They hold the potential to preserve bio diversity, the native flora whilst catering to all our growing needs of being outdoors.



Fig-10: Podium garden (Pinterest- Rooftop garden)

iii. **Compound walls and vertical Greens:** Another common element, which is often underrated in terms of its potential to act as a breathing wall. Though small in scale, yet if treated well, can turn our concrete jungle to greens.



Fig-11: Green compound wall (mehker.wordpress.com)



Fig-12: Green verticals (Thearchitectsdiary.com)

14. Guidelines :

We identified areas to create our own pocket of Nature, within a small housing unit, to a residential building, to a colony of buildings. But as mentioned earlier, population growth is inevitable, so we need certain guidelines, adhering to which we can achieve the module of sustainability, to happily co-exist with Nature.

We identified the 'where' of the problem, but the 'how' of the problem needs to be addressed too. For that, we need to first identify what we plan to achieve, what are the problems we are attending to. The questionnaire highlighted some very important points,

- i. Biodiversity,
- ii. Native plantation
- iii. Easy access to open greens

In the housing societies there are residential units at different scales, individual bungalows, twin bungalows, multi storied apartments, etc. There could be different guidelines laid to create the green pockets at all these scales of residential units.

To achieve these points the following guidelines are proposed,

A. Individual Unit Guidelines:

- a) At individual bungalow level it is easy to set guidelines and to implement it. In such cases in the open spaces within and around the built up, the foreground, the background and the available setbacks native plantation can be done with a proper design approach and understanding the functionality of the spaces(Eg. Kitchen gardens, sit outs spaces, planting in courtyards, etc).
- b) Every single residential unit will have its own kitchen waste management, and will suffice to the compost required to maintain their garden at unit level as well as the common gardens.
- c) In any residential unit in an apartment there should be 10% of the built up allotted as Green area.(This will include all types and scales of residential units).
- d) Only 20% of the plantation should be allowed as per client's needs, so that the holistic plantation scheme is maintained.
- e) Awareness regarding why green should be introduced as an integral part of our living and how we can do that, should also be given.

B. Residential Apartment Guidelines:

- f) For every building going above 10 storied, every 5th floor to be converted as an green area or respite area, providing easy green access to the inhabitants residing in higher floors. This green area could be a good mix of vegetable/fruit gardens and plants for aesthetic purpose. Some percentage of this area to be left for the residents to plant(within the guidelines) and maintain so that this gives a chance to reconnect physically and visually with nature.
- g) Plantation in the building, i.e. in balconies, terraces should be given by the landscape architect of the scheme, using only native plants, and also catering to the local fauna.
- h) Every society will appoint an agency which will maintain these gardens, to ensure its proper health and for long term results.
- i) The Development Control Regulations (DCR) has bylaws for common areas such as corridors/passages, terraces, staircase blocks, parkings, refuge floors, which should be stringently followed, and maintained as green areas.
- j) The common terrace of the building should be used as Terrace garden with activities like growing vegetables catering to the needs of the residents, managed by the willing residents or as per the agency appointed by the society.

C. Residential Colony Guidelines:

- k) Residential colonies, comprise of no. of residential buildings having their central open space, or a podium open space. These spaces should be treated in the form of leisure gardens, which are necessary, but a part of these open space could be left for productive gardens which could include vegetable/fruits farming /medicinal plants, etc all native. This will also cater to the inhabitants vegetable demands to some extent.
- l) Every society will have their rain water harvesting system, to tap as much of rain water as possible, directly in the ground and also collection in tanks for the maintenance of these productive gardens.
- m) All the boundary plantation, roadside plantation should be mostly native and appropriate for the fauna of that region, helping to maintain and manage the biodiversity of that region.
- n) All the compound walls of all types of residential unit should be integrated with plantation.
- o) Practises like Mulching, Composting, Wormiculture should be followed for proper growth and maintainance of the whole Residential colony gardens.

CONCLUSION:

Consideration and implementation of the above guidelines will definitely help us in bringing back the biodiversity lost from our cities and also will reconnect us and our future generations with nature physically and visually.

A small step from our side by bringing green in our homes, in our day to day lives, is going to make a big difference in how we look at Nature and treat Nature. This awareness is of utmost importance to bridge the gap, which is caused due to the so called progress of Man. We just need to make Nature accessible to all, physically and visually, to bring back the lost memories and restore the balance between Man and Nature.

Its the first step for our sustainable living - to Re-connect with Nature.

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CLOSING THE LOOP

Integrating Waste Management Systems in the Open Space Design with focus on Urban Slums.

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ABSTRACT :

Urban waste management processes, facilities and infrastructure that are formed to manage organic waste and wastewater have universally been overlooked by the community, the municipality and veiled by architects and planners. Several issues affect the cities' waste management but the principal concern has always been the migration of the people from neighboring villages, which becomes an uncontrolled illegal slums. This brings an added strain on the city's waste management infrastructure both financially and physically making it a challenge to give waste management services to the slums. Often the people living within the slums are left to handle the waste disposal on their own. This adversely affects the neighborhood's health and also the overall urban environment. Hence this issue of waste management within the slums is of a fundamental significance to urban sustainability. This paper analyses the waste management systems that are effectively employed in the informal sectors i.e; the slums of developing countries and the way their innovative methodologies have reformed and transformed the waste sites into productive and public accessible places. The paper demonstrates use of waste management techniques to bring community people closer to waste infrastructure facilities by amalgamating waste management activities with gardens and an area for income generator throughout the informal city fabric. It looks at ways to cultivate a feasible and effective urban structure that transforms the liability of waste management into a natural and regular activity within which the community contributes. It demonstrates how by making the waste management infrastructure a part of the community, it changes the overall public attitude towards waste by relooking at the way waste management site can be designed into creating a brand new landscape idiom. It strives to make a positive change and shift towards the way waste should be seen as a resource.

KEYWORDS: WASTE MANAGEMENT, COMPOSTING, RECYCLING, WASTEWATER, INFORMAL CITY/SLUM/FAVELA.

1. INTRODUCTION Our cities are overflowing with wastes; both municipal solid waste and wastewater. Globally, it is estimated that over 80% of wastewater is discharged to the environment without acceptable treatment [1]. As per World Bank in 2016, the cities across the globe generated 2.01 billion tones of solid waste and are expected to increase annually by 70% from 2016 levels to 3.40 billion tones in 2050 [2]. And yet the focus of city planning always has been towards services like electricity, food and water, but major public services like waste management has been largely ignored or overlooked. As a result of this, waste management has become one of the key environmental concerns all around the world. Overall change in lifestyles, consumption patterns and human behaviors has resulted in an increase in generation of wastes. The ways to manage these wastes vary for developed and developing countries, for urban and rural regions. In most developing countries waste management for the most part remains both disorganized and insufficient causing several environmental, social effects. Over the last century, rapid urbanization in developing countries have caused an alarming rise in the number of informal settlements around the city and this has resulted in several adverse effects and is considered a major problem facing these countries. The paper aims at critically evaluating the waste management strategies employed in the informal sectors in the developing countries with respect to the community, understand the local dynamics of the place with regards to food habits, life style, income, climate and topography of the place. Based on the evaluations gathered from the case studies, the research aims at creating a management model to address the waste generated. It would be an opportunity to transform the urban landscape of the informal settlement, by using waste as a resource following the zero waste concepts. Often in an informal settlement, improving their built form and at times infrastructure is often talked about but enhancing the quality of living of the people living in the slums and their open spaces where they spend their maximum time tend to be ignored. The battle for preserving sanity in these physical-scapes is a serious one; one that is not often dealt with the rigor that is needed, one that is often not even understood. This paper would be emphasizing on strategies to tackle waste generated locally, both organic and wastewater and create a ready reckoner to help other cities develop a similar strategy to tackle their own waste generated in their informal settlements based on their local conditions. This would result in successfully implementing a zero waste dumping into landfills/ municipal sewage plant. It also aims at exploring the generic nature of landscape idioms in the context of the informal settlements and the country by large. Though the waste management infrastructure today performs the backbone functions of any city, it has increasingly been reduced to being just that and nothing more. Is it possible that such areas can play a larger role in terms of public function in the city? Can the waste treatment plants be a part of landscape and not be an ignored back yard service? These are few questions that need to be tackled in a more pragmatic manner.

Ian McHarg in his book "Design with Nature" has stated that "*Clearly the problem of man and nature is not one of providing a decorative back-ground for the human play, or even ameliorating the grim city: it is the necessity of sustaining nature as source of life, milieu, teacher, sanctum, challenge and, most of all of rediscovering nature's corollary of the unknown in the self, the source of meaning*"[3].

2. RESEARCH QUESTION: A. Can organic waste turn into resource and economy generator? B. How can the waste water treatment plant be a part of landscape and not be an ignored back yard service?

3. METHODOLOGY: In the first phase of study, two cities from developing countries were selected on the basis of the waste management strategies that were successfully implemented in their urban areas by privately run organizations. The strategies were studied through their websites. In the second phase of study, secondary data were collected on the basis of in-depth interviews with the organization, end users and field observations. The data collected from the field were assessed and analyzed for their strategies and action plans. In the third phase, based on the data gathered and analyzed from the fields, the site where the strategies are to be implemented were then evaluated in terms of its suitability and feasibility.

4. CASE STUDIES:

4.1. Community-based decentralized composting by Waste Concern, Dhaka, Bangladesh

Dhaka, a city of ten million residents, is facing environmental problems due to the mismanagement of urban solid waste. The city generates over 3500 metric tons of waste every day, around 70% of which is organic. 30% of Dhaka's residents live in slums, where there is no municipal waste pick-up service [4].

Another problem that Bangladesh faces is the loss of topsoil fertility from overuse of chemical fertilizers and pesticides. Soil organic matter is now estimated at less than 1%; the critical level is 3% [5]. Earlier, farmers utilized cattle dung as manure but now; chemical fertilizers are being excessively used. As a result, the rivers and canals are polluted with the chemical fertilizers that get washed into it, further degrading

the environment.

Maqsood Sinha and Iftekhar Enayetullah founded Waste Concern in 1995, to conduct research in developing strategies for the decentralized management of municipal solid waste. Waste Concern has set up a series of decentralized community-based composting plants that turn the waste into compost, which is then sold. They have adapted technology to aid the composting process and to keep the odour to a minimum, hence making it a more acceptable solution for the people. The government recognized the work of Waste Concern and they are allotted vacant lots to carry out their work. Waste Concern has designed and implemented inexpensive solid waste management programs in two slums of Dhaka: Mirpur and Khulna. Their approach is conceptually simple: they propose to transport organic matter from where it is surplus, to where it can be composted. By working with neighborhood associations, educating the public through posters, and creating appropriate training materials, they gradually taught the importance of separating trash at the source, keeping composting at a later stage in mind, as well as recycling in general. Waste Concern has signed a memorandum of understanding to supply a fertilizer company, which will purchase in bulk and market the compost. Today Bangladesh has several small-scale organic waste recycling projects initiated by waste concern. WWR Bio Fertilizer Bangladesh Ltd is the first one on a larger scale. It is also the first worldwide organic waste-recycling project to earn carbon credits. The carbon credits account for about 30 % of the waste concerns revenues. The remaining part comes from selling compost fertilizer to farmers.

Their mission is to: 1.Convert Waste into Resource. It can be managed in a decentralized way with public-private-community partnership. 2.By converting waste into a resource Waste Concern is turning the problem into an opportunity. 3.Simple, low cost and labor-intensive technology can be used to manage solid waste. 4.Converting Organic Waste into Compost Using Community Based Decentralized Approach Integrated with House-to-House Waste Collection. Compost enriched with balanced nutrients can gradually replace the indiscriminate use of chemical fertilizer in agriculture.

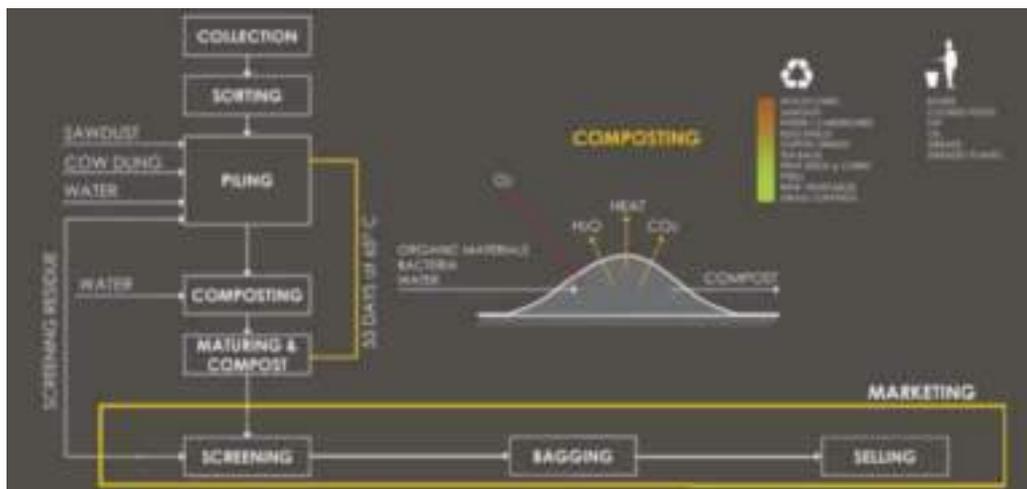


Fig 1: Process of organic waste composting (Source: Waste Concern, Dhaka, Bangladesh)

Waste Concern has replicated their composting model in 20 cities and towns of Bangladesh as well as the rural areas. It has its model replicated in some Asian Cities like Vietnam, Srilanka. The communities are now cleaner and healthier because of the efforts of the waste concern.



Fig 2: Photograph courtesy: Waste Concern Group

4.2. Community-based decentralized composting by Waste Concern, Pune, India : M/S. Energy Tech Solutions Pvt. Ltd. is an environmental engineering firm based in Pune since 1996 [6]. Three directors who are civil engineers and have done post graduation in Environmental Engineering have founded the company. The company provides a sustainable solution for wastewater treatment by offering expertise in setting up Solid Immobilized Bio-Filter (SIBF) system - a non-conventional, eco-friendly and natural wastewater treatment system. The SIBF system is based on ecological engineering and is best suited for de-centralized wastewater treatment. The pollution caused by the wastewater is resolved and the treated water is offered for reuse, thereby, helping in creating a cleaner, better environment. Since the methods used are biological, there is no harmfulness due to chemicals in the secondary or tertiary treated water. Further, when this treated water is reprocessed, the food chain is not contaminated by toxic and carcinogenic elements.

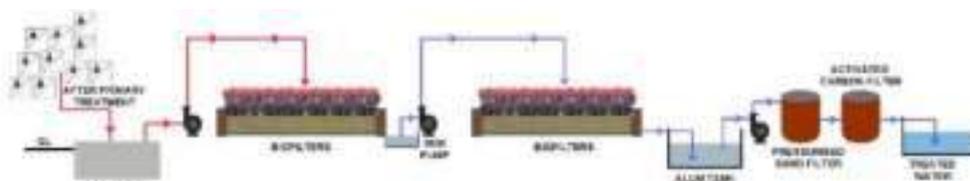


Fig 3: Flow diagram of SIBF system (source: www.sibf.com)

The SIBF system is very easy to operate. There is no secondary sludge that is generated, hence no need of sludge disposal facility as needed by the other treatment plants. The bio filters stabilize the trapped impurities and the canna plants as nutrients eat this matter. Even during fluctuating flows, the SIBF system functions consistently.

As compared to the conventional STP, the SIBF system is much more efficient as seen in the comparative table below:

Comparative statement for 300 m³/day STP

		Conventional STP	SIBF System
1.	Capital cost	More	Less
2.	Annual operation cost	More than Rs. 30 / m ³ (@ Rs. 9,000/- per day i.e., more than Rs. 33 lacs per year)	About Rs. 4/- m ³ (@ Rs. 1,200/- per day or @ Rs. 4 lacs* per year)
3.	Savings (treated water)	280 m ³ (avg.) x 20 Rs. per m ³ x 365 days = about 20 lakhs	280m ³ (avg.) x 20 Rs. per m ³ x 365 days = about 20 lakhs
4.	Pay Back period	No Pay back	Less than 4-5 years

Fig. 4: Comparative statement for 300 m³/day STP (source: www.sibf.com).

Based on the two case studies in Dhaka, Bangladesh and Pune India, the issues and concerns about waste and its management is understood and how and which strategies were employed in a more tactical and innovative manner to turn the organic and waste water waste into a resource. These strategies are used in the slums of Cantinho do Céu, São Paulo, Brazil.

5. PROPOSAL FOR CANTINHO DO CÉU, SÃO PAULO

As cities grow, land changes hands. Bought for development, land lies often for decades before the city needs it. When the city claims it, it obliterates the memory of the land unless there are compelling markers.

One such land is Cantinho do Céu, São Paulo, which has an evocative dense urban grain. It has been a witness to tremendous change over a period of time. As Jane Jacobs rightly argues, “it is the patin of history that lends vitality and life to cities”. This vitality is visible in the various parts of Cantinho do Céu, each having its own character. But under pressures of contemporary globalization there is an imminent threat of this individuality being replaced by faceless homogeneity. In this scenario, it is imperative that we as designers re-act to skillfully tackle the sometimes-conflicting needs of contemporary reality and established vitality.

Some of the issues that needed to be addressed in Cantinho do Céu are the; 1. Lack of open spaces 2. Wastewater illegally dumped without treatment to the reservoir 3. Storm water management 4. Lack of jobs 5. Removal of houses along the water edge.

1. Lack of open spaces- People in the favelas have to travel 14 kms. to Ibrapuera park in Sao Paulo to enjoy the recreational green space. Ironically there is a potential water front open space right in Cantinho along the reservoir that wraps around itself the peninsula. Yet due to lack of accessibility to the water space, the water edge and water being polluted due to illegal dumping of garbage and wastewater in the water reservoir has rendered the water edge unusable to be used as open recreational space to the people of Cantinho do Céu.

2. Waste water illegally dumped without treatment to the reservoir -The wastewater that is generated in Cantinho do Céu is pumped 70 kms.to a treatment plant. Not all the wastewater generated is pumped and taken to the treatment plant; a large quantity of it is illegally let into the reservoir without even primary treatment to it. This has resulted in uncontrolled growth of water hyacinths in the water, which has led to the choking of the water reservoir due to lack of oxygen in the water and in the process is a breeding ground for mosquitoes.

3. Storm water management- Currently the storm water is very poorly managed in the favelas and it runs off into the reservoir, which then cannot be used for portable or agriculture purposes.

4. Lack of jobs- The community is today facing the growing phenomena of unemployment and results in the community being socially unsafe for a better and healthy life.

5. Removal of houses along the water edge- As per the conservation law and HABISP, the buffer zone that has been demarcated is resulting in the removal of more than 2490 houses, which is a greater of an issue today as several families have been in the favelas for more that 3 generations.

These above issues need to be addressed in the manner that the design develops a landscape syntax that can be understood, discerned and hence valued, to find reason for being retained as the favelas claims the land. The project is an attempt to tackle these issues in the slums and integrate it as a part of the social, economic and landscape fabric.

5.1 TACTICAL APPROACHES USED: The number of houses to be removed as per HABISP is 2490, whereas the buffer zone of 50 meters as directed by the conservation law would result in removal of only 460 houses. The buffer zone of HABISP is more than the 50 m buffer zone as they picture lesser population along the water edge to prevent the wastewater disposal into the reservoir [7].

The wastewater would be locally treated using the ‘Solid Immobilized Bio-Filter system (SIBM), which has very low operation and maintenance cost; an important factor to be considered for the design in favelas. It produces usable treated effluent and does not emanate aerosols or odour and the treatment plant gives an appearance of a garden and not like a conventional waste treatment plant. As per the calculations the amount of space needed for treating wastewater generated by 15,000 people is 3.80 Hectares. The wastewater bio filters will be located below the power lines in the corridor that cannot be developed for any built development.



Fig. 5: Section through Bio-filters (Source: Author)

The highly contoured nature of the favela accommodates the bio-filters that use the slopes for transporting the waste from one filter to another by gravity. The bio-filters are mixed with agriculture fields for the community to be a part of the infrastructure grain and hence having a sense of belonging to the community project. The plants used in bio-filters are canna plants that can locally grow in that region.

The organic waste plant would cater to the entire waste generated in Cantinho do Céu. The plant will be located right next to the market place of Cantinho, below the power lines in the corridor. This would facilitate easy collection of organic waste from the vegetable and fruit market as well as the houses of the favelas. The amount of organic waste generated in Cantinho do Céu is 8 Tones per day (market+ households). The area required for the organic waste plant is 1500 Sq.m. The organic waste collected from households will be house-to-house waste collection method. Using aerobic composting method, the output would be 2 Tons per day.

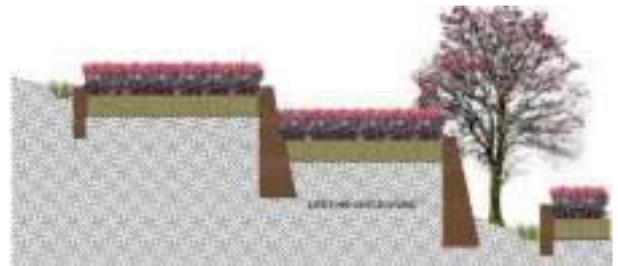


Fig. 6: “Zero waste” loop for organic waste (Source: Author)

The compost generated from this plant would be sold to the local market for agricultural needs at US \$ 45 / Ton [8]. The emission reduction would be sold to the international market as carbon credits. The organic waste plant would also create employment for 16-24 people to help in its operations and maintenance. The agricultural fields, organic waste composting plant and wastewater treatment plant will generate employment in Cantinho do Céu and tries to address the issue of lack of employment. The wastewater and organic waste generated in Cantinho do Céu becomes a generator for the landscape idiom to be established. This forms a loop, where in the waste generated is mitigated by its reuse either as compost or treated water and is adapted for agriculture, which in turn generates the waste and ‘closes the loop’. In this manner the land is returned to become agriculture in a manner in which cultural idioms of agriculture and terrace farming are explored. The agriculture nurtures the land, till the favelas does, and will recede in almost a choreographed dance, tip toeing out, and allowing urbanity to take stage.

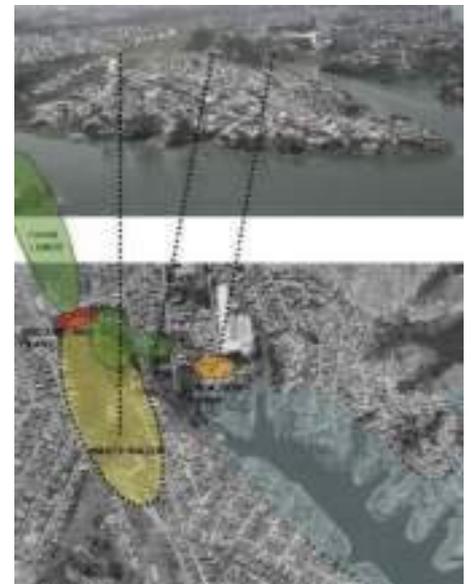


Fig. 7: Site plan showing wastewater plant, organic composting plant, storm water wetlands, and recreational water edge. (Source: Author)

The site selected for the project connects the power corridor area, the watershed area of the favelas and finally touches the reservoir.

The water edge would provide the much needed recreational open space to the people of Cantinho do Céu with a board walk that wraps itself around the entire water edge passing through wetlands; designed to mitigate the storm water, forested edges, play areas, amphitheater, decks and sailing area. The project also will also ring in a nucleic core- a community center/adult education and a samba school, each recounting, reminding, and providing a being to lost nature and values.



Fig. 8: Views showing Boardwalk, cleansing wetland, playfield along water body and recreation water edge. (Source: Author)

This integrative approach works under the notion that, with more refinement, distinction, and access, design of waste management facilities not only helps adapt aesthetic sensibilities, but also cultivates shared ownership and accountability. Clearly, the community is much more keen to care for and designate funds to facilities they can see and use. This methodology uses design strategy to respond to community wants and desires. Beyond cleaning contaminated land and water areas and establishing a supervised structure, desirable community green spaces and employment are generated. For instance, a constructed wetland is integrated into a wastewater treatment plant as a secondary treatment in the process, or a composting facility is built next to a vegetable and fruit market; waste-to-resource plant. This integrative approach brings employment and social life into coexistence. Waste sites are proposed as places for play and recreation as well as social meeting places. Indeed, these newly created spaces are beginning to contain new social economic rituals associated with the disposal and recycling of waste. New congregation places arise at the local wastewater treatment center or at the central informal city site where the entire community gather collects their organic waste to be composted into manure.

The integrative approach acknowledges that waste disposal or collection sites, apparently disordered and filthy, involves energetic and productive practices of nature at work. There, human processes of categorizing mingled with natural processes of breakdown and decay becomes discernible texture in the landscape. Indeed, wastewater plants, organic waste disposal sites, can be motivating set-ups to visit. The potency of the integrative approach is in its practical and feasible synthesis. It balances program and aesthetics, realistic wants and significant metaphors, natural science and art, public sensibilities and avant-garde ambitions. The project presents urban landscape strategies that criticize past infrastructural interventions from which Cantinho do Céu's problems emerged. The strategies directly engages with real, current issues of the integration of engineering and design, by inserting alternative infrastructures that are engaged in close loop thinking, income production and benefits such as recreation and food production.

6. CONCLUSION

Hence an option of locally treating the waste that is generated within the community by designing a treatment process that is contextual to the place like Cantinho do Céu and the one that plays a larger role is the need of the hour. The project recognizes that it not only needs to find the right ways to do things but in doing so, it should also allow the making of a space that will nurture, provide succor and will be cherished by its inhabitants over generations. Today, its essential for any project to acknowledge that waste management is an integral part of the design and it needs to be conceptualized right from its inception stage.

Architects/ landscape architects should take on and foresee the innovative prospects and employ the integrative approach to the everyday situation at all city stages: the neighborhood, the district, and even in their informal sectors of the city. Today architecture has the power and architects the responsibility to resolve seemingly intractable dilemmas of the city today, and that design has the influence to adopt global challenges with evocative indigenous solutions. A system of publicly accessible waste reclamation and rejuvenation sites intertwined into the informal city's fabric as a kind of "Open Waste System" system of parks can be designed and setup. The discredit and apprehension of waste as a resource have made its capabilities obscure, unapproachable, uncontainable, and perilous. Instead of detaching oneself from waste, its appropriate management and design can get people nearer to waste processes and help nurture innovative solutions to problems inherent to waste disposal and its concerns that are communal to all people. Waste issues not only have enforced us to reconsider aesthetics, but have aroused environmental planners, engineers, urban and landscape designers to look beyond the limitations of professional norms and the series of social taboos and create place for the formation of different landscapes that are resilient in form, function, space, and value. As landscape architects, we need to revisit our aesthetic prejudices and must continue to look for methods to create new prototypes that integrate unexciting, excluded spaces with everyday and leisure environments. Landscape design should not try to obliterate technological guilt. Rather, it should create a better understanding, concern, and commitment amongst the common man regarding waste management in their communities. The designs or strategies thought by a landscape architect or a planner should invite the community to see a renewed interface of landscape and culture-a process in which community would play a fundamental role, in which their involvement in the waste management is as unavoidable as their consumption of goods leading to waste. It should be a practice in which waste management is considered not only a setback but also as a design opportunity for landscape architects and for the community people.

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NEW BEGINNINGS

Architectural Interventions towards the Revival of Arts and Crafts in Ajrakhpur, Bhuj

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ABSTRACT

New beginnings call for a renewed passion, driven by a humanly wholesome and biologically balanced sensitivity. Bhuj and its regions are a unique example of restructuring lives after setbacks. With a culturally rich background and a conglomerate of communities that have assembled from far and wide, with every challenge it provides a canvas to start afresh. Not too long ago, this region was devastated after a massive earthquake wrecked it in 2001. Rebuilding the lives and spirit of the people of the region has been an ongoing task since then. The study emerges from a concern about how most attempts of rebuilding communities after being struck by natural calamities, particularly in the Indian context, seems to lack of sensitivity in approach. Functionality, quick building methods and economic concerns become forbearers, leaving behind the prospect of nurturing a new landscape and developing spatial expressions that can show the way ahead. The paper traces this narrative of revival in the regions of Bhuj, re-inhabiting the people and re-building their spirit. It demonstrates the outreach of architectural intervention in two case studies that amplify a plausible approach with a sustainable and climate responsive means, while simultaneously balancing the homogenizing and monocultural trends of the contemporary world. It attempts to showcase how a built environment harnesses the power to reform society, undo errors in prevalent building methodology.

KEYWORDS *Ajrakhpur, Bhuj, transition, revival, re-habilitate, sustainable,*

INTRODUCTION

“Many countries are at the turning point of their destiny at the dawn of a new age in their life. The domain of building - town planning, structures, sculpture and paintings, the synthesis of the major arts, has generated the form. The techniques, the means, are assured. It only remains to turn courage into action.” [i]

Le Corbusier in his essay back in 1948 predicts a necessary marriage of the arts and the task of building. He emphasizes the use of materials to serve a social need, controlled by proportion and tradition, a prerequisite for the rich and diverse social fabric of a country like India. That emerging spirit of manifesting an identity and building for a new democracy, dictated the architectural narrative of India in its early nation building efforts.

As was the context of India in the early years of independence, so was the scenario of Kutch, more accurately - Bhuj and its regions after a massive earthquake wrecked it in 2001. Finding the courage to restart and adapting to transitions is a difficult yet inevitable recourse. This narrative of revival focuses on the rehabilitated village of Ajrakhpur, on the outskirts of Bhuj. An arid and demanding climate add to the challenges in re- building. Ajrakhpur provides us opportunities to explore directions in transition at the macro and micro level.

The region of Kutch encompasses 6000 square kilometers of land, and is home to a range of communities that have migrated and eventually settled here. The resulting diversity of crafts concentrated here is overwhelming. Their proficiency over the crafts they practice is evident in their weaving, block printing, tie-dye, batik, silver work, metal work, lacquer work, mud work, woodcarving, painting, pottery, and embroidery. The list is exhaustive! This passion for the crafts takes a backseat each time they face adversity. However, they have realized the value of the skill they possess and are keen to take it to another level.

CONTEXT

Contextual Distinctiveness

Kutch is unique in its geography, geology, ecosystems, diverse communities and values that it embodies! The synergy of all these factors makes it a unique habitat. The landform of this region rose from the womb of the ocean when the East West plate surfaced out. The fault blocks of the Kutch Basin offer a unique occurrence of the Jurassic-Cretaceous-Paleogene sediments rarely occurring anywhere else on the Western Indian continental margin. Owing to this geological amalgamation, this region has given rise to diverse ecosystems – namely the desert of the Rann, the mangrove along its coast, the thorn forest with its extraordinary biodiversity, and the grasslands of Banni. The diversity in the ecosystem provided a familiar habitat to many communities from Central Asia and other parts of Asia. This possibly caused them to settle in Kutch, post migration from their homeland, owing to various reasons such lack of water or to further fortify their trade associations. Each community came in and found their place to live sustainably off, one of the four ecosystems that Kutch is blessed with.

Tracing the Crafts

A few migrant Muslim communities from Central Asia drifted and eventually settled in the north of Kutch bringing along with them a lot of their crafts and their embroidery skills from the traditions - Persia, Baluchistan and Turkey. They inhabited the Banni region of the north, being essentially a community of cattle herders (*maaldhaari*). Some communities namely– Mutva, Node, Haalepotra, Jatwandered around in the Banni grassland regions, trailing rainfall and building temporary homes wherever they could find fodder for their cattle. The seafaring communities occupying the coastline on the south, traded with people around the world, owing to their navigational skills and entrepreneurial ambitions. These belonged to the Hindu communities – Jain, Bhatia and Lohana. They sourced the best timber from regions they traded with, to build their wooden mansions called *havelis*. In doing so they patronized several crafts and several generations of craft families. The *khundkaam* (woodwork) artisans indulged in intricate wooden carvings. The craftsmen from the Gajjar community were known to erect entire *havelis* without nails. While the *kamaagarikala* artisans excelled in fresco wall paintings.

The presence of different communities and their varied skill in crafts was responsible for the rich and varied crafts tradition that we see today. A myriad range of craft skills included mirror work, carved woodwork, inlay work, wall paintings, *Aari* embroidery, *Ajrakh* (resist block printing) and silver work. The crafts enjoyed participation from both the men and women. While woodwork and metal work

skills were taken up by the men folk and more as a source of revenue, women indulged in embroidery as a personal craft. Girls learn embroidery while still young in assisting their mothers. Later they get an opportunity to display their skills in putting together their *aanu* (wedding trousseau). Kutchi artisans and craftspeople are gifted with skills of perseverance and diligence beyond mention, evident in the finesse of the work they produce. It is this quality that instills in them a resilience to survive, no matter what!

Hardships and Setbacks

In spite of the positive narratives mentioned earlier, the biggest setback this region faces is being prone to earthquakes and hence it undergoes severe changes in topography. A vulnerable geological fault line that runs between the Indian Plate and the Eurasian Plate, causes continuing continental collision. Recorded earthquakes of magnitude 7.7-8.2 in 1819, magnitude 6.1 in 1956, followed by the most recent one of magnitude 7.7 in 2001 have time and again caused destruction to life and property.

Given that it is one of the most arid regions in India, a drought is not something that the people of Kutch, are unfamiliar with, yet what varies each year is the intensity! Kutch has seen the worst periods from 1966 to 1968 and then again from 1985 to 1988, when the district faced three successive years of severe drought each time. In times like these food and hope are hard to find, and the human spirit takes a beating. A fundamental shift in the methods of living, comes about when a settlement goes through times of hardships. In order to survive it looks at renewed methods of focus and rejuvenation. However, in the current times of globalization, these departures can undo traditional value thus causing a loss to the traditional heirlooms of art and crafts.

DEVASTATION AND TRANSITION – AJRAKHPUR



A settlement of about a thousand or more villagers inhabit Ajrakhpur, a small hamlet located 18 kilometers south west of Bhuj. Around a hundred among these are resist block-printing craftsmen. The Khatris who populate this village, originally hail from the Sindh province of modern Pakistan. As a community of block-printers, they have been practising the 3000-years-old art of Ajrakh [ii]. All of them came here by way of resettlement after the Gujarat earthquake of 2001.

“It is important we work together and pass on our skills...In 2001, many traditional block-printing artisans of this region died, everything was destroyed, but we have survived,” he says. [iii]

As a collective association they moved from the ancestral village of Dhamadka, 50 kilometres from Ajrakhpur, which was devastated by the tremors. Post the earthquake they lived in relief tents and began work in temporary sheds. Traders who marketed Ajrakh products chipped in with monetary loans and work gradually picked up. However, that summer the high iron content in the Saran-Ganga river (due to the earthquake) caused colours to bleed and rendered the water unusable for washing printed fabrics. At the same time, as part of rehabilitation measures, the Gujarat government allotted a new site for resettling these villagers and artisans, who latched on to the renewed hope for a fresh start and chose to resettle in Ajrakhpur, a name christened after their cherished craft.

Figure 1- Ajrakh printing in process, wooden Ajrakh blocks, patterns of Ajrakh fabric. (Source: unknown)

“Designing for transitions would mean a completely different design solution. For housing, we should create the conditions where infrastructure can provide the context for people to build.” [iv]

This transition prompted by extraordinary circumstance and a will to restart afresh by the inhabitants has blossomed into a possible lesson in rebuilding settlements. The single purpose of keeping this ancient and yet complex craft form involving time-consuming stages alive, drives this settlement. The community itself charted out its settlement plan, with a series of plots measuring about 350 to 500 sq. m. each separated by roads and common open spaces, similar to any contemporary community plot settlement. Several dwellings housed printing shed within its compound and a roof or courtyard to dry and wash printed yardage. A disjointed and sparse dwelling typology emerged as the inhabitants gradually moved in to build their dwelling units. The overall density of the Ajrakhpur is fairly sparse today as well. A central community resource of water for washing and drying with open tracts of land, a small mosque, community spaces and sparse vegetation define its landscape today. The village is fairly featureless, set in the middle of endless, open, flat Kutch country. Faint remote outlines of hills or elevations rise in the distant horizon. Most houses and workshops look the same, lacking any typological inferences. They are drab, flat roofed, single storied or at most few have an additional first floor, all done in bricks and concrete, the only saving grace being that they are ‘earthquake resistant’. They derive no lessons from the place and in doing so lose out on an opportunity to provide a fresh outlook at rebuilding.

Ajrakhpurat its best doesn’t make for the ‘absolute’ solutions we envision while shaping settlements in a hyper globalized scenario, but succeeds in its purpose. As Rahul Mehrotra further emphasizes in his keynote speech at the India Design ID in Delhi 2020, that designing for transitions can be messy, but it helps achieve real goals. The entire picture only unravels itself in time, to tie it all up meaningfully. Thankfully the demand for Ajrakh fabric as an is growing within India and distant places abroad. Ajrakhpur has found its economic bearings in a globalized market. In India, firms like Fabindia, Anokhi and iTokri source what is created here and spark a glimmer of hope in these artisans. It provides a reason for the art of Ajrakh to go on. It is too beautiful and aesthetic to let perish!

Subsequent Architectural Directions - Ajrakh Studio



Figure 2 – Ajrakh Studio view of entrance (Source: Ar. Shridhar Toknekar)



Figure 3 – Ajrakh Studio view of dyeing and washing courtyard (Source: www.indigo-architects.com)



Figure 4 – Ajrakh Studio view of block printing room form courtyard (Source : www.indigo-architects.com)

Within the precincts of Arjrakhpur lies Ajrakh Studio, a resource centre showcasing the technique, production, and the art of Ajrakh. It was commissioned by Dr. Ismail Mohmed Khatri - a highly acclaimed artisan and a community leader, carrying forward his ancestral craft. Conceived by Indigo Architects, this studio draws references from the old typology of their original family home in Dhamadka that exists no more.

A distinct layering of spaces transitioning from the public to private inner working courtyard is seen in its zoning. The Ajrakh studio comprises of two linear volumes oriented North-South capped with inclined lean-to roofs on the shorter sides. The two volumes are united by an open court and wrapped at the short ends by services. The studio is designed to occupy the periphery and leave out its heart, open to the sky above. Spaces of public interface namely the entry, office, retail shop and a large hall are housed in the first volume. The central courtyard forms an interlude between the public functions and the focused inner work-spaces, it doubles up as an informal gathering place and provides a processing space for dyed textiles, simultaneously. The other volume flanking the courtyard, houses the printing workshop with ancillary storage area, the wood fired chulha (wood stove) and wash area for dyed yardage.

A contemporary nuance is added in the method of incorporating a steel and bamboo fabric drying structure on the southern and the western terraces of the building. Symbolic of elements used widely by printer communities in western India.

Concerns of thermal comfort are addressed in the evident choice of materials and elements. The louvered openings allow funnelling of prevailing breeze and control of light while simultaneously creating an aesthetic that adds a contemporary touch. Local fly ash bricks with lime mortar, lime plaster finished with dolomite plaster and yellow mineral pigment from Kutch shapes the walls. Responsible and sustainable material choices are seen in the use of recycled teak wood, a large underground rainwater harvesting tank and radiant cooling devices embedded in the floors.

A refreshing departure from the uninspiring built environment of its surroundings, Ajrakh studio chalks out the necessary frameworks to follow while building in a context like Ajrakhpur, for this community of artisans. It succeeds in shouldering the mantle of a renewed identity true to the place. An opaque yet intriguing exterior, nestling porous interiors to afford spaces that create deep shade and shadows and a remarkable play of light, brings together an architectural prototype that shows the way ahead.

SHRUJAN - INITIATIVES TOWARDS REVIVAL



Figure 5– LLDC museum exhibits ‘The living Embroideries of Kutch’ (Source : www.shrugan.org)

Our narrative now shifts to yet another challenge of living in this region – water shortage and periods of drought. Post the drought of 1966-1968, economic survival of the nomadic maaldhari settlements came under a lot of strain. The basic reaction of the people was to retreat from these lands and move onto greener pastures, prompted by a promise of an easier life.

The earthquake in 2001 had a devastating impact on the built habitat of the entire region and it resulted in the tragical loss of lives and livelihood all at once. This resulted in extraordinary gestures of help in monetary, emotive and other terms. Furthermore, tax sops offered to industry by the government to rebuild the lost economy, rapidly brought about changes in the landscape of the region. The native craft skills were staring at a dwindling future and losing out to impending migration in lure of other jobs at offer then. An imminent fear of losing out on the participation of an entire generation and its skill loomed at large.

It was then that ‘Shrujan’ [v] stepped in and pioneered a shift of the traditional embroidery skills of the women folk, into a home based sustainable and dignified form of livelihood. This move nurtured a meaningful existence to their personal craft and give a

larger sense of purpose to the task. Since then, Shrujan - a not-for-profit organization has successfully catapulted their skills to a global platform. It has infused a renewed passion for the crafts within the regions of Kutch, with its programs for the uplifting the lives of the women folk and subsequently the entire community.

LLDC – The Living & Learning Design Center

The prevailing circumstances of the times prompted Shrujan to conceive -Living and Learning Design Center (LLDC). It was destined to be a comprehensive repository of the various crafts of Kutch. Its primary role was that of a resource center for artisan, and a secondary role of showcasing these crafts through a public museum, along with demonstrative workshops for hands on learning. Above all it aimed at involving the current generation to participate in its crafts with pride and passion. Paddhar or Ajrakhpur as we know it now, was chosen as the proverbial place for LLDC to take form. Both Ajrakhpur and LLDC sprouted around the same time, and have since added value to each other’s existence.

Ahmedabad based -Indigo Architects were roped in to give form to this inspiring idea. About 18kms from Bhuj, this institute sits within an 8 acre parcel of orchard land nesting mango, chickoo and coconut palm trees. The overall master plan has three main components, the museum, the crafts school and the residential block that intermingle with the orchards. A solid block like volume houses that the museum, which is punctuated by skylights, that allow refreshing pools of natural light into an informal yet well curated journey. Connecting passages and shaded spaces for craft demonstrations and impromptu workshops, attach to the core spaces as porous appendages and allow for varying experiences alongwith thermal insulation. The Crafts school houses working spaces for every art and craft of Kutch, making it the single largest living and working craft environment in Kutch. The crafts shop and museum shops allows artisans to develop their marketing skills as well. The master craftsmen, artisans, visiting academicians and scholars co-habit the residential block. Designed as a series of modular courts with dwelling units linked by internal streets, this block negotiates a delicate connection to the work studios. Artisans are thrust with an opportunity to communicate and comprehend their world and its diverse cultural and social nuances, food habits and living patterns.

Non air-conditioned spaces, dealt with through passive cooling, assisted by shaded zones amplify the call for sustainable design strategies in a place starved for resources and thermal comfort. Meticulously proportioned fenestration, in the form of windows and cutouts on the west and south, allow the winter sun to warm the interiors while keeping out the summer sun, a basic strategy to ensure ventilation without causing any thermal gain. Traditional building materials are employed through the use of lime mortar and natural lime plaster.

With its bold form and stark walls, carved out to create a contemporary environment, LLDC chos to depart from the vernacular notion of the Kutchi way of building. Emulating the reach of its inhabitants and their frugal lives in stark paradox to their decadent artistry; the building addresses place making through a sustainable design approach to enable its people to experience a built environment unlike any they have ever been in!It showcases the cause of rejuvenation through built environments.

CONCLUSION

The efforts of revival and rejuvenation that are on display at Ajrakh Studio and LLDC, enumerate a host of lessons to take away. The habitation of people, an issue that concerns prevalent urban directions – screams out for a purpose to be the primary driving force. It negates the reason of utopian ideas concerning relocation that are often clouded by illusions of problem solving. The need to involve and understand the people that form part of this transition is of utmost importance. The pristine built forms of Ajrakh studio and LLDC provide a responsible direction to follow. It shows an ideology of building with sustainable means pertaining to the place in order to achieve transformative powers. It succeeds in instilling a sense of pride of belonging in the user, by providing vernacular beings with a contemporary space and a distinct identity. Not conforming to the homogeneity of the hurriedly constructed monocultural buildings of the contemporary times.



Figure 6 - LLDC view of Museum block from the entrance court (Source: Author)



Figure 7 – LLDC courtyard within Museum block (Source: Mohammad Kamil Shaikh)



Figure 7 – LLDC Museum block (Source: Mohammad Kamil Shaikh)

Today we are challenged as designers to wade through a flux of unending transitions, backed by climate change and globalization. India is in need of a responsive built environment in its non-urban pockets. The strain on resources in our cities, calls for infusing its towns and villages with a passion for its dying traditions and arts, restoring meaning and forging purpose to revive its spirit!

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INNOVATIVE TEACHING METHODS AND TRENDS

Constraints As An Opportunity In Design Process

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ABSTRACT

Design is the backbone of the architecture education. It is a process of generating ideas and approach towards acquiring objective with taken into consideration opportunities and constraints. Design is a result of our physical and mental processes. Especially design studios adopted in educational institutes have potential to create interest in design generation. Teacher can open different vistas for the students by introducing them different channels of creativity to embrace the design process. Design process means continuous progression or series of action, an architecture design outcome is end result of this process and one of the important or core element in architecture design. Whereas, the constraints plays an important role in whole design process. The constraints faced by the students during design process may stimulate them towards more exciting approaches and possibilities.

The paper talks about the study of architectural design process and role of constraints in design process. The design and design process in architecture is very subjective sometimes. At the same time, the cognitive processes involved in the architectural design process, and how it plays throughout the process of design, such as design studio focuses on the physical, mental skills and holistic approach towards design. As Constraints are the undividable part of design process. The study identifies varied constraints faced by students of 1st year and tries to resolve them through design decision model, problem solving processes. It further elaborates on the creative techniques. Its application to design studio which identifies one approach in detail at 1st year studio level. Studio results are analysed to showcase 'Constraints as an opportunity'.

KEYWORDS: *constraints, design process, creativity, design*

INTRODUCTION:

Design is a creative process which Leads to useful product. It is a solution to problem, where the problem is defined by user and use. The act of designing in architecture is a complex process. It operates in a loop and is endless. It is not a straight forward process. The process is usually interactive, in that you finish one step and move to next step, only to discover that you miss some considerations and constraints that to fulfil you have to go back to previous step. There is no any defined correct process of design. Frequently the designer will answer that his or her reason for making a particular design decision is based on 'feeling' or 'intuition. Design is backbone of architectural education. Every designer has different design approaches. Every design is a new challenge for designer. Pre-design and design process contribute towards shaping the design output by triggering different design opportunities. Freedom in design is a great thing, it allows the designer to explore new ideas and possibilities but when designer explore too much, he/she much tend to get lost , constraints gives directions to design process in more creative and constructive way.

Man built most nobly when limitations were at their greatest.

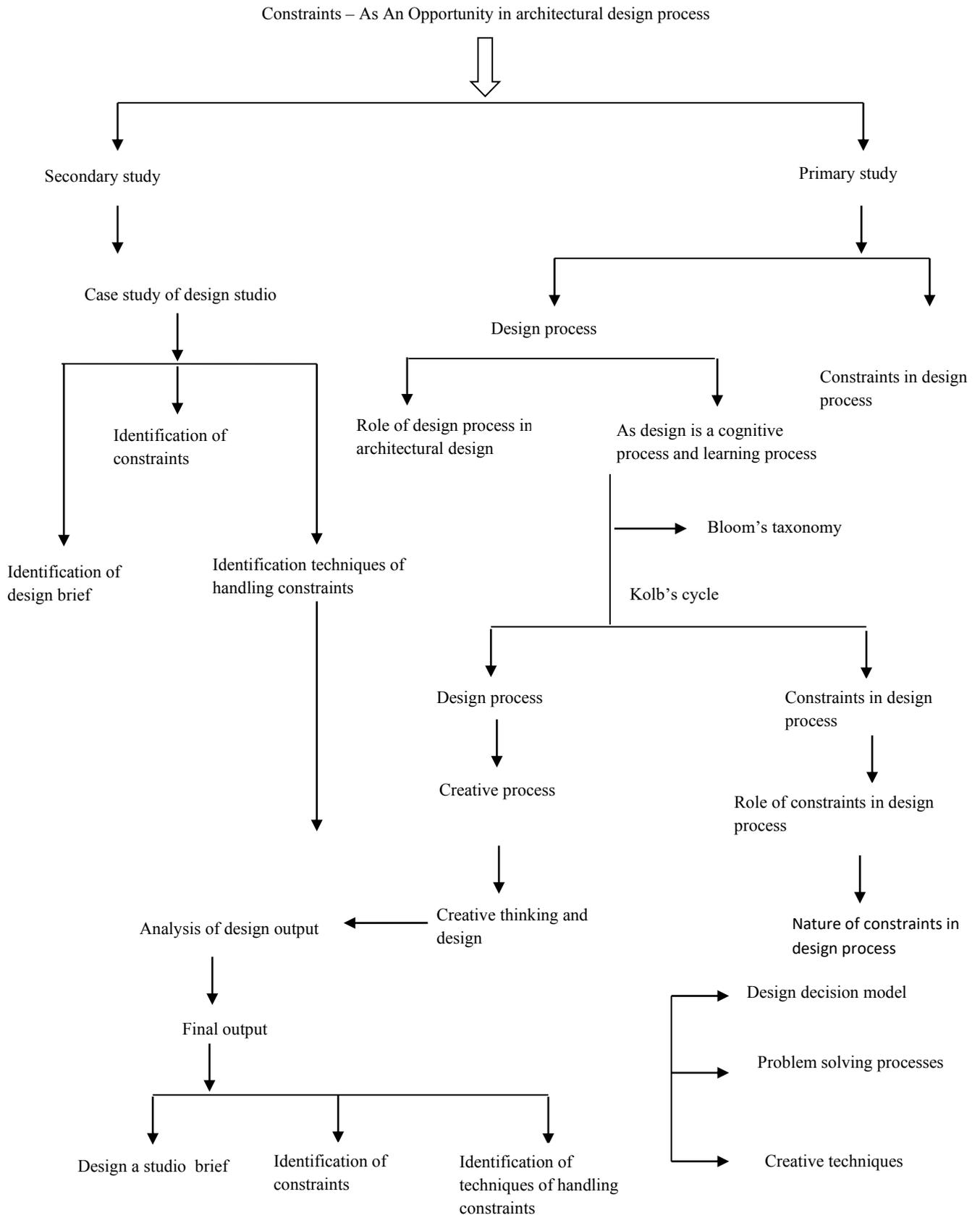
-Frank Lloyd Wright

To face the constraints and challenges of the design process, understanding the factors that facilitate the creativity in design process is essential. While experts agree that, to explore different possibilities of design constraints in design process. It is uncertain that how the constraints contribute towards design process and final design output.

NEED OF THE STUDY:

Design process plays a vital role in architecture design. We need to go through the design process with taken into account all consideration, possibilities, constraints and opportunities. The aim of this paper is to enhance the cognition of physical and mental skill of students of architecture we need to resolve the constraints at students' level for their future perspective. So, the study focuses on the constraints faced by students in 1st year level, where they learn to tackle the constraints and resolve it for the better design objectives.

METHODOLOGY:



Design is a process of working to develop solutions in a conscious and innovative way in which both the functional and aesthetic requirements are based on the user's needs. Whereas, architectural design linked with, every subject of architecture education, structures, mathematics, building construction, graphics, basic design, visual arts Etc. We need to have integrated approach towards the architecture design. Each subject contributes to the design studio. They have their own approaches, limitations and challenges towards design.

¹Process is the system of operations in the production of something and the method is a means or manner of procedure, especially a regular and systematic way of accomplishing anything. Architectural design process really start with the way which the programme or brief. The inventory needs is read how problem are defined and interpreted, how student is engaged and even how background research is conducted and information collected. Visualizing possibilities, formulating concepts all are very creative activities.

Teaching design- a creative process

Learning design- a scientific experience

Design process is the important phase of the architecture design as design is the core subject of architecture design. Design process is very subjective as it differs from individual to individual. The design process is that where the students go through the whole design process to get proper output. There are various stages and approaches towards design process. Every successive stage of design process depends on the previous stage. There is need to fulfil the every stage then move forward to the final output of design. There should have new approaches towards the design process, where if a stage missed we need not to go back to the previous stage, and fulfil it. There should be interactive process where there will not have any loop in the design process and we can approach towards final design output.

In design process, identification of problem is the important phase, which involves design brief, from where the actual design process starts, and ends up with the final output of design.

DESIGN PROBLEM:

Design problems are considered as to be ill-defined and as such cannot be clearly formulated. A characteristic is that they are unique, complex, and inaccurate and as such cannot be solved exactly like previous similar problems. It is difficult to know what information can be considered as useful until a solution is attempted. Rather than producing optimal solutions, the design process is about finding a solution that may satisfy enough constraints or factors to be acceptable. The design process was viewed as a series of actions based on problem understanding, gathering information, analysing information, synthesis, decision making, evaluation, and so on.

DESIGN BRIEF:

Design brief is the First step in design process which defines any parameters or constraints that may influence your decisions. Sets the direction for further investigation.

CONSTRAINTS - Aspects of the design brief or situation that cannot be changed, or have boundaries or limitations.

CONSIDERATIONS – other aspects of design brief that must be thought about or considered. Often these considerations will set the direction for the research.

RELEVANCE OF BLOOMS TAXONOMY WITH ARCHITECTURE DESIGN:

In architecture education, design is a learning process for students; simultaneously the learning domains of blooms taxonomy are complementary to it. Cognitive learning i.e. gaining knowledge, affective learning i.e. development in the areas dealing with emotions and attitudes and psychomotor learning i.e. learning physical or manual skills are all achieved in design process. The objective of the design process is to go through the all learning domain to create individual style, reasoning, and power for facing design constraints, problem solving ability towards design final outcome.

RELEVANCE OF KOLB'S CYCLE WITH ARCHITECTURE DESIGN:

The Kolb's theory is a four-staged learning cycle (Figure 6) that is broad enough to provide a base for the entire design process as well as each individual cognition learning experience. Also, this cycle is democratic and diverse that can recognize various learning style. According to Kolb, this complete cycle needs to exist if the total design process wants to take place entirely (Kolb 1984). Additionally, Kolb's Cycle is inherently democratic and inclusive in its approach as each stage recognizes distinct learning style variations. Surprisingly, other than few instances, Kolb's Cycle has less been appreciated and applied limitedly to architectural education and even more, specially, what is seen to be highly relevant, to the realm of design process. According to Kolb: Learning is the process whereby knowledge is created through the transformation of experience. Knowledge results from the combination of grasping experience and transforming it. Kolb's states that learning involves the acquisition of abstract concepts that can be applied flexibly in a range of situations. Kolb's views learning as an integrated process, with each stage being mutually supportive of and feeding into the next. It is possible to enter the cycle at any stage and follow its logical sequence.

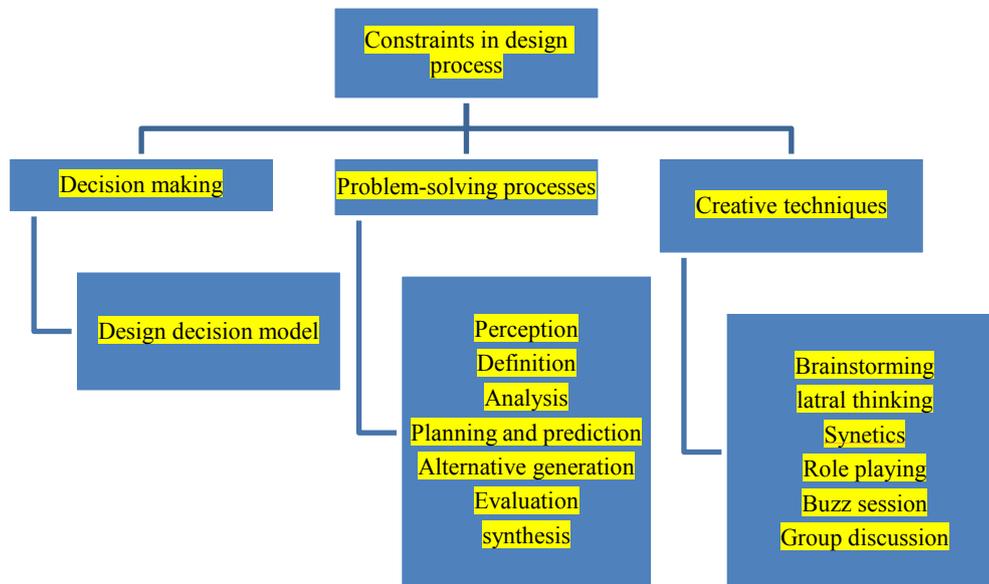
CONSTRAINTS:

Constraints, is by definition a negative connotation. Its imposition prevents us from acting as we would like to because it restricts us in some important way. Constraints hold us down, knock us back, and make us fail. But on the other hand, constraints can be enabling and desirable. They are catalyst forces that stimulate exciting new approaches and possibilities.

NATURE OF CONSTRAINTS:

The constraints in design problem are decisions, and making of this decision is design. Simon lays out design as a problem solving activity, the design process of problem solving, which provides a cognitive framework of analysis, synthesis, and evaluation is used by many professional designers to create solutions to design problems. Students may be taught this process as an effective life skill, which starts with defining the problem and moving through steps to creating a logical solution.

¹ Dr. Ujwala Chakradeo, Alternative educational ways for teaching and learning architectural design
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Source: Author

CONSTRAINTS IN ARCHITECTURE DESIGN PROCESS:

Designing is rather to find a balance between all constraints and information generated during the design process. Constraints are the undividable part of design process. Constraints are which have to be faced to the students of architecture and professional practicing architects too. Design problem is defined by well-structured set of constraints, in the overall design process, in which limited number of constraints and parameters are taken into consideration into account by a designer, in order satisfies the design problem, need to resolve constraints into better design outcome. Identification of constraints in individuals is necessary to resolve problems and foster the design process. at the same time in academics students of architecture faced constraints during design process, which can be resolved by creative techniques. So, here we are focusing on the constraints faced by students.

CONSTRAINTS FACED BY STUDENTS:

- Mental skills
- Physical skills
- Imagination
- Idea generation
- Holistic approach towards design
- Graphical thinking
- Presentation skill
- Verbal communication
- Creative approach
-

CREATIVITY IN ARCHITECTURE DESIGN:

Several techniques have been developed as aids to help designers and thinkers generate ideas and creative solutions to problem. Five techniques appear in the literature of design thinking and problem solving. Brainstorming developed by Alex Osborn (1964) and synectics develops by William Gordon (1961). Other techniques, such as role playing, buzz session, and group discussion. Have been developed and derived from Brainstorming and synectics. The striking observation in these techniques is that they are utilized within group interaction and collaborative efforts.

INTRODUCTION:

Design plays a vital role in the architecture education. Every student has different design approaches. Every design is a new challenge for students, as there are presence of constraints, which force the students to think critically or creatively. Where the design constraints are present in the design process and the form in which we want a design outcome. Novice students face difficulties in design process, identifying constraints and in finding solutions to it. They have their mental and physical blocks in mind, to remove these blocks which are the constraints of students and the constraints in design process both are resolved by creative techniques.

As the students of first year 2nd semester, they have enough knowledge of architectural language, like elements of design, principles of design, basic shapes, colour scheme, design composition and combination etc. They have developed their cognitive domain, now this is the time to apply this knowledge for the better design objectives.

DESIGN STUDIO: 1ST YEAR:

DESIGN BRIEF:

Aim: To make student understand the 2d composition by using basic shapes, design elements and colour scheme.

Objectives:

- To help students to identify the basic shapes, design elements and colour combination.
- To understand students the two dimensional composition at 1st year level.

Exercise by students of 1st year S.M.M.C.A. Nagpur.



Image 1

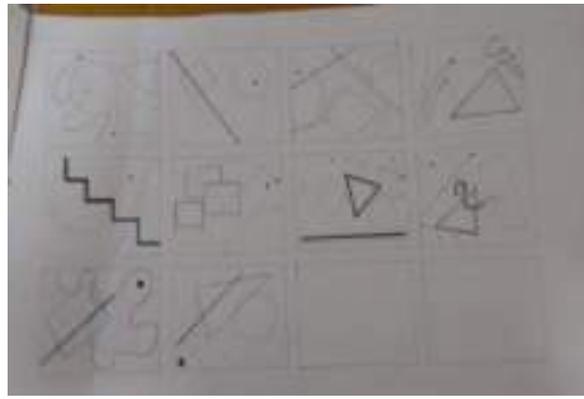


Image 2



Image 3



Image 4

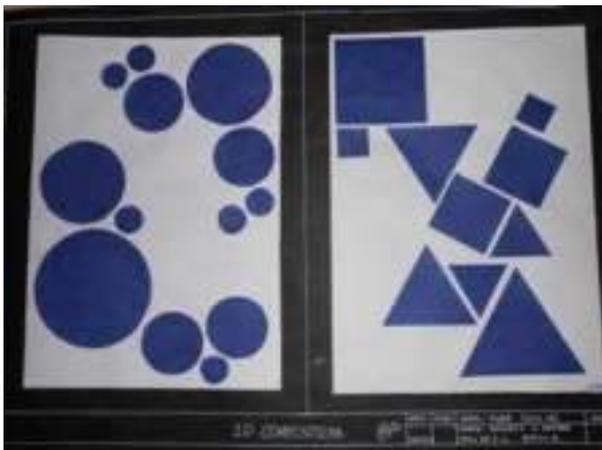


Image 5

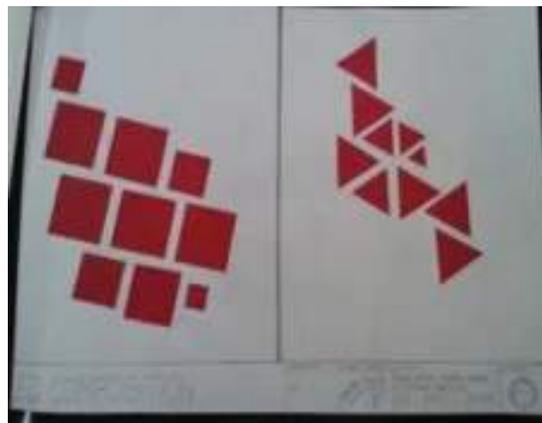


Image 6

ANALYSIS:

About design brief:

- There is no clarity in the design brief.
- The design brief is open ended, as no specific instructions are given.
- There is no specification about the basic shapes and design elements.
- In this composition students have not used design principles of composition.

About students:

- The design brief is open ended, where a student tends to feel lost in the composition.
- Because of no proper instruction of using shape and size, a student gets confused.
- Students could not visualize the composition as per the principles of design.
- Students get confused about using no. of basic shapes connections of shapes to each other.
- There is also confusion about repetition of shapes and the final outcome.

REVISED BRIEF:

Aim:

To make student understand the conversion of 2D composition to its 3D form.

Objectives:

- To make student understand about basic shapes.
- To make student understand principle of design for composition purpose.

STUDENTS DESIGN OUTPUT:

Exercise by students of 1st year Sinhgad College of Architecture,Pune
2D compositions



Image 7

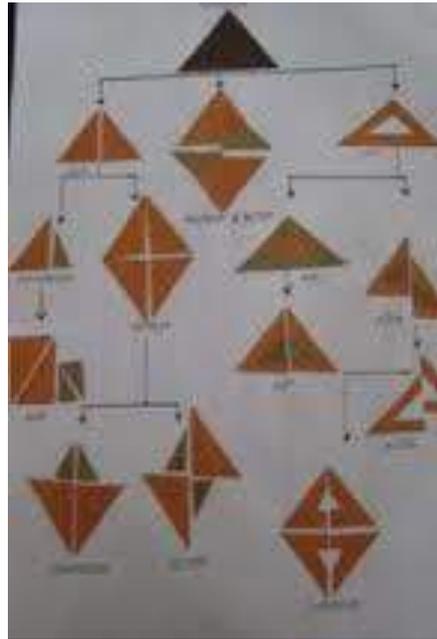


Image 8



Image 11



Image 10

Principle of design helps student in composition. Using of verbs to manipulate the basic shape by changing its position or by altering its shape, function, size, etc. Choosing of verbs also part of students imagination, graphical thinking, presentation skill, physical skill and visual communication. Brainstorming Session helps student to trigger mental activities and lateral thinking helps student think critically and creatively.

3D form:



Image 11 Bus Stand



Image 12 Bungalow



Image 13 waterfall (landscape element)



Image 14 Outdoor Sitting Area



3d forms of 2d composition, helps students to visualize the 3d form, and knowledge about volumetric study.

Where the students can identify spaces, scale of the space and the proportion.

It improves the students imagination and visual communication.

Image 15 Pathway and Roofing

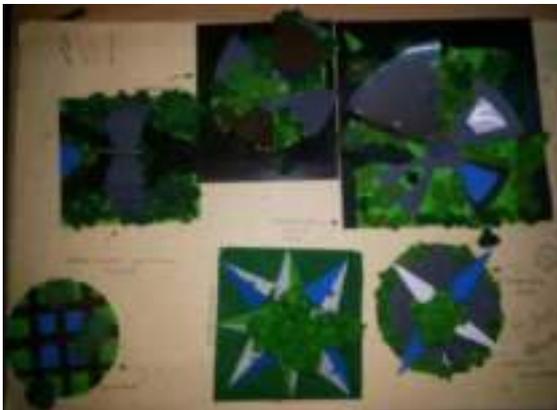


Image 16 Roof Forms



Image 17 Roof Forms

Here, student has made 3d roof forms for various activities.

ANALYSIS OF CREATIVE EXERCISE:

Analysis is to be done on the basis of design process and identification of its consideration, constraints and the method of problem solving. Mainly the how's the student approach towards handling constraints and design outcome.

IDENTIFICATION OF CONSTRAINTS IN DESIGN PROCESS:

- Selection of only one basic shape.
- Selection simple verbs to manipulate the shape.
- Selection complex verbs to manipulate the shape.
- Lateral thinking; using one complex verb or mixture of simple and complex verb
- Outcome of composition which will make some form/
- Output of the whole process.

IDENTIFICATION OF CONSTRAINTS IN STUDENTS MIND:

- Selection of simple verbs
- Repetitive use of verbs
- Problems in manipulating shapes
- Imagination for form making

- Thinking process i.e. lateral thinking
- 3d modelling

If the design brief objectives are not defined well, the output which we have got was not expected without these stage wise constraints in design process. For every stage, it was a challenge for student, to give justice to every stage as the each is successive to previous.

INFERENCE:

Design is a core subject of architecture education; it plays a vital role in architecture design. Design process is complex process; it is quite difficult to find a single authoritative definition. Design is a cognitive process where the blooms taxonomy of learning domain and Kolb's cycle of experiential learning are also involved cognitive processes which are helpful for the design process, to get better objectives of the design output. At the same time there are some considerations, constraints and opportunities in design process. To resolve these constraints we identified some problem solving activities where, design decision model, problem solving processes and creative techniques which trigger creativity in students mind, design considerations and constraints we have to take into account, but the constraints in students mind can be resolved by using creative techniques like brainstorming, lateral thinking etc. For the application these creative techniques and solving the problems of students mind in design process, the work of 1st year student is analyzed, by identifying constraints in design brief, design process and constraints in students mind. For resolving the constraints the brief of the studio is revised, and creative techniques held for the better objectives.

CONCLUSION:

- This procedure conducted in design studio helps students to get clarifies about elements of design, principles of design colour scheme, composition and combinations.
- Use of verbs to manipulate the shape, and brainstorming session helps student to work in a group and group discussion helps in clarifying blocks in students mind.
- So by these quick brainstorming using manipulative verbs, brings students ideas in focus in unique and exciting ways.
- Lateral thinking helps students in thinking critically and creatively.
- Basic Design & Visual Arts Objective- Developing skills in manual presentation techniques, use of various media of presentation, Principles of 2-D & 3-D compositions, Principles of Design. Theory of Basic Design- The study of this subject is aimed to understand the Visual & aesthetic qualities of Art and relating these to Architectural Design situation. This subject forms the direct input to Design as 'Basic Design'.
- When we decide to alter, multiply, eliminate, divide, or transpose, we are using manipulative verbs to change the way we view a particular process. Changing a verb can alter the sense of a statement and can have a dramatic effect on preconceived meanings.
- This creative exercise can be taken into basic design studio for 1st year students.

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PRESERVING THE HARI MANDIR OF THE PRARTHANA SAMAJ AT PUNE

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ABSTRACT

An alley running from the Pasodya Vithoba temple at Budhwar Peth, Pune, leads to a heritage structure bearing the history of the social reform movement known as the Prarthana Samaj, which was established in Mumbai on March 31, 1867. The heritage complex, locally known as the Hari Mandir has a prayer hall for the Samaj, a primary school building and a stupa bearing the ashes of the social reformer Sir R G Bhandarkar. The ongoing construction work in the adjacent sites, unplanned parking lots, old dilapidated structures, and the commercial activities in the neighbourhood of the Hari Mandir have engulfed the Mandir complex of the past.

This research paper focuses on the unconventional architecture of the Hari Mandir and delves deeper into the existing attributes of the spaces in the temple precinct. It researches the heritage management aspects of the temple complex by analyzing its repair works, maintenance, preservation, and scope of adaptive reuse, among other features. Empirical solutions and strategies to solve the existing problems have been recommended for this declining milestone of the past.

KEY WORDS: PRARTHANA SAMAJ, TEMPLE PRECINCT, UNCONVENTIONAL ARCHITECTURE, HERITAGE MANAGEMENT, ADAPTIVE REUSE

INTRODUCTION

Every Sunday morning at 9.30 am, attendees recite hymns echoing the poetic literature of Marathi saints such as Dnyaneshwar, Namdev and Tukaram, that transforms the premises of Hari mandir at Budhwar Peth into a spiritual and musical divinity. A tradition that is more than a century old immerses the entire premise in the surreal depths of philosophy embodied in the verses of the upasanas. Tucked away in the alleys of dilapidated houses of the old Pune city, behind the Pasodya Vithoba temple at Budhwar Peth, is the Hari mandir, a prayer hall of Pune Prarthana Samaj. The significance of this century old structure can hardly be conceived and the tonal value of its masonry in grey basalt can barely be cherished from the adjacent busy roads. Throughout the day the neighbourhood is bustling with commercial activities. The main approach road to the temple is cluttered by ongoing construction work. The physical and visual access to the premise being partially blocked, the prayer hall needs to be approached from the narrower secondary lane leading to the rear entry to the hall. The chaotic and unplanned streetscape of the neighbourhood interferes with the curiosity to explore and experience the solemn space that resonates the socio-cultural heritage of the yesteryears.

AIM

This paper is an attempt to preserve the architectural merit, historic interest, cultural value, and authenticity of the Hari Mandir situated in the crowded urban fabric of Budhwar Peth, Pune.

OBJECTIVE

The objective is to study and reveal the conditions of the existing structures of the Hari Mandir complex. This is done to formulate probable strategies to conserve the tangible and the intangible values of the Prarthana Samaj. The intention of the researchers is also to create a sense of awareness to keep the vicinity of the Heritage site clean so that the architectural splendour of the Hari Mandir can be accentuated.

RESEARCH METHODOLOGY

The main source for data collection was the literature survey from books, articles, publications, and web resources. Repeated field trips to the heritage site is done for the purpose of building appraisal through visual investigation and visual analysis. Information based on observation of the finished surfaces and exposed structures have been gathered and recorded. Interviews with Prof. Dilip Joag, secretary of Pune branch of the Samaj and with the local people were conducted to understand the present scenario regarding the functioning of the Samaj. To identify the strength, weaknesses, opportunity, and threats of the Hari Mandir and to recommend the probable strategies for the Heritage Management and Architectural Conservation of it, detailed photographic documentation is done.

HISTORY

The Prarthana Samaj, a social reform movement was born on March 31, 1867 in Mumbai, Maharashtra. The Samaj or the movement was started by the Indian physician and social reformer Sir Atmaram Pandurang in Mumbai under the influence of the Brahma leader from Bengal Sir Keshab Chandra Sen. It eventually spread its wings across the state of Maharashtra. Aligned to the principles and philosophy of the Brahma Samaj in Bengal, the Prarthana Samaj was against the social evils and those religious customs that the Samaj perceived to be baseless for the society at large. The motive of the Samaj was to ‘**Humanise, Equalise and Spiritualise**’ the society of Maharashtra during the pre-Independence era. The Pune chapter of the Prarthana Samaj came into existence in 1870. The proponents were great scholars and reformers such as Justice M G Ranade and Sir R G Bhandarkar. Though neither Sir R G Bhandarkar nor Justice M G Ranade was physically present in Mumbai when the Prarthana Samaj was actually founded on 31 March 1867, they were chiefly instrumental in formulating the creed and the ‘Six Cardinal Principles’ of the Prarthana Samaj in 1873. In doing so they adopted the root principles of Brahma Samaj but modified them to give their organization a distinct identity of its own. Its guiding principle, according to Sir Bhandarkar, was “the Fatherhood of God and Brotherhood of Mankind”. This principle, he said, implied not only “an obliteration of caste distinctions, but also the levelling down of all social distinctions”. With these ideals, the Prarthana Samaj became the chief center of reform activity in Western India. The doctrines of the Samaj are chiefly derived from the indigenous sources, namely the Upanishads, the Bhagwadgita, Buddhism, and the teachings of mediaeval saints like Sant Tukaram. A plot of land measuring about 1700 sq.m. was solely purchased by Justice M G Ranade and was donated to the Samaj in 1878. The construction work was started under the leadership of Sir R G Bhandarkar. A small meeting hall was built in the site to mark the rise of the movement in the soil of Pune. The Prarthana Samaj of Maharashtra

undertook bold steps against the social evils such as child marriage, sati, widow suppression and other superstitions. The Samaj abandoned discrimination based on caste, creed, and religion. The members of the Samaj had community meals prepared by a cook from a 'low caste.' Their bread was baked by a Christian and they drank water brought by a Muslim. Idol worship was denounced, and monotheism was the doctrine followed for worship. The meetings of the Samaj were held in secrets for the fear of backlash from the staunch religious followers of the age-old traditional ideals and customs. The year 1909 is marked by the consecration of the existing hall of the Prarthana Samaj at Budhwar Peth, Pune which came to be locally known as the Hari Mandir. The philosophy of the radical movement of the colonial era found a completely new expression through Architecture. The style of architecture tuned to the concepts of the social movement was simple, modest, and secular in nature.

LOCATION MAP



Fig. 1 & 2: Map of Pune & satellite image showing location of Hari Mandir (Source: www.googlemaps.com)

ARCHITECTURE

A frontal approach across the foreground leads directly to an arcaded porch of the prayer hall of the Hari Mandir. The Mandir apparently has the attributes of the Indian Colonial Architecture. The three arched portals with the prominent key stones leading to the front porch, the corbels below the projecting bands, the scrolls adorning the upper corners and the blind tracery work at the center of the gable end clearly indicates the influences of the Colonial Architecture of the pre-Independence era. The unconventional treatment of the symmetric front façade with its arched gable end draws attention and sets questions in the minds of the viewers regarding the typology of the structure. The prayer hall also served the purpose of an assembly hall for the Samaj. This is the hall where objective and rational decisions regarding the social reforms were taken in the past. It was open to the people of all religions and hence the architecture of the hall portrays the features of the Hindu, Islamic as well as that of the Christian Architecture. The capping finial is like the kalasha of the Hindu shikhara. The gable arch resembles the front façade of Islamic tombs whereas the interior of the hall strongly mirrors the features of the medieval Parish churches of the western Europe. The polygonal staircase blocks protruding on both sides from the main frame of the rectangular hall like the turrets of a church lead to a gallery running on the three sides of the hall. The prayer is chanted from the lectern and the attendees occupy the temporary seats in front of the lectern. The 3-sided gallery above provides additional space to accommodate the followers in times of special occasions. The exposed timber trussed roof, triangular braces supporting the gallery, simple stained glass in the windows, details of the copings, the unpretentious flooring in Shahabad stone and the abundant use of locally available grey basalt speak in volumes about the past style of architecture and heritage. According to the cardinal principles of faith of the Prarthana Samaj, to worship and to pray to image and other created objects is not a true mode of divine adoration. Monotheism and the belief in a formless God of peace, knowledge and love explains the absence of an idol in the prayer hall. The grand hall is well lit and ventilated by the segmental arched window and door openings. The load bearing structure in dressed grey basalt and the repetition of the openings with the visible voussoirs and key stones of the arches render simple articulated exterior facades.

Off the linear axis of the Hari Mandir, in the rear part of the premise is the secondary point of emphasis, the Bhandarkar Ashram built in honour of Sir R G Bhandarkar, the great social reformer. The foundation stone of this structure was laid by Sir Nararyan Ganesh Chandavarkar on July 6, (Sir Bhandarkar's birthday) 1920. The Bhandarkar Ashram is a simple double storied structure in grey basalt with a 5 arched verandah and pitched roof. An exposed wooden staircase connects the two floors. The elevation treatment does not deviate from that of the prayer hall and the visual coherence in the two structures have been consciously achieved. The ashram housed a primary school till recent years. North of the ashram is a small stupa- a memorial which bears the ashes of Sir R G Bhandarkar. The marble plaque reads, "The Stupa of the Venerable Dr. Sir Ramkrishna Gopal Bhandarkar, K.C.I.E., President of the Poona Prarthana Samaj, Oriental scholar of World Renown, Leader of Indian Social & religious reform, Revered of His Countrymen, born 6 th July 1837, Departed life 24th. August 1925."

On the edge of the premise stands the caretaker's dwelling unit. Its colour scheme and building material being starkly different from the existing structures is somewhat out of sync with the visual harmony of the site. The Hari Mandir is demarcated by a paved pathway along its periphery and is separated from the school building by a low-heighted boundary wall to differentiate the activities of the two distinctly different zones.

The heritage structures within the same premise are standing today in their solitary spaces unrelated to one another by function and linked only by a path of movement.

OBSERVATIONS

A close introspection of architectural heritage of the precinct of Hari mandir reveals that the once active space for the Samaj is at present silently striving hard for its self-existence. The study of the structure suggests no signs of structural failures or corrosion in the stone masonry. But the lack of continuous review and monitoring of the structural health of the building is evident from the glimpses of the heritage that is ignored for years.

TABLE-I Observations in Hari Mandir, Budhwar Peth, Pune (Source of images: clicked by authors)

SR.NO.	IMAGES	OBSERVATIONS
1		<p>➤ HARI MANDIR</p> <ul style="list-style-type: none"> • Basalt walls showing signs of mortar deterioration • Loosening & dislodging of pointing material • Stair shafts used as storage spaces • Masonry cracks in the treads • Peeling of plaster • Corrosion of iron railing • Wearing of paints from the wooden frames of doors & windows
		<ul style="list-style-type: none"> • Creeping vegetation & penetration of the root into the wall core • Terrace space unused for years • Blackening of the joints in Shahabad stone flooring • Accumulated dust on surfaces • Treasure trove of archives stacked in an old cupboard in a corner • Etching on the marble plaque next to the entrance gate not readable • Prime spaces in between the existing structures of the heritage complex left vacant and not landscaped
2		<p>➤ SCHOOL BUILDING</p> <ul style="list-style-type: none"> • Two storied primary school shut since 2007 • Classrooms turned to the voting centers & operational only at times of elections • School children being shifted from Marathi to English medium schools in pursuit of so-called modern education • Discontinuity of vocational courses in the classrooms • Seepage in floors • Rusting of iron bars • Peeling of paints from wooden surfaces • Creeping vegetation from crevices in the walls • Overhanging cables between the prayer hall & the school building
3		<p>➤ STUPA</p> <ul style="list-style-type: none"> • Is hardly identifiable • A small scaled stone memorial raised on a podium • Epitaph in marble losing its clarity • Visual cacophony and unplanned activities in the adjoining spaces

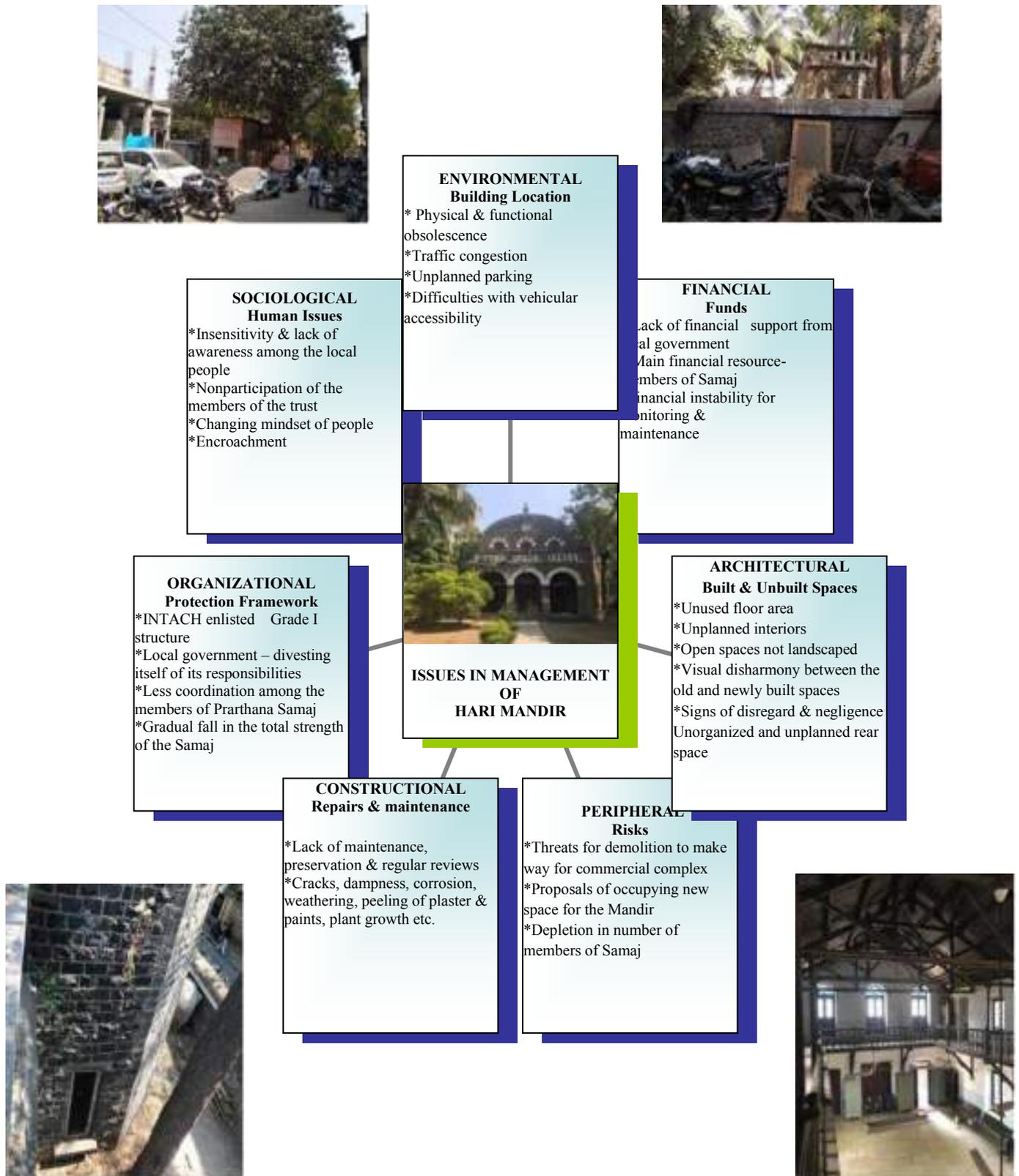


Fig. 3 Issues in Management of Hari Mandir (Source of images: clicked by authors)

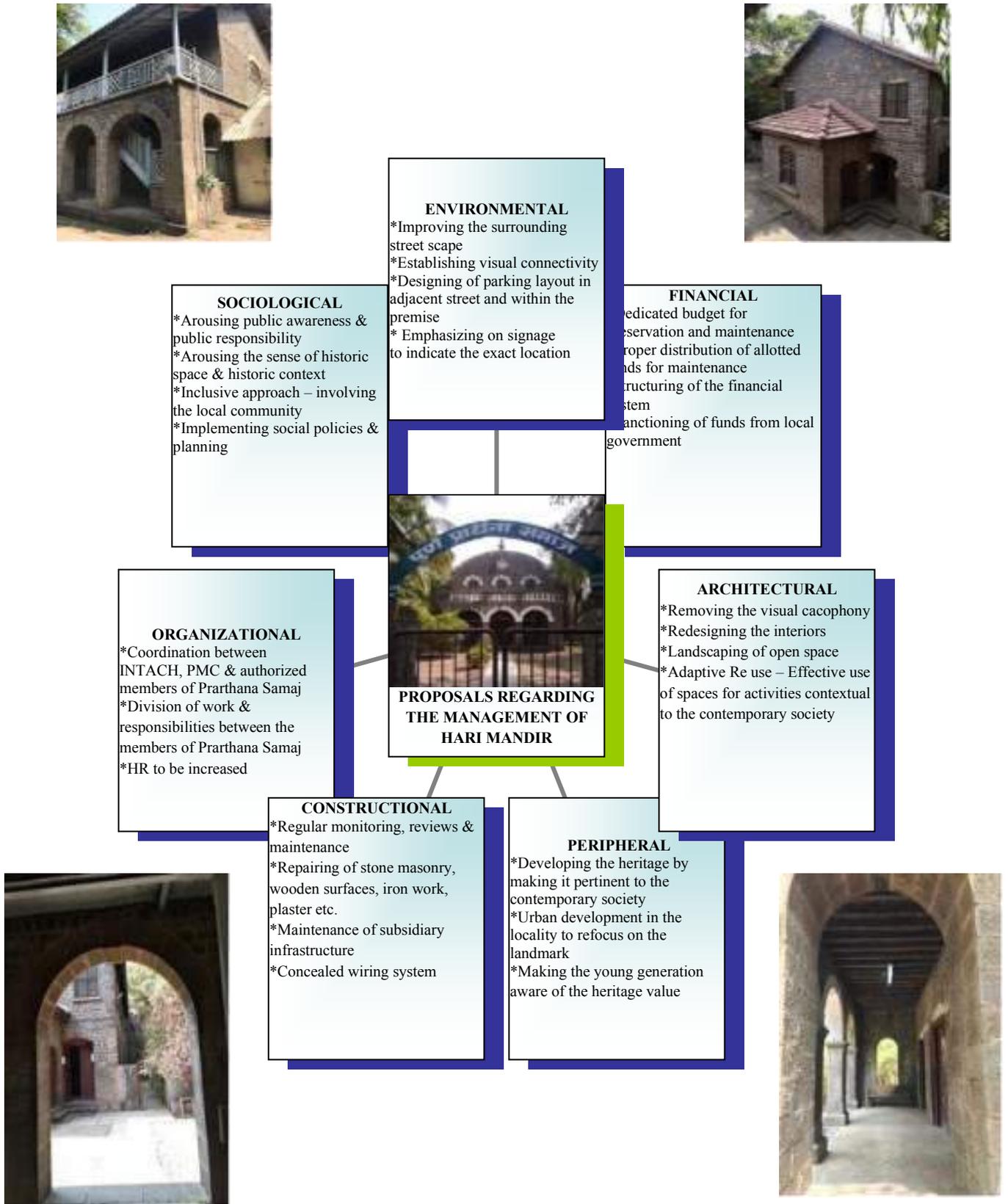


Fig.4 Proposals regarding the Management of Hari Mandir (Source of images: clicked by authors)

SWOT ANALYSIS

Strengths

The Hari Mandir complex of the Prarthana Samaj is listed as a Grade I structure by INTACH. It is of national and historic importance and is associated with a historic movement started by great personalities who initiated the social reforms of the Indian Renaissance of the 19th century. The traces of history in the spaces, the marks of the masons, the craftsmanship identifying the age of the building and the elements of architecture used in the prayer hall signifying the respect for all religions make it a landmark of the past. The manifestation of secularism using elements of Hindu, Islamic and Christian Architecture in the same building gives the Hari Mandir a distinct character of its own. Apparently, it may seem to be just a simple old structure of stone but when the hall rings with the chants of the upasanas, the mind pacifies and the positive energy experienced uplift the mind beyond all faiths and beyond all religions. The intangible value that the prayer hall carries is the core strength of the space. The physical identity of the built spaces has not altered through times and the Hari Mandir is a standing document of the past for the current and the future generations.

Weaknesses

The number of members of the Prarthana Samaj is reducing in present times. The major reason behind this is its location. The site being in the crowded interiors of Budhwar Peth and being difficult to reach, the Samaj is fast losing its importance and value. Mandir complex is engulfed by the congestion of the surrounding commercial cum residential spaces. The construction work in the adjacent site is going on at an accelerated rate and the main approach to the premise is almost blocked. The MSEB transformer housed at the entrance has completely obstructed the viewability of the front façade. Immediate surroundings are messed up by uncontrolled traffic congestion and unplanned parking lot of the two wheelers. The mixed land use of the greater setting has changed the streetscape and the character of the area is no more dictated by the existence of the heritage building. The open space within the premise is not landscaped to draw attention.

Most of the inhabitants dwelling in the area being migrants from the other cities of India have little regards, respect, and sensitivity towards the rich heritage of Hari Mandir. They are unaware of Hari Mandir's rich historic context and consider it to be a predated structure occupying a prime location in the urban fabric. Some of the archival documents and books related to the Prarthana Samaj are not displayed and are lying in closed lockers of the prayer hall in neglect.

Opportunities

The heritage dimension of the Hari Mandir complex can be enhanced through the development and active maintenance of the buildings and its surrounding. Both the Mandir and the school building are structurally stable. They have the potential to be converted to active spaces through minimum interventions. Redesigning the interiors can make the hall more functional. There is enough open space around the structures to be converted to gardens with seating arrangements. To create a value based and knowledge-based society as per the teachings of the Samaj, the free unused floor area of the Hall and that of the school can be easily used for social and educational purposes. Adaptive reuse of these unused spaces to library, history museum or hostel block have been thought of by the members of the Samaj. The gallery space can be effectively used for exhibiting the documents, records, archives related to the Samaj. This will help in sensitizing the people and making them aware of the rich past. Hari Mandir can regain its pre-eminence if included in the Heritage walks conducted in Pune.

Threats

The major threat that was identified through survey are lack of financial resources, maintenance deficiency and encroachment. Due to the limitation of funds, the protection mechanism is also weak. Funds received from the local government are not adequate for managing and maintaining the heritage site. The fund collected from the members is the only source and is not enough to provide the legal, physical, or moral protection to the Hari Mandir complex. Within the premise there is encroachment of a hotel and a transformer which are totally incompatible spaces in a heritage site. Current human activities and traffic congestion around the site is polluting its sanctity. The school has been shut for years on account of changing social and educational trends.

CONCLUSION

The Hari Mandir was once a prime landmark in the heart of Budhwar Peth. The widow remarriage movement, formation of widows' home association, propagation of women's education, abolition of child marriages, dowry system, polygamy, and infanticide, are only a few of the social activities which were promoted from here to create a new Samaj of Maharashtra. The Prarthana Samaj of Pune is losing its legacy. The austerity of the grey basalt mandir is shadowed by the mixed development of the areas engulfing it. The mandir complex though enlisted as a heritage structure, is lying unused, uncared, and unadorned by the fast-changing society of today. Adaptive reuse, proper repairs and maintenance, development of built & unbuilt spaces, structuring of the financial systems, increasing the coordination between INTACH, PMC & authorized members of Prarthana Samaj and arousing public awareness will help in making the Hari mandir an asset of Pune. Attempts have been made to revive and continue the tradition of the Samaj through varied social work. Spiritual discourses, lectures, refresher courses, summer camps for children, sessions on poetic literature by saints in Maharashtra have been organized from time to time in the prayer hall to carry on the past heritage of the Samaj. Besides getting the website operational, the members of the Samaj also have plans to be active on social media to spread the message of unity. More than the participation in social reforms, social activities and social media, the need of the day is to work towards the **Architectural Reforms** through conservation works and to concentrate on the **Heritage Management** of the mandir. The Hari Mandir if revived, can provide a space for the new generation of thinkers and intellectuals to contribute to the continuous evolution of the larger society.

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SUSTAINABLE LUXURY

Container Homes

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ABSTRACT

The idea of converting a shipping container (steel box) into a product of luxury and lifestyle is itself a juxtaposed statement. Changing the criteria for luxury spaces & redefining the opulence can be achieved through comfortable designs and not just by giving elaborate spaces.

So, why are container homes sustainable? These steel boxes are usually supposed to be left unused or expensively reprocessed in a complicated manufacturing process, which not only costs money but also uses energy. So upcycling or converting them in houses is a sustainable solution to this emerging problem of storing empty containers.

Container homes can be a solution for a building or a group of buildings that are structurally stable and environmentally friendly with very high capabilities of achieving aesthetic values.

These steel boxes eliminate the structural barrier which gives us a number of permutations & combinations which give birth to modular housing solutions.

KEYWORDS - Sustainability, minimal living, shipping container, luxury & lifestyle.

INTRODUCTION

Sustainability is a mandate factor in today's era, wherein we try to reuse/recycle the materials. In building technology and architecture, sustainability is considered as an important ingredient. Therefore to create a space that can host various functions not only economically or financially but also environmentally, the UN has stated 16 goals for sustainable development.

The container homes and tiny houses are an emerging lifestyle shift in today's era. It checks out all the pointers which make a sustainable home, also the rapid shift to minimalism or minimalistic living has set container homes as a vogue.

The designs to date host a minimal living but, can it be a luxury?

Aim

The idea of converting a shipping container (steel box) into a product of luxury!

The aim is to define luxury in a confined space, to create a lifestyle and design analogy between tiny homes & regular homes for minimal yet luxurious living.

1. To contribute to the understanding of how shipping containers can be converted into luxurious living statements which can be considered as a second home. Minimal living projects are initiated worldwide as a collective and relational endeavor including how this fits into a wider policy of social, economic, and environmental processes.
2. To discover how individuals have been involved in initiating minimal living projects to conceptualize and communicate their desires for a unique second home.
3. To explicate knowledge of forms used by architects in the very early stages of an architectural project.
4. The idea behind this research paper is to develop a product of sustainable luxury which can cater to both ends.

The objectives of the research are:

1. To identify a specific desire for a second home and to create a niche in the movement of minimal living.
2. To infer relationships between an architect's knowledge of form, space, and order with clients untapped experience.
3. To establish a sustainable solution to the emerging problem of storing and reprocessing the shipping containers.

INTERVIEW

When we asked Mr.Lav Chaurasia & Ms.Mona Gonsai the founders of the URBAN CAMP LLP. the main reason to build container homes or rather what was the ethos behind the sudden shift for a successful graphic design company DU99 to get into a completely new venture? URBAN CAMP LLP. is a company that sells a sustainable lifestyle in a shipping container where the authors of this research paper are a part of the team.

“The thought of building container homes emerged through many events that occurred simultaneously in 2017-18.

We bought land on the outskirts of Pune and around that time we came across the concept of tiny homes, minimal living, and VIPP Shelter. We wanted to build one for ourselves on the land we bought. But could not do it due to some constraints. But the idea of container homes and minimal living stayed with us. We evolved this idea further and began to gather a knowledge base and team.

The inspiration gradually turned into a passion.

This intention evolved to build sustainable homes to live in the midst of nature.

Why Shipping containers and no other material?

Upcycle

Our intention is to upcycle shipping containers as it is estimated that several million of these containers have now been discarded due to the shipping cost of sending them back to their port of origin.

Modular & mobile

Shipping containers lend a great amount of mobility and is versatile. It's like Lego!

Affordable

Shipping container homes are affordable and it does not require any construction related permissions.

The excitement of building a home in less time is truly a big plus point.”

RESEARCH METHODOLOGY

1. To understand how the geometry and the material of a shipping container have been perceived this research is backed by a few case studies.
2. Since the container responds to magnetism, the orientation of openings and the placement of the container was determined to keep in mind the earth's magnetic field.
3. To understand the psychology of a different age group w.r.t a need/desire for a second home the following survey was conducted which

helped to achieve the objective.

4. To accommodate shipping containers as a livable structure, considering the climatic conditions of India and how the metal will behave.
5. This paper includes three design proposals that have been structured after manipulating the key aspects of architecture i.e. form, space & order which will invoke luxury.

SURVEY

To formulate a design analogy between tiny and regular homes and to get statistical data on people’s choice of second home and luxury the following survey has been conducted on empirical grounds.

The people chosen for the survey were categorized as follows:

1. The age group belonged between 21-60.
2. Then, depending upon the profession the list was made according to the client’s potential. (IT Professional > Designers > Artist > Businessmen > Retired professional)
3. Lastly, also the people with a decent spending capability with a bracket of 8-18 lakhs INR.

The questions are as follows:

1. Are you aware of Tiny House Living?
2. Have you ever seen a shipping container?
3. Which one of them is a shipping container?
4. Which image gets your attention first?



5. When looking for a second home what are the top three things you consider.

- a. Budget - Location - Building Style
- b. Building Style - Building Material - Location.
- c. Budget - Size - Rent/Own
- d. Budget - Location - Size

6. When you make a decision of building/ renting a second home, how fast do you want your house to be built?

- a. less than a year
- b. more than a year

7. What age group do you belong to? a - 15-25: 55%, b - 25-40: 29%, c - 40-60: 14%

8. Are you interested in living or working in a sustainable infrastructure?

9. Do you know what sustainable development is?

10. Do you agree that it is important to begin implementing sustainable housing infrastructure for the future?

11. When you visit someone else's second home/farmhouse, where do you like to spend most of your time? Imagine you are with your group of friends/family.



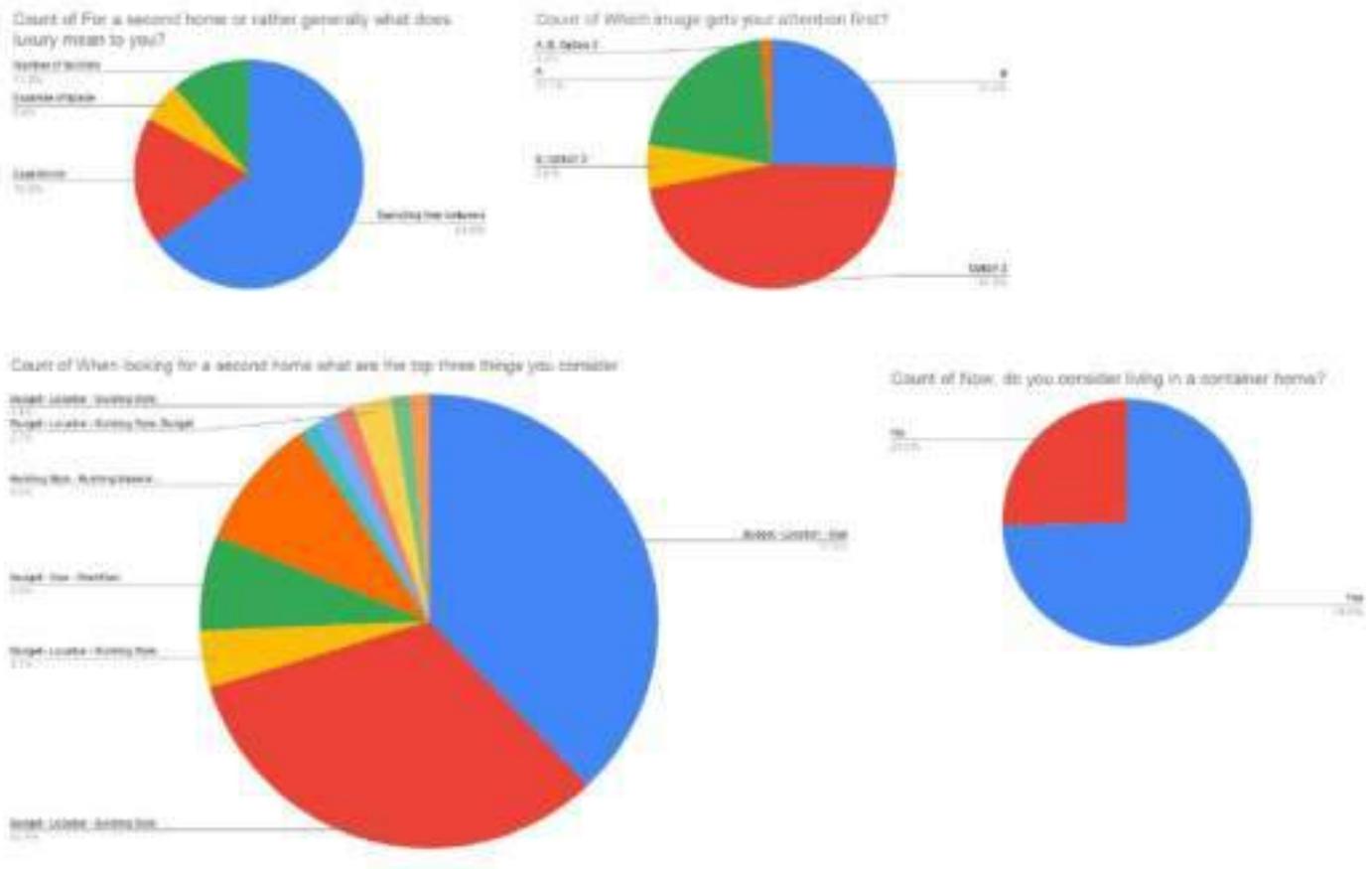
12. Apart from a bed to sleep and a place to eat what else do you expect in a second home?

13. Look at the image below & for instance consider yourself as a proficient hiker.

Would you like to stay in such a place? If not, then explain why.



14. For a second home or rather generally what does luxury mean to you?
 a. The expanse of space.
 b. A number of facilities.
 c. Experience
 d. Spending time between nature & structure.
- 15 Now, do you consider living in a container home?



Survey Conclusion

Following are the conclusion as per the survey results:

1. Respondents preferred to go for a box-like structure with a sense of luxury attached to it.
2. They want a faster turn around for their second home with criteria of Budget-Location-Building Style - 43 %
Budget-Location-Size - 46 %
3. A majority of the crowd opted for a sustainable future in architecture.
4. Along with the basic requirement of a bedroom & kitchen, this survey could discover a desire to own interactive spaces and yet have a self-indulgent experience.
5. With the exact image shared to them of a 40’ shipping container home, more than 70% are ready to opt for such a different kind of a second home.
6. The desire to have scintillating experience took over the usual want to have a lavish space filled with ultra-modern technologies. Spending time between nature & structure got the most votes. Which gives these steel boxes capability of hosting all the above dynamics which the people actually expect in a second home rather than the adaptability.
7. With a new perspective and willingness to experience this new approach to a luxurious lifestyle under a small shelter this survey could manage to convince 75% in the favour of container homes as their second home. Giving us a new direction to introduce sustainable luxury.

WHY DO WE SAY ITS A SUSTAINABLE LUXURY?

“Each and every room under a built space has its own ‘function’ & vibe. If we could achieve the same function with a better experience inside a 160/240/360 sq.ft box then we can call it a container home.”

Sustainability

Being available in large numbers or rather lying abandoned on the dockyard, has raised a huge problem of not only storing these empty boxes also melting even one of such containers takes about 8000 Kv of energy. This is an expensive process of reprocessing. Hence, upcycling the shipping container for various other functions specifically in architecture has become a better solution to this global problem. In the design modules which have been discussed below show the use of energy-saving alternatives like solar panels, green roof to maintain the temperature inside the metal box which could trap heat in countries which have a similar climate to India.

The ease and the time involved in making a container home itself is a huge breakthrough in building a second home that too

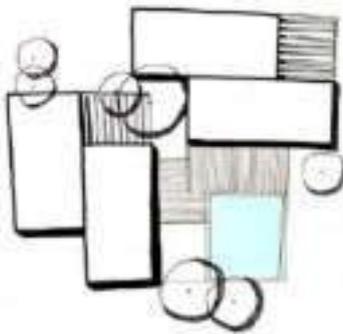
remote locations. Being modular the house can be made at the workshop itself and later transported to the desired location reducing the carbon footprint caused by transporting the construction material.

Cold Shell

Structurally strong, economically affordable, and lego-like qualities make this cold shell a quick turn around option for a second home. These shipping containers are geometrically rectangular giving us a constraint of size and form thus, challenging the designers. Shipping containers can be used in its form and size as a flexible module for a house. This cold shell has the capability of stacking multiple units on top of each other and this can hold different capacities of people with their specific requirements.

Orientation, placement & mobility.

Being a metal box responds to the magnetic field of the planet earth, therefore the orientation plays an important role. Thus, the placement of the container with large openings should be placed preferably facing the north-south direction to help the free-flowing of the magnetic field. And these containers are easy to shift & can be easily transported on any truck with a carrier, thus the same home can be moved whenever and wherever.

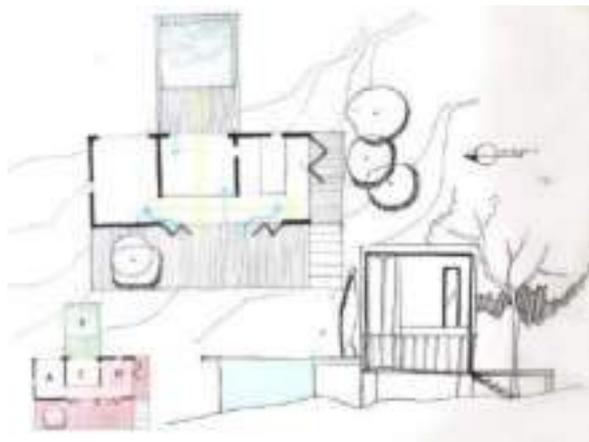


Luxury

Now juxtaposing the charm of luxury in this tiny house will give birth to a completely newborn lifestyle, where luxury will be intended towards the experience of the space and not just the expanse of the space.

Considering it to be a second home the correlation of the interior and the outside space also accounts for the luxury of these homes. Spending time with your closed ones in the midst of nature with a cozy placement of the containers facing the pool and other such amenities will inculcate a new perception in the people.

Note: The design which has been discussed below has already been built on the footsteps of Purandar Fort, Pune. Catering to clients of different age groups with different interests and professions.



Module 1

This module has a completely unique design character that has the actual luxury of dedicated activity space. Provided with a lavish bathing area with a plunge pool appearing only from the bedroom. All these components have given this module a different perception of luxury in a small space.

Design Movement

The design demands free-flowing access to connect the different zones of the container home, thereby creating a transverse & longitudinal circulation movement. The impact of the two different entrances have completely different uses; one extends the kitchen and the other extends the bedroom to create a small spillover area.

Play of light & Shadow and airflow

Multiple huge openings bring in a different kind of sunlight and the placement of two huge doors adjacent to each other helps to build a vibe of an outdoor kitchen & dining. The two openings also bring the maximum amount of air.

Spaces and Volume

The inclusion of big openings gives the space a sense of openness as it infuses lighter and makes that particular space feel bigger than the actual size. The orientation of the room w.r.t the openings have created two zones not visually but functionally. The kitchen with the extension of a huge deck and a bedroom with its own private plunge pool having its approach from the bedroom window in all shows the play in spaces.

Architectonic Elements

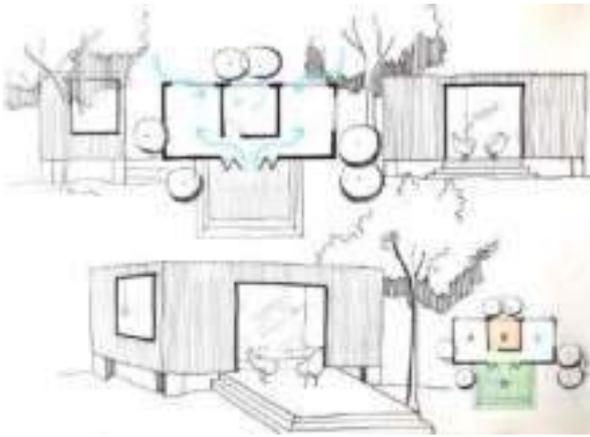
The bedroom window has two functions; one is to act as a ventilator and the other is to behave as a door to the plunge pool which will give the user a completely different kind of experience. Also, the bifold doors which

enhance the view from the kitchen act as a frame of a scene for the people sitting on the opposite side of the counter. With an addition of a pergola over the deck will extend the living space with a semi-outdoor area

Module 2

This module is designed keeping in mind the conventional planning of a home.





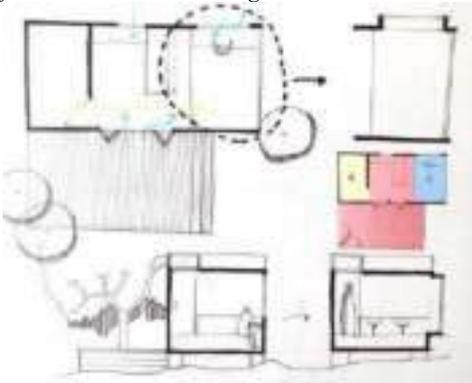
Majorly dividing the space in the kitchen, bedroom, and bathroom. Yet we have tried to amalgamate the circulation area and outdoor area to create a sense of one plane but divided by different textures of the floor.

1. The design movement for this design flows by dividing the space using the Fibonacci series, from least to most-used spaces. eg: bathroom-1x and bedroom & Kitchen 2x-2x and the passage connecting them create a sense of solitude.
2. Each opening brings in a different kind of sunlight due to its placement and also brings in fresh air allows to cross ventilate the space and creates a play of light and shadow.
3. The inclusion of big openings balances the proportion of the room hence divided.
4. The rear long wall has 3 slits, one for each room to bring in all sorts of sunlight throughout the day. The shorter sides have a huge open-able horizontal casement window that gushes in direct sunlight along with fresh air which gives the space a sense of openness as it in-fuses lighter and glass doors are intentionally bigger than usual to give a grand entrance.

makes that particular space feel bigger. Also, the sliding bifold

Module 3

This module has been designed for a completely different kind of user. The only partition inside the container is of the bathing area. The furniture used in this design is modular.



1. The design movement for this module is similar to a studio apartment with modular furniture having a very different kind of a user who does not demand enclosures and is intended to spend most of his time outside the container.
2. An enormous glass opening lights up the whole space. The sloping skylight roof will make it easier to see pleasant night skies during winters and an adjacent solar-paneled roof which allows the container to work off the grid. With a green roof over steel, the box solves the heating issues in extreme climates and keeps the interior pleasant.
3. The spatial expanse can be felt not only by giving one huge opening but also by not giving any partition to bifurcate the kitchen from the bedroom.
4. The modular furniture gives us the opportunity to get done with multiple jobs in a constrained space. The kitchen counter has an extension to become a bar counter which again breaks the monotony of the open space.

CONCLUSION

After knowing the idea of luxury through several interviews and surveys it can be concluded that luxury in a tiny house especially in a shipping container is achievable. Thus, a product of luxury is attainable.

The confined and monotonous character of these metal boxes can be converted into beautiful design spaces as discussed in the designs above by following the basics of form, space & order.

Through the survey, it is understood that the people would opt for a container home and are willing to experience this sustainable lifestyle. Also, most of them are not aware of such concepts of minimal living.

The process of melting containers is far more expensive than constructing a home out of it which has good strength and durability with modular designs. Easier transportation, mobility, availability gives the designers a new challenge.

Luxury is relative which was easily observed after the survey that it is experience-driven and not just by space and technology.

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DHARAVI REDEVELOPMENT PROJECT (DRP)

Impact, Reforms and a case-study from Architectural and Sociological Viewpoint

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ABSTRACT

The stigma of being 'the dejected class' in our social hierarchy, has always been attributed with the slum dwellers, and Dharavi always had precedence over the rest. Although in the past few years attempts through NGOs have tried to change that, in some instances the inhabitants have formed various alliances to better their living conditions exhausted by the apathy of the state. By admitting to the complexity and scale of the problem, the state has its own limitations in implementing the DRP in its complete essence, with the private developers in the equation it does not make things any easier for the people of Dharavi. The failures of Government policies need to be studied thoroughly to find the loopholes that are commonly tapped by the Private Developers to exploit the residents of Dharavi which has led to their formation as a staunch opposition against all such policies including the DRP. As a means to provide them with a medium of expression through this paper, several categories were formed and people belonging to different sectors like Residential Owners, Tenants, Industrial Owners, Tenants etc. were assigned to each group to conduct interviews and have them speak freely regarding the DRP, and more importantly the role of Dharavi as a community and a place in their lives, talking to its residents, hearing their grievances and studying the social fabric and other key aspects of Dharavi, we can only then develop 'people-centric' solutions and reforms that work for a hardworking and yet the poorest and the most marginalised section of our society, so that these solutions can be scaled up to work for other groups of the 'Urban Poor', across the country.

KEYWORDS

SLUM REDEVELOPMENT, SOCIAL MOVEMENT, ARCHITECTURE ACTIVISM, DIGNIFIED LIVING

INTRODUCTION

An approximate of 600 Acres land of Mumbai belongs to Dharavi, it is a mosaic of tin roof squatter belonging to over one million residents. Like most slum dwellers around the world, Dharavi is a non-regulated and illegal settlement, and through this often quoted technical excuse by the authorities a majority of its residents do not qualify for basic public amenities like clean water, sanitation, health-care and waste disposal services, leaving the people on their own. In the glamorous city of Mumbai, Dharavi is often perceived as a shameful eyesore for the city's inhabitants, for many have never visited nor have any intentions to visit any time soon, people suffer from social exclusion at the hands of a more 'privileged' section of the society, much of it is very evident when the literate section of the society applies for jobs outside. More than anything, the tourism industry that is flourishing here is rather dubious in nature, tourists visiting from different parts of the world pay exorbitant amounts to these 'tour groups' who in return take them on a curated tour of its resident's misery. These 'tour organisers' belonging to a more privileged part of the society have been making money showcasing Dharavi's despair.

'Asia's Largest Slum' – a quote that is often attributed to Dharavi, having sold it through movies and online media it has attracted tourism from almost the entire planet – certainly not a badge of honour, and yet it has been 16 years since the proposal of the 'Integrated Development Scheme' (2003-04) introduced by Ar. Mukesh Mehta and taken into consideration by the Slum Rehabilitation Authority (SRA) has neither been implemented even partially nor moved an inch towards its set goal. Since its proposal the administration and state has been shifting goal-posts claims Mr. Rajendra (Raju) Korde in an interview conducted for this paper, laughingly he adds "Lord Ram had finished his 'vanvas' in 14 years and returned to Ajodhya but our vanvas is turning out to be much longer than Lord Ram's". Raju Korde is the activist and forefront runner fighting for the welfare and rights of the people in Dharavi those who have been scammed previously by state appointed private developers for those who would eventually be affected by the implementation of DRP, recently he had been summoned by the Hon. Chief Minister of Maharashtra Shri Uddhav Thackeray after repeated requests for a meeting with the residents and business owners of Dharavi, much of their concerns have been heard and has been promised immediate resolutions.

Dharavi is a hub of informal economy that has a turnover of about 650 Million USD per year, contributing up to 1.5% of the city's GDP, wherein the contribution of Mumbai is 5% of India's GDP ^[1]. This entrepreneurial spirited community thrives on the availability of cheap labour, who reside while paying minimal rent as low as 300 Rupees per month. People of Dharavi live in dire conditions with a toilet block to share between 600 to 1000 people and in some cases up to 1500 people, inadequate sewer lines, inspection chambers and collected sludge and waste in *Mithi* river often lead to flooding in monsoon and an eventual widespread of diseases, such as Malaria and Dengue, in the situation of a pandemic the society will witness the apathy of Legislators and Law-Makers who have been conveniently abandoning them since more than two decades. In some instances, only one water tap is available to share between 20 to 25 families, making it extremely difficult to obtain a potable source in summer due to heavy usage and lower supply pressure. Residents go through these hardships mainly because of cheap accommodation and Dharavi's proximity to rest of Mumbai, connected by trains from Sion to Central, Harbour and Western lines making commute rather easier. Unlike many slums globally, Dharavi is placed in a close proximity of wealthy neighbourhoods and real estate sharks have their eyes set on Dharavi since the time Bandra-Kurla Complex has come up as a commercial hub, resulting in a rapid real estate development. Dharavi is unique for its residents entrepreneurial endeavours; for example, the manufacture of suture threads used in surgeries that complies with WHO standards comes out of here, the recycle industry that employs thousands to go through the waste produced by the entire population of Mumbai to sort, organise and dispose it in the correct manner, these sorted waste then goes through re-use to generate alternative fuel to run small scale industries such as leather products, pottery, baked goods, knock off clothing brands etc. Dharavi is an exemplar of a multicultural entrepreneurial spirited community that has made its place known in the 21st Century Metropolitan Mumbai, despite of constant neglect amidst political shifts. One of the most common quote amongst the residents of Dharavi is that if they want they can turn the city of Mumbai into a 'dumpster' the day they collectively don't show up for work. That is the importance and a peculiar role of Dharavi in the upkeep of Mumbai, keeping it presentable for the world.

"Instead of a neighbourhood characterised by misery, I find a bustling and enterprising place, packed with small-scale industries defying their circumstances to flourish amidst squalor. Rather than pity, I am inspired by man's alchemic ability to thrive when the chips are down"

-Simon Crerar

1. CREATION AND EVOLUTION OF DHARAVI

The compulsive human instinct to pull one's family out of poverty brings a large influx of people rather incursive moving from rural to urban areas looking for employment. Slum settlers in Indian cities are accepted as a natural consequence of urbanisation. The role of central

government in the realm of slum policies in India has been to provide enabling policy framework for slum rehabilitation along with financial resources & channelling funds from international donors to state governments. Migration to ‘Bombay’ started around 1958 when an industrial revolution within India was taking shape soon after the Independence, this age was unravelling its potentials that sparked interests of rural India to migrate into the cities and make a life of dignity and material wealth that was denied during the British rule, India had begun experimenting with its capabilities of what is ‘possible’ and migrants were in the forefront of it all. Dharavi at the time was a marshy land with swamps, that saw migrant communities such as tanners of Tamil Nadu and U.P coming to Koliwada and turn it into their homes, this was the beginning. While residents run businesses within the slums, exploitation of cheap labour is rampant, living in small makeshift houses due to unaffordable rent in Mumbai going as high as 50,000RS per month to as low as 3,000RS per month for a room and kitchen shanty within Dharavi. The businesses are untaxed and unregulated mostly since the capital or seed money involved is rather low, in some cases women run these businesses within their households in leisure hours of the day, children and women of the same household and the neighbourhood depend on these businesses as a source of employment and income to support their individual families to cover their monthly rents or start a rainy day fund, and in the process children quit on schools and some never even start. At times the work environment is ill suited in terms of safety and hygiene, these businesses being run on mezzanine floors does not allow for the best of ventilation or spatial sensibilities to prevail which eventually leads to cramping and fire hazards. Having emerged over the late nineteenth century, expanded rapidly after 1960 and is currently spread over roughly 600 acres of land. ReDharavi (KRVIA and SPARC) study divides the history of Dharavi into three phases, namely ^{[2][3]}:

- **Colonial Phase:** (16th century to 1900): The key feature of this period was the gradual transformation of an active fisher folk settlement (*kolis*) into an informal settlement at the edge of the city
- **Post-Independence:** Two important processes of the post-independence period were:
 - Increasing occupation of lands around Dharavi by migrants from neighbouring states and its emergence as a large slum
 - The declaration of Dharavi as a slum in 1971 through an act of legislature and providing basic amenities through the same
- **Post 1981:** This is the period which witnessed the shift of Dharavi to an industrial hub. The development Plan of the city of Mumbai, comprising Dharavi was created in 1981. This was a period of increasing recognition to Dharavi in policy. The first of these was the Prime Ministers Grant Project (PMGP) in 1982 which was linked to the then prime ministers special grant of 100 Crore RS for the development of Dharavi. This was the first clear recognition of the political importance of Dharavi and other such settlements

2. MUKESH MEHTA

Before getting into the DRP and its policies, it’s far more important to know and understand the man behind it, the vision with which he has been striving for the welfare of the people since 1996, understood the scams of private developers who were eyeing Dharavi and through government policies were exploiting the masses in the name of development. The DRP was a result of ambitious lobbying by an Architect and Developer Mr. Mukesh Mehta, who argued for a comprehensive development plan which would cover the entire area of Dharavi as opposed to the prevalent scheme of Slum Redevelopment which engaged in small pockets by mostly private developers. The DRP proposes the intensive utilisation of land in Dharavi for rehabilitation of slum dwellers and commercial development. The argument is that this will lead to more integrated development and benefits for residents of Dharavi and enable them to integrate to mainstream development of the city. He spent six months in Dharavi meeting the people, staying there and trying to understand them, these were not the stereotyped criminal slum dwellers but tenacious, hardworking and aspiring people, they reminded him in many ways of his father who had come to Mumbai from a small village in Gujarat, with only a few rupees in his pocket, he spent his initial years in a chawl, but later built a sprawling mansion in the Santa Cruz area, he says “My father got a break. Many of the people in Dharavi didn’t”.

3. DHARAVI REDEVELOPMENT PLAN (DRP)

Under the Maharashtra Housing and Area Development Authority (MHADA), government created the Slum Rehabilitation Authority (SRA) in 1995, to identify and resolve the issues of slum dwellers in the state by means of Slum Rehabilitation Scheme (SRS). There had been many schemes put forth prior to SRS which did not account for the shortcomings faced when it came to implementation on the ground, through this newly proposed scheme the state granted benefits to the people who held voting rights, having been enlisted in the previous census, allowing them some legitimacy to their existence. Even though it was a move in the right direction, it was not implemented successfully. 3/4th of the inhabitants had to consent to implementation of SRS. Due to poor participation by the year 2000, 3,846 residential units of an approximately 100,000 units went into redevelopment. Eventually, in the year 2004 Dharavi Redevelopment Plan (Project) came into picture, aggressively proposed by the state, bringing private developers in the mix. The key feature of this proposal was to rehouse only those who could provide photo pass (proof of residency) as of 1995 in a 300sq.ft apartment in a high rise, freeing up the space for private developers to develop and sell at their own convenience and rates.

The key proposals of DRP ^[4] are:

- The entire area will be accorded FSI (Floor Space Index) of 4.0. It proposes that this high FSI will lead to a financial model where rehabilitation of slum dwellers and a premium to state government can be cross subsidised from the profits to be potentially accrued from high end commercial development, taking advantage of the proximity of Dharavi to Bandra Kurla Complex, which has emerged as an international finance centre
- The entire land of Dharavi is divided into 5 sectors to make the plan commercially viable. Each of these sectors take advantage of the central location of Dharavi. Thus, sector 1 is located along the Kurla-Sion road, Sector 5 on the Bandra Link Road, sector 2 on the Matunga-Mahim Link Road and so on
- Each eligible household is entitled to receive an apartment of 300Sq. Feet free as a rehabilitation package. These apartment buildings will be of 30-40 stories. In addition, developers were also expected to contribute to the maintenance of the buildings.
- The DRP was considered as a model for redevelopment of large stretches of slums. It was considered as an example of government initiative and so the conditions of consent, slum rehabilitation schemes in the city have a condition of 70% residents consenting to a development proposal. This provision is contentious as a mode of expressing genuine participation and there are reports of its vulnerability to manipulation

4. THE INEVITABLE FAILURE OF THE DRP

Policy failure has been at the core of Dharavi’s story as an age old tune, coming from a vastly social backdrop the people of Dharavi feel that a high rise structure destroys community sentiment that Dharavi itself has nurtured in them over the years. Small scale, domestic, non-

regulated industries form the spine of their economy which has thrived for many years. Commissioned Architects of the state formulated the new plans of DRP, having no real connection to the place and its people, their grievances, demands and requirements. To implement these redevelopment norms, clearance teams began forced evictions with the help of local goons and slumlords in darkness of night, hand-in-glove with the private developers, despite Article 21 of Indian Constitution, which recognises the right to life. However, despite legal framework it is evident that the BMC in its efforts to achieve a vision of modern Mumbai is ignoring the plight of poor. Authorities never admits to any such questionable operations, which it allowed under the garb of redevelopment, there are never any takers of such wrongdoings. These evicted and hapless inhabitants moved to the edge of Dharavi, some of them went back to where they came from, some who could afford staying back, stayed back to see their new houses in these tower structures, those who could manage to survive their businesses, did. While the rest were pushed back into a life of poverty and non-existence that they had fought all their lives and turned invisible for the rest of society. More than eight years after the DRP was announced, the situation in Dharavi is one of opposition (documented in personal interviews conducted with varied categories of people). There is a section which clearly advocates urgent execution of redevelopment, others hope that it never happens. In the meanwhile, the comprehensive proposal may never succeed since it has never covered the most dreadful question – ‘what of the migrant labours of Dharavi?’ a non-existent policy for them would never earn the trust of business community of Dharavi because it directly hampers the trades, but redevelopment of some form is inevitable given the central location of Dharavi and the growing clout of the Bandra Kurla Complex as a commercial hub.

Overview of past redevelopment plans ^[5]

	Project	Year	Features	Reasons of Failure
1.	Slum Improvement Project	1972	Provision of basic amenities to the slum like water, electricity, toilet blocks and sewage disposal	No comprehensive census on number of households and residents obtained
2.	Slum Improvement Project (continued)	1976	Granting the residents ‘Legitimate Status’, photo identities (photo pass as generally known and still in use) were issued to establish legitimacy of residents	Administrative issues due to lack of census; de facto control of slumlords over parts of the slum in which no redevelopment could take place
3.	Slum Upgradation Project	1985	Leasing out existing slum land to cooperative groups of slum dwellers at affordable rates; granting loans for environmental and housing improvements	A large portion of the area to be redeveloped was held by private developers & couldn’t simply be redeveloped without adequately compensating
4.	Slum Rehabilitation Scheme	1995	Transferable Development Rights introduced to attract private developers, central monitoring and clearing agency developed, redevelopment efforts more decentralised than before	The scheme required consent from 75% of the slum dwellers, which was not obtained due to fragmentation of slum communities
5.	Dharavi Redevelopment Project	2004	Rehousing Dharavi’s residents into tower block apartments, freed up slum land would be sold for private development	Unacceptable to Dharavi residents since livelihood depended on Dharavi’s sprawling layout

5. CONCERNS AND EXPECTATIONS OF THE INHABITANTS WITH THE ‘DRP’

This paper tries to build on information that is readily available for all, reforms and policy making must make use of this information before the formulation of said policies, local architects, grass-root organisations and NGO’s must be looped in during this process, providing the people with an empathetic space to voice their concerns and ask their questions must always be at the centre of these decision making processes, their requirements and opinions must be welcomed and heard at the least, fear of the unknown that comes along with redevelopment schemes is inevitable and can always be addressed and resolved by the authorities given the right public outreach programs. Muzzling their opinions does great disservice to their contributions, individuality and community as a whole. As a research methodology several categories were formed and people belonging to different sectors like residential owners, Tenants, Industrial Owners, Tenants etc. were assigned to each group to conduct interviews and have them speak freely regarding the DRP, and some common questions to all these categories being:

- How would they be affected by the implementation of DRP?
- Given the choice of relocation at their current expense would they do it?
- Extent of Dependency of their current occupation with other businesses/trades within Dharavi.
- Expectations from the DRP?

The purpose of making these categories was to get an overall picture of people’s views from all walks of life who lived in Dharavi for years (it was made sure that they have spent a minimum of 5 years in Dharavi to be relevant to the research). The research seeks to build on previous projects undertaken by SPARC ^[3] in collaboration with KRVI ^[2] – an urban design and architecture school in Mumbai. This research cannot suggest solutions, the goal is to analyse and learn what one piece of Dharavi – the ‘90 Feet Road’ neighbourhood has to offer and document these responses as a reference to future policy making decisions. This locality is in a grip of constant restlessness, having witnessed the low quality developments by the MHADA and dishonest schemes of private developers, these hesitant inhabitants who have witnessed the aforementioned are looking for a much more trustworthy alliance for their welfare programmes. The initial responses to Dharavi are often conflicting to either preserve this informality, a multi-culturally well-equipped society with a sense of community and productivity of this place, or start with a clean slate to put an end to poor sanitation, ventilation, light, lack of open space and overcrowding issues. The documentation of these interactions are in Digital Format, the views expressed are elaborate and informal, for the sake of a formal presentation of their views and concerns expressed, the passages below are brief and not verbatim but stays true to the intent.

I. Residential Owner - Gita Chirsat, 36, Homemaker

Ms. Gita has been living in Dharavi since birth, she has moved back to Dharavi from Matunga within two years of her marriage to take care of her ailing mother and is a co-owner of the property since the death of her father. She earns a living by renting (for 3000RS) a small space on the ground level of her G+1 house to a mobile shop owner, additionally her mother runs a small grocery shop from her living room. She feels more comfortable staying put in her current house rather than moving in an apartment which would hamper her income and the lack of education guarantees no job safety. Public participation and outreach of these development policies are non-existent and the lack of information on these matters makes her fear forceful evictions. She has many reasons to stand with her choice of staying in Dharavi, some of them being easy access to public transport, cheaper daily provisions and a strong sense of community and unity among the masses who come to her aid whenever needed regardless of their individual belief systems.

II. Residential Tenant - Moin Khan, 32, Advocate

As a Public Prosecutor in the Bombay High Court he naturally has many concerns regarding his residential tenancy and validity of property ownership in Dharavi once the DRP is implemented. A family of 11 members comprising of parents, two elder brothers, their respective spouses and children residing in a G+1 unit. One of the many concerns that he had was the lack of public infrastructure, access to education for his children, clean water, and the viability of government hospitals in the vicinity. Proximity to other parts of Mumbai by local trains is vital for him through a five-minute walk to Sion station. "It's well within my financial capabilities to relocate but being in Dharavi gives me a sense of home which no other apartment building in a developed township like Navi-Mumbai can ever provide, the uncertainty that comes with redevelopment is worrisome" he asserts as a response to the question of relocation, "To make our living conditions better here, should be of prime importance rather than erecting towers in which we do not know how to live". People have been duped earlier in the name of redevelopment by private developers and all the residential tenants had to face forceful evictions and were displaced. His father is a scrap dealer operating close to their residence, their livelihoods solely depended on it prior to their earning capabilities, now as a unit they support their family. Implementation of DRP directly harms their individual businesses and professions along with their Residential tenancy.

III. Industrial Owner - *Shaikh Hasan, 52, Proprietor of a Printing Press*

Mr. Hasan is a veteran in his field printing bill books, challans and wedding invites, supporting a family of 5 through this co-owned business, he employs 4 other people who support their individual families only through an income generated by this printing press. His business entirely depends on other trades within Dharavi, even the procurement of raw materials and toner inks. As per the amended DRP of 2015 his business that runs on the ground floor of a 6 storied residential complex will be directly affected and no relocation or compensatory promises have been made by the concerning authorities or the number of private developers who have approached them consistently. The residents have no complaints with his business being run in a residential structure like many others, since the people employed are mild mannered and keep to themselves. He does not wish to relocate at any cost because of the network he has created for his business. Although, Mr. Hasan and the residents are open to negotiation if they are allotted the same location in redevelopment and primarily if the government is involved throughout the process without any involvement of a private developer.

IV. Industrial Tenant - *Mahesh Lal, 37, Wholesale Trader*

As a migrant from Bihar in his early twenties, Mr. Mahesh was employed in a production unit of leather bags in Dharavi, eventually he learnt the trade and saved enough to start his own entrepreneurial journey when the economy was at its peak. Buying in bulk from a manufacturer of metal buttons, buckles for belts, zippers and other accessories essential in apparels and leather bags, when leather products in Dharavi were being sold like hot cakes, his business took off. He has rented a 100sq.ft shop in a prime location close to the leather market, and to his luck the 90 Feet Road was laid within a year of his tenancy. "At that time rent was hardly an issue, supplying to an ever increasing demands was the concern but now it has been reversed" he adds "I used to employ 5 people at the peak of my business, but eventually I had to let go of all my workers except one who now makes deliveries and I sit at the shop" the trade he belongs to is in a decline because of excessive imports and the love people have for online shopping, the demands from manufacturers have decreased and being an informal, untaxed and cash based trade he is suffering the losses and drying up his savings. His future in Dharavi is at stake because the property he rents will soon be demolished and the residents as a majority have agreed with a private developer. Relocation is out of question for him since his business entirely depends on orders received from leather product manufacturers of Dharavi.

V. Commercial Owner - *Md. Shahbaaz Malik, 42, Retailer*

As a retailer of leather goods, he buys the raw materials himself and provides it to the workshops that manufacture the required product which in turn employs labourers, mainly migrant workers as per the size of the order. So the interdependency of trades is very crucial for him to sustain a family of 6, operating from a 250Sq.Feet retail shop on the 90 Feet Road. He is one of the earliest retailers of Dharavi, having made a name for himself, relocation does not have a place in his future plans. The authorities have notified him & the entire street of retailers of redevelopment scheme which will soon be implemented, since a high rise residential complex, with a stark sense of luxury has begun to set its foot ironically in the face of Dharavi across the road, the dissatisfaction with the terms offered has put his business in a state of uncertainty. As per terms, he will be relocated and moreover a 10% cut on the current carpet area is only adding to his worries. "Why are we not included in any talks with the authorities, some *babu* comes from Delhi and tells us how to do our business is not the right approach, we are willing to co-operate but nobody asks us anything" for him the bigger worry is regarding the small scale industries upon which his business depends entirely, without them it's impossible for his livelihood to survive like many other retailers.

VI. Migrant Worker - *Dhanu, 29, Apprentice Tailor*

Dhanu works as an apprentice to a Master (chief tailor at a knock off apparel workshop), like many other migrant workers in Dharavi he came here looking for work following the footsteps of his neighbour back at home, a major portion of his earning goes into supporting his family living in Satna, Madhya Pradesh. "The food is cheap here, I have boiled eggs for dinner that costs 20Rs for 3 pieces" slightly embarrassed he exclaims, the owner has provided him with accommodation as 12 others that he works with, so he manages to save around 4500Rs per month of which a sizeable chunk goes home. Sunday is entirely for himself, he loves going to the sea-face at Bandra, and also admits to spotting certain celebrities on the street once in a while. On the topic of redevelopment, he admits that it's inevitable and it's a good thing if it happens, and hopes that his livelihood isn't affected too much, since he is the oldest of his family and expectations are high of him. However, he is largely excluded from any such benefits of the redevelopment because policies regarding migrant workers are still undefined.

6. REFORMS

The example of 'Baan Mankong' (secure housing) project in Thailand which was launched in 2003 is of relevance, it has been extremely successful in addressing the housing problems of Bangkok's poorest urban citizens. The plan has improved living conditions of over 90,000 households in 1546 communities across Thailand from 2003 to 2011 at a low cost. The success of this program has been largely credited to putting the city's slum dwellers at the centre of the policy making process. Slum residents initiated the survey and development of settlement plans and also developed budgets and a plan for secure tenure housing. They then worked with NGOs and consulting organisations on implementing these plans ^[5].

7. THE BEGINNING OF A SOCIAL MOVEMENT BY SPARC, NSDF AND MAHILA MILAN

NSDF (National Slum Dwellers Federation) and Mahila Milan who leads the social movement of the Urban poor have been organising informal communities and helping them develop confidence and capacity to present information regarding themselves to the BMC and to each other to serve many ends. The process begins with helping informal communities especially the women and youth to believe that they have a great deal of knowledge about their own lives, their needs and probably some solutions to the challenges they face, through community surveys. In Mumbai in 1985, pavement dwellers undertook a survey of pavement spacing evictions and produced a report called

'Be the Invisible' which laid the foundation of a pavement dwellers policy to get alternate housing. By facilitating communities of the Urban poor to participate in the survey, NSDF and Mahila Milan ensure that everyone is included, they own this information, they provide ID Cards to the families which in turn can help external ID Card providers like the state to ensure that everyone is included, in some instances it can lead to ensuring that all children get immunised, children go to school, young adults get job trainings, older people get collective attention in the neighbourhood and many other such possibilities that can lead to the community taking charge of themselves. The act of collecting and collating information about themselves begins a process of participation within that community because whoever collects the data owns it. SPARC: Society for the Promotion of Area Resource Centres is one of the largest Indian NGO working on housing and infrastructure issues for the Urban poor. In 1984, when SPARC was formed, it began working with the most vulnerable and invisible of Mumbai's Urban poor – the Pavement Dwellers. Since 1986, SPARC has been working in partnership with two community-based organisation, the National Slum Dwellers Federation and Mahila Milan. Together they are known as the Indian Alliance, fighting for the welfare of the people of Dharavi [3].

8. ARCHITECTURAL INTERVENTION OF THE STATE

The ever increasing resistance of the people of Dharavi stems from one of the most crucial aspect of this housing problem – Quality of apartments provided by the private developer. The state appointed private developer after winning the bid on a tender, has only one thing on his agenda – capital gains through cross subsidy. The quality of construction and the architectural value of the property is compromised in most of the developments that took place in Dharavi and at some places in Kurla, that majorly alarmed the inhabitants to stay away from their lucrative and hollow promises. In many cases, people are not opposed to redevelopment but the involvement of private developers who do not take into consideration, their most basic needs such as proper ventilation, lighting and respecting the timeline of redevelopment. In some cases, the developers left the work midway forcing the people to live in unfinished structures with tin sheets serving as walls and compromising their safety and dignity. While some were forced to set up another '*Jhuggi*' and wait till the state takes necessary actions to provide them with what was promised, which is generally never fruitful. The architectural intervention of the state through bodies like SRA and MHADA (which employs a staggering 6000 people in MHADA alone) can put an end to these pocket developments, and an all-inclusive integrated development scheme be implemented for the welfare of the people, where the basic architectural requirements of a structure is fulfilled and a regulatory body oversees and develops these schemes. So that the promises of true redevelopment can be materialised. Moreover, public outreach and participation is of vital importance, which is missing from the current framework, the fear of uncertainty and forceful evictions can be eliminated through programs designed to include the vision of the people in it, to help them visualise a better future that the state intends for them, without including the migrant workers in redevelopment policies any plan will fall through, it directly attacks the businesses and the informal economy which has been the backbone of Dharavi, people have the right to dignified living conditions, it should not be classified as demands but requirements.

9. CONCLUSIONS

Any redevelopment scheme regarding Dharavi is incomplete without the mention of Jockin Arputham, to not mention his contributions would be a great disservice to his memory and this paper, he became a community-organiser in the 1960s when the slum where he lived, Janata Colony, was threatened with demolition. When Janata was Bulldozed, despite official assurances that this would not happen, he realised that slum-dwellers would never be able to stop forced evictions and influence government policies unless they were organised. He founded the NSDF. In 2001, he was awarded the Ramon Magsaysay Award and eventually a Padma Shree Award. An excerpt of his open letter to the authorities would summarise the entire paper:

"...Every city needs its cheap labour force. City planners and administrators look at Dharavi and the airport settlements as 'slums', as problems, as eyesores. Although government regulations on 'rehabilitation' seem progressive, requiring all 'project-affected' persons to be rehoused, every government agency tries to limit the number of people that get rehoused, to push the resettlement to the cheapest peripheral location and to minimise costs. But the residents of Dharavi have not been consulted about this plan. It is not clear that everyone who lives in Dharavi will get rehoused. Any commercial developer will want to restrict the number of people they have to rehouse which is easily done by only rehousing those who have 'proof of residency' that many Dharavi dwellers cannot produce. It is very unlikely that the housing they will get make provision for their livelihoods. At best they will try to cram as many poor households as possible into multi-storey tenements which ill suit their needs and whose maintenance cost they cannot afford. New housing will have to be developed-but to rehouse the current population, most of this will have to be in three or four storey buildings – with provisions also made to accommodate enterprises. We have also worked with architects from KRVA college and students from CEPT, Ahmedabad to show how this can be done. How high density redevelopment for residents can be achieved without High-Rises. We recognise the need for redevelopment to include new commercial and residential developments that help cover the costs. We do not want to oppose official plans – but we will do so, if you ignore our needs and priorities. We have the right to benefit from city development plans too. This is an offer of partnership or a promise of Conflict" [6].

Architecture activism is the need of the hour, to save Dharavi. Attention of Architects, Engineers, and professionals from other allied fields needs to be diverted to this labyrinth of sociological, anthropological and planning issues that has engulfed our society, and the people of Dharavi are right in the centre of it. The social exclusion of a large group of people does not bode well for the future of our country. Their concerns are valid and their anger is legitimate, and the complexity of their issues cannot be measured in a single spectrum. Inputs of historians, philosophers, and thinkers are of vital importance, in trying to address their problems. I see the Architect as a professional whose job is to combine the project in hand with awareness of the past, technological expertise and humanistic knowledge, which despite their different codes and languages belong to a single stream. Technological knowledge captures the '*novum*' of the present. It looks forward, it provides answers, harnesses and makes use of available resources. Humanistic knowledge deals with the '*notum*' of history, it follows that the architect has a social responsibility. It is his duty to provide an answer. He must be upstream of politics not downstream of politics, in the forefront of action. As Vitruvius eloquently states at the beginning of *De Architectura*, the Architect possess empirical knowledge and technical skill but also theoretical and humanistic know-how.

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INTANGIBILITY THROUGH THE TANGIBLES

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ABSTRACT

Weaving, composing and bringing in tangibles together in a harmonic fashion to create an intangible impact has almost been the unsaid process for many artists. It is only when the creation almost becomes intuitive; touches many. The form of both tangible and intangible though is a variable being very subjective. Through this paper the author intends to identify some of the common threads and acknowledge the unique ones which though transcending through various contexts, personalities, times, etc. contribute towards reaching 'intangibility' in the process of; Finding a process (or leaving it untraced) to this Intuitive: Intangibility through the Tangibles, and specifically acknowledging the significance of the same in Comprehensive Architecture of the Built and the Unbuilt, the author has chosen to find similes in Music, Natural phenomena and experiential Architecture/ Spaces- some of which are an integral and inseparable part of almost everyone's life. Unfolding the complex and blurry mix of Tangible and Intangible; and the inevitability of the same through an individual's progressive perspective is the spine of this write up. Art form- here 'a song'; natural phenomena, role of different geographies and landscapes; natural forms; some architectural spaces are discussed to draw the common elements contributing to cause the effect and also to point out the unique too while doing so; is what forms the body of this paper. Personal opinions and experiences of some artists and architects; also the story behind the creation is quoted to address the subjectivity of creation and intangibility quotient.

WHILE YOU READ THIS PAPER,

As the paper focuses on subjective interpretation of the objective; it is written from an individual's perspective which resonates with certain common viewpoints too. Hence, personalised terms like I, My, me, etc. forms an important key of this paper as subjectivity of the reasons behind response and expression is the point intended to be addressed. The paper is written in the form of small essays deriving a set of elements/ findings independently. One can hence read each essay independent of the remaining ones. Since, the author is putting up an idea of context as an important tangible in the process of creativity; the time at which the essay is written too becomes a relevant factor. As, it may have led to another examples or topic heads had it been written at any other time... Perhaps? The format of paper is more 'narrative' one to evoke certain visualisation in readers' mind- 'that which makes it intangible'. Hence, any graphics or pictures are purposely avoided. Also, there is a use of some newly composed words- words which do not form a part of a dictionary but, are derived to explain the point to a conceivable degree. e.g. like [1] adv. intuitivised and n. intuitivity from intuitive, [2] adv. essence-cally, essence-ical from essence; [3] adj. desiderial- from desiderata; [4] adj. catastrophic- from catastrophe; [5] adj. jungle-ly - from jungle; are created to suggest that at times one needs to create a different grammar. Calling this an artistic liberty it-self takes away the liberty from it! The extravagant use of adjectives is not only for adding poetic value but, to show and open up layers that build a creation.

KEYWORDS

Tangible; Intangible; Kinaesthetic; Intuitive; Individuality; Senses; Essence

INTRODUCTION

Being an Architect and more to it being in the field of academics- major subjects like basic design, design, electives; and a devout ghazal music listener; I began delving into finer nuances of Design as a whole. And once you begin this, the wholesomeness of reading design then seldom restricts to a particular faculty or stream or field but, becomes a key language to connect with any art form or event or likewise. Why art of certain artists or an architectural space becomes truly experiential while others though created with conviction loose the 'character' that creates impact...is a question which was and is quite prodding. The prodding then led to a conscious effort of identifying influential, contributing and affecting factors of and for Design.

1. There are some stimuli that affect us in a similar way and are very familiar ones.
2. There are certain things that do not occur to everyone easily but, once introduced by someone are conceived easily. And,
3. There are some abstract ideas' the impact of which is sensed but, one cannot always distinctively point at it. 1 and 2 are quite 'tangible'. Whereas, 3, being the 'intangible' one, lures us more.

Various essays in this paper are a reflection of an individual's perspective on myriad stimuli, experiences, and interactions; all to derive 'the commons' and 'the unique' of the design/ creation.

A few words those are synonymous with these artistic interactions which are recurrently used and are of significance, [from Cambridge learner's dictionary]

'Tangible: something which is tangible is real and can be seen, touched, or measured.'

'Intangible: an intangible feeling or quality exists but, you cannot describe or prove it.'

'Tantalising: something that is very attractive and makes you want it and often you cannot have it.'

'Kinaesthetic: connected with the ability to know where the parts of your body are and how they are moving', (here in this paper: sensation and of feelings)

13th Feb 2020, 9:00a.m.

DECIPHERING TO THE ELEMENTS AND INFLUENCING FACTORS

O palanharé a song from Hindi film Lagaan, composed by A. R. Rahman: those in the Indian subcontinent will relate to this mostly due to their sheer knowledge of lyrical language. The song is composed for a universal audience though. You change the scale and pitch of it and it will change the stir that it causes in the listeners mind. We technically hear the song through our brain via ears (and at times I feel the intensity through skin also) and build our own kinaesthetic atmosphere with it. Atmosphere that has a peculiar setting, backdrop, temperature, fragrance, colour, texture, elements. The same song- The same stimulus, triggers a wave of visuals or experiences (of form and familiarity mostly: tangible) which are of myriad nature be it assorted, discordant, multifarious, linked or heterogeneous, anomalous in different listeners (right now only considering human beings) depending on the various known and identifiable contributing factors collectively termed as 'grooming and/or exposure'. The Stimulus here is designed or created of 'Auditory nature' avalanching into a series of Visual, Olfactory, Kinaesthetic, Ethereal experiential interpretation which has blurring boundaries between tangibility and intangibility and often leading to an intangible and elevating feeling as a desirable residue. The artist who composed it may have conceived it in its pure form with his utmost clarity of the tangibles like timbre, tone, scale, pitch, and all the grammar he has learnt, imbibed, derived, intuitised [1] over years. Not to be ignored the contribution of his own angels or demons-grooming, enabling and shaping him to express through

'His Song' - in this fashion, for this song, at that time, for that film, at that age, with those instruments, with that team, for his ears (a holistic term for senses here) first and then for several others'.

14th Feb 2020, 1:00p.m.

SUGGESTIVE FORM OF NATURE

The Magnanimity of Karakoram ranges at Ladakh, clubbed with seemingly endless stretches of barren terrain in the monochromatic palette against eternal looking cobalt blue sky evokes a feeling of spirituality in almost everyone who visits the place. The suggestive co-existence of all the elements mentioned above is so strong and sharp that it results in an equally unambiguous clarity of response by visitors of different and varied backgrounds.

The stretches of ocean that seem the definition of vastness with its persistent waves that meet and blur the line between two worlds: land and water; horizon that shows the edge of waterline; all of this that becomes the skin of mystery that it openly hides under it, as a whole all this in spite of its incessancy; has but one effect on the viewer- the sense of surrendering to the cyclic nature of nature.

In both the above examples, the abundance and stretch of a single element: The tangible, clubbed with the distinguishably audible silence of the mountains and the recurring thud of the waves, leads to a similar experience in different people. This feeling which is 'Intangible' is almost universal for these peculiar stimuli of a strong design language that is derivable.

The characteristic patterns of branching in trees which give them a form (that suits several biological functions) make them an integral part of the defining landscapes. A line of willows along narrow paths in barren plateaus of Afghanistan, weeping willows along lakeside of American gardens, line of palm trees along paddy fields in Bengal-India, baobab avenue of Africa, maple avenue of urban streets, lime to sap green lines of poplar along streets in Leh-India...all trees with their linear arrangement and peculiar branching and canopy induce a character to the landscape or the street; evoking or reflecting similar or varied responses. This becomes an open for interpretation design language as some other strong players team up to enhance the ambient effect. viz. terrain, sky, sun: shadows, moon: mystery to form, stretch: length, destinations linked, etc. A similar open to interpretation green element is grasses. The swaying nature: tangible- of this adds a sense of charming ambiguity: intangible - often making it an interesting prelude, engulfing backdrop. The complementary strong team member here is breeze, light, area spread over, height of grass, panicle type, colour, etc. The impact of these significant natural forms often is dramatized with the company of other natural elements forming the foreground or backdrop!

15th Feb 2020, 9:00 a.m.

CONGRUITY OF RESPONSE

Response to the very recurring and not at all unknown phenomena like Sunset, Waves of sea, Moonlight, Rain-shower, Waterfall, and likewise is seldom incongruous. Almost every one of us when asked upon our feeling about all these, come up with similar set of feelings. These events though happening on regular basis in their most natural state, still manage to entice us when we feel them consciously. 'Overfamiliarity in this case fails to cease the intensity of our response to it'. The magic of these stimuli completely belongs to the stimulus itself and does not depend on the state of receiver. For the receiver though, it enhances; alters; gives a new direction to thinking; deepens the already developed feelings; gives a respite; or leads to various simulations of different degrees of impact. This further strengthens by the other teaming elements as where- urban, rural, hilly setting; with whom-group of known or unknown people, alone, the beloved; state of mind; vantage point- from where you see or hear or sense it; etc.

The Phenomenon here becomes an intriguing platform for all these varied people with all above and more parameters, to somehow celebrate and interact with it on a very similar note. This Intangible but much known set of reactions is a result of these natural phenomena which is reasoned for by science and hence can be termed Tangible.

These very effective natures of these and such phenomena and elements have remained an integral part of many artists' creation knowingly or unknowingly. As, it enhances; enthrals and exaggerates their creation. At times you cannot separate them from the creation like moonlight in romantic songs, night as a canvas for picturing love, *Taj Mahal* in moonlight, *Eiffel tower* framing sunset, the mysterious looking *Angkor vat temples* of Cambodia against pouring rains, the rock cut temple of *Ellora* filtering morning sunlight all over and around it ,...All the above examples have a strong personality of their own which only reaches to the experiential heights upon 'touch of these other variables'.

18th Feb 2020, 10:15a.m.

TO DISTURBANCE (there is construction work noise outside the library where I usually sit for writing)

Thoughts and responses are like a chain reaction. This is a crucial factor in the design process. Either we respond based on past experiences or, surprise ourselves at times with newer ways. The noise outside today, disturbed that chain of thoughts but, started another. (It might not have done so yesterday or won't do it tomorrow)

Absurd as it sounds but, disturbance too is one such widely felt reaction which is very evident or at times grows over you; when planned and designed for.

Our Rendezvous with Ruins is often disturbing as it starts establishing a dialogue with the individual in us. I have often observed while wandering through 'ruin sites' people who start in groups disperse gradually trying to explore and read what the history has to whisper through its left-overs (my architect friend Dhvani Iyer, invariably begins to imagine the then existence of all historic places). The incomplete looking members, traces, shout out a complete story that once had been. And, this I feel is - the most interactive any space can get. It evokes the urge of completing the then existing story in our imagination by constantly taking the visual cues it is now decoratively showing off. It provokes us to read the impact of merciless time, uncaring weather, brutal invasions, and all the strong negative actions at first. And then... it provokes us to sense the beauty of someone's private life, the music that once filled the walls, the chatter that once gleamed with life, the quality of life through the quality of spaces, all the subtle hints of yesteryears existence. It becomes that novel the reader wants to devourer, all coz there is so much left open for the viewer/ reader to imagine, visualise. It thus by becoming a 'heightened' kinaesthetic experience, very disturbingly interactive in its nature becomes an influential experience.

So as to derive,

Ruins: the physical or memorial existence of something that existed before times in its physical, essence-ical [2] and abstract-conceptual form or of an event that had to undergo destruction (of man or time induced) that affected life and charred minds for generations to come; seemingly dead but not truly dead.

To take this thread further, 'The Holocaust' (another rendition of ruins) amongst all other post war impacts; has remained a strong inspiration for the movie industry (when it started reaching its artistic heights). Many talented directors have shown the catastrophic [4] - effect of 'what hatred can lead to' in varied forms of storytelling. The intensity of this message reached the universal audience coz of various elements in their creation: all 'tangible elements' like: the way of storytelling, the light effects, sets, cinematography that made us a part of each frame, the extremity of emotions, the ambiguity of actions, the contrast of harmony and discord, the actors-with their immense involvement and one-ness, the background score keeping the melancholic texture alive; and many such elements one can individually identify with. All woven together to create this fabric that makes the agony personified- an Intangible feeling. The intention is not to start another war of hatred but, the exact opposite to it. And, the creators are successful in dealing this with acute skills and talent.

20th Feb 2020, 8:45a.m.

FROM MELANCHOLY

The intensity of grief of the Holocaust (World War II genocide of the European Jews) gave birth to the architectural expression of several architects. Two such cases are explained here. I personally have not visited these but, seen some pictures; my appraisal is based on what these spaces in pictures depict and tell; also how the structures and experiences are explained on internet. This appraisal is focused on; establishing a co-relation between feelings to be induced and the elements, design language used for achieving them with it.

1. Daniel Libeskind, Architect, through his 'Jewish Museum at Berlin' [6]. He used the passage through this museum as passage through time: the zig zag nature of path creating a dead end at each path patch from distance- no hope as it just keeps on going, seeming an endless and vain attempt, lengthening the time for experience; exaggerated narrow volumes of dead corridors- evoking the sense of being trapped and helplessness; grey of concrete masking the emotions to create a gloomy sense that lacks hope; monotony of the constant width of entire corridor space, add to it the narrow proportions encouraging the sense of a creeping fear while moving through; the glass on wall with scarred appearance only to resonate with the scarred memories; walking over the face-plates without any option once you enter- creates a deeper kinaesthetic impact; all of this designed in way to empathise with the victims and the mass melancholy.
2. Peter Eisenman, architect, responded in a similar way through his 'Holocaust Memorial at Berlin'[7]. Spread over 4 acres of land are 2711 concrete rectangular blocks of same- monotony, of gradually changing and of drastically changing heights. All these spaced out uniformly in such a regimental pattern that in the beginning it awes you by the sheer sense of discipline. As one starts moving through, it is then when one starts realising how the same lanes start appearing narrower with the increasing heights of blocks; narrow enough for you to easily separate out from the group you started with; the otherwise charming texture starts getting monotonous and endless and a sense of fear and separation takes over one with the further increasing heights when they start intimidating you. You look anywhere from there- it all looks the same without a sense of hope- one gets into a more lone sense of suffering at times.

In both the cases, the conceived core intent behind the design remains the same: revisiting the melancholy at personal level and not through those inert filters of history which has time and again read to us many such mass kills just in a quantitative manner. There are certain common elements like: walking at lengths, monotony, seeming endless, cold and inert concrete masses trying to suffocate you, scanty presence of light giving a hint of life in a meekly way as a reflection of whatever life was left. The primary expression is very different though: one is a forced linear movement while the latter is moving in all directions. Both these spaces are excellent examples of provocative proportionate spaces in architectural terms. They affect one in almost a similar Intangible way. To the contrary: the same concrete texture in Tadao Ando's designs bring in a sense of tranquillity and warmth- just by his way of marrying it with sunlight, water, glass and humble proportions

Place of and for Worship

A place of and for Realisation. Realisation of the Abstract and Conceptual..? Need another paper for this.

24th Feb 2020, 8:45 a.m.

IS THE GRAMMAR ENOUGH

From grammar to individuality

Reaching out to a mass audience, user, visitor, spectator, reader who is not trained for the respective faculty; use of right grammar often isn't enough. But, having said so 'the correct and apt grammar' seldom fails as it is in a way a result of years of effort: 'to derive a system and a structure to follow for convenience and in-ambiguity' based on observations (and hence relevant) to form a definitive structure.

Grammar: The way you combine words (here- elements of respective art forms or fields) and change their position in a sentence (here- composition or design or strategy or process), or the rules (here -derived way of working with it to achieve the desired impact) or study (here- observations, previous cases, similar experiences, context, style, etc.)

We feel that our introduction to grammar behind anything is a result of training: audio, visual, demonstrative, etc., experience sharing, self-realisation, knowledge, reading, research, etc. But, who taught us all to sense the hint of 'a new beginning' at the sight of sunrise?; a full moon in the company of ocean stirs everyone emotionally without any guidance; or almost all the examples I have mentioned in my write up above have; a universally similar response when it comes to feelings. The degree and nuance of which may vary as per our personalities but, the core remains the same, mostly irrespective of our literal exposure to the relevant grammar. Most of the times it is directly related to the physics (form, photo-optic, sonic, olfactory properties) of the stimulus, the context and the response is a result in terms of bio-chemistry of the one who is experiencing (the degree and nature of which is a result of his previous history too).

This means that if an act/ art form is done/ performed in a particular manner/ grammar then it will produce a definitive desired result. 'It thus for sure keeps the probability of success very high.' This grammar is not a secret anymore and shared through schools, institutes, mentors or even Gurus.

Some examples:

In Indian classical music: Hindustani or Carnatic music- Ragas (a composition of swaras to form a melodious tune), voice culture, gharanas-way of performing

In Architecture- theories of proportions, visual and tactile qualities of materials, technology, principles of design, etc.

In both the art forms mentioned above, all the students are exposed to almost a similar set of knowledge through resource material or teachers. This has been happening for thousands of years. But, creation by only a few people has become timeless. For that matter even delightful in its experience.

In this light ; Usually- in case of Music: Timbre (oxford definition- Timbre: distinctive character of musical sound or voice apart from its pitch and volume) of each instrument and the instrumentalist; the vocalist ; are the most crucial factors which are of quite an inherent nature and can only be enhanced with proper tuning, practice, voice-culture and techniques. This 'Individuality' is the one which makes it Delightful or Intense. The symphony, light effects, reverberance, backdrop, setting, etc. will complementarily enhance the Impact of it. But, 'The Individual' makes it Timeless.

and, in case of Architecture: Timbre which can be derived as 'a distinctive character that enables the bearer stand out from others by creating a subtle or conspicuous impact; be it the design philosophy, the designers perspective, style.' Here, with each design; a different timbre of material, colour and light can be explored.

27th Feb 2020, 9:00 a.m.

CAN WE AND HOW WE CAN?

From skill to Intuitivity : Once while I was watching Sherlock Holmes series on Netflix; Holmes mentioned (which is confirmed by psychologists with almost an universal affirmation –source: google) that- 10,000 hours of deliberate practice: practicing in a way that pushes your skill set as much as possible; makes one achieve the excellence in a particular field. To actually try and find out how many exact hours, intensity of involvement, subjectivity of 'deliberate', reflection upon different nature of skills- cognitive and physical, etc. is an

altogether different debate. But, essence-cally [2] it talks about self-training. In an experiential art form like Architecture: Training ones' senses by exposing them to a variety of spaces either physically or in visualisation or watching it; reading about it...being with it constantly; develops an intuitive sense of and for design. Statistical cases to prove this will be futile coz of the highly volatile subjectivity of it. And, again it comes as that 'Intangible aspect' which is known to be felt. The Intangibility- which is a result of several tangible factors responsible either directly or indirectly; for that time or over the years.

Directly: training, reading, references etc.

Indirectly: seeing (not with a particular aim), responding, absorbing different contexts; cultures; arts; readings; response to people and their behaviour; geographical exposure; etc.

An Intuitive artist, music composer or an Intuitive architect or even a scientist; will try to cross and wander beyond these boundaries; not deliberately though- just for the fact that he can't be bound; not even by himself. This intuitivity [1] in the creation reaches the other being without any effort. It is this Intuitivity [1], all of us are aspiring for; knowingly specially in the field of arts.

MARRIAGE OF ARTS AND ELEMENTS

We all (mostly if otherwise with a condition) respond to and experience things, incidences, spaces, phenomena, etc. through our senses like seeing; hearing; touching; tasting; smelling; all easy to comprehend and respond...sense of thinking; visualising; relating to past memory of similar impact; projecting; predicting; grouping of things; feeling; ...are segments of the further evolved chain of responses or consequences to the same. The latter set enables us to Experience a particular event or thing (now the word Stimulus is purposely avoided as it sounds too impassive and toneless at times: how words evoke emotions). The basic senses we all can state- the first set; usually defines what is 'Tangible' and the effect achieved by arrangement or planning of these tangibles (it is on knowing the latter set) can lead to the 'Intangible'.

28th Feb 2020, 7:00p.m.

We hear and say this a lot of times-“ the way she sang that day was 'something!'”; “that night the moon was something else!”; “it looks very different today but, that day the whole space was just so peaceful and meaningful!”; ... and, the way this narration happens- the other person almost understands the degree of it without truly witnessing. What makes the 'familiar' so charismatic most of the times is the touch of or union with 'some other familiar; some other exotic; some other variable; that takes the experience to another level 'of being carved into the memory'. Stating some personal experiences here to make it elaborate onto this point and to make it more relatable.

When I was a student of Architecture, in our study tour to Bijapur- we visited Gol gumbaj at around 5:30 in the morning; the morning zephyr, stillness of the stone monument, reverberation of breaths in that magnificent dome, a hint of sunrise filtering through the scanty windows...all of it was mysteriously engaging; and one of my classmates started singing some Beethoven -ish song that filled 'The Dome'; with such heightened spirits we all came to the outer gallery; walking alone in group we heard the azaan someone was singing across the lawns , further taking the spirits higher; language was not important nor was any message: the DOME and that hour of morning provoked the singer; created a platform for this entire drama for us that makes me remember even the temperature of the then awakening Bijapur.

2nd Mar 2020 11:00 a.m.

1. Again, on some other study tour; this time I was a teacher; we visited 'Gandhi Ashram-Ahmedabad', designed by architect Charles Correa; morning 8:00-month of February; we were the only visitors at that time- a group of 20. This is a highly experiential place designed on the Gandhian principles of: let there be no walls; let the breeze- elements pass through. A beautiful repetition of a square plan with hipped roof -intimately proportioned built form; interwoven with courtyards; courtyard of water; of champa tree, that of pebbles; that which shows the sky; of sun and rain;... while moving through the galleries one comes across these linear seatings along the courts; everyone started dispersing and exploring once the museum people put the record of Lata's (Lata Mangeshkar: a one of her kind singer from India) ethereal bhajan (a devotional song to express spiritual ideas in Hindu way of life)- 'Vaishnav jan toh...' Correa has designed this as a great platform where one starts absorbing the Gandhian philosophy of simplicity, humility and openness. Lata's bhajan took that moment to a different degree of introspective realisation. Everything was so peaceful! Did we really go there looking for peace? But, all these above gave us and giving everyone else a realisation of 'Peace within' each day.
Next time I visited this place was around 3:00 in scorching June afternoon; Lot of school kids were queue-walking/running through the space; the built beauty was still the same but, Still (inert enough). There was no Lata singing; there was huge crowd moving in all directions almost rampaging; courtyards still were doing the magic; built and un-built still was charming. But, Gandhijis legacy remained unheard. The senses failed to become permeable at once.
2. Some other sunny afternoon; we were visiting the Lake structure in Jaisalmer, Rajasthan. One has to descend down to the lake through an almost unfinished ramp. Bare dirty yellow sandstone walls with the horizontal superstructure above create an inconspicuous but natural sense of entry towards the lake side. A lone ek-tari (an instrument with single string-folk art mainly) player has/ had found his nook along this small path. As if he is playing a Prelude to the Lake. The still water of lake and bare walls of sandstone induce the right reverberation to his ek-tari; making it resonate with the desirable painful feeling that stirs the listener- that of a desiderial [3] compathy. It is this beautiful marriage of Sandstone, Lake and *ek-tari* that creates a memorable relief or longing in scorching suns.
3. Ganga Aarati on Ghats of Varanasi: the calm and mysterious stretches of the Eternal river Ganga; *ghats* running along to accompany her; people associating to the place as the 'final destination'; the blurry and longing nature of twilight which always puts one on the brim; the synchronised steadiness of breath of thousands of spectators which have gathered only to become a part of this phenomenon; the pujaris (priests performing Puja) standing in a designed formation- moving hands holding fire in an orchestrated fashion; the revered river forming the stage and the deity herself; all becomes an experience that translates to the 'realisation of transition: that of meaning of breaths- *prana*; that of life; that of light and dark; and the intangible- sense of Truth that it echoes'. All tangibles like the width of river, the length of *ghats*, the enormous stretches of steps, the city skyline that forms a perfect picturesque backdrop, the way the city lanes and walkways hurriedly open out and become one with the *ghat*-steps, the theatrical and engaging appearance of the '*sadhana*', all comes together to evoke this intangible sense of truth that everyone that witnesses it feel and share.

9th March 2020, 9:00 a.m.

TRASLATING IDEAS INTO THE FORM

An architect's expression through the spaces he (he means a person and not gender here) designs changes its intensity based on variable factors right from context (geography, site, culture, time...), his own life, his interactions with the client, his intent behind the creation, etc. I am stating a few reactions or thought lines, where I was a witness to or part of the process; for both client and architect; to find the common chord that struck 'intangibility'. Again a personalised story as 'story changes if a different writer writes it, designs it. There is so much of an individual in every creation that it seldom can be objectivised. One such story with 'A Client' and another with 'Not One as a client'.

Hariharan's Farm House At Karjat

When I asked Hariharan, The Ghazal Maestro, a phenomenal singer and friend, about his response to the Karjat Farm house, (Sameera Rathod is the architect of his farm house- designed in the year 2000) he said and I quote: 'I identify myself with this house. It is a non-pretentious space. Very realistic and resonating an earthy essence. Lot of people don't understand this house. I feel very 'Alive' when I come here. The house opens out to the untamed trees and river as a whole...the sense of continuity in flowing river by your side from the verandah...this true connectivity with the outdoors is what I love!' Sameera's note on this creation of hers as mentioned in her website: 'The house is devised as a series of spaces to create a narrative of tactile spaces. Large openings blur the edge of the inside with the outside allowing the outdoors integrate with the indoors.' Blurring the edges tangibly to establish a constant sense of belonging and connectivity with unique outdoors, the intangibility is both designed for and sensed dominantly.

When Hariharan spoke about the Open Air Theatre (Landscape, terrace lounge extension and Open air theatre- The Thin Architect-Gautami (the author of this paper) and Nikhil Renuse were the architects - year 2009), he said ' I love being in the amphi, I wish I could come here more often. The proportions and acoustics of the place are so good. It is so open and yet so quiet! I hear the sound of silence here. The clarity of sound this place gives is something I cherish.'

Story behind the amphi-design: I had just come back from my Pattadakal and Hampi tour and wished to create a *Kund* (a stepped water body in premise of old temples) when; we started working on this project. My recent experience and encounter with the stone *kunds* in a way led me to design an amphitheatre in square-*kund* form. Nikhil, looked at it and called the geometry too intertwined and stagnant; and broke open the design to form some derivative of the same which was a much more conversant space. Upon me asking him why he felt like doing so? His reply was 'coz it needed a break'. When Hari saw this he was instantly taken up by this fractured kund. All this led to the amphitheatre which doesn't fail on what it was designed for: an elevating interaction of sound and acoustics; and a unique- liberating experience of charming open-ness. The design process was with the tangibles and experience is intangible. One's idea revisited by someone else with an individually different perspective of sensing and making spaces.

The landscape that binds all this is a stretch of lawn; bamboo, mango trees forming layers of dry leaves adding the jungle-ly [5] psithurism (sound of rustling of leaves); the river side with old trees with mysterious forms left as it is; charming terrace roof that opens out to the mountains in monsoons; all make an ensemble to experience.

Feelings and reaction or experience like 'identifying with', 'alive', 'so open yet quiet', ' sound of silence' are the intangibles

One intuitively takes a call on where and how much to intervene and add. 'The sense of leaving gaps and pauses to and for experience is what gives fullness to the creation'.

The Black Taj

(a shortlisted entry by Nikhil Renuse, The Thin Architect)

I am stating this Design entry for an Ideas competition: The Black Taj

The competition brief was: 'The Black Taj', if it was to be designed today...

Taj-the White Taj, symbol of love, Shahjehan's gift to the world- I will call it as 'a perspective of and at love'.

Black Taj, Azal: the eternal, he- the architect- named it, is proposed as an acknowledgement of Hatred: that which is Intangible.

The abstract concept of hatred by the architect is somewhat like Newton's law of equal and opposite forces that co-exist; only the expression and impact are of different degrees. He calls this 'kinaesthetic of the ruins'

He said about his design and I write 'Love is a broader expression that tries to keep things together- like the dome, minarets, whole composition of Taj that is built to form one broader entity. The Black Taj we have proposed is the white Taj blown apart; scattered Taj to acknowledge the individuality of its own elements. Hate gives an existential clarity to these elements. They are free to express their individuality yet together they create a sense of space one can explore and interact with while walking through them; while touching the otherwise untouched. Here, the Dome which is all lying broken to show its ripped skin- is a voluminous space you can enter, touch, be awed by and not just a symbolic ceiling resting at heights; Minarets accompany you with their seemingly unending linearity and not just try to fit love in a frame.' 'White Taj refuses to acknowledge the existence of The Black; whereas the The Black Taj knows and shows the white one both metaphorically and physically as, it is nothing but the broken and scattered white one. Also, you see the white one on the other shore constantly through all frames.' Here, a distinctively Personal perspective of the architect gives a different viewpoint onto 'how to respond to monuments that defined and defied times'...A highly individual perspective which is Intuitivised [1] from personal interaction with spaces over growing years.

EPILOGUE

INTANGIBLE FROM THE TANGIBLES

It is upon the quest for deeper and meaningful experience of things happening around us that we start dissecting and acknowledging them more and more. Not doing so and just experiencing it at a surface level is not going to do any harm but, only will restrict or close for us the wholeness of an experience; for which it otherwise has a potential to offer. Intention of revisiting all these experiences is evoking a version of visualisation; triggering a chain of thoughts in each reader; Thoughts... that occur different to each one...individuality being the key. Thoughts that make us feel at first and dissect it later to understand what the contributing factors are... so that it can be recreated. There is a mix of the common and the unique in most of the experiential creations. There is a hint of familiarity and the unexpected. This is almost a common denominator to creativity of varied modes of expressions.

The very 'Tantalising' experience through and of- creations and spaces; be it of an auditory, visual, imaginary or kinaesthetic nature...which has the hint of the Intangible; known or conceivable to almost all of us is often a result of proportionate mixture of ideas, experiences, nature, knowledge with the star and secret ingredient of Intuitivity. [1]

Yes there are many known factors or elements that create or set up the stage for 'the intangible' experience. The 'intangibility' may give it a miss at times. If only all the tangibles are woven together for the possibility of the former, the notches of the lock will fall in place at once and the 'intangible' may just come as the 'inevitable'!

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ARCHITECTURE AND THE INTERFACE OF THE MENTAL AND THE MATERIAL AND THE ORIGIN OF DESIGN

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ABSTRACT

The German semiotician Roland Posner has defined Culture as comprising three components, namely, a society (people and their institutions); a civilisation (all artefacts and texts that the people have produced); and a mentality (the codes that inform the other two components). The codes are meaningful mental, social or material units that express the people's world-view.

The mentality component of Culture is only studied by anthropologists. Architectural works are the material expression of thought. Architects consciously design a building, yet their design also reflects the culture of which they are part. These expressions may be called hidden codes. With the help of anthropological tools, I will crack the codes. This will first be illustrated with an example from the Arts. The case of origin of design among the Nagas of NE India shows how doorposts carvings and design of the dormitory are expressing the indigenous Naga world-view. In the case of the South Indian farmhouse, I compare the farmhouse with a modern apartment. The Hindu temple and the Greek temple are compared with respectively a Hindu house and a European house. Thus, this paper presents the interface between the mental (component of culture) and the material (architectural expressions). It opens new vistas for architectural design.

KEYWORDS: *world-view; mental codes; design; structural relationship; unconscious in culture*

THE ANTHROPOLOGICAL PERSPECTIVE¹

Anthropology is an academic discipline that studies human culture everywhere and at all times. It is not only, as so many people think, the study of tribes. The word anthropology is a composite of the Greek words 'anthropos' ('man') and 'logos' ('knowledge' or 'study'). It may be referred to as 'the study of Man'. The earliest anthropologist was Herod in 400 BC. The Greek wanted to know more about those who lived across the sea. This marked the beginning of the concepts of us and them or We and the Other. One may even argue that the ancient Indian linguist, Panini², was also an anthropologist as he was conducting field work to collect his linguistic data. Anthropology as an academic discipline dates back only to the 18th century. As such it makes a distinction between knowledge and understanding. Anthropology as I see it, is not mere knowledge but understanding. We do not study individuals but collectivity - cultures. We do not only consider the tangible and visible but also views, perceptions and ideals whereby the Ideal is distinguished from the Real.

THE DEFINITION OF CULTURE

In two ways Anthropology is an umbrella discipline. It covers a wide range of sub-disciplines on the one hand and it has a holistic point of view. This means that it considers Man in culture in the widest sense of the term. The German semiotician Roland Posner has coined this definition of Culture.⁴ Culture comprises three components, namely, a *society* (people and their institutions); a *civilisation* (all artefacts and texts that the people have produced); and a *mentality* (the codes that inform the other two components). The codes are meaningful mental, social or material units that express the people's world-view. Social anthropologists study society while cultural anthropologists focus on civilisation and mentality but do not neglect society.

THE MENTALITY COMPONENT OF CULTURE

The mentality component of Culture is sometimes also referred to as the Indigenous Knowledge System (IKS). The Indigenous Knowledge System delineates a cognitive structure in which theories and perceptions of Nature and Culture are conceptualized. These may be called the hidden codes. It thus includes definitions, classifications and concepts of the physical, natural, social, economic and ideational environments.

ARCHITECTURE

Architecture is the Art of combining building materials in such a way that the result is a construction suitable for its purpose. The art involves planning, designing and constructing and thus the origin of design is to be found in the interface of the material and the mental. Architectural works are the material expression of thought. Architects consciously design a building, yet their design also reflects the culture of which they are part. A poet, for example, constructs a poem, being consciously aware of economy of speech and metaphors or the signifier and the signified. But an analysis of a poem will show underlying meanings or cultural codes. Similarly, the material form of buildings includes the hidden codes of the culture of which the architect is a part. Architecture is the science of building that involves a patron, a designer, a builder, the contractor and the worker as well as the materials, the cardinal points, climate and the environment.

THE CRACKING OF THE CODES

Basically, we have two tools at our disposal to discover the hidden codes of a culture. These are universal categories and culture specific categories. Our analysis moves along the lines of confluence of both sets of categories.

An example of universal categories is the meaning of lines.³ Lines play in any work of art or architecture. Fundamentally, there are three types of lines: the vertical (vertical lines express not only stability but also dignity); the horizontal (this line gives us a feeling of balance and peace) and the diagonal (this line gives us a feeling of movement and expresses an unstable condition).

Our eyes themselves are standing still but they follow these lines as if they make a walk. Along vertical lines our eyes walk upward and downward while along horizontal lines our eyes move from left to right. The horizontal line gives us a feeling of balance and peace. In contrast to the stability of the horizontal line, the diagonal line gives us a feeling of movement and expresses an unstable condition.

Examples of culture specific categories are the local classifications of flora, fauna and people and their world-view.

EGYPTIAN MURALS AS EXPRESSION OF WORLD-VIEW

One of the oldest well-preserved material cultures of the distant past is that of ancient Egypt. Its civilisation comes to us in the form of structures – the well-known pyramids and temples – and texts in the original hieroglyphic script or in Hebrew, Greek, Roman and Arab translations.

It is generally accepted that Egyptian art served a purpose in the rituals and cults surrounding the dead. But recent studies proved that the pyramids were not only tombs of the pharaohs but also astronomical instruments.

About the cult of the dead we know that the Egyptians believed in an immortal force called 'KA' that is the spiritual twin of the mortal human body. The body was embalmed and placed in a durable chamber. In addition, a carved image of the deceased was placed there by way of a spare body. The walls of the tomb-houses were decorated with texts and images in low relief or painted. These images served as 'supporters' to assist the 'KA' in its fight against divine and demonic forces aimed at conquering eternal life or immortality.

The walls were divided according to a strict order. If we compare the way the Egyptians depicted, for example, three stones and the way we would do that today, we see a remarkable difference. In the Egyptian way, all the three stones are of equal size whereas we would the stone in front big and the stone behind smaller. Our way of depicting may be called optic.

An ancient Egyptian text says: "Get up, King Unas, take your head and collect your bones and your limbs, clear your flesh from mud! Receive your bread that cannot become mouldy and your beer that cannot become stale. Get up, King Unas! Thou shalt not be dead."

In the ancient Egyptian view, there was thus all-round immortality in the hereafter. This view is expressed in their Art. All human beings, animals and objects are depicted with straight lines and closed contours so as to transform them from mortals into immortals. This way earthly Time and earthly Space was banned from the representations. In other words, the Egyptians could only speak to the eternal by freezing Time and all its fleeting qualities.

Nothing on this mural is depicted as we see it with our eyes. The representation of images of the life of Chnem-Hotep is not optical. We see the human figure in profile but the eye *en face*, the shoulder frontal, the hip and the legs from aside and the feet are seen from the inside. The measurements too are not optical that is not seen from front to back but depicted according to importance. The pond does not show curved lines but is painted in section. The fisherman with the prey on his spear is static and the water is even painted vertically. The way he holds his spear is unrealistic. The birds do not fly but sit on a man's hand with two wings of equal size.

Everything is eternal: there is no movement, not even a suggestion of movement. Nothing is imperfect or accidentally deformed or distorted: there is no suggestion of depth or perspective. The mural on the tomb of Chnem-Hotep, Beni-Hassan (1950 BC) is a good example.

HINDU TEMPLE AND CHRISTIAN CHURCH

We may also apply the line alphabet to Hindu and Christian art and architecture as expressions of the respective world-views, distinguish two levels. With the risk of oversimplification, we may contrast two world-views. Firstly, the Hindu view in which liberation of the soul can be attained by coming alone and pure thus without attachment and without social relationships from a sociality in which habitats and niches play a role. One of the major Hindu schools of thought tells us that Men = God (*tat twam asi*) and thus an individual takes care of his own risk of mortality. This calls for a control mechanism: jati (caste) and hierarchy in the world. And most importantly for architecture it entails logically a system of descentance and inheritance that are called patri- or matrilineality and the principle of segregation. On the empirical level we thus see reductions of social relationships, strong individualism and the protection of one's own and the other's autonomy.

In the Hindu world-view, the riddle of death remains with individual Man in the world. This is expressed in a usually narrow horizontal structure housing the idol of a deity in a chamber at the end of a corridor.

Secondly, the Christian world-view⁵ in which God is not Man; God is out there and takes care of Man's mortality and this leaves Man in the world with tasks. While the group is paramount, the control mechanism is the individual. It entails logically a bilinear system of descentance and inheritance and the principle of integration. On the empirical level we thus see strong social relationships, tensions between the collective and the individual and the protection of the group and group's autonomy.

The Christian world-view refers to a higher authority up there who is the answer to the riddle of death. Early church architecture did not draw its form from horizontal Roman temples, as the latter did not have large internal spaces where worshipping congregations could meet. It was the Roman basilica with high ceilings, used for meetings, markets and courts of law that provided a model for the large Christian church and that gave its name to the Christian basilica. Throughout history the vertical form of the church became more emphasized expressly in the church towers.

WORLD-VIEW AND ART

It is the exceptions in a culture that always get much attention. In Europe, the Mono Lisa painting stands out because of the Smile. No other paintings till then and at that time has smiling faces. The faces were serious or loud laughing but not the so-called "mysterious smile". The smile is not of this world. In Hindu sculpture and indeed in posters, all deities are looking young and smile. It signifies the perpetual present, out there. It refers so as to speak to the eccentric who has so as to say be talked back into mainstream. In India sculpture is grounded and static so as to express the perpetual present. The exception is the Shiva Nataraj or the dancing Shiva with only one leg on the ground. He represents the world in which we live: the present time. Both the Mono Lisa and the Siva Nataraj are exceptions in their respective cultures and therefore they get so much (scholarly) attention.

THE ORIGIN OF DESIGN

Discussing the world-views of ancient Egypt, Hinduism and Christianity we have seen how these are major resources of design. A world-view can also indirectly be the resource of design. The Nagas were inspired by Nature and in a complex arbitration between their views and environment they arrived at their authentic designs.

THE NAGAS OF NORTH-EAST INDIA

Among the Nagas the hill knife or *dao* and the hornbill are the main sources of their designs for both decorations and the architecture of the Naga dormitory. The Naga case demonstrates that the choice of design is based on perception and world-view while the choice of raw materials is based on availability. The patrilineal Nagas were all head-hunters⁶. Their main weapons were the spear and the *dao* (hill knife). While the spear was used to kill, the *dao* was used to behead the killed human beings and to prepare vegetables for meals. Once the enemy was killed, he was beheaded with a *dao* and the head taken back to the village of the victor. Ethnographic reports all emphasize that the Nagas never practised human sacrifices or cannibalism.

Above the main entrance to many Naga huts there was a wooden beam with carvings of two double *daos* and four skulls. Arithmetically there are thus four *daos* and four skulls. This suggests that the *dao* and the skull share a meaning. The Naga survival policy is targeted on others. The enemy is killed so that one can outlive the other, while self-preservation including one's own continuation through marriage and issues is guaranteed in the practices of head-hunting. The skulls are brought back home and displayed at home and in the dormitories. The more skulls one has the higher one's prestige. One may have inherited the skulls and increased their number oneself. Obviously, the chiefs had the largest collections. Along with their carefully memorised pedigrees they demonstrate their long survival records. They are the records of immortality. By inference the *daos* share this value.

The individual endowed with a *dao* enters the dormitory. Having one's ears pierced and being "endaod" one becomes a member of the dormitory and is entitled to participate in head-hunting expeditions. It is thus during this period that the thrust of immortality is separated from that of mortality.⁷ The individual himself has now to stretch the capacity to live. His token of immortality, the *dao*, is his technical tool. In this survival policy each death is individual, private and lonely. The consistent separation of mortality (in the self) from immortality (in the *dao*) creates a frightening and unbearable loneliness that is sought to be overcome in the re-collectivized sphere of the dormitory. The Naga needs others to come to terms with his private uncertainty in a shared audacity and temerity of numbers. The elder members and the other bachelor members of the dormitory are the experts of enculturation that he needs. (See also: Bauman, 1992:20) In other words, the dormitory rather than being an expression of unification is an expression of separation. In the Land of the Dead-King the distinction ceases to exist; it is the land of immortals. Immortality is thus collectivized. The Naga belief in instant reincarnation for those who lived a good life this means that one returns to earth in a condition in which the distinction between the concepts of mortality and immortality does not exist. The *dao* and the dormitory mark a new condition.

ANTHROPOLOGY, SOUTH INDIAN FARM HOUSE AND APARTMENT

The unconscious of culture can also be seen in the continuity of basic design in the architecture of South India. In general, the south Indian farmhouse is a courtyard surrounded by rooms. In between two rooms on the Eastern façade there is a passage to the internal veranda along the open court.

This looks very different from a modern apartment in South India. Not only the materials are different but also the design.

Yet, if we consider the relationship between people and structure nothing seems to have changed at all. **Entering the farm house**, you will be seen by the landlord whose chair is placed on the veranda on the side of the court right opposite the entrance. **When you enter a modern apartment**, you enter into a living room where the landlord can see you entering. In both designs, the landlord controls from his seat all movements of all who enter the flat.

The oldest standing farmhouses in South India are not older than about 300 years. Major architectural marvels can be seen among the Vokkaliga Gowdas of Mandya District and the Bunt Shetties in Dakshina Kannad District of Karnataka.

ANTHROPOLOGY, GREEK TEMPLES AND EUROPEAN APARTMENTS

When we see a European house or apartment it looks very different from the ancient Greek temples. Let us have a closer look. In its most simple form, the Greek temple is one room (the cella) with a veranda and two pillars. There are thus three spaces: the room, the veranda and the outside. The room is a constructed, enclosed space; in other words, it is Culture. Between Culture and the outside – that is Nature – the veranda mediates. It is constructed but it is open.

One enters a European house as well as apartment in a vestibule from where you enter a hall or corridor. In the hall or corridor, you find doors to the rooms, kitchen and toilet. The vestibule mediates between Nature and Culture as much as did the veranda of the ancient Greek temples.

ARCHITECTURE AND THE UNCONSCIOUS

Anthropology, especially studying the mentality component of culture offers absolute new vistas for architects. This component comprises the hidden codes of society and civilisation. These codes can be cracked with the help of semiotic and structural techniques and the Line Alphabet. Mentality refers to the hidden codes in design and social interaction while lines each have their own meaning in drawings or paintings and indeed in design.

We thus move from practices to underlying concepts and back to practices. On this trajectory we find contrasting concepts of space and time and the culture specific location and perception of "man" in the environment. It traverses the local and global contexts.

In sum: through anthropology we learn to see space from the vantage point of the interface mental-material. This opens new vistas on known topics in architecture through an understanding of thought behind practice. It allows us to envision new and authentic design.

Notes

1. This paper was read at the National Conference 2020 on Empirical Theories in Architecture, Planning and Construction Management, at ACOA, Pune, April 2020

2. Pāṇini (approx. 6th-4th century BCE) was an ancient Sanskrit philologist, grammarian, and a revered scholar in ancient India. Considered "the father of linguistics" after the discovery and publication of Pāṇini's work by European scholars in the nineteenth century, his influence on aspects of the development of modern linguists is widely recognized in the profession; his grammar was influential on foundational scholars such as the linguist Ferdinand de Saussure and subsequently the anthropologist Claude Levi-Strauss.

3. Today Anthropology is not the only discipline that studies Man. The social sciences and humanities all study Man or aspects of Man. Psychology and psychiatry study Man as an individual. Linguistics and its sub branch Social Linguistics study languages and sociological aspects of language. Sociology focuses on groups of Man and studies people and their institutions. The difference between Sociology and Social Anthropology is a matter of accent. Sociologists study their topic in isolation of other aspects of culture while social anthropologists consider their topic within the wider cultural context. Physical Anthropologists study the relationship between the biological characteristics of Man and its cultural activities. Paleo-anthropologists study the relationship between artefacts and activities of prehistoric peoples.

3. A combination of verticals and diagonal lines may express psychologically being moved as well as physical movement. A piece of art dominated by vertical lines expresses not only stability but also dignity. In portraits the diagonal lines going upward from the centre express happiness and those going downward from the centre express sadness. Lines may also be broken. There are closed and open broken lines. Examples of closed broken lines: the zigzag line, a line with sharp edges, a line with obtuse angles, and a line with square angles. These lines add stiffness to the representation. Variations in the edges and angles express different moods such as crisp, sharp-edged, fierce, and even aggression.

Open broken lines *appear as* dots, dashes, spots or touches such as those left behind on paper by a painting brush. In this case our eyes have to jump and thereby the expression of movement becomes stronger. Finally, there are surfaces. A surface is a flat area bound by a contour. Contours may be closed or open. For example, a man standing with his arms alongside his body represents a closed contour while a man in a walking or running pose represents an open contour.

4. Roland Posner, 1989, pp 240-295.

5. World-view supersedes religion. Religion is one of the channels through which a world-view is expressed. A view is not the same as an opinion. A view relates to concepts that lie behind practices.

6. What we call head-hunting has five dimensions:

1. The social (genealogy);
2. The ritual (expression world-view and perceptions);
3. The economic (survival);
4. The fertility (survival);
5. The political (territory).

7. Inside the Ao dormitory just after the entrance there hung a cradle (*arrangkang*) made of solid cane (*arr*). The cradle was used to punish an offender of the dormitory rule. They used to hang him from it and they light fire below giving heat and smoke to the offender. This suggests that the violator is temporarily put back into the childhood stage where mortality and immortality is not yet separated from one another.

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ANALYSIS OF CHANGE IN HOUSING TYPOLOGY (A SHIFT – RURAL – TO SEMI URBAN – TO URBAN CONTEXT) IN POST INDEPENDENT BHARAT FROM 1947 TO 1969 BY OVERVIEW OF BHARATIYA CINEMA

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ABSTRACT

The silver screen of Cinema does not always focus on the pure entertainment, many artists & producers have also utilized this mass media a source of awareness about socio-cultural & socio-economic issues of the society. Likewise, can we study the architecture of built forms by watching Bharatiya Cinema? This paper tries to find out the answer, whether we can treat Cinema as a source of information in a broader perspective, to understand the architecture of that particular period & whether cinema reflected it truly. With the focus only on Housing Typology of a particular period of 1947-1969 showcased in the commercial and parallel (art) movies to understand till what extent this medium can be considered to study the initially design governing factors & eventually through decades, how it transformed to end up in current Architectural scenario. This is an initial step towards the awareness of making Bharatiya Cinema as set method to understand the architecture.

KEYWORDS - *Bharatiya Cinema, Residential Architecture, Cinema & Architecture, Rural & Urban Context, Post Independent, modernism.*

INTRODUCTION

Cinema is the art or technique of making motion pictures (Marriam Webster), which has become a primary source of entertainment in the urban areas of Bharat & it is now also spreading its roots till the very last person in the countryside. Architecture is the art or science of building (Marriam Webster) in which Bharat holds its own position in terms of Vernacular, indigenous style & being exposed to western styles after the arrival of Europeans. Today most of the contemporary style is mixture of these two with higher percentage of second form. Interestingly both these activities can either be performed as art forms or expressed as science / technique. Not only that, they share many fundamentals in common e.g. Time, Space, Light, Colour, Texture, Motion, Rhythm, Continuity, etc. Both are result of a team work carried out many Artisans & Technicians where Director is the Architect of Cinema & Architect directs the Building project. When succeeded, brings out the Drama within the Picturesque marvel of architecture & well-designed Cinema creates its own Space in the History. Architecture & Cinema are integral part of day today life of a common Bharatiya. As Bharatiya Life is so closely connected to these Artistic expressions, they have become an inseparable part of our culture & traditions too; mostly after independence, when our society reformed as a consequence of change in socio-cultural & socio-economic phenomena because of the need of individual expression & better earning opportunities. Also, policies implemented by government bodies plays a major role in all this situation. Some of them were welcomed, others were unexpected & resisted. Cinema expresses these all situations & incidences occurred in the life of common man with the help of Architecture to support the story line. Here, architecture becomes essential for cinematic expression & it becomes significant to use real-life architecture (few exceptions) to create a real-life cinema which eventually occurred. Hence, Cinema can become one medium to understand the broader concepts of architectural design, planning & urbanization. As Bharatiya Cinema is a one medium reach out people in large scale (crores) at the same time with comparatively cheap prize. Influence the crowd with its big silver screen & larger than life expression. It appeals to the masses as well as classes & on top of it, you can experience (virtually) the structures & feel the spacial quality as if you are living that movement. It creates a remarkable impact on the life of spectators not only therefore becomes a source to understand the people society & also the architecture.

METHODOLOGY

The methodology follows the sequence of processing the information as follows-

It starts with categorizing the housing typologies (**Annexure 1**) existed in rural & urban Bharat which would be based on economic conditions as well as Caste system (wherever applies). This will be followed by collecting the information from right / authentic sources like watching selected movies & putting the screen-shots to support the data (primary source of data), reading articles & papers published in various national / international journals concerns with architecture & cinema of Bharat (secondary form of data) & carrying out personal interviews with film critics & architects (as reference) examining the authenticity of primary data. After gathering the enough information, the observations need to be carried out to find out details & reliability of facts & figures. Further these facts will be summarized in a tabular form to better understand this transition by comparing the Cinematic information with actual facts. This analysis will be followed by the conclusion where author of this paper will be in position to describe till what extent Cinema can lead us to understand architecture in housing typology.

CASE STUDIES

Following are the movies selected on the basis of director, production house, story line, critics acclamation & appraising by people & most significantly application of architecture.

CASE STUDY 1- SHREE 420-1955

Shree 420, a movie which was a commercially hit & one of the critically acclaimed movies of Raj Kapur is a very good example which showcases a variety of housing typologies suites to people of different financial & social status. Housing is being used as an effective background to narrate the story.

This film guides us on the housing typologies existed in urban areas for each sector of the society old styles co-existed with contemporary of early 1950's. In this film, director has used sets as well as real-life locations as per the story demand.



Urban Poor

The director has exhibited a slum from outside (ironically) just adjoining to a big mansion. This give just a brief idea (not in depth though) about the single storied, ground floor Kaccha or temporary shelters made out of cane mesh, tree section, thatch & leftover materials put together using basic construction methods, somewhat closer to a house of a rural poor. The footpath here acts like an extension of it, which is not true in all cases, even though in 1950's. As it is an

illegal, unplanned / crowded settlement we cannot expect infrastructure facility & film also picturizes closer to reality.



Urban Middle Class - Independent House

As the lead female character belongs to this section of society, her residence gives us an opportunity to look inside Pucca (permanent) independent house of common lower middle-class family.

Exterior

This example provides information such as, it is a composite structure made up of load bearing walls & Timber columns & beams supporting slopping roof resting on timber truss covered with Mangalore tiles.

Interior

Living area quite spacious but full of basic wooden furniture items like arm chairs, rocking chair, coffee table, study table & small book shelf which also makes the space used as a study area. Long back ago painted plastered walls holding the circular electrical wire conduits, also housing wooden photo frames of beloved persons & great personalities. Kitchen is a cooking area with a Chool (cooktop) & just enough utensils. The windows with wooden frame & panel with vertical rod grill, partially covered by home-made curtain tied to frame from inside just enough to block vision from lower portion & allowing ventilation from upper side; topped with semicircular fixed glass with grill. Doors are also made up of wooden frame & panels (decorative in case of interior door). Director here tries to show the house of a family whose financial conditions was better in past but going through a tough time.

Group Housing:

Both the old & new group housing for middle class can be marked in some of the scenes, which is used as background scenery but still provides a brief idea. This cinema helps us to witness the shift in urban housing & introduction of western concepts of apartment buildings co-existed with older Chowls of Mumbai.



Chowl

Chowl is meant for lower / working class people. A independently placed. Basically, a ground plus 2 or 3 storied structure divided into many deep & narrow rooms mostly rented to different individuals or families (migrants from same or different state) by a single owner. Thicker wall sections, low height stone verandah & Wooden columns to support the corridor above will comprised the ground floor which is connected to above floors by means of wooden staircase. Upper floors with corridors safeguarded by wooden railing (approx. 1m high). The corridor area in of the room will be treated as a balcony for the tenants. The C-shape plan will create a courtyard in between acts as the only open space (common for all) also accommodates common

amenities like public water tab & toilet block. Though it does not provide very hygienic condition, but a better living condition than slum, with compromising the privacy.



Apartment Building

In the initial part of film, we can find this very much familiar housing typology (a real-life location) with the R.C.C. structure. In the background when the Lead character gathers people around him to market his (fake) product we can observe the series of these R.C.C. construction with different styles & façade treatments. Familiar elements like Balconies, Chajjas, Common terrace with parapet wall & staircase block crowned with O.H.T. (overhead tank). One phenomena to look at is the height of the buildings is not crossing the limit of ground plus five

floors matching with the height of Chowls; as the floor height in case of Chowl is more than that in apartment building.

Higher Income Class

This segment of typology has its own place in the story, as the life of lead role changes witnessed by the contemporary interior design of a bungalow. Not only that, even we can observe the colonial architecture of Mumbai in the form of beach side bungalows & mansions.



Colonial Bungalows

Colonial bungalows can be observed built with local materials like Deccan trap, Teak wood, Mangalore roofing Tiles, etc. Bungalows with front court garden, slopping roofs covering front verandah following the instructions by architectural guidelines of 19th Century (Bombay Gothic), 2-3 storied mansions with terraces & architectural features like Lancet arch & other feature of Gothic architecture.



Contemporary Bungalows

Here stress has been given on the interiors rather than on building components. There is no clear idea what style, ism or architectural movement has been followed for interior design but just random arrangement of furniture item to look the space fancy & attractive for the audience.

Overview

Overall, we can observe some architectural features just enough to understand the financial conditions & co-existence of old & newly adopted building typology which exhibits pure western design features in terms of planning, material & finishes with more exposure to western interior design ideas. Majorly focusing on the architecture of elite class.

CASE STUDY 2-DO BIGHA ZAMEEN-1953

Do Bigha Zameen, a master piece by Bimal Roy which has paved the way for future Parallel Cinema. Forceful migration together & desire of modern infrastructure in semi urban & rural area are some few factors contributing in development of urbanization showcased here.

Housing Typologies showcased

Movie based on issues of that period displaying demands the use of variety of the housing typologies of early 1950's in and around Kolkata Help of Sets as well as real-life locations is being taken to demonstrate intense situations. An example showcasing housing typologies suites to people of different financial & social status in rural as well as in urban areas.



Village Farmer

A vernacular dwelling of common farmer made up of locally available materials including agricultural waste. Separate rooms with separate plinth (approx. 800 mm) used for different activities. A demarcated entry topped by roofing tiles followed by granary of right & main kitchen-rest area in front. Mud walls with timber columns (tree trunk) supporting the slopping roof of Mangalore tiles. Wooden doors & windows, openings with timber bar sections just enough for natural light & ventilation. Kitchen with Chula, inbuilt shelves & Earthenware. Khatiya with rugs and no extra furniture item just enough survival. Other houses being covered with bamboo mesh & Thatch roofing with high pitch planned

closely.



Urban Slum Area

Densely populated group housing with narrow streets & low roof profiles in contrast with village houses. Water supply and others being common amenities served as meeting points. Rooms with different construction technologies, some showing close connection with rural construction methods with mud walls, timber columns (tree trunk) & mud plinth coated with cow dung. On the other side, some rooms made out of waste metal sheets used as walls, roof & door opening as well supported by appropriate timber sections.



Zamindar Haveli

Being richest person of village & having contacts in nearby city, the exposure to western style of architecture can be observed here in exterior building facade treatments as well as in terms of interior design elements. Porched entrance supported by Greek Doric order & ornamented brackets (may be Art Nouveau) supporting balcony projection a few to mention concerning the exterior & Victorian style wooden furniture items, sculptures of European figures, Wall mounted Glass lamps & Chandeliers contributing to upliftment of interiors.



RCC frame Structures

Comparatively new way of construction initiated in urban areas & spreaded slowly in nearby semi urban & rural areas. The beginning of the RCC structures can be seen here with an example of under construction building being erected on the same land which was taken away from the farmer. This construction process symbolizes beginning of new era by replacing the traditional vernacular style of living & construction. The process of RCC construction demonstrates the sequence of erection of RCC with help of bamboo scaffolding followed by burnt brick partition wall & plastering in the end.

Overview

This pioneering film of parallel cinema tries to focus more on the details of residences of lower class in rural as well as in urban context.

CASE STUDY 3-DO RAASTE-1969

Do Raaste, a film by director Raj Khosla talks about the growing idea of individuality & privacy.

An urban issue which helped in increasing the speed of real estate industry creating more no. of housing units. First started in higher income group followed by middle class in later period.

Housing Typologies showcased:

As the story is being woven around upper middle class & elite class, we can observe typologies & trends related to that particular income group.



Higher Middle Class:

An old mansion enough to hold eight members of family divided into 2 floors ground & first floor. Load bearing walls painted with light blue colour forms the envelop of mansion. As the floor height is more than that of an apartment, it allows bigger openings with higher lintel level. Half covered (from bottom) by homemade curtains to block the view follows the same window character which can be observed in 1955 movies Shree 420 even towards end of 6th decade of

20th century. Timber columns with stone base & stone capital on ground floor supporting the timber corridor above. Flooring is made up of concrete flooring providing base for the furniture items, which shows their connection to Victorian style of interior design with sofa, chairs, mirrors & other items. On the first floor one bedroom exhibits exposed brick work. Segmental Arches & cornices can also be observed.



Higher income group:

This movie picturizes 2 different styles of interior design with the help of same post-modernism. To show the difference between two generations, two sets of combination of colour, textures & interior elements have been used.

Interior of the bungalow belonging to an old businessman has been represented by use of purple, blue beige & ivory white colours, textures used are also not dominant rather variety of use of texture creates some kind of blur effect, together imposes an image of an old house. Even though use of post-modern elements such as wall papers, red carpet, Sofa set, Chairs, shelves, floor lamps, etc. it could not create any impact because of multicolour treatment & joined by various other furniture items belonging to different era & architectural movements, such as Victorian Queen Anne style, Art Nouveau, etc.



When it comes to a newly designed bungalow for a higher rank official the (brother started living separately), it is crystal clear that this house follows a certain style of living. There is no place for any doubt as what is the architectural style other than post modernism. Use of same bright orange colour for Furniture items, Curtains as well as floor carpet contrasted by blue carpet covering staircase. Use of wooden flooring & wooden finish for staircase railing (deformed) as well as wooden cladding for structural column enhance the effect topped by use of designer floor lamp just next to the staircase. So even one living room interior provides us with lot of information of that how the newly emerging elite class was following the western trends.

Overview

Stress is given on the interiors rather than building facades which is hardly being shown in the entire plot. Director has tried to show a house relating to colonial architecture by its construction & interior design methodology. Or that might be a trend in cinema to show all these design elements when you want represent old big house. Use of post modernism in terms of interior design was an interesting observation as the cinema was following latest trend of USA of that period. This was supposed to be the pick-period for post modernism, it was immediately followed by bollywood movies as it promotes use of bright colours & diverse use of interior elements unlike the previous design movements. Which helped in attracting the audience.

ANALYSIS

The journey of cinema presents the adaptation of western architectural styles not in just residential planning and designing but also in terms of interior designing like Modernism, post modernism, etc. (**Annexure 2**).

These individual films whether from main steam Cinema or Parallel Cinema focusing of one factor of socio - cultural - economical change that took place in Bharat after independence which led the way for today's urbanization. These films in their own distinct styles comment on the situations & influential factors that changed the way people used live, the housing typology which used to dwell, necessities & priorities of earlier families & the transformed (westernized) housing concepts & citizens' lifestyles modified accordingly. Exposure to western culture and its blind adoption, The socio - cultural - economical hierarchy between Colonial Architecture of High income group & local construction of Urban / Rural Poor has also been displayed strongly in the 1st decade of independence. Next decade cinema has exhibited newly developed urban areas which follows RCC structures for independent bungalows and high rise residential buildings with increasing number of storey. The RCC which was considered earlier for high income group residences, became common construction practice for all categories of group housing.

CONCLUSION

Architecture has been used as a tool of expression, the emotions or ideological differences or simply followed director perception. It can be concluded that cinema can be treated as one of the sources to study architecture of that particular period. Even though the architectural styles & details shown were not hundred percent accurate, it represents lifestyle of Bharatiya people & the influenced of western architectural concepts of design. As well as socio-economic factors which drove those decades & how the housing typology get evolved with peoples' requirement & expectations along with co-existence of some of the native typologies like Chowls in post independent Bharat till 1969.

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ANNEXURE 1

Housing Typologies showcased

TABLE-I Housing Typologies in Bharat

Economic Groups in Rural & Urban Areas		Individual Houses	Group Housing	Construction Materials & Finishes
Low Income Group	Rural Poor	Huts — One / Two Rooms-No Farms attached – Location Outside Village.	Lower Caste people-lived together in small groups (of huts) of same caste – No Sanitation facilities.	Local Materials – Mostly left over of Street, Mud Bricks, Timber, Bamboo, Thatch, etc.
	Urban Poor	Sham Shanty – One Room —Initially on the outskirts, Away from City com– Near Railway lines, near Ports, at foothills, etc.	Large Sham areas – Horizontal spread (increachment) – Densely populated – unplanned / unplanned planning – no private life – no space consideration for services – open drainage, sewers – Open Toilet Area – Later developed as small independent settlements within cities.	Broken A.C. / Metal sheets, Scrap Materials, Tarpsulin, etc.
High Income Group	Zamindars, Politicians & Royal People	Big Courtyard Houses – Havelis – Vernacular Architecture – Part of Village & Part of Social life / Local Governing Body.	Not Applicable	Natural, High quality Building & Finishing Materials – Not necessary Local.
	Industrialists, Businessmen, High Rank Officials	Bungalows — Sprinkled planning in combination with landscape design – Will be located in particular city areas (generally quiet zone away from crowded core areas)	3BHK to 4BHK to Penthouse to Duplexes – Very Spacious apartments giving a feeling of Bungalow. Privacy of prime importance – Landscape areas – less of common areas – Cosmopolitan Culture.	Changes in Materials & Technology from local to imported with major influence of Colonial Architecture in terms of Structural elements / Interior Design
Middle Income Group	Villagers	Single Storied – Usually having Front / Back courts – Compact Planning – Courtyard / Open Planning depends on income – Part of Village.	Location-on the basis of Caste with hierarchy of open spaces & road. Toilet Area located away from village	Local Materials – Stone, Mud Bricks, Timber, Bamboo, Thatch, etc.
	Urban - Lower Middle Class	Generally, won't consist individual dwellings – Compact planning (Sprinkled Charis) – On the periphery or near industrial zone	Live in Large groups settlements – Charis-Vertical Growth- Courtyard utilized for Common amenities (Toilet & Water tank). 1 / 2 Rooms – No private life. Cosmopolitan Culture.	Materials – similar to Village Dwellings with combination of frame structures (RCC)
	Urban - Higher Middle Class	Small Individual Houses or apartments in buildings – Better space proportions than LMC – Within City (some core area).	Ranges from 1BHK to 3BHK – From single apartment building to group of buildings to townships more amenities. Less open spaces – More Vertical growth-Privacy. Cosmopolitan Culture.	RCC frame structures – New Materials & Finishes (Interior & Exterior)

ANNEXURE 2

TABLE 2- Comparative Analysis of Architectural character showcased in movies

Criteria	Decade	1947-1950		1960-1969	
	Movie	Shree 420	Do bigha Zameen	Do Raaste	Upkar
					
Context / Income Group	Urban	1. Poor - Shams 2. LMC – Charis & Individual House 3. HIG- Bungalows	1. Poor - Shams	1. HMC- Individual House 2. HIG- Bungalow	1. HIG- Bungalow
	Rural	-	1. Villagers – Individual House 3. HIG - Haveli	-	1. Villagers – Compactly Planned Small Haveli 2. HIG - Haveli
Architectural Character	Exterior	1. mud walls, Timber support, Bamboo Mesh, Thatch Roof. 2. Stone Plinth, Brick Walls, Roof-Mangalore Tiles. 3. Stone-Brick Walls, Timber Columns, Terraces, RCC Frame Structures, High Rise Buildings.	1. mud walls, Timber support, Bamboo Mesh, Thatch Roof. 2. Broken A.C. / Metal sheets, Scrap Materials, Tarpsulin, etc. 3. Stone-Brick Walls, Timber Columns. 3. RCC Structures.	1. Stone-Brick Plastered Load Bearing Walls, Timber Roof. 2. RCC Frame Structure.	1. Exposed Brick Work / Lime Plastered Walls, Timber Framing, RCC Structures. 2. RCC frame Structure with Cladding.
	Interior	1. Lime finished Walls, Wooden Door & windows with Grill & Kalf curtain. Minimal Furniture 2. Interior Wall Finishes & Furniture Items Reflecting American Modern Style of Interior design.	1. Mud walls with wooden Doors & windows minimal furniture-Khatiya, Earthware & Utensils 2. Victorian Style of Furniture & Light Fixtures.	1. Victorian Style of Furniture Items, Concrete Flooring 2. Victorian as well as Post modern interior concepts-Design: Wall papers, curtains & furniture color contrast & to neo-dramatic colors scheme. Wooden Flooring & carpets.	1. Lime plastered walls with decorative Minimal, local furniture items. 2. Post modern interior concepts-Flour embedded Circular seating, Wood as interior finish material- wall cladding & flooring, Landscape Furniture
	Style	Colonial & Modern Architecture	Vernacular & Colonial Architecture	Post Modernism (Interior Design)	Vernacular Architecture & Post-Modernism
Influential Factors	Showcased	Migration of Youth from towns to metro cities in search of job. Funds into construction industry.	Forced takeover of land migration of farmer-conversion of farms into construction sites-	Joint family divided into nuclear families in urban areas. More stress on privacy. New emerging class of young rich.	Migration of Young generation of farmer-wants to live in cities for better lifestyle. Black marketing of grains

SPACE AND DANCE

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ABSTRACT

This paper explores the interrelation between Dance and its fundamental compositional element - Space. It defines the concept of space and dance, while describing how dancers interact with space using various movements. Since space has a major impact on a dance choreography and how it is received, the paper also highlights how dancers utilize external factors like background, lights etc. to influence and manipulate space. The challenges and problems, regarding a performance space, faced by dancers have also been described. The purpose of this paper is to give an insight into a dancer's perspective of space and providing a deeper understanding of the requirements of a performing space for improved designing.

KEYWORDS – space; dance; performance; movement; choreography.

INTRODUCTION

What is space? The most basic understanding of space is emptiness or a void. However, the perception or meaning of what is referred to as space changes based on the factors of consideration. The geographical concept of space is relational, i.e. it acquires meaning only when related to other concepts. Thus, space may be conceived as vacuum/emptiness, a field of force or synergic depending on whether it's in relation to objects, individual landscape or the whole environment.

Dance is understood as a performing art form where the dancer moves the body, usually to music, in a rhythmic manner, in a given space with the purpose of expressing an idea, emotion, feeling or simply for delight. While there are various types of dance styles and skill levels depending on the dancer, these basic four elements are necessary for any kind of dance-

- Body which is the main instrument of dance.
- Action which refers to movement - body postures, limb movements, facial expressions or dance steps.
- Time as the dance is based on rhythm and lastly
- Space the canvas on which the dancer etches movement. There's a dynamic involvement of the space in each performance, even during solo performances.

Space is shared by both dance and architecture as a medium either to frame or to express conceptual, emotional and very concrete ideas. This paper outlines how do artists define, perceive, understand, consider, think, use space. It also explores how space impacts the choreography of a dance piece as well as how it is received, while highlighting how lack of the appropriate space can hamper a performance. The paper also briefly touches on the similarities and differences in the way architecture treats space.

BACKGROUND OF STUDY

Architecture uses basic compositional elements like line, shape, space and form to define and evaluate the architectural design. Similarly, other art forms like sculpture and painting have defined and use their own set of compositional elements.

Dance is transient and fluid in nature. It is unique, in the sense, the dancer is constantly carving the same physical space to create different visuals. Being a form of art, dance too has its own compositional elements to work with. Among them the most critical and fundamental one is Space.

Space is the way the dancer occupies the physical world. Art forms like architecture and sculpture occupy physical space in three dimensions; however, this concept works a bit differently in dance because there is motion involved and the dancer has to move for dance to happen. So, the compositional element, space, refers to the way the dancer moves through and interacts with the physical world. There are various ways in which a dancer interacts with space. It is determined mainly by:

- Shape - the design of the body: open/closed, symmetrical/asymmetrical, angular/curved (individual and group shapes)
- Focus – audience (where viewer's eye is drawn) -dancer (single focus – looking in direction of movement; multi-focus – changing head/eye focus during movements).
- Size – number of dancers
- Level - the vertical distance from the floor (high, medium or low)
- Direction - forward, backwards, up, down, diagonal
- Pathways - patterns we make as we move across the floor: straight, curved

Considering how architecture, though primarily a spatial art form is also temporal and requires engagement for experience, and since movement in space is very fundamental and essential to dance, providing an intense way of experiencing space, dance can be used as a tool by architects to gain insight into the correlations between movement and space.

SPACE: A DANCERS PERSPECTIVE

Movement through Space

Dancers interact with space in myriad ways. They may stay in one place or they may travel from one place to another. They may modify the direction, level, size, and pathways of their movements. The interactions of the dancers to each other may be based on geometric designs or quickly alter as they move close together, then apart. Even when a dancer is dancing alone in a solo, the dancer is dynamically involved in the space of the performing area so that space might almost be considered a partner in the dance. Dancers may focus their movement and attention outwardly to the space or inwardly, into themselves. The path of travel may be quite direct towards one or more points in space or indeterminate and meandering.

As mentioned above there are several aspects to consider when exploring movement as a compositional element of dance: the number of dancers (the possibility of creating lines and visuals depends highly on it), the actual direction of the movement (sideways, forwards, backwards, diagonally), as well as implied movement in gestures or placement; facing, how the front of the body is positioned in relation to the audience; the pattern the dancer moves in as he or she travels through space; levels, the relationship of the body to the floor- leaping, lying down, standing etc.

Dancers may also orient their movement towards objects or in relation to natural settings. Sometimes dances are choreographed for specific locations, for example, an elevator or on a raft in a lake for site-based performances. Spatial relationships between dancers or between dancers and objects are the basis for design concepts such as besides, in front of, over, through, around, near or far.

Positive space, when it comes to dancing, is the body of the dancer and the negative space is everything around the body. The air, any objects etc. The negative space can affect a performance in diverse ways. Say, for example, the dancer moves around during the performance, the dance looks spacious and more open, whereas when it is performed at a fixed point, the dance has a different special appeal to it.

External factors influencing Space

Dancers also alter space according to the purpose of their presentation, using external aids like- lights, backdrop, wings, curtains, props, flooring, seating. A few examples of these are:

- While creating a piece on an imaginary dialogue between the poet Federico Lorca and his murderer Juan Trescastro, the choreographer Serge Bennathan chose to seat the audience on all four sides of the stage as the idea was to have them not only as spectators but also as witnesses. This delimited and calculated space was set up like an archaeological dig. The lighting was also set up on tripods on the stage to resemble an archaeological site. This created a very intimate and confined performance space, adding to the mood of the performance and enhancing the experience for the audience. [1]
- In the 'Open Spaces' project Daeilik wanted to create a performing space that could be constantly redefined, drawing the audience into the performing space and allowing them to move around freely. To achieve this, they used cardboard boxes that could easily be moved around. At one point the dancers went behind the wall of boxes and the audience had to follow them to watch the performance, at another time he placed them in the center with two different acts going on simultaneously making the audience choose which one they want to watch. [2]



Figure 01 –Comparison of altering the same performing space using lights (Aditi Mangaldas)

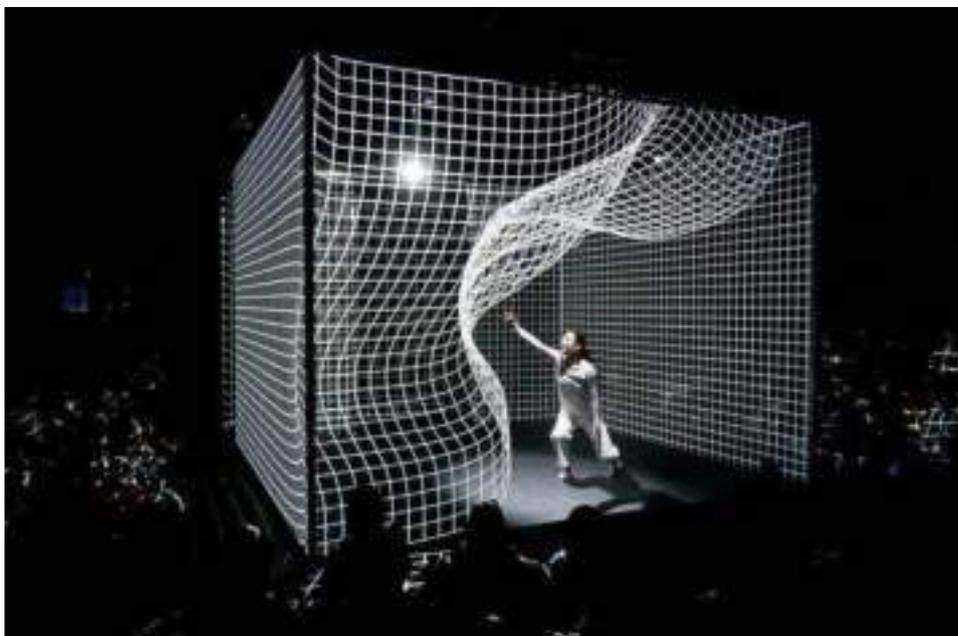


Figure 02 –Modifying Performing Space with props and lighting

All the above examples refer to indoor performances where the space is limited and pre-defined to a certain extent. However, what happens when the dance is outdoors without a proscenium setting to define the setting?

Many a time in open air settings it becomes difficult to define a frame and can negatively affect the impact of the choreography. At times the performance is against a larger than life, majestic backdrop of a temple, fort or even a palace e.g.: Mukteshwar temple festival, Modhera festival, or Shaniwarwada festival. Hence, using dancers in large numbers to enhance the movement, using various props, wings, curtains to contain the viewing space and structure it, using bright lights to highlight the performing space are some ways to draw attention to the performance.



Figure 03 –Performance in open air (Konark Dance Festival)

Another trend is to work with unusual props/ dance partners like the French dancer Georges Prêtre who performs a choreography where he dances with a JCB! This work is performed in an open ground due to the requirement of the choreography. There are many such examples where dancers work with props/objects or have site specific performances outdoors where the framing of the performance completely changes, (as opposed to indoors) hence creating a very different visual and perception by the audience.



Figure 04 –Creating visuals with levels and water for site specific performances

Challenges and problems

As highlighted above, technical and structural details like the stage, the lights, seating, background, the acoustics etc. play a major role and as dancers we face a challenge of performing in less than ideal settings more often than not. Some of the main hurdles in terms of dance space that dancers face are:

Stage: One of the main issues is that of dimensions of the performing space. This includes not just the length and breadth of the stage but also the distance from the audience, the height of the stage, the height of the backdrop and the overhead bars. With the right dimensions, the viewing of a performance is enhanced. In case of obnoxiously long stages with hardly any depth not only disrupts the formations in a choreography but also makes it difficult to do a good light set-up. Accessibility to the stage, location of the tech-rooms, etc. are some other concerns. These concerns all arise in indoor performances. In case of outdoor performances with a temporary, make-shift stage an additional concern is of the stage being very unstable. The height and the viewing distance is even more crucial in outdoor spaces. An amphitheater setting could be very helpful outdoors provided the dimensions are right.

Flooring: Flooring is crucial, especially in case of Indian classical dance. Many times, the dancing space has carpeted flooring but dancing on carpeted surfaces deteriorates sound hampering the performance. Sometimes the surfaces are uneven which is potentially hazardous especially for Indian classical dancers who dance barefoot. In outdoor settings, especially amphitheatres, the flooring material should be chosen keeping the weather in mind as it can be very painful when the floor is cold and could burn the dancer's feet in extreme heat.

Acoustics: Poor sound quality or an echo in the dance space can take away from a performance. Many times, the stage, though with a wooden flooring, isn't acoustically sound and gives a loud boom noise with every stamp of the foot to add to it missing curtains, wrong flooring, odd dimensions, or even the material used can affect the sound quality. The problems encountered in outdoor settings are different with no reflective surfaces thus increasing the need for sound amplification.

Though some of these play an ancillary role, they do contribute in making a performance more impactful and having the ideal settings will aid the dancer in delivering the best.

Similarities and Differences: Dance and Architecture

Dance and architecture both art forms work fundamentally with body and space. Both work with the physical boundary of the body to craft space while working with the limitations imposed by gravity – on body for dance and on materials for architecture. In both the creator choreographs or designs to express a defined idea and utilize lines, shape, curves, levels, patterns, positive and negative spaces to express it effectively. Both have influenced each other through the centuries. A prime example of this is the temple architecture in Orissa and southern India with dancers frozen in various sculptural poses.

Dance being a transient and temporary way of structuring or carving space makes it possible to use the same space multiple times to showcase different choreographies and also show multiple settings in the same choreography. A classic example of this is the depiction of the famous mythological story of the Birth of Lord Krishna. The same space which is shown as the prison where Devaki and Vasudev are captive is transformed into a raging river as Vasudev carries baby Krishna across and the same space becomes Yashoda's abode. As opposed to this architecture works with space in a more defined, concrete and permanent. While dancers mainly work with the body, architects utilize various materials.

CONCLUSION

Space is an active element in a dance performance. Right from the point of conception to the delivery of the show the dancer has to work around the space and choreograph the piece- whether it is theme or abstract presentation. As shown above space has a major role in dance and the right setting and manipulation can improve the impact of a dance performance. Understanding the concept of space from the dancer's perspective will help build better spaces for artists since both dance and architecture require creating an imaginary design through movement of the body. In conclusion, I would like to state that the right space can enhance a performance and give an immersive experience to the audience.

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**CROSS-CULTURAL INFLUENCES OF ISLAMIC ART AND ARCHITECTURE
IN THE INDIAN-SUBCONTINENT
(Sub-Title: Islamic Art and Architecture)**

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ABSTRACT

Throughout the process of human evolution; the development of art forms is always influenced by climatic, psychological, cultural, religious concepts that are carried away and influenced by the migrating/trading communities with various regions. IAaA is no more exception. But can be counted as a good example of the confluence of religious concepts and existing intricacies, technics, materials of that particular geographical location. This paper is focused on the Indian sub-continent with an understanding of evolution from European influence in the background. Authors tried to understand how the decorative elements and planning concepts based on a religious platform that distinguishes the Islamic style from other styles like Arabesque, Calligraphy, Inlay-work, Jali-work, Shallow reliefs, Symmetry-Geometry, and 8 pointed star shapes, Charbaug garden designs are assimilated with the existing Indian styles, materials, and elements that gave birth to new Indo-Islamic landscape style. These elements, later on, are adopted by local/regional architecture like Maratha, Rajasthani styles, etc. This process can be identified until 19th – 20th C. But in a contemporary context, the thread of beautiful collaboration of these styles or concepts is getting missed out. In the present scenario, scholarly efforts and conscious interventions for the revival of the same is the need of the period.

KEYWORDS - Arabesque, Calligraphy, Inlay-work, Jali-work, Shallow relief, Symmetry-Geometry in planning

ABBREVIATIONS: Islamic Art and Architecture – IAaA, Indian Sub-continent – ISc

I. INTRODUCTION

Islam is one of the largest religions in the world, covers varied geographical regions spread over different continents. The research tries to understand the spread of the culture on the platform of these religious concepts, and how some specific aspects reflected in the society can be seen through the art and architecture also. The focus of the research is delineated to the ISc due to the vast scope and time limitations. The study of human evolutionary history supports that no culture flourishes completely on its own but picks up some existing ideas molded with new concepts. Islamic art and architecture is no exception to this. It has many elements influenced by the territory from where this religion has emerged and spread in early days like Egyptian, Persian, Byzantine, and Germanic Visigoths in Spain. The earliest surviving Dome of the Rock [Qubbat at-Sakhrat] in Jerusalem built in 691 CE with interior vaulted spaces, the palace of Alhambra at Granada (Roman-Byzantine elements) the Great Mosque of Samarra, Iraq are a few examples of the same. Existing techniques, materials were adopted; at the same time additional elements & ideas introduced based on Quranic verses and historical proclamations. The elements which distinguish Islamic architecture from others like pointed horse-shoe shape arch, onion-shaped dome, and minarets are the examples of evolutions of earlier forms into newer version while decorative calligraphic designs, repeating geometrical-curved lines patterns known as Arabesques, etc. are the theology based new additions.

II. METHODOLOGY / RESEARCH PROCESS

For this paper, the authors adopted an Analytical research process in which the already established information about IAaA is used for comparison, and inferences are drawn. The literature study in the form of secondary data is collected from the library, Internet and research journals, etc. and few of the primary data is collected from actual site visits by photo documentation and observation are crosschecked from literature. Data is categorized broadly in two parts i.e. IAaA before and after entering into the Indian subcontinent. The broader title is subdivided into Art forms and Architecture first. Main art forms are delineated as Arabesque, Calligraphy, Inlay-work, Jali-work, Shallow relief, Carpet making, and pottery for the limitation of paper size. Similarly architectural studies are focused on Rajasthani, Maratha, and colonial period Indo-Saracenic architectural styles as the main specimens from the region. The examples chosen are not just informative but they are with the vision of Comparative analysis with respect to the aim and objective of the research. The tabular form is used for art forms and paragraphs for architectural studies supported with relevant pictures, for the better readability of the paper.

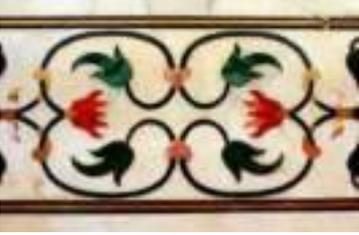
III. THE INDIAN CONTEXT

Islam being part of the ISc since 12th C., the potential of the study of cross-cultural influences become substantial in the anthropological study of History of art and architecture. Till the time Islam reached in India, its culture had been established in terms of art forms, structural and space requirements, use of material, design patterns with some specific beliefs behind, rituals and traditions and architectural manifestations of the same. Repetition, fractal geometry, radiating structures, rhythmic, metric patterns were the key utilities in the design i.e. in the plan as well as decorative elements. The Islamic architecture was evolved enough till the time with the theory of structural mechanics, vaults, domes, pointed arch, squinch arch while the native Indian architecture was based on the post-and-beam systems in stone and wood. The intricate carvings were used as decorative elements majorly including natural forms, idols of gods-goddess-secondary gods like ‘Yaksha, Kinnar, Apsara’, etc. The buildings from the Delhi sultanates by Mughals like mosques and Mausoleums built during 16th – 18th C. are noticeable examples of the interaction of the Hindu and Islamic ideologies. Any Art form (applied art, fine art, decorative features, etc.) can always be seen as the face of every culture. The stability and prosperity of culture are measured with the developed art forms. On these criteria, Islamic culture can always be placed on higher grade points with the tremendously developed art forms like arabesque designs, pottery making, paintings, carpet/rug making, calligraphy, inlay work, shallow reliefs, etc. and many more. As the focus of the study is the ISc, the below table discusses and compares these art forms before entering into this region and the influence of local art forms on the same. This analytical study of both columns can help to understand the cultural exchange of ideas and artists/master masons.

a) Elements of Famous Islamic Art

TABLE-I

Sr. No.	Before coming to the ISc	Blending with Local Artforms In the ISc
1	Arabesque – The endless design patterns symbolize the transcendent, indivisible, and infinite nature of Allah which is beyond the visible material. Motifs are characterized by the application of repeating geometric forms and combined patterns conveying spirituality without icons. [1], [2]	

<p>Emphasis on a combination of construction patterns of curve lines, straight lines, and geometric forms. Floral patterns observed in some places but geometry and lines were the main tools of expressions. This is supporting the religious concept of not using forms from nature which may be a severe offense to Allah if the Mason failed to blow breath in that form on the day of 'Kayamat' which is the capability of only Allah and no human being (based on the narratives).</p>  <p>Fig. 5 Arabesque Art Of Islamic Spain, Alhambra [Source - http://islamic-arts.org/2011/arabesque-art-of-islamic-spain/art-of-islamic-spain/ Last Accessed Date: 29.02.2020]</p>	<p>Floral patterns and natural elements added in the designs along with the earlier geometrical patterns Following image is from Red Fort Agra. The Mughal era is one of the peak periods of IAaA and shows good examples of local and Islamic cultural blending. The addition of the 'Chinikhana' element during the Shahjahan era to display China porcelain artifacts is clearly visible here. [13]</p>  <p>Fig. 2 Complex Mughal arabesque, Pietra-dura and ChiniKhana at Agra Fort [Source: https://en.wikipedia.org/wiki/File:RedFortAgra-Musamman-Burj-20080211-2.jpg Last Accessed Date: 28.02.2020]</p>
<p>2 Calligraphy – Islamic calligraphy is not just a way of writing or script but again on the similar concepts like arabesque, it is a combination of specific strokes which depicts the unity in diversity which is the nature of supreme power Allah. Quranic quotes, religious verses, poems, about the ruler are some of the examples of Islamic calligraphy. [1], [2]</p>	
 <p>Fig. 3 Calligraphy on the tiles having a separate existence. [Source - https://www.britannica.com/topic/Dome-of-the-Rock, Last Accessed: 29/02/2020]</p> <p>Emphasis on a combination of construction patterns of curve lines, straight lines, and geometric forms. Floral patterns observed in some places but geometry and lines were the main tools of expressions. This is supporting the religious concept of arabesque.</p>	 <p>Fig. 4 Calligraphy with the sandstone carving embodied on the base surface having no separate existence. [Source – By the author during actual site visit on 16/01/16]</p> <p>Calligraphy in the Indian context is not so changed form-wise and used in similar art forms like pottery, rugs, tiles, stone carvings, etc. The arch inside picture is from Ajmer, Adhai-Din ka Zopada near Salim Chisti's Darga</p>
<p>3 Inlay Work / Pietra Dura – Islamic Pietra Dura or Inlay work is a technique in which all the above-discussed art forms are used as arabesque, calligraphy, geometry-symmetry, etc. by mixing different material or with the same material but in different colors. Preferred in different color combinations most in contrast as black and pearl, blue with yellow and all other natural forms and designs</p>	
 <p>Fig. 5 Geometric designs on the tiles FROM Alhambra, Granada. [Source- Last Accessed: 29/02/20] https://in.pinterest.com/pin/404620347743161385/?lp=true.</p> <p>Tile work and calligraphy in the Mexuar Hall, Alhambra, Granada, Spain; 14th century. Many typical Islamic motifs, including geometric designs, such as the eight-pointed star, the use of bold colors, a focus on symmetry, and a sense of infinite repetition can be seen.</p>	 <p>Fig. 6 Pietra Dura work in Taj-Mahal also known as Parchin Kari [Source - http://www.taj-mahal.nettaj/textMM/Inlay.html Last Accessed: 29/02/29]</p> <p>As this is the technique of expressions of design elements, the changes reflected are similar to calligraphy, arabesque, etc. But major noticeable influence of the ISc is a change in color schemes with the mixing of red-orange and other locally available stones as red stand stones, yellow stand stone with granite, marble combinations. [11]</p>

<p>4</p>	<p>Shallow Relief – The art form enhancing the surfaces depicting decorative elements in low depth carvings. Materials were mainly stones but sometimes wood also has been used. Like Inlay-work or Pietra-dura, it is also a technique to decorate surfaces with arabesque, calligraphy in religious quotes, vegetal, floral patterns, etc. Material use is influenced by local availability and carving details.</p>	 <p>Spray topped in red sandstone disposed of in a symmetrical and graceful manner which captures the natural forms of the petals and leaves. Extensive use of this art form can be seen Mughal period. [4]</p> <p>Fig. 8 Shallow relief in Red Sandstone from Humayun's Tomb, Delhi [Source: (Michell, 2007) Page no. 170]</p>
<p>5</p>	<p>Carpet / Rug – Also known as Oriental carpet or rug. One of the best popular concepts and art form outside its original home also. Utility from floor coverings to architectural enrichments, in cushions, bolsters, bags, sacks, and prayer rugs. Deeply embedded tradition in Islamic societies, in cities as well as rural communities and nomadic encampments. In older times, special establishments and workshops functioned directly under court patronage in Islamic kingdoms. [10]</p>  <p>Ribbed and Zigzag design patterns and geometric star patterns added aesthetical values. Seljuk carpet, 320 * 240 centimeters</p> <p>Fig. 9 Carpet from Alâeddin Mosque, Konya, 13th century [Source: https://en.wikipedia.org/wiki/File:Seljuk_Carpet_Fragment_13th_Century.png, Last Accessed: 28/02/2020]</p>	 <p>As per the Mughal period development, designs and elements in carpet making also influenced by local designs.</p> <p>Fig.10 Mughal time carpet from the archaeological museum of Red Fort [Source: (Michell, 2007) Page no. 200]</p>
<p>6</p>	<p>Pottery Making – The use of glazed ceramics is very prominent since ancient times till 18th C. Tin-glazing finishes to pottery were one of the earliest new technologies developed by the Islamic potters. First Islamic opaque glazed pottery can be found as blue-painted ware in Basara, dated 8th C. Another significant contribution is the development of stone-paste ceramics originating from 9th C. Iraq. The credit of the earliest industrial production of innovative pottery can be given to Ar-Raqqah Syria (8th C.), Fustat (975-1075), Damascus (1100-1600), and Tabriz (1470-1550) [7],[8]</p>  <p>Fig. 11 Ar-Raqqah Turquoise Glazed Pottery vase, Syria 13th C [Source: pinterst.com Last accessed: 29/02/20]</p>	 <p>Fig. 12 Huqqah bowl, Delhi, India, Mughal period, c, 1700, Jade, Gold, Rubies and Lapis lazuli, Honolulu art museum [Source: https://commons.wikimedia.org Last Accessed: 29/02/20]</p>

Observations: Changes in art forms with the influence of indigenous art forms

- Designs well developed and natural elements well established in the art forms
- Local influence and artisans working were from regional areas which blend two cultures very smoothly and finishing product is a treasure of aesthetical values.

b) Influences on Architectural Manifestations

❖ **Mughal Architecture:**

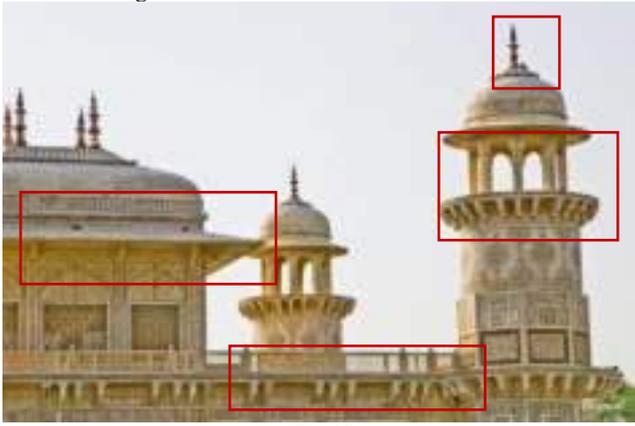


Fig. 13

ITIMAD-UD-DAULAH, AGRA, 1628

[Source: <http://islamic-arts.org/2013/the-tomb-of-etimad-ud-doulah/> Last Accessed: 29/02/20]

❖ **Influence on Local/Regional architecture:** Though there are many, only 2 styles are considered as the specimens to understand the influences, i.e. Rajasthani and Maratha Architectural elements.



Fig. 14

Central Courtyard, Mehrangarh Fort, Jodhpur

[Source: <https://www.ohmyrajasthan.com/mehrangarh-fort-priyanshu-bhatnagar/> Last Accessed: 29/02/20]



Fig. 15
Ghats and temple at Menavali, Satara, Maharashtra

[Source: Photograph by Author during a site visit on 13/09/15]

Fig. 16
Indo-Sarcanic style: Jejuri Temple, Maharashtra

[Source: Photograph taken by Author during a site visit on 14/08/16]



The most countable period for the Islamic architecture in India is the Mughal Era during 16th to the 19th centuries. Though the finest achievement of this era is the Taj-Mahal at Agra, there are many other remarkable examples of building structures and gardens like Humayun’s Tomb, Jama Masjid – New Delhi, urban level city planning example like Shahajahanabad with Red Fort, Akbar’s tomb in Sikandra, etc.

Figure 13 explains the features (highlighted with red rectangular box) like Rajasthani Jali-work, Chhatri style, pinpointing ‘Kalash’ on the top of dome-like Hindu temples, cantilever overhangs, Chhajjas and canopies with a support system in Itimad-Ud-Daulah Mausoleum in Agra, commissioned in 1628 by Nur-Janha, the wife of Emperor Jahangir. This mausoleum is built in 2 phases, the first one is in red sandstone and marble decoration as in Humayun’s tomb and second in white marble with Pietra-Dura in the artwork. This can be counted as the transition stage of shifting from red sandstone to marble in Mughal monumental architecture. [4]

○ Influences on Rajasthani Architecture:

Most of the Rajasthani Princely states were under the rule of Supreme Delhi Sultanate. Hence the influence of Islamic architectural elements and art was very obvious and can be easily identified in Rajasthani structures built after 14th – 15th C. One of the example explaining the same is above-mentioned figure No. 14 showing Jali-work, façade decoration giving the overall effect like elements arabesque - Pietra-Dura - shallow-relief decorative facades. The structural techniques are locally based but art forms are influenced by the features of Mughal architecture. [13]

The material in red sandstone and openings are based on environmental needs with arched canopies and decorative base. Combination of local art, techniques with new ideas adopted from supreme rulers’ palaces and mausoleums.

○ Influences on Maratha Architecture:

Maratha period is considered between late 17th C to 1818 CE till the time Peshwa lost the rule by British. During the 125-150 years, they encouraged the building of temples and residential structures known as Wada throughout India. Wada planning was specific to the socio-cultural activities and climate-responsive but forms of temple structures are influenced by Islamic features being prominent social structures.

The example in Fig. 15 is the temple built by Nana Fadnavis in 1782 CE from Peshwa Period. Shikhara of the temple shows onion-shaped dome with floral petals at the bottom, a miniature of minaret forms used at the corners as decorative features and ‘Bel-Paan’ at the edges which later on becomes one of the features owned by Maratha style architecture. [5], [14]

❖ **Indo-Saracenic Architectural Style**

Eventually mixing of two cultural expressions in architectural terms got a specific name as ‘Indo-Saracenic’ during the colonial period around late 19th C. and early 20th C. The British rule had introduced their European structures, functionally as well as style-wise also. Parallel to these constructions, the style that had been evolved from the mixing of two cultures were still continued with building form, elements, features and artistic decorative forms. This new style had been used by many British architects e.g. ‘Madras High Court’ by J.W. Brassington, Chennai. These elements and style are also used for local monumental structures like Jejuri Temple renovations under the patronage of Holkar from Indore Princely state during the early 19th CE.

IV. ANALYSIS

Confluence with Local concepts and elements:

Till the Mughal period, Islamic religion and rules were established and set in the ISc. The styles they brought from Europe, Turkey, etc. and the religious concept supporting these art forms were confluence to some extent with well-developed architecture and art of that region. The temple architecture, the decorative forms like façade treatments with floral patterns, natural elements, arches, carving patterns, palaces, and secular building planning etc. changed the flavor of the knowledge carried from the Western Region. Though the patronage and architects were Islamic or influenced/ordered to design as per Islamic concepts, artisans working on the ground were local. The material used was indigenous. The dominance of geometrical forms, lines, and pseudo vegetal forms were reduced to some extent and use of actual floral patterns, leaves, trees, few animals forms added and used more. The concept was repetition depicting infinity was the same but with more natural elements in design patterns.

Mughal rulers starting from Babar who encouraged gardens based on Char-bag concept of heavenly garden 'Jannat' with 4 holy rivers dividing the space into 4 equal areas was continued by next emperors. In the Indian architecture, the gardens were as the serving areas providing flowers, fruits, vegetables needed by temple complex precincts, connected to the deity and temples were situated in the garden itself. This idea of mixing built forms with nature and the surrounding environment was adopted in combining Tombs, mausoleums with gardens based on Islamic Religious concepts. The best well-known example is the Taj-Mahal, Agra by Emperor Shahjahan in the memories of his beloved wife Mumtaz Mahal.

V. CONCLUSION

The new way of living introduced with the rise of ISLAM initiated new space requirements that directly affected the planning and designs in the Architectural field. The common practices of the region were; use of natural-human forms which were denied with reference to religious perceptions of Islam. For example, an intangible way of worship of single divine power i.e. ALLAH. Seeds of Arabesque designs, calligraphy lie in the concept of 'NO-other' worship of any living being which then stretched into the 'NO- use' of natural-human forms as motifs in decorations. But in the Indian context, decorative forms and designs like the intense Inlay-work, shallow reliefs were influenced by existing local art forms of flowers and natural elements. Symmetry-geometry in the designs, patterns derived from a grid of polygons, heavenly places, gardens, etc. have a base of holy text Qur'an. Mughal gardens and pavilions being the best example of the same, based on *Charbaug* concepts. The domes, bell towers, the secured walled gathering spaces connected to the mosque, etc. are few of the elements influenced by European architecture were widely used in Indo-Islamic architecture also. But the materials used were indigenous.

These influences are never in one direction but also left footprints on local art and architecture i.e. cross-cultural knowledge sharing. Islamic art forms in jewelry designs, metal utensils, carpets and architectural ideas like form, proportions, symmetry, the art of gardening, etc. are widely accepted in regions where Islamic reigns were flourished like Bijapur, Bidar, and Maharashtra, etc. Forms in Maratha architecture, Jali-Works in Rajasthani architecture, many architectural elements from Northern India like arches, door-ways, Chhatra, etc. and many more are the examples of these effects in local conditions. This gave birth to the Indo-Saracenic style in 19th C. in the colonial period by British architects.

Any art that evolves through the years hardly dies but changes through time and technology. Architecture is a combination of art and technology. Hence in the contemporary era of continuously developing technology, ancient Islamic art is reflected in architecture with a different perspective. There are examples in which the concepts in the design forms are based on religious perceptions but material and techniques are modern. Ex. PETRONAS towers Kuala Lumpur.

In today's context, the thread of these concepts is getting missed out. The great collaborations of these art forms are not getting reflected in contemporary structures. Preserving the existing tangible heritage along with the intangible heritage of traditional knowledge systems; master-masons worked on these arts since their ancestors; is an equally responsible job. There are few examples of influence on forms e.g. Library building at MIT World Peace University, Loni Kalbhor, Pune. But more intentional efforts are needed. In the present scenario, scholarly efforts and conscious interventions for the revival of the same is the need of the contemporary period.

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STUDY OF TRIBAL SETTLEMENT IN MATHERAN VALLEY

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ABSTRACT

The indigenous wisdom of tribal settlements reflects diverse culture of India. Tribes have different styles of vernacular architecture, responding to its native environment. This reflects an advanced response to four spheres of sustainable living that is social, cultural, economical & environmental. The settlement consists of composition of built and un-built spaces. There are many tribal settlements in Raigad district of Maharashtra; few of them are in Matheran valley surrounded by Sahyadri ranges. The region is important because of being an outlier of the main Western Ghats and is covered with evergreen thick forest rich in flora and fauna. It is declared as eco-sensitive zone. This research paper studies about the tribal settlements in the Matheran valley and their lifestyle. The paper focuses upon documentation of the settlement with reference to its physical setting and environmental conditions; study is carried out to understand the concept of indigenous habitat and its integration with nature. The study concludes that for a tribal settlement to sustain in its native lifestyle, all 4 spheres needs to be equivalent and flourishing. As balanced economy plays a vital role for a healthy lifestyle, ecotourism is proposed, thus strengthening the other spheres and sustaining the tribes.

KEYWORDS - tribal settlement, vernacular, sustainable, ecotourism.

INTRODUCTION

India has a tribal population of 104.28 million. Maharashtra has the second largest tribal population in the country. The total tribal population living in the geographical boundary of the State is estimated to be 10.51 million, which is 9.35 per cent of the total population of the state [1]. The tribal people constitute the most deprived and neglected section of the population in the State.

The Western Ghats of India are one of the hottest Biodiversity hotspots of the world that are endowed with a rich diversity of plants and animals [2]. Matheran is an outlier of the main Western Ghats. It has a rich natural environment with dynamic landscape. The deep valleys around it are covered by dense forests and the top of the hill is a large plateau. [3]. To protect the unique flora, fauna, mountain ecosystem and serenity of this area, Central Government declared it as an Eco sensitive Zone. This Eco-Sensitive Zone covers an area of 214.73 sq km. [4].

In addition to rich biodiversity, the Western Ghats are a home to diverse social, religious, and linguistic groups. There is high cultural diversity of rituals, customs, and lifestyles in the region, including a significant population of tribes and forest dwellers. The Katkari (Kathodi) tribal community is found in the Matheran valley. A Katkari settlement is called a Katkariwadi. This research paper studies two such tribal settlements, Arkaswadi & Pirkarwadi located in Matheran valley region on the banks of river Dhavari. These settlements are base camps for the trekkers of Matheran & Prabalgarh. These settlements came into existence during the construction of Morbe Dam in 1999.

TRIBAL SETTLEMENT IN MATHERAN VALLEY

Regional context and location

The Matheran region forms a major part of the Matheran Malang gad hill chain that consists of Malang gad, Prabalgarh and Irshalgarh. This 30 km stretch is an outlier of the Sahyadri range that is long chain of hills stretching from Mumbai to Goa in the south [5]. Matheran lies in Karjat taluka of Raigad district in Maharashtra State, India. The study areas, Pirkarwadi and Arkaswadi in the Matheran valley are under eco sensitive zone of Matheran.



Fig. Number 1 –Location of settlement (Source: Google Earth 2019)

Methodology

The approach adopted for this research study is observational descriptive method. Primary data was collected through interviews, field observations and through surveys. Secondary data was collected from State and District Government offices, Indian Meteorological Department and from several research papers, related articles and reports. Empirical Survey was conducted for data collection of the tribal settlement, to study the impact of four spheres of sustainability, which are social, cultural, economical and environmental.

Climate

The climate is warm and humid climate [6]. Summer starts from February and ends till May. The temperature is highest in the months of April and May. It ranges from 38to 40°C. Winter starts in November and ends till February. Temperature is lowest in the months of January and February. It ranges from 16 to 18°C. June to September is the rainy season. The average annual rainfall is 4073mm [7], [8]

Economy

Forest is the basic life supporting system of tribes. Their occupation is agro-forest based. The tribes indulge in various activities to earn their livelihood. The occupation of the tribes is classified into four groups namely daily wage workers, agriculture, fishing and animal husbandry (cattle rearing). The daily wage labourers work on construction sites or as bamboo handicraft workers in the neighboring villages and nearby towns. The river near the settlement has promoted agriculture and fishing activities. Tribes who own farmlands practice agriculture. Rice is the major crop grown in the Kharif season. They also grow certain vegetables like bitter gourd, bottle gourd, beans, ridged gourd and green leafy vegetables. The cattle rearers look after domestic animals like cows, goats, sheep and birds like hens and roosters.

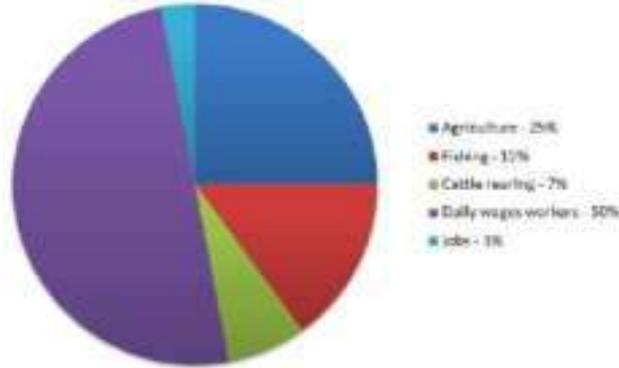


Fig. Number 2 –Occupation of tribes in the settlement (Source: Author)

Demographics

Pirkarwadi consists of 37 houses. It has a total population of 213 people comprising of 110 males and 103 females. Amongst them there are 33 children belonging to age group of 0 to 18 years. Arkaswadi is a small settlement consisting of 4 houses. It has a total population of 32 people comprising of 14 males and 18 females. There are 9 children belonging to age group of 0 to 18 years.

Settlement

Humans started living in settlements from prehistoric periods. Community living started developing for safety and security reasons. Every settlement genesis is near resource of water. These settlement patterns are in linear, nucleated & cluster forms. These settlements being at the foothills of matheran are far away from the main highway and also from the city thus for education facilities and health care facilities they have to depend on the neighbouring city.

Arkaswadi and Pirkarwadi, in Matheran valley are dispersed type of tribal settlements. These settlements are developed according to the topography of the place. They are in form of clusters of three to four houses. There are no defined pathways connecting the clusters. Arkaswadi is a cluster of four houses, all of them are kuccha houses with common courts. The back yards of the houses are the farmlands. There are common warehouses for storage of farming equipments. Pirkarwadi is comparatively larger settlement having five clusters of kuccha houses with common courts.

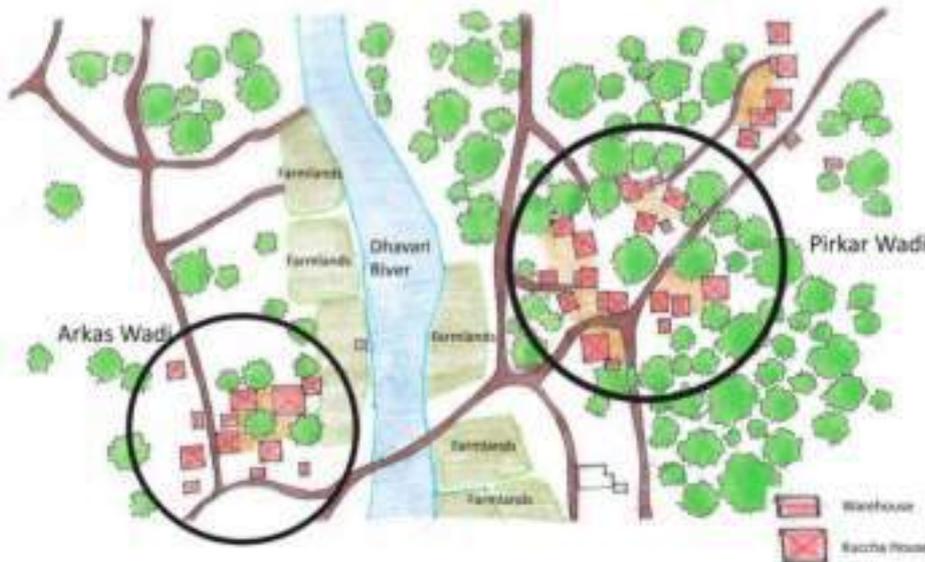


Fig. Number 3 – Settlement pattern (Source: Author)

Housing typology

The tribal housing typology is Kuccha houses. All the housing typologies have a semi open space, verandah (otla) at the entrance. It is used as a sit out space, which also serves as an interactive space. It is covered by a lean to roof which is an extension of the sloping roof. The habitats can be classified into four typologies on the basis of their spatial configuration.

Typology 1 consists of a single multifunctional room. A semi open space (padavi) is attached to the room, which is used for keeping hens and roosters. It is also used for storing fuel wood. As these houses do not have proper allocated storage space, they usually have storage bins to store the grains. The bath area is a temporary shed outside the house.

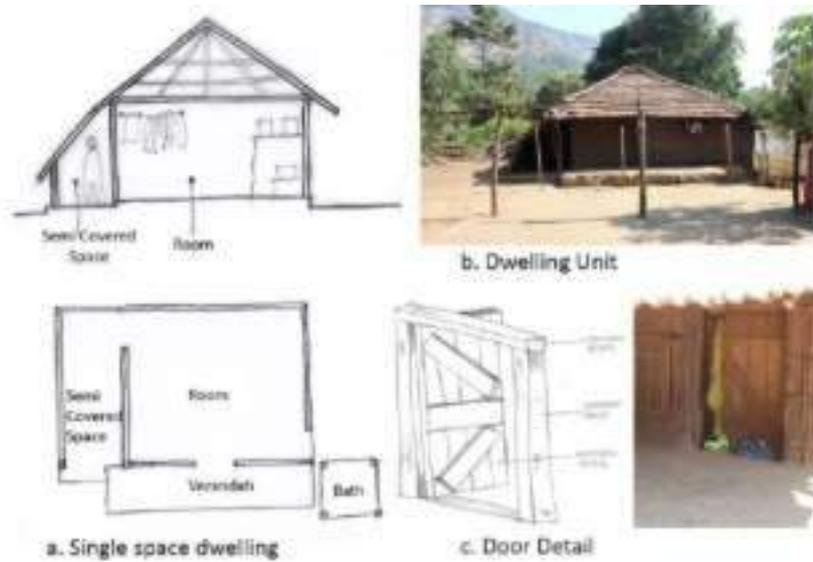


Fig. Number 4 –Housing typology 1 (Source: Author)

Typology 2 consists of a multifunctional room with a cooking area separated by a partition wall. It has a semi open space (padavi) for keeping hens and roosters. There is a separate space for storage to store grains, groceries and fuel wood. There is a small semi open space (gotha) on the back side for cattle.

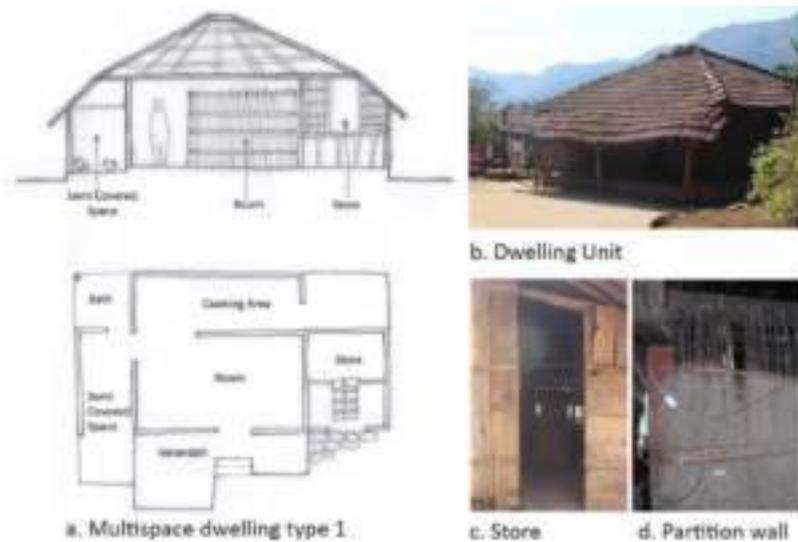


Fig. Number 5–Housing typology 2 (Source: Author)

Typology 3 and typology 4 follow a hierarchy of open, semi open and covered spaces. It has a semi covered drying yard in front of the house (angan) used for drying grains. A semi open enclosure on the backside is used as animal yard (gotha). There is a multifunctional room and a cooking area.



Fig. Number 6–Housing typology 3 (Source: Author)

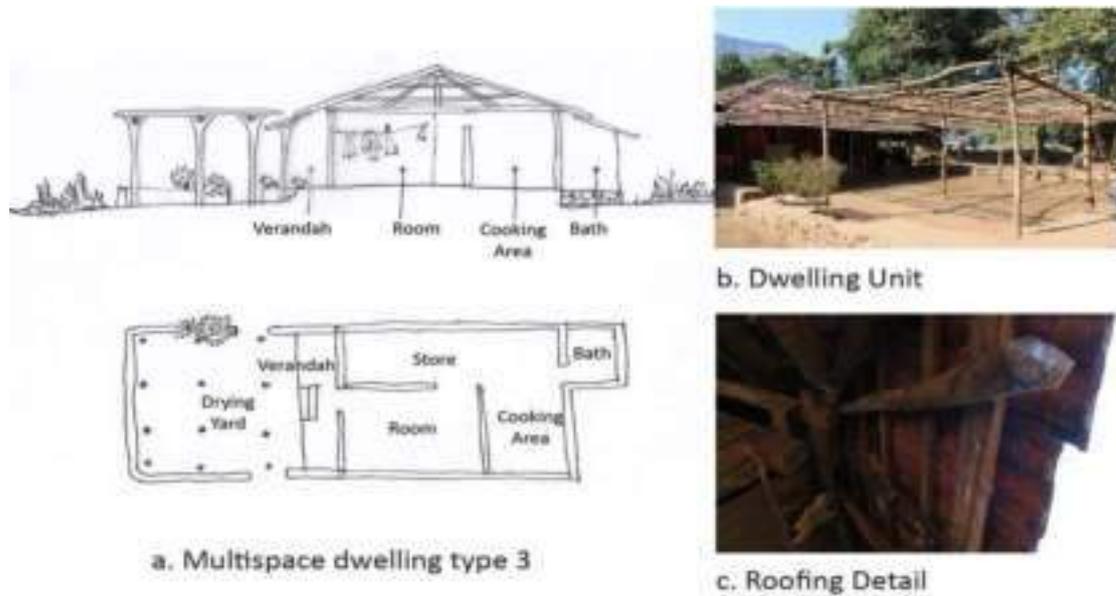


Fig. Number 7–Housing typology 4 (Source: Author)

Warehouses (Beda)

Some dwellings share a common warehouse (bedas) used as storage for agriculture equipments, some big utensils and in some places used as storage for fuel wood. During Monsoons River passing through the settlement gets flooded so the tribes store enough grains, groceries and fuel wood to meet their needs.



Fig. Number 8 –Warehouse (Source: Author)

Climate responsive architecture

The passive design strategies used in the tribal habitats provide indoor thermal comfort. Since the climate is warm and humid type, the orientation of houses is such that the direct penetration of sun rays is minimised. The drying yard (angan) in front of the houses and the backyards help in wind circulation. The semi open spaces like verandah (otla) and padavi help in reducing solar gain. The wattle and daub walls absorb moisture in humid conditions and release it when conditions are drier. They allow openings for ventilation and entry of filtered light into the structure. The plan with minimum partitions allows cross ventilation. The pitched roof finished with clay tiles helps in drainage of rainwater. It also serves as a means of escape for the hot air from the gaps in between the clay tiles and hence keeps the interiors cool. The roof overhangs provide shade and also protect the walls from rainwater.

Construction techniques

Tribal people adapt to sustainable lifestyle as they admire nature the way it is, hence locally available materials are used for construction of their dwellings. The plinth height is varies from 0.15 m to 0.45 m. Plinth is constructed with locally available stone. It is then pressed and finished with a final layer of cow dung and mud slurry. The housing typologies have plinth extensions in form of otle (verandah), padavi (semi open space), gotha (animal sheds). The walls are made up of wattle and daub walls. Wattle is made by weaving thin branches (either whole or split) between vertical members. Daub is a mixture of cow dung, rice husk and red soil. It is then applied to wattle and allowed to dry. Partition walls are made from thin tree branches cut into halves that are tied by using twigs, usually these walls are kept unfinished. Wall openings are made of locally available wood. They are of a lower width and height. The frame is tied with wattle and daub wall. The roof is pitched roof. It is supported by locally available wood for making of rafters and battens and clay tiles are used as roofing material. Semi Covered spaces like otle, padavi, bathing areas, gotha are later extensions to the roofing system.

Sustainable practices

The tribal settlement is analysed on the basis of four interconnected spheres of sustainability : social, economical, cultural and environmental.



Fig. Number 9 –Spheres of sustainability

Social

The tribal community is a self-reliant community based on principles of simple living. Since the major occupation of tribes is agriculture, their daily movement is either by walking or on carts, which increases the amount of interaction between them, thus contributing to social cohesion [9]. The women are engaged in household activities. The river being the only source of water, it becomes a place of interaction for the women. Their houses share common meeting spaces between them and are used for various community activities raising social value.

Economical

The economic dependency of the tribes is mainly upon agriculture and forest products. Since they have a controlled population growth, it helps in less resource depletion. They build their own storage bins for grain storage. These bins are made with least possible resources. In this way, they manage scarcity and hence satisfy their needs. They use roof top solar panels to generate electricity, which is a renewable source of energy. This reduces resource consumption and promotes economic growth.

Cultural

The tribes maintain cultural beliefs and traditional practices. The festivity is the essence of tribal life [9]. The community celebrates festivals such as Ganesh festival and Holi together. They have traditional ecological knowledge of plant species used for different purposes such as food and medicine.

Environmental

The climate responsive architecture of tribal habitats using locally available materials and eco friendly design principles provides them thermal comfort. The wastewater from the houses is disposed on the streets or directed in the backyard, which dries up in the sun. The waste from the cattle is used as organic manure. Cow dung is used for flooring in their habitats. The tribes use minimum natural resources. Though they are dependent on forests, they do proper management of forest products.

CONCLUSION

Future progress should be in the interest of maintaining ecological integrity. The existence of an undeveloped tribal settlement is strongly associated with the social and economic condition of the population. Matheran valley being eco sensitive zone, limits scope for future development in the region. But the indigenous construction techniques of tribes and use of natural resources and locally available materials should be conserved and the knowledge should be transferred to the coming generations. The tribal community respect the flora & fauna and their inter relationship with each other. The massive indigenous knowledge of tribes in protection and conservation of natural resources and environment should be passed on to the people. So, ecotourism can be proposed in the area as a sustainable approach to tourism development. Eco tourism can also be a source of economy generation for the tribes. Tourists can explore the natural areas, educate to protect the environment and help developing the local people. Apart from providing them employment to the local people, ecotourism will also promote conservation of natural assets and enhance the cultural integrity. The location of tribal settlement in Matheran valley also gives an opportunity for home stay programmes. These programmes can be designed for the tribal settlement, which bridge the connection between tribal lifestyle and urban lifestyle. The economical development can support the environmental aspect of sustainability which is main objective of ecotourism. It is not necessary to disturb ecology for development but both can go hand in hand with thoughtful land use and integrated planning. This can help to sustain the entire ecosystem and thus help in protecting the species and also to spread awareness along the globe.

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PRE-CONSTRUCTION CONSIDERATIONS IN DESIGN OF DAIRY PLANTS [For Medium size (150 KLpD) Dairy Plants in Processed Branded Milk & By-products]

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1.1 ABSTRACT:

India's White Revolution (Operation Flood) was launched in 1970, as an initiative by India's National Dairy Development Board (NDDB) and was world's biggest dairy development program transforming India from a milk deficient nation, to world's largest milk producers. Milk is highly perishable and decays, if not chilled to less than 4 degree Celsius or other processing methods, within 4 hours of milking causing entire supply-chain to collapse. Today with highly automated milk processing, construction of large dairy plants meeting international norms of food-grade hygiene, safety, quality, cold-storage, secured supply chain upto the consumers in national or international markets, is important. From routine collection of milk at farmer level, to processing dairy products, 'commercial branding' and branded sale of milk products, is a highly organized commercial activity and a huge agro-based industry. While Dairy plants are industrial buildings, the similarity between any other industrial building (shed-type constructions) and a dairy building ends here. Dairy buildings are very specialized 'Food-processing units' where the ingredient processed is milk, having self-life of just a few hours, if not treated. Thus, from raw milk reception to delivery of processed milk and its by-products has challenges related to maintaining food-grade hygiene within the buildings, maintaining controlled room environments, heating, cooling, washing, sterilization in the process areas, temperature controlled storage facilities and delivery.

While addressing the above primary issues in Dairy building design, machinery and equipment installations, process piping, other building services, light and ventilation aspects also comes in picture, creating comfortable working environments on shop-floors along with function and aesthetics. It is thus, the performance of these buildings in addressing the above issues, which play key role in the success of the products. Due to the manufacturing requirements, structures are normally long-span, tall or double-heighted and heavy industrial loading which pose technical challenges to construct. Hence it is obvious, that focus has to be on reducing construction timeline. Apart from construction delays, it has been observed that lack of clarity on 'pre-construction considerations' have been one of the main causes for dairy project delays, upsetting the start of commercial operations and affecting Cost of Capital. This paper aims at understanding the 'Pre-Construction Considerations' which shall help manage better construction Time-lines for Dairy plants. It attempts to look at important planning considerations, which shall help new investors & architects in planning new dairy-plants with reduced construction time, thereby help achieve early BEP (break-even point).

1.2 KEY WORDS: *Processed branded milk, RMRD, CIP, Floor drains & Amul-traps, HACCP, construction timeline.*

1.3 INTRODUCTION:

Machinery installation and construction many times happen as parallel activities, with finishing happening after installation of equipment and testing & commissioning of equipment happening after finishing. While designing Dairy plants, understanding the product demand, determines the capacity to produce and thus the size and scale of the buildings. Also the production processes, space requirements of equipments related to processes, special needs of hygienic spaces and the building services are diametrically opposite requirements, which need to be understood and considered for each department of manufacturing, at the design stage itself and its installation & maintenance, as well as building maintenance, ultimately lead to better performance. Clean environments (essentially dust free, bacteria & insect free) are essential in these buildings and design has to cater to this aspect also.

Dairy process plants are complex structures to design and construct. They require a multitude of skills and technical inputs. Smooth co-ordination between the project stake-holders and the key-actors in the process such as the project owners, planners, process-consultants, architects, structural consultants, electrical consultants, dairy-equipment vendors, hygiene consultants, HVAC agencies, piping & instrumentation contractors, plumbing and sanitary engineers, fire-safety experts, other specialist consultants and the construction management team, are essential to achieve success in the project. The manufacturing processes are water intensive and huge amount of liquid alkaline effluent is generated, which has to be handled effectively, so as not to harm the product as well as the environment. The other requirements are of statutory approvals, registrations, licenses for the manufacturing activity and products, which also affect the time-line. Thus, Dairy-plant constructions can be very interesting, if only, imaginatively worked upon.

On the overall, it is observed that construction of dairy plants take only about 1/4th of entire Project Cost, whereas it consumes atleast 4 times more time than machinery installation; hence an investor is not so much concerned on construction cost, if construction is achieved well with-in time-line. If the production starts earlier, it gives better RoI. Saving construction time, is thus, very crucial for construction of dairy plants. Hence it is essential to optimize the dairy construction timeline, which would value add to success of the commercial venture.

1.4 AIM:

A clear 'pre-construction road-map' can help improvise and reduce 'implementation time' that is crucial for success of any Dairy. The aim is to identify these 'Pre-Construction Considerations' which affect the design of dairy plants.

1.5 OBJECTIVES:

Dairy buildings with its complexities can take several months or some years to start commercial operations. It is necessary to realize the unique construction requirements of this sector. The time spent is a big variable, at various stages such as "finalizing the process needs", broad scale planning, detailed design, obtaining pre-construction approvals for construction as well as dairy-process, construction, equipment finalization, procurement, delivery and site-installation of equipment, trial runs, post-construction maintenance stages, etc. Most importantly it is a 'Matrix working' until the work comes to equipment installation and trial runs.

It is the pre-construction consideration which have a long 'gestation period'. If these are understood correctly, then further implementing the project happens smoothly. Hence the objective is to understand the "Pre-Construction road-map" for Dairy plants so that investors, architects and project managers can develop a better understanding of the complexities in this typology and can in turn give a fitting response while planning.

1.6 NEED, RELEVANCE AND SIGNIFICANCE:

- i. It is usually seen that though Process-consultants for machinery & equipment are appointed on priority. However, construction managers have so far not been seen actively or involved by the owners, for the construction, as the importance of a good infrastructure is only realized by the owners, after the building is completed. At that point, it is too late, since lacunae in construction cannot be rectified when the plant becomes operational or after start of Commercial Operations.
- ii. Lot of milk-process plants actually operate in unhygienic environments, as due care was not taken during pre-construction stage. It is difficult to rectify their flaws after production starts.
- iii. Dairy & Milk process facilities have to be designed in a special way for creating and keeping maintained, clean 'food-grade' environments which are dust free, microbe-free and insect-proof, right from bulk milk-reception up to processing and delivery.
- iv. Various norms are expected to be implemented in a 'Food-Grade Industry' for construction also.
- v. There are many types of consultants involved at various stages and each of their requirements has to be coordinated during construction. Next in line are the vendors whose 'Design Freeze' and 'Go' decisions are crucial.
- vi. Many-a-times, even the Civil Contractors / Constructors are generally not specialist in this typology and rely on their experiences in other industrial works, which is actually an eye-wash, unless they are not exposed to intricacies of dairy constructions.
- vii. Site-management from mid-course of construction till completion, is one of the toughest part of such project as multi-tasking is involved with multiple agencies. In most cases the structures are of Long-spans, Extra-heavy Industrial loading, double or Triple heighted slabs. Working at height is difficult, reduces work speed & is risky due to windy conditions.
- viii. Thus, proper awareness of managing such constructions at pre-construction / planning stage is the way forward to reduce the greater risks involved and such constructions getting delayed.

1.7 SCOPE & LIMITATIONS:

Milk processing is a prominent Agro-based industry in Western Maharashtra. This study is based on practices seen more in Western Maharashtra. The study is limited to Processed Branded Milk plants of 'medium to large scale' with 'Normal By-products'. The study is limited to private dairy businesses only. Here we shall not consider the co-operative sector, as the outcome from co-operative dairies is not clear, with conflict of interest amongst different pressure groups and lobbies.

2. GENERAL INFORMATION

The processing of milk is with the objective of extending its shelf life & saleability. This objective is typically achieved by (a) heat treatment to ensure that milk is safe for human consumption and has an extended life with quality, and (b) preparing a variety of dairy products in a semi-dehydrated or dehydrated form (butter, ghee, hard cheese and milk powders), which can be stored. Even pasteurized pouched milk has a shelf life of about 4 days, but only under refrigeration. Since the ingredient is processed milk, hence there is a lot of stress on not allowing any stagnation of milk anywhere within and outside the 'process system'. Even splashing of a drop of milk anywhere on any surfaces, due to system-leakages is a risk as it leads to bacterial growths which then quickly infects the whole plant. Hence constant washing of floors and cleaning of machinery, etc. is necessary, which requires huge amount of water. Even air-borne bacteria can affect the product. Clean environments (essentially dust free, bacteria free, insect free) are essential and building design must cater to this aspect in all aspects.

3 IMPORTANT PRE-CONSTRUCTION CONSIDERATIONS:

From a routine collection of milk at dairy farmer level, the simplest commercial activity is 'Chilling and Sale' either at individual level or a co-operative level. The next stage is pasteurizing and selling which is also a very common activity, from where milk supplied in bulk tankers is known as 'Bulk selling'. Further comes the evolution of retail sale of processed "pouched milk". At this stage 'commercial branding' of milk begins and this is a highly organized activity. This processing activity also results in many 'by-products' of milk getting manufactured as a part of natural outcome of the business process. Dairy processing may be a relatively easy task. However, the difficult parts in setting up a good Dairy Plant arises when the following points are considered by the "Project Proponents"[1], [2], [3]:-

- i. **Availability of milk & milk collection:**– Milk being the raw material, before finalizing the site it is necessary to do study and research on its easy availability. The extent of milk procurement area, percentage of milch animal population, average milk yield, marketed surplus, etc. will determine the size of the plant. The biggest challenge in dairy industry is the 'quality of raw milk', as it is something which cannot be improved further from the point of its reception, but only be maintained. The method of procurement, transportation, the availability of other inputs such as packing materials, disinfectants and consumables should be ascertained.
- ii. **Consumer profile** – Though processed milk can be sold far away from the point of its processing, it is very essential to do market research for knowing the target consumer.
- iii. **Marketing Potential & current requirements** – The manufacturing strategy and processing capacities shall be decided based on market potential and current trends, to meet the immediate demands of achieving early BEP.
- iv. **Location of the Plant site / Site selection** – It is a primary need to locate site close to potable water source. Also, the other important factors to bear in mind while finalizing the site are – availability of uninterrupted electricity, proper road upto site since milk tankers upto 40 tons weight commute to and fro the site, ease of access to a main road or a highway for faster dispatches and proximity to an urban area. Proximity to potential 'market' and type of 'Business model' a dairy proposes is important to create its niche in market.
- v. **Site requirements** – From constructional point of view the site shall be an almost levelled ground (gradient between 0 – 2 degrees). It shall be generally hard murum with good founding strata available upto about 2.5m. In case of very soft soils or black cotton soil deposits, the foundations have to be taken deeper and it increases the time and cost upto plinth. In case of rocky strata, foundation work upto plinth becomes expensive. It also becomes difficult to excavate in hard rock over long distances to lay drainage lines from plant to the ETP. Most importantly, an important part of expenditure on work upto plinth happens, but it is not seen.
- vi. **Product mix** – Any business process requires a good product mix to survive in the market in all seasons. Thus a study of market potential is essential for deriving the product mix.
- vii. **Potable Water supply** - Availability of large quantities of potable water is required - Since milk processing requires huge volumes of potable water.
- viii. **Availability of funds** – This aspect starts with seed capital and ends with availability of sufficient working capital. An early completion of building and commissioning of plant helps owners in getting better working capital from financial institutions.
- ix. **Seasonal fluctuations in the availability of milk** – As a commercial venture, the dairy plant has to take care of seasonal fluctuations in availability of milk. At times they need to make provision for adequate storage of raw milk.
- x. **Competitors** – The owners / project proponents have to study the competition for their proposed product before entering the market.
- xi. **A plan for future growth** – "Post-Establishment Plan" must be in place, say 5 years or 10 years hence. Thus the site identified must have sufficient additional space for well-planned future expansion needs.

3.1 KEY ACTORS IN SUCCESS OF ANY DAIRY PROJECT: [1], [2], [4]:-

For making such a project operational the primary involvement is of the following:-

- i. **Owners:-** Any Industrial Construction is initiated by the “Business Process Owner”. Typically the business model is of a ‘start-up’ as a ‘Trader’ or dairy farmers and progresses further to becoming a ‘Manufacturer’. In some cases, it is expansion of activity by an existing manufacturer.
- ii. **Process Consultant:** For a Dairy Plant to be set-up, it is necessary to appoint a Dairy Process Consultant. He initiates the forecasts for a product and its process and prepares the initial system layouts. Planning of building and role of an architect begins here. The process consultant and architect work in co-ordination at this stage to evolve the final building plans.
- iii. **Architect & his sub-consultants:** The architect has to spend a substantial amount of time along with the process consultant and the owners in the initial thought processes, primarily to understand the process requirements. Many times the requirements keep revising or changing and so also the architectural plans, since finalizing the product, the processing techniques, capacities and future needs, take a long time. The other consultants such as electrical, HVAC, fire-fighting come in picture in due course.
- iv. **Equipment Vendors:** Owner’s negotiation with equipment vendors, begin early; sometimes even before the plans are finalized. However, the point of ‘vendor freeze’ and ordering the equipment sometimes may still happen after design finalization or at times when civil work commences on site.
- v. **HACCP Consultant:** ‘Hazard analysis and critical control points’ is an important criteria in any food-process factory. There are norms for hygiene and food-safety, not only for manufacturing practices, but also for the construction of such plants. It is necessary that their interaction with architect happens early in the planning stage, so that HACCP norms are incorporated in design.
- vi. **ETP Agency:** For any good dairy plant, it is necessary to have an efficient ‘Effluent Treatment’ plan. Since most of the effluent is liquid with fat contents, it needs to be treated before letting it mix with any other water-body or soils. For design of effluent treatment plants, ETP vendors need to be appointed at the planning stage itself and need detailed architectural inputs.
- vii. **Civil Contractors:** For construction of good Dairy buildings, the basic requirement of a civil contractor shall be that he shall be a civil engineer with about 10 to 15 years of experience specifically in industrial building constructions. It shall be an advantage if such a contractor has previous experience of dairy constructions. He shall have special shuttering systems such as “Cup-Lock” for casting of heightened floors and sufficient man-power - about 25-30 persons as rcc fitters and carpenters, and about 23-30 general labour.
- viii. **Piping Contractors:** They are mechanical contractors, specializing in stainless steel piping and fabrication work. They work under the drawings and instructions of the process consultant.
- ix. **Government + local population:** It is widely observed that government departments & government officers play a very important role and they impact the timeline for completion and success of the project. Also in case of dairy plants, being agro-based industry, the support of local villagers and surrounding population has a positive impact on plant operations.

3.2 IMPORTANT CONSIDERATIONS in MILK PROCUREMENT AND PROCESSING: The organized dairy sector (both cooperatives and private) presently handles about 15 per cent of total milk production in the country. Thus it indicates, there is a wide scope for organized processing of milk and systematic manufacture of milk products for domestic consumption as well as export and creating a value added supply chain. We are world’s largest producer of milk, but still we are not an exporting nation for milk products. Thus there is a huge scope in organized processing and branded milk products. [1]

3.2.1 PROJECT DETAILS [3], [4]:-

- **Land and Location:** Ample space is required for buildings, its future expansion, parking of transport vehicles, for empty cans and for produced inventory and material storage which mostly requires cold store warehousing. Atleast about 2 – 2.5 acres of land is required for milk processing plant handling about 1,50,000 ltrs. of milk per day. The built-up area to total plot area should be normally around 1:3. The exact design and details of built area are decided in consultation with machinery supplier or Process consultants.
- i) The plant should be close to the milk producing area in case of byproducts manufacturing unit and if liquid milk is the main product it should be also close to the consumption centers.
- ii) The site should have proximity to road/rail facilities, services, such as water, electricity and effluent mains, social infrastructure, etc.
- iii) Subsoil of the site should be firm with proper drainage.
- **Site Development:** Preferably the entire site should be fenced with barbed wire or ideally a compound wall is constructed with gates at suitable places.
- i) Internal roads should be of asphalt / concrete depending upon the soil conditions for heavy milk tanker loads (40 T), rainfall and the number of vehicles moving every day.
- ii) Raw Milk Reception area should provide for unloading cans & tankers from different types of vehicles. Dock levellers or conveyors may be required to be installed.
- iii) Proper drainage arrangements should be made to ensure cleanliness.
- iv) Stagnation of storm water in gutters or effluent water in effluent drains must be avoided.
- **Layout and Buildings:** The civil works comprise of main processing building, which includes Raw Milk Reception Dock, Main processing halls, provision for manufacture of other products, cold storage, CIP, Laboratory, quarters, office, garages, security office, etc. The factory building for the milk reception, quality control, processing, packing and storage of milk products should be as per BIS. The total covered area / built-area depends on the processes involved, products manufactured, the quantity of milk handled and the equipment chosen for product manufacturing. However, about 25,000 s.ft. area of built area is required for handling 1,50,000 ltrs of milk / day. The essential sections of a milk processing plant are as under:
- **The milk processing plant shall have the following essential facilities [1], [4]:**
- i) **Raw Milk Reception Dock (RMRD)** - consisting of can conveyor, can washer, weighing balance, dump tank etc. including Tanker CIP facility.
- ii) **Milk Processing Hall** - homogenizer, pasteurizer, cream separator, chiller and other related machinery are installed.
- iii) **By-Products manufacturing area**- depends upon the type of products, quantity of milk handled and the machinery to be installed.
- iv) **Storage area**- for milk storage tanks / silos.
- v) **CIP** – Cleaning-in-place system is installed in all dairy plants and is essentially an internal cleaning mechanism for all processing equipments and it requires special room for equipments.
- vi) **Floor Draining Systems** – This is a very intricate system and success of any constructional facility in a dairy depends on efficient floor draining system, every part of which is again cleanable periodically to eliminate any bacterial formations.
- vii) **Pouching / Packing area** - for packing of liquid milk and other products.
- viii) **Cold storage & Warehousing** - for keeping the milk and milk products before sending to market.
- ix) **Quality Control Laboratory**-for testing the quality of milk and milk products.

- x) **Utilities area** - for installing Boiler, Generator set, Refrigeration plant, maintenance workshop and store area for spares.
- xi) **Service bridge** – for transporting services like steam, hot water, soft water, raw water, refrigeration piping, CIP piping, electrical supply and raw material (milk) or product supply from utilities to the plant or otherwise.
- xii) **Water Treatment Plant** – for treating raw water before usage in the process.
- xiii) **Effluent Waste water treatment plant** - for treating the dairy effluents before releasing to the surrounding environment. This shall require about 1500 to 2000 sq. mtrs. of land.
- xiv) **Quarters and Office area**- for all the essential staff.
- xv) **Vehicle parking area for tankers**- both for the milk procurement and distribution vehicles.

3.2.2 MILK PROCESSING HALLS: Primary processing, pasteurization and homogenization is carried out here along with separation of milk and cream and further chilling is done. Processed milk is then stored in milk storage silos (horizontal or vertical S.S tanks). Process halls are controlled environment room for cream separator, chiller, homogenizer, pasteurizer and other related machinery. The floor preparation is done with grade slab or tremix (if it is on plinth) or floor-slabs capable of carrying loads varying between 5 to 10 T/sq.m. The floor and walls have to be washable & the corner-junctions have to be curved /chamfered or smoothed out to avoid dust collection and improve cleanability. The corners may be lined with S.S. edge-trims. Most importantly, the processing room must be lined with full-body vitrified ‘Dairy Tiles’ min. 12mm to 15mm thick acid-alkali resistant industrial flooring capable of trolley movements. The floor joints are kept with 3mm spacers filled with epoxy-grout. Altrnately Epoxy or PU-flooring is required. Walls have to be washable and hence clad with glazed tile dado or painted with Epoxy paint upto 3 m height. Window cills in granite or S.S. have to be fixed at least 30 deg. slope. The windows are either fixed or openable with S.S. mosquito mesh. Sliding windows are absolutely avoided as there can be accumulation of dust or dead flies or insects in the window-tracks, which cannot be cleaned. All HACCP norms for construction apply in totality for all processing rooms. The soffit of slab is designed to carry the load of service piping racks; thus insert plates at slab soffit of adequate capacity are to be provided during construction. The doors are usually with granite jambs or Stainless steel doors on door closers. Floor springs are avoided as they may stagnate water if floor is washed. [4]

3.2.3 MILK STORAGE TANKS AND SILOS: Dairy plants require storage system for the receiving, processing and keeping the milk or finish product before packing or further processing. Milk storage tanks and silos are one of the key equipment in the dairy industry. Manufactured from SS304 or 316, these tanks are available in horizontal or vertical design suitable for indoor or outdoor installation with holding capacity from 10,000 ltrs. to 1,00,000 ltrs. They need a suitable platform connectivity to the building in a certain way.

3.2.4 CIP SYSTEM – cleaning in place: Cleaning In Place system is a cleaning system whereby the machine or systems are cleaned on the manufacturing line rather than dismantled and taken away for the purpose. It is a method of cleaning the interior surfaces of pipes, vessels, process equipment, filters and associated fittings, without disassembly. On account of its constant everyday use and service, the presence of water, steam, ammonia, brine and a variety of cleaning agents, the Dairy equipments are more expensive to maintain. A CIP room is required to house the the various tanks containing the cleaning agents. The floor level is usually sunken be about 150 mm for CIP so that in case of any eventuality the cleaning agent (acid or alkali) do not spill to other areas. [1], [4]

3.2.5 FLOOR DRAININGS SYSTEM:– is a very intricate system and success of any dairy depends on efficient floor draining system, every part of which is again cleanable periodically to eliminate any bacterial formations. The drains can be preferably open drain systems with necessary SS grating. Drains end in ‘Water-seal Traps’ which are cleanable ‘goose-neck water seals’.



Diag. no. 1 -Typical ‘Cleanable Goose-neck trap’ (commonly known as ‘Amul Traps’)



Diag. no. 2 – Typical conventional floor drains Vs. Pre-Fab SS floor in floor drains.

As against conventional, Pre-fabricated Stainless Steel floor drains of necessary sizes with adjustable legs for maintaining line, level and gradient with respect to finish floor are today available. [2], [4], [5]

There are many inter-dependent activities in and during construction, such as piping, equipment installation, insulation below floor in cold stores, etc. which need proper planning.



Diag. no. 3 – interdependent activities in construction & cold stores detailing [4], [5]

3.3 UTILITIES & SERVICES -

- i. **Power:** Normally a three phase electricity supply is required for milk processing plants.
- ii. **Water:** A typical milk processing plant requires the water in the ratio of min. 3.5:1 (3.5 litres of water for 1 litre of milk processed) for processing, cleaning of equipments; cold storage and drinking purposes. Accordingly, the size of the well or water tank is required to be designed and depending on the quality of water, the water softening plant may be considered.

- iii. **Steam:** The steam requirement (kg/hour) depends upon the processes involved and the source of steam may be met by coal / oil / gas fired / electric boiler plants are required.
- iv. **Fuel:** The fuel is need for various processing operations. The type of fuel will depend upon the type of boiler used for steam generation and needs a space for fuel yard.
- v. **Compressed Air:** It will be required for various pneumatic operations, flow control operations as well as for cleaning purposes.
- vi. **Vehicles:** The vehicles required for procurement and distribution of milk depends on the quantity of milk to be handled. The requirement of vehicles may be considered in the project cost. Generally, insulated vehicles will be required to transport chilled milk and refrigerated vans for transport of finished products like ice cream, cheese, etc.
- vii. **Other Services:** A suitable Refrigeration plant and maintenance workshop are an integral part of milk processing plant.
- viii. **Environmental Aspects and Pollution Control:** The effluent will be in the form of washed water and milk solids apart from the detergents and sanitizers used in the plant. Planning of suitable effluent treatment plant is necessary for treating effluents before discharging for proper disposal. The final effluent should meet the requirements of Pollution Control Board and is necessary to get clearance from them. The treated water can be utilized for irrigation, farming or creating a biotic zone where plants can be grown in and around the dairy plant.

3.4 Licenses, Statutory Permissions and regulations [1], [4]:

A. Dairy & Equipment related:

no.	Name of Permission	Act/Regulation /Rules / Code	Originator / Authority
1	Air pollution	Air (Prevention and Control of Pollution) Act, 1981.	State Pollution Control Board
2	Boiler inspection	Indian Boilers Act-1923	The Inspectorate of Boilers & Smoke Nuisances – State Govt.
3	Water pollution	the Water (Prevention and Control of Pollution) Act, 1974	Central Pollution Control Board (CPCB) of India, Ministry of Environment & Forests(MoEF)/State Pollution Control Board
4	Fuel & Diesel storage	The explosives rules, 2008, Petroleum Rules 2002	Chief Controller of Explosives, Petroleum And Explosives Safety Organization (PESO), Nagpur
5	Weights and Measures	The standards of weights and measures act, 1976	As per weights and measures dept. rules, Director of Legal Metrology
6	Stamping of electronic weigh scales	The standards of weights and measures act, 1976	As per weights and measures dept. rules, Director of Legal Metrology
7	Factory License	The Factories Act, 1948	Chief Inspector of Factories, Sate Govt.
8	FDA Registration	Prevention of Food Adulteration Act, 1954	The Food & Drug Authority, Government of Maharashtra
9	FSSAI Registration	Food Safety and Standards Act, 2006	GoI Ministry of Health & Family Welfare, Chief Executive Officer of Food Safety & Stds. Authority of India (FSSAI)

B. Land & Building Permission:

No.	Name of Permission	Act/Regulation /Rules / Code	Originator / Authority
1	Govt. Demarcation & Title document (7/12)	The Maharashtra Land Revenue Code, 1966.	State Revenue Dept. – Taluka Land Records Office (TLR)
2	N.A. (Non-Agriculture) use Order for plot	Maharashtra Regional & Town Planning Act - 1966	District Collector / Sub-division office, Revenue dept.
3	Fire-Dept. NOC	Maharashtra Fire Prevention & Life Safety Measure Act, 2006	Maharashtra Fire Services (MFS), Mumbai / Local Municipal Fire Department
4	Road dept. NOC	Maharashtra Regional & Town Planning Act – 1966 / Local municipal by-laws	National Highway Authority / Local PWD office / ZP office, as per plot location
5	Health dept. NOC	Maharashtra Regional & Town Planning Act – 1966 / Local municipal by-laws	District Collector's office
6	Electrical dept. NOC	Maharashtra Regional & Town Planning Act – 1966 / Local municipal by-laws	Power Supply Company (eg. MSEDCL)
7	Lift License	The Bombay Lift Act -1939 / The Maharashtra Lifts Act	Inspector of Lifts, PWD office
8	Rain Water Harvesting	Maharashtra Water Resources Regulatory Authority Act - 2005	Regional Town-Planning dept. / Local municipal office / MIDC, as per plot location
9	Civil Aviation NOC –if building is within aircraft approach zone	Govt. of India notification SO 84 (E) / By-laws of the concerned town	Airports Authority of India
10	Environmental Clearance if Built-up Area more than 20,000 sq.m.	EIA Notification, 2006	State Level Environmental Impact Assessment Authority
11	a. Bldg. Permission b. Plinth checking c. Bldg. Completion	Local Building By-Laws and National Building Code	Regional Town-Planning dept./ Metropolitan Region Authority/ Local municipality / MIDC, as per plot location

Generally the project proponents start realizing the need for commercial sales model as soon as the milk collection reaches about 10,000 ltrs. per day. The 'Branding' need comes into picture at around 25,000 ltrs. of collection, and processing pouching and branding may start.

For manufacturing ‘Processed Branded Milk’ the following factors are considered in defining the size and scale of plant [1]:-

- The ease of availability of milk and the plant location with respect to availability of market within about 6 hours’ drive i.e. an overnight journey are considered important, for morning sale is the maximum. – Later-on day sales of milk are not that high. Today, people going to super market to buy weekly stock of milk are not even 1% in India. Rest of all 99% is a daily delivery at doorstep – and for this the plant has to be nearer to markets / urban areas.
- Secondly, size and scale is ‘Profit Driven’ – Maximum Profit is in liquid milk. In by-products the scale of market is very less, unless marketing scale is very large like Amul & Nestle, spread over a wider geographical area & large market spread; or Hatsun in South India has a diversified setup of many plants nearer to large cities.
- Thus normally, ‘closer to market’ is a necessity for size and scale. Additional milk if not consumed then goes to powder plant for making milk powder which has longer shelf life, but this requires special processing needs. Some Dairies are closer to market, but their processed milk is less in retail and they are more focused on the by-products. Thus different business models are also seen in market, which try to create local monopolies.

Time consumed in project conceptualization, infrastructure planning, statutory approvals to “Project go-ahead” decision and finalization of contractors [3]:

For a well managed project this period is very important and stake-holders generally neglect this part. It is observed that this takes almost about 1/3rd of the entire project life cycle, if not more. Further, failure to appoint consultants & contractors who have experience of working for dairy industry, affects the time-line.

Construction techniques: It is seen that most of the constructions have so far followed traditional techniques of RCC, masonry and plastering. Cold-stores have been insulated with industrial polystyrene and lined with plaster or in PUF. However, today with advent of PEB, it remains a challenge to use PEB in dairy without violating HACCP norms & food-safety criteria. Structural steel being corrosive, is not a directly recommended material in dairy plants where washing and use of water is extensive and discharge of alkaline effluent is normal. Thus, if composite structures can be evolved using PEB + concrete + PUF panel walls & cladding, then it can be an evolutionary technique in saving time without diluting the haccp norms for construction. [4]

Various probable reasons for delays in construction of dairy plants: There are various causes of delays in constructions and these may vary from place to place. The common reasons seen are: Lack of clarity in the pre-construction considerations, unsuitable contractors being appointed for projects, owners imposing their own contractors whose past professional competence on such works is not clear, delay in timely disbursement of payments to equipment suppliers and contractors, Government permissions, government restrictions on use of certain construction raw-materials on some sites, Site location (remoteness from major town) and site-conditions.[3], [4]

CONCLUSION:

1. Clarity and knowledge of the pre-construction process intricacies of this sector would help produce faster, suitable, hygienic and better designed dairy plants.
2. Pre-construction considerations if understood and followed, shall help in reducing the construction time for dairies there by help in achieving early ‘commercial operations date’ which is main focus of lender financial institutions and creditors.

RECOMMENDATION

Dairy Industrialists and investors must appoint architects having experience in this sector and also process consultant, at initial gestation stage of project, so that the above pre-construction considerations are taken into account in project development, thus help control time and cost escalations.

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EXECUTION PARTICULARS OF CONSTRUCTION OF A PRIVATELY OWNED JAIN TEMPLE

Documentation of small scale temple construction at Pune

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ABSTRACT

In architectural practice and education in our country, we are hardly exposed to temple architecture. It is limited to History of architecture where the subject tries to make the students aware of different styles of the temple architecture and terminology of major parts of temple. This typology of building is seldom practiced by architects. We have different types of people in the country who deal with this typology who are not majorly Architect but they are designing and dealing in temple construction from their generations. There is no formal education for this and knowledge is limited to these families only. This paper focuses to highlight certain aspects of temple execution – Jain temple, privately owned, through the Author’s own experience. This temple was a “Jain Temple”, designed by “Sompura” [1] from Ahmedabad. The Author was a local architect to get the execution done with an engineer on site. The client has given full authority to the team,- the Author and the site engineer, to get the temple executed. At last, this paper will help the reader to understand certain basic concepts and basic knowledge one shall have before one starts the execution of the temple without external help.

KEYWORDS- Temple execution; Sompura; Jain Temple; Architect’s role in temple Construction.

INTRODUCTION:

In today’s architectural education system one deals with all sorts of building typologies possible throughout the 5 years course. Even the construction management courses try to focus on the management of typical building typology. None of these really talks about the religious structure – Temples, which is also an important building typology in INDIA, unless it is taken up by someone for his/ her Thesis. Hence building temples with conventional building methodology and materials, discarding rituals and religious aspects, may be an easy task for any architect. But when it comes to building it with a completely traditional method, one needs to know all the beliefs and methodology that is followed traditionally. Assuming that this would be told by someone in the process of construction by - client, the Sompuras or anyone may not work out the process easier since the time at which the information is shared might not be shared at the correct time.

AIM :

To document the construction process of a Jain temple.

Objective:

To make one acquainted with various stages of construction of a temple.
To make one understand the relevance of rituals followed in today’s context.

Limitations :

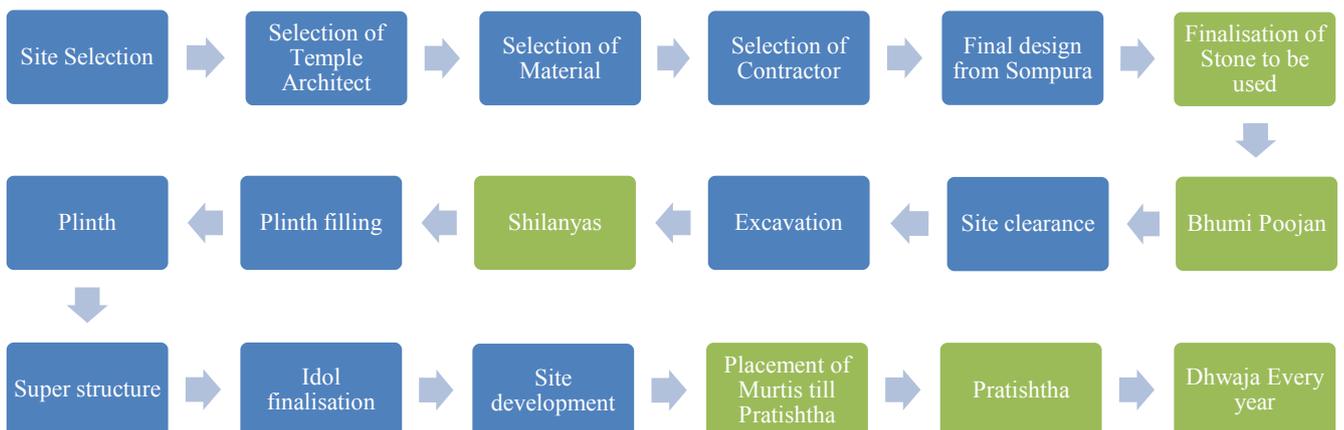
The paper talks about a Jain temple where idols of *Tirthankaras* are not established. The deities are the ones who are not only worshiped by Jains but also by other religions also. It is privately owned means, till the construction is completed, there is only one owner who is going to fund the complete activity. No trust is involved in it. The rituals discussed in the paper are the only those which were practiced in this temple and related to the goddess whose temple is this. Understanding of rituals was through the persons involved in the temple construction only.

METHODOLOGY:

Since the paper is completely based on the Author’s experience from the construction he was involved in; there are no research methods employed. Field research was done during the construction process to understand the rituals in today’s context.

The overall flow of the construction of the temple:

As an architect, we can categorise the overall process of the construction of a temple in two main parts. One is Rituals and customs that are followed and the other is actual civil work activities involved on-site and off-site. While executing the temple construction, no one can separate out oneself from either of these 2 categories since they are part and parcel of the completion of the project in totality, and compliances need to be done for the rituals in civil activities.



This workflow shows civil activities and rituals in different colours.
One cannot think not to get involved in rituals when it is to be built a traditional way.

THE OWNER:

Construction of temple generally involves huge monetary support. Most of the time it is carried out by trusts / pedhi, where various people from society contribute as per their convenience and capabilities. There can be differences of opinions when trust is involved. Various changes may occur and suggestions are given by various people during the construction period, when trusts construct the temple, unless someone very strong decision-maker is not there. This all generally leads to a delay in construction time.

As per the *Sompura* involved in our project, the temple of this scale shall take somewhere about 4 years to complete (excluding RCC work for basements). But here the owner, Mr. Bhandari, had a clear mandate of completing the temple within 2 years maximum, in all respects – from *BhumiPujan* till *Pratishtha*. To support the timeline, the owner was very quick to take the decisions, and gave total freedom to the team to take technical decisions where ever needed. This was the reason the temple was completed within 2 years and 9 months including the basement, its interiors, site development, and all rituals.

The owner is a key person in this building typology to give quick decisions, full support to complete the project in terms of funds and other allied resources.

TEMPLE ARCHITECT, *SOMPURA*,

Scope :

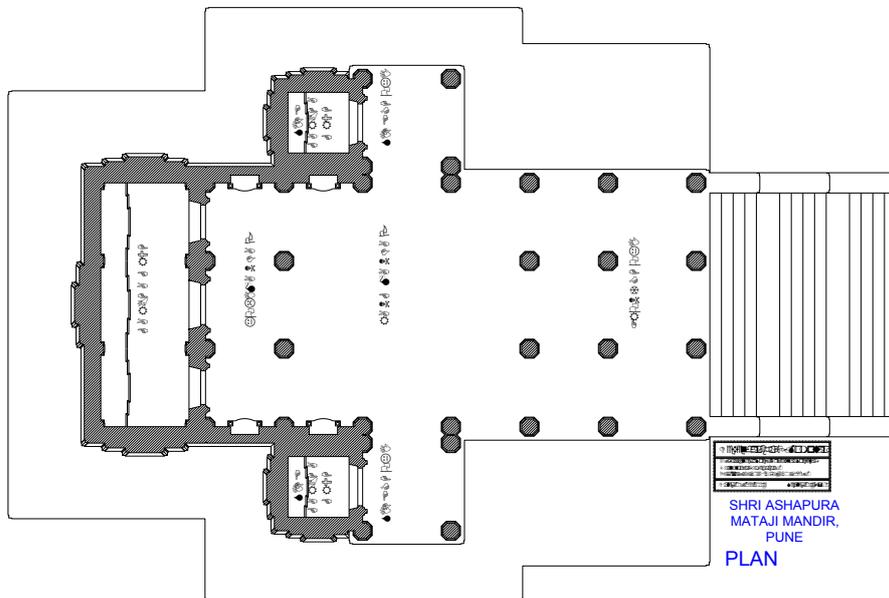
There are different families in different parts of India who are into the designing of the temple. The knowledge that they have is transferred to them through their generations. *Sompuras* in Gujarat and Rajasthan, *Sthapati* in Southern India, *Mahapatras* in the east are examples of these. There is no formal education that they gain but they work with their family members and get the knowledge through practice. This knowledge is limited to these families only.

The knowledge that these people have regarding temple architecture is enormous. Being a Brahmin community, they know most of the things regarding various gods and their respective rituals also. The drawings that they produce are very technical as far as the stone carving work is considered. They use computers for drafting i.e. they are that way technical but may not be technical to correlate drawings from various agencies / consultants like RCC consultant, MEP, etc.

Drawings and Documents from *Sompura*:

They will provide you with a complete set of drawings of the temple in the form of a plan, and general sections, and all side elevations just like us Architect. But apart from that, they will provide you booklet called “work order” where they provide details of all stones to be used with their dimensions and its quantity in Cubic foot.

This document is very useful for any person to understand the terminology used for stones at various locations in every course / layer. One can measure the quantity of stone used in construction for billing. Such order books are issued to the client and to the contractor who is working on stone. Hence study of this order book before the execution of that particular work is essential.



Drg No. 1 : Plan Of The Temple Executed (Source : Author’s Collection, Issued by Mr. DevendraSompura)

THE RITUALS:

There are several rituals associated with temple construction. Many times it is wrongly portrayed that Jain people spend so much money on construction of a temple. This is never looked from the need of that time in the older days. We all know that after agriculture, the building industry is the second largest job generator industry. In ancient days too, when many other building typologies like hospitals, institutional, commercial, etc. did not exist, the temple was the major building type in terms of volume, time, and employment. Not only Jains, but all those who were wealthy used to contribute money to build the temple, and many other trades used to be employed – craftsmen, sculptors, *vaidyas* to look after labours, etc.

When money is given, obviously these people used to get something in return. So someone will gain the opportunity to worship the main idol at the time of *Shilanyas*, someone will gain opportunity to do *Pratishtha* of the main deity, someone will gain the opportunity of opening the eyes of the *idols*, or hoist the flag, etc...

Hence there used to be a ritual wherein the rich and wealthy people will offer the money for several of these activities in the temple. This used to take place in a social gathering. This method involves the *Pratishtha* of idols before the temple is constructed completely. Here first *GarbhaGriha* is constructed, the idol is established and then the construction of the remaining temple continues.

Hence all rituals have spiritual relevance as well as construction management aspect to it, which may be related to fundraising also [2].

Such rituals are [3] –

Shilanyas – where nine directions are worshiped and the location just below the main deity is also worshiped.

Pratishtha – Establishing the Idols in the temple.

Drishti – The first day when the doors of temples are opened.

Kanyapoojan – 9 unmarried daughters from society are worshiped.

Dhwaja – Hoisting the flag on top of the Shikhar of the temple. Every year it is changed.

Many activities are involved in all of these apart from the main activity explained above.

THE CONTRACTORS:

There are several activities involved in the temple. Hence several agencies required which are similar to the conventional building typology. The main contractor is the one who would get the stone, carve it as per *Sompura's* drawings and install it in place. Usually, in ancient times, local stone, and local craftsman / artisans used to do this job. But now a day due to the advanced technology available and mode of transport available, one can get stone from anywhere the world and the workers and be got to the site from any distance. Hence the contractors work on-site as well as off-site also to speed up the process. Main bulky items are prepared off-site may be at quarry location or the workshop of the contractor and transported to the site. The small items are majorly prepared on site. As far as marble work is considered, Rajasthan is the area from where the material and related contractor team comes from. Till the plinth is achieved, they can be made to work off-site.

This working off-site is possible because the temple architecture is modular. Each stone at every layer is labeled, and a book – order book which contains the size of a particular stone, its placement, and carving details, etc. hence such work can happen at the workshop.

The flooring of the temple is generally done by special agencies. They prepare panels if the design given by *Sompura* and get it on site for final execution. The flooring work includes marble, colour full onyx, and colour full acrylic material for making design patterns.

Another important agency involved is the one who works on the wooden door, laminating it with silver, preparing decorative panels behind the idols, making the “Dan peti”, Copper hooks, and “DhwajaStambha”.

The other major role is of sculptors of IDOL. These being in Marble, are based in Rajasthan. They take up the turnkey contract of supply and sculpting of stone to final sculpted piece – idol. One who is managing the construction of the temple has to visit at various stages to the workshop of these sculptors. Various stages of checking are –

At the time the stone bought by the agency; When the basic size and shape is sculpted; Before the eyes are carved in the idol.

The above stages are for regularly sculpted idols like Tirthankars, Buddha, goddesses like Mahalakshmi Saraswati, etc.



Image 1: part of modular column (Source : Author's collection)



Image 2: Flooring pattern, (source : Author)



Basic shape of an Idol

Clay model of an Idol

Replica of clay model

Final Idol.

Image 3: Various Stages Of Checking The Idol, (Source : Author's collection)

For unusual idols, like we had, “Ashapura Mata”, the sculptors want you to see the idol made of clay. Hence first it is made by an artist on clay, which one has to finalise and give approval. Then the sculptor working on Marble will replicate it by carving in stone.

The size of all the idols is again an important aspect of the temple. As we follow the human anthropometry for our regular building typologies, *Sompura* follows anthropometry of the IDOLS – *SHILPA SHASTRA*.

Either the *Grbhagriha* size is derived on the basis of idol size or the idol size is derived by the *GarbhaGriha* size. The same is with the door of the *Grbhagriha*. There is a relation of lintel level and the “*Drishti*” (eye level) of the idol. Hence the size of the idol shall be finalized in the beginning if one wishes to complete the temple and then do the *Pratishtha*.

Along with this how the idols will be taken inside *Grbhagriha* and established in position shall be given a thought at this stage.

CRITICAL AREAS OF CIVIL WORK:

Foundation :As a regular construction procedure, one has to do excavation work for the foundation. The only thing in this typology is that when you are building it the traditional way, you have to excavate till the rock. One cannot get away with plum concrete. The backfilling one can do with boulder concrete. No steel is to be used – under “*GarbhaGriha*” atleast. The temple in the case study was having a conventional method of construction only for the basement, and the traditional method for “*GarbhaGriha*” & complete superstructure. Foundation is, in general, to be done by local contractors.

Nabhi : One of the most difficult tasks during civil work may be erecting the “NABHI”. It is a copper pipe of 50mm diameter to be erected on the day of *Shilanyasat* the location of the main deity, but not on touching Shila (stone). This pipe shall be high enough above the plinth

level. Here one has to construct small chambers around all *Shila*, protect them throughout the construction procedure till they are buried in the foundation work. It is to be done carefully since the site might be excavated. In the urban scenario, the site might be tight with hardly any margins left out for supporting purpose at ground level. The pipe has to stand straight in plumb. This Nabhi shall be generally a single continuous pipe, but if due to excavation and final proposed plinth level, if it is difficult to have it in one piece, another copper pipe is to be welded to extend the height.



in excavated site Location for Nabhi Nabhi seen above plinth work of *GarbhaGriha* Shilanyas
Image 4: Nabhi at various stages (Source : Author’s collection)

The Axis : During all this process the axis of the temple, which is a very crucial element, has to be maintained with precision. There is no allowance of error. Since the position of the deity is fixed and just below that the shilanyas is done and the nabhi rises from there up to above plinth level, if any error happens in this Nabhi and foundation work, the door of *GarbhaGriha* and the Idol alignment may not be seen as expected.

Superstructure : Construction of RCC part seems to be very simple compared to the stone construction done for the superstructure. Being modular and final finish product being used, contractors take utmost care for it to be perfect in line, level, and plumb. Where ever one sees marble wall, it is the composite masonry where brick work is backing the marble members which are facing out. And these brick walls are cladded with plain marble from inside. The columns, arches, and beams are solid homogeneous material – stone. Also, the superstructure is modular and symmetrical structure; there is no leeway one can give for error to happen.



Image 5: Composite Masonry (Source : Author’s collection)

Rang Mandap : It is the part where mostly there is no slab but the dome above to cover it. Beams of stones that have to be monolithic in nature are raised and kept on top of the stone pillars. Space for a crane to move around and lift the stone beams and position them on the columns has to be there. Otherwise it becomes a time consuming job to lift these members manually.



Image 6: Rang mandap various stages (Source : Author’s collection)

SERVICES:

All the services like electrical, drainage, CCTV are not designed / marked in the drawings by *Sompuras*. One has to design and generate co-ordinated drawings to be issued to the respective agencies. Here what is critical part is that one cannot provide conduits of any metal. PVC as a material is allowed. But the disadvantage of these conduits is that they can be broken by the dead weight of the stones during the construction. Sometimes the pipe gets chocked just because it is pressed.

These conditions reveal when at last wiring is done. At that time no one can help the electrician because one can not use a drill machine or such an instrument to create a new passage. The walls / stones are so thick that one can not really judge the position of drilling. Hence laying of the conduits shall be done very precisely and at such locations with the consultation of the main contractor that there are least chances of pipes getting blocked.

This becomes very critical for the CCTV cabling. Since the cables have to be laid simultaneously with the construction process, after completion of the temple it might be the case that camera did not get signal since the wire is broken somewhere inside the structure.

Sometimes *Rang mandap* may be an open structure – no walls only columns and roof, one has to take electrical lines from roof / slab to the interior of the dome. The provision of extra conduits becomes essential in such a case. Provision of extra plug points for plugging in musical instruments has to be made.

All this is critical when an architect is involved from day one and may not want services seen all along the beautifully carved marble pillars, and walls. Of course, exposed piping (casing capping) is an easy solution which many temples follow.

Drainage:

Stormwater drainage has to be done carefully since the *Pradakshina path* (ambulatory passage) is open to the sky. In our region, we have 4 months of monsoon, and the marble floor becomes slippery during this period. So fast-draining off of the water is important. Also, the

water from the roof slab is to be drained off. Most of the temples have spouts which drain out water directly on the floor, many times on the *Pradakshina path*. Hence carefully identify the place where spout shall be or can provide a down take pipe that can be hidden. Secondly, draining of water from *GarbhaGriha* after the idols are washed is very important. It is not considered auspicious that this water comes under the feet of any person. Hence provision of outlet to take this water out and release in the soil shall be designed.



When all this is done with a spiritual intention, the almighty power helps one to complete the project.

CONCLUSION:

Temple architecture, executed by traditional method or conventional method, is also an area where we architects shall get involved in. Our knowledge and ability to deal with various situations and synchronise with various agencies is very much needed for such projects. Our traditions have a lot to teach us about modular construction and geometry. *Sompuras* may talk about this as a set formula of religion, but we need to look at it as rhythm and series for construction which is described in various books pertaining to temple architecture. One gets to know various thoughts / viewpoints about a single matter

Today, not all temples which are constructed are given full attention to all aspects of services and site development. Many times the beautiful marble walls are nailed to fix the soundbox. This can be controlled by an Architect. An architect, if knows this process of construction can really make a difference the way temples are executed.

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DELAY CAUSES AND CONTROL STRATEGIES FOR EFFECTIVE CONSTRUCTION MANAGEMENT

FOR RESIDENTIAL AND COMMERCIAL PROJECTS BY PUNE BUILDER DEVELOPER ORGANIZATIONS

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ABSTRACT

Construction projects are often delayed due to many reasons. Delays result into numerous complications including monetary losses for the project developer and the various stakeholders – from the consultants, to the investors, to the society at large. This paper attempts to explore these reasons and discover the strategies implemented to eliminate the delay causes or, at least, reduce the impact of the delays. The scope is limited to residential and commercial projects in Pune which are initiated by promoter builders for profit. Townships are excluded.

15 numbers of respondents were identified based on various parameters like scale of work, size of organization, ISO certification etc. This was done to ensure that all types of builders are covered. In addition, there were two factors which were common to all respondents: they had to be members of some professional organization like CREDAI, and, the owners/ top management had to be technically or legally qualified. This was done to ensure good construction practices were employed. Two questionnaires were used to elicit responses. Wherever possible, personal interviews were taken with the top management to ensure there is no loss in communication. These findings were collated to arrive at the conclusions and further recommendations.

There were two significant reasons for delays – statutory processes and legal processes. All respondents agreed that the best control strategy was pre-planning. This is possible by employing construction or project management personnel. While delays caused increased costs, there was also evidence to show that proper planning not only ensures a project is completed before time, it also results into monetary savings.

KEYWORDS - *delay causes, internal causes, external causes, avoidable causes, control strategies, ISO, pre-planning, construction processes, management*

INTRODUCTION

This paper aims to identify delay causes in residential and commercial projects in Pune which are initiated by promoter builders. The basic premise is that delays are detrimental for the project, and as a result, for the stakeholders and the society at large. They cause numerous negative impacts from time and cost overruns to project abandonment to litigation. Hence, any strategy used to prevent delays and reduce or eliminate their negative impact is worth studying. These strategies may be employed in subsequent projects and help prevent the delay causes and hence, reduce or eliminate their impact.

This study aims to prove that pre-planning is a good strategy for effective construction management that will lead to cost benefits. Implementation of pre-planning may be done with the help Quality Management System - QMS. ISO 9001 certification is an indicator of QMS implementation.

Scope and Limitation

Residential and commercial projects up to 500 units, in Pune that are initiated by promoters-builders for profit. This study excludes townships. The data is limited to 2015. Subsequently as of 2020, there have been certain changes in the context which are enumerated further.

Research Methodology

Steps of research methodology:

- Construction process: understanding background, delay locations, impact of delays
- Literature and website review
 - I. Principles of Management text books
 - II. ISO 9001:2008 standard
 - III. Websites that offer information about construction delay types, causes and recommendations for control
- Data collection from selected representatives of the builder community of Pune through
 - I. Two questionnaires
 - II. Personal Interviews
- Compilation of the received data to identify areas of delays, delay types and controls
- Analysis of the delay impact and to establish a link with various processes undertaken in a typical project
- Identification of delay control strategies adopted by the respondents

This sample database of builders is carefully chosen to ensure that practically all permutations and combinations of various parameters like organization type and size, volume of work etc. is covered through this selection.

Two questionnaires are designed to obtain information about

- Delay causes and control measures along with organization background
- Implementation procedures based on ISO principles

Compilation of responses is done under various heads like delay type, respondent answer percentages to various questions etc. to create information that will lead to ease of analysis. Generation of graphs has been done to transform alpha-numeric data into visual data for identifying trends. Analysis of the graphs is done to develop correlations between different heads.

Construction Process Flowchart

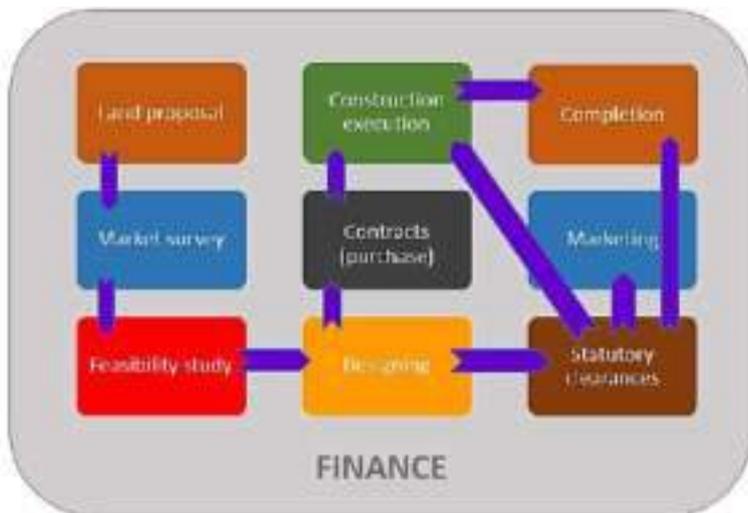


Fig 1: Typical project flowchart

There are typically 9 processes in any construction project that is within this scope. Their inter-relation is as shown. In addition, the 10th process – Finance – is always present in the background, many times controlling other processes. Delays can be seen in any or all of these processes. An organization that can identify and address them is successful in controlling the delays and mitigating their effects.

Effects of Delays

1. Time overrun
2. Cost overrun
3. Dispute
4. Arbitration
5. Abandonment
6. Litigation
7. Legal prosecution

All these effects have a negative impact on the organization as well as the stakeholders. Hence, it is important to do the following:

- I. Identify delays
- II. Where they occur
- III. How they can be avoided

This process will help in

- I. Controlling delays by preventing them
- II. Mitigating their cascading negative effects



Fig 2: Typical project phases

Control can be executed by understanding the source and stage of delays – if it is internal to the organization or if it is external to the organization. Accordingly, control strategies can be identified and implemented suitably. At the pre-execution stage and mobilization stage, a potential delay can be better controlled as it falls in the pre-planning stage; at the execution stage, it is more difficult to control. This has been confirmed through website reviews and responses seen in questionnaires.

Pre-planning stage includes all the activities undertaken before the mobilization and execution of project work. It will include time spent on decision making for consultant and contractor selection to feasibility studies to identification of potential plot owners as well as market study – be it for new materials and technology or for sale trends, including study of competition.

DATA COLLECTION

Website Review:

According to a study ^[7] regarding delay causes for government projects, typically applicable for infrastructure projects, the following are the principal observations:

- I. There are 4 defined stages of the project lifecycle.
- II. The delays are classified into external and internal issues.
- III. Most of the internal issues are related to lack of suitable, trained and experienced manpower for projections and coordination.
- IV. Many internal issues are also related to design and scope creep and change.
- V. An important internal issue is related to ineffective procurement planning.
- VI. External issues related to decision making, funding and disputes.
- VII. The most important external issue is related to statutory and regulatory approvals.
- VIII. The critical issues are government policies and approvals process.

(Source: http://www.pmi.org.in/downloads/PMI_KPMPG_2013.pdf)

Business Today states that “Delays in construction of residential projects are common in India. Developers include a grace period, generally six months, in their agreement with buyers. Most homebuyers take a delay of 6-12 months as granted. Sometimes, possession is delayed even beyond the expected tenure. Not all causes for delay are due to developers.” [9]

(Source: <http://businesstoday.intoday.in/story/delayed-real-estate-property-project-heres-what-to-do/1/186561.html>)

Book Review:

Deming’s PDCA cycle [2]: PLAN, DO, CHECK, ACT. It is also known as PDSA cycle: PLAN, DO, STUDY, ACT

Harold Koontz: System Approach: Input to Output through the steps of Planning, Organizing, Staffing, Leading and Controlling. All these with effective communication that re-energizes the system. This system of the organization works in the External Environment which gives the input and receives the output. [1]

ISO 9001 standard: Principles of QMS for improvement from various aspects including customer feedback, involvement of people, suppliers etc. [3],[4]

Hence, based on the above studies, the strategy for the study is as follows:

1. Establish the fact that most construction projects get delayed
2. Establish the fact that delays are harmful to the projects and hence, to all stakeholders and society
3. Categorize delays as avoidable and unavoidable
4. Identify the source and occurrence stage of delays
5. Classify the delays accordingly as external or internal to the organization
6. Identify control strategies that are employed accordingly
7. Assess the impact of the delays
8. Assess control strategies implemented – mainly preventive, where possible
9. Conclude that effective management is essential for avoiding delays
10. Pre-planning results in effective management
11. This can be done by employing services of professionals
12. Suitable training is also required for effective management

Questionnaires:

2 questionnaires were evolved to obtain data from promoter builders.

- Pre-planning questionnaire: this dealt with organizational information, delay causes, project stages – processes where delays were observed, causes as internal or external, preventive action taken, if any, impact of delays; project cost division as pre-execution and actual construction.
- QMS questionnaire: this dealt with improvement implementation aspects resulting from records, analysis of records and overall strategies – at all scales within the organization and the assessment of the effectiveness of the improvement plans. Some organizations are ISO certified, while others implement the systems without certification. Hence, the focus is on the implementation and its result into improvements.

Case Studies:

The study was undertaken with 15 case studies with different builder developers. The parameters were varied to ensure that all categories were included in this sample – organization types, size, product range, ticket size, brand status, ISO certification etc. The quantum of work done by these respondents was about 17% of the quantum of work executed in Pune in 5 years. Conclusion: sample data represents the population with a high degree of confidence (greater than 5% as required statistically).

All respondents were asked to rate their personal assessment of Risk Appetite and Expected Project Profitability as general aspects. This also helped to understand their decision making process. These are two aspects that differ from person to person because each person has a different psychological profile. See Fig 3.

DATA COMPILATION, ANALYSIS

Project process were classified as Internal and External and their contribution towards project delays. See Fig 4. The impact of delays were not identical. These were evaluated as percentages, categorized as Severe, Moderate and Low with respect to Project Processes. See Fig 5. This helped in proceeding with identifying those processes that caused maximum delays with the most severe impact. A comparative Pareto chart helped to assess this. See Fig 6, Fig 7. This chart identifies those processes that cause the maximum severity impact regarding project delays. Consequently, organizations can consciously choose to focus their resources and energies on improvements in these processes, so that the severity may be reduced, perhaps to zero! Naturally, the delay sources that were Internal to the organization were easier to tackle and handle; hence, most organizations focused on modifying these processes accordingly – leading to strategically improving them and learning from past mistakes. This is an integral part of ISO thought process – CAPA: Corrective Action and Preventive Action.

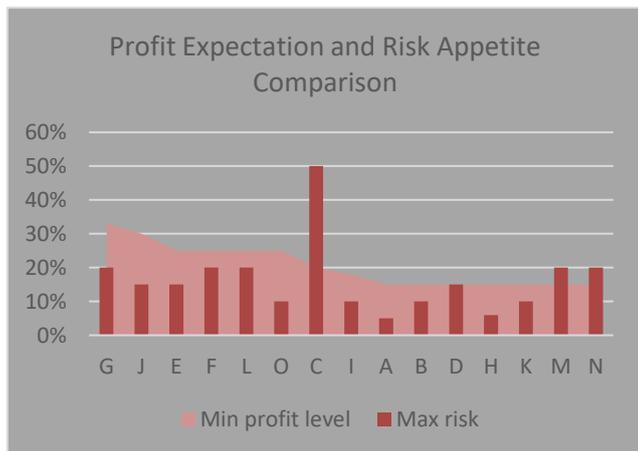


Fig 3: Profit and Risk Comparison

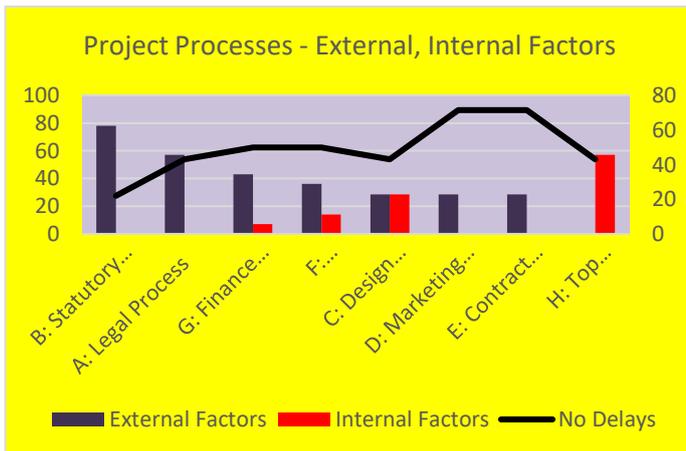


Fig 4: External and Internal Factors in Processes in percentage

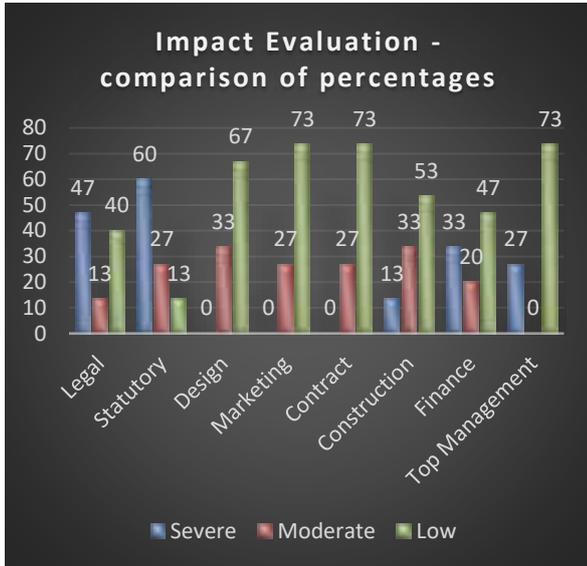


Fig 5

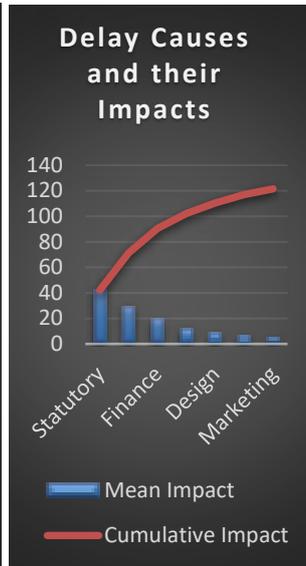


Fig 6



Fig 7

Fig 5: Impact Evaluation of various Processes

Fig 6: Delay Impact due to Processes – Pareto chart format. Each value represents percentage figure of occurrence and intensity

Fig 7: Delay Reasons and their rate of incidence as a percent

Training Impact:

Training is an often ignored part of construction activity. Indian labourers have shown that their skills, abilities and mettle matches international standards. With appropriate training, construction related delays can be controlled and hence, avoided. “Two construction labourers from the city proved their mettle at the recently concluded WorldSkills Oceania competition held in New Zealand by winning bronze medals in task of brick-laying and tiling.”^[5] (Source: The Times of India, 22.04.2015) Tikam Singh brought home the Gold Medal in Sao Paulo, Brazil in 2015 in Wall and Floor Tiling.^[6]

Kushal is a Pune based organization. It was formed under the aegis of CREDAI-Pune Metro. Its mandate has been to train construction workers under NSDC – National Skills Development Corporation, a government of India organization. These award winning labourers were trained under Kushal.^[6] (Source: Constro Newsletter, April 2015)

Similarly, trained professionals contribute towards appropriate planning that results in time and cost savings. Project and construction managers are doing a yeoman’s job in project forecasting, coordination and thus, resulting in overall benefits to the stakeholders.

Some Control Strategies adopted by the respondents:

- Customer segmentation clarity
- Good ERP system
- Partnering - selection of good consultants who work well with each other
- Planned cash flow management
- QA plan, SOP for various In-Process activities
- Single family owned plots to reduce the possibility of unauthorized claims
- Standardization of contract documentation
- Standardization of various in-house processes
- Strong in-house design team to ensure adequate coordination and accuracy of drawings
- Strong in-house liaison team to ensure clarity and correctness of drawings for statutory sanctions
- Strong in-house legal team ensures adequate due diligence of relevant documents
- Top management personally involved in problem understanding and resolution, especially cash flow management

CURRENT SCENARIO

This data is relevant till 2015. In 2020 today, there are some changes that indicate that the conclusions drawn here are correct, and in the right direction. The 2 principal changes are mentioned:

1. RERA -**Real Estate (Regulation and Development) Act**, 2016: With RERA in place, the responsibility of timely completion has been attributed to the project owner i.e. the top management. “Chapter III of the Act states about the functions and duties of the promoters. The Promoters must include in the prospectus or the advertisement registration number and the website address of the authority where the detail of the registered project has been entered and shall make available the allottees the information including sanction plan, lay out, the stage wise time schedule of completion of the project.”^[15] The chart (Fig 5) showing impact of delays shows that more than 70% delays can be attributed to decisions taken by top management. However, the same chart also shows that these delays have a LOW impact; presumably as the delay gets made up during the course of construction, till project completion.
2. ISO 9001:2015: This new, current version of ISO includes the RISK management aspect which was absent in the earlier version. Hence, one can conclude that the aspect of risk identification, risk appetite leading to risk management are integral to smooth working of any organization. This aspect of risk has been included in this study, even though it was not a part of the previous version of the ISO 9001 standard, the ISO 9001:2008 standard. In addition, the concept of Interested Parties has been elaborated in the new version. In a construction project, all stakeholders and the government are Interested Parties as their actions have an

impact on the success of the project. Similarly, SWOT (Strength, Weakness, Opportunity and Threat) analysis is also included in the 2015 standard. [4] These aspects have been addressed in the questionnaires.

CONCLUSION

Considering an average time of 12 months for project planning and 24 months of execution time, totaling to 36 months, the following delays were noted.

- | | |
|---|--|
| 1. Delay status – current condition of average delays: | 9 months – 25% additional time required |
| 2. Delay at pre-planning or pre-execution stage - average: | 8.6 months – 24% additional time required |
| 3. Delay at execution stage - average: | 9.4 months – 26% additional time required (maximum) |
| 4. Avoidable delays at pre-planning or pre-execution stage: | 7.25 months – 20% additional time required (minimum) |
- I. The incidence of avoidable delays was an overwhelming 80% - causing an increased time of 20%.
 - II. These delays, as they are of avoidable nature, can be prevented through pre-planning.
 - III. All respondents agreed that pre-planning is an excellent strategy for delay control.
 - IV. Pre-planning is possible where the causes of avoidable delays are invariably, internal to the organization.
 - V. Maximum delays are caused by Statutory and Legal Processes – these are typically external to the organizations.
 - VI. Where they are external to the organization, these delay causes can be addressed through other means like interaction by advising and influencing government policies, for example.
 - VII. The delay factors, if identified in time with suitable strategies can result in savings in project cost from 5% to 15%!

This was further proven by an interesting anomaly – an exception in the data received about delays. The example was given by Shri Sandeep Sonigra of Orange County Foundation. Phase 1 of Orange County is located at Pashan in western Pune - a residential scheme. The time frame was 2005 to 2007 – the planned duration was 24 months. The project was completed before time by a period of 6 months – a time gain of 25%! This time saving of 25% translated into a cost saving of 5%!

The reasons for completion before time given by Shri Sandeep Sonigra were:

1. Total pre-planning
2. Adherence to the planned schedule
3. No deviations from plans

RECOMMENDATIONS

Some major recommendations as suggested by KPMG and PMI in the study undertaken on behalf of government of India are equally relevant to the construction organizations in Pune. They may be summarized as follows [7]:

- I. Set up a single window clearance mechanism to simplify the regulatory approval process – EXTERNAL FACTOR
- II. Training and coaching of project managers to ensure proper project planning is done which will control scope and design change; similarly, procurement planning will also be handled by these professionals – INTERNAL FACTOR

Based on the study, analyses and conclusions, the following recommendations have been identified:

1. Pre-planning is a highly recommended strategy for smooth construction management by ensuring potential delays are identified, analyzed and suitable action plan devised for prevention of the delays.
2. Avoidable delays must be addressed in time as their incidence as much as 80%.
3. Delays that are avoided with the help of pre-planning can reduce project cost up to 5%.
4. Design and Execution Professionals in the construction industry contribute to smooth construction management of projects, hence their services to be utilized.
5. Strong In-house teams play an important role by ensuring good coordination and communication.
6. Proper finance management plays an important role in reducing potential delays.
7. Incorporating ‘float’ for potential delays that cannot be avoided will be useful for suitable fund flow and cash flow.
8. Monitoring of activities that are under execution will help in spotting delays that in the process of occurring or likely to occur; hence, monitoring is important and imperative.
9. Training must be looked as investment, rather than a cost. Trained personnel contribute to good project management.
10. Top Management commitment plays an important role in successful completion of the project.
- 11.

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ALTERNATIVE EXTERNAL FINISHES AND CLADDING SYSTEMS IN PUNE

Comparative Analysis for Decision Making

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ABSTRACT

The rules of architectural grammar have changed drastically in the last few decades.

Building skins, besides fulfilling the functional requirements of enclosing the space and shielding the surface beneath, play an important role in the building's aesthetics. Technological advances in cladding systems have led to unique looking building skins.

Exploring external finishes and cladding materials available in Pune and analyzing their suitability of application could help in creating more environment responsive buildings.

54 different material properties & characteristics were extensively studied for 19 materials to enable a comparison between 15 decision making criteria to reach the relevant conclusions.

The selection criteria for external finishes and cladding may vary for different project typologies. Understanding the priorities of the decision makers (Architect, Builder and Project Management Consultant) and identifying their relationships with the material properties and characteristics is the first part of the thesis study.

Creating a grading system to evaluate the material performances based on their properties and characteristics will enable compare different materials against different selection criteria.

The study presents a matrix which enables the decision maker to select the most suited external finishing or cladding material as per his priorities, along with a ready-to-use combination of priorities.

KEYWORDS *External cladding materials, decision making criteria, relationship matrix, material characteristics, grading system, material performance.*

INTRODUCTION

The aim of the study is to create a database of various cladding systems and external finishes that will help a design and/ or construction professional to arrive at the most suitable option for a project.

The objective of the work is to compare parameters of various cladding systems to the basic, conventional elevation treatment i.e. plaster and paint. The parameters are as follows:

- a) The availability in terms of various companies and agencies marketing it and the available sizes.
- b) Its suitability in terms what type of buildings and till what height can be cladded, whether the systems are appropriate for horizontal, vertical, or inclined surfaces.
- c) Design requirements such as orientation of buildings, structural strength required to bear the load of the cladding system, other infra-structural requirements if any.
- d) Cost of material, equipment, or hardware, labour and cost of execution or installation.
- e) Time required for the installation of the systems.
- f) Labour requirement for execution or installation, whether skilled or unskilled labour, what team size is required to perform a particular amount of installation.
- g) Common design or installation flaws that lead to poor quality of finished product.
- h) Safety norms prescribed by the local authorities and by the manufacturers.
- i) Environmental impact the cladding system would have on the interior or exterior of the building.
- j) Weatherability / durability of the cladding system along with its supporting hardware.
- k) Cost, frequency, manpower and equipment requirement for maintenance and repairs of the same.

This has been done by developing a matrix which will help in devising a method of selection of a suitable cladding system. The suitability of a cladding system for a given project would be based on priorities of the stakeholders.

The study is limited to external wall and roof (vertical and inclined surfaces) cladding systems, other interior surfaces and horizontal surfaces are not included.

- a. The typology of buildings includes residential, commercial/ merchandise, corporate & facility in Pune (being exposed to the climatic conditions of Pune)
- b. Building constructions up to 36 meters height have been included for the study, the constructions (above 36 mts) are not considered.
- c. The study focusses on cladding systems installed on permanent structures only, it does not include semi-permanent and temporary structures (exhibition kiosks)

DATA COLLECTION

Material Data

Materials under consideration

About 33 different materials have been studied in detail to understand their characteristics and applicability [2],[3],[5],[6],[7],[8],[9]. Some of the above-mentioned materials have become redundant to Indian markets due to their poor material properties or have yet to find introduction to Indian markets. Some materials which could see light soon have been considered for comparison. 19 out of 33 materials have been considered for comparison.

A compilation of the various material's performances based on their properties and characteristics can help the decision makers to choose external finishes and cladding systems more judiciously. The selection criteria for external finishes and cladding may vary for different project typologies. Understanding the priorities of the decision makers (Architect, Builder and Project Management Consultant) and identifying their relationships with the material properties and characteristics is the first part of the thesis study.



Fig. 01 - Material Categorization*

- Materials in *Italics* are not considered for comparison. Either the materials have become redundant or they are yet to be introduced or used popularly to the Indian markets

Management Data

As part of the Management data collection, Interviews were conducted with the stakeholders of the industry. The stake holders consisted of Architects, Builders, Structural Designers, Project Management Consultants, Installing Agencies, Environmentalists and End Users. About 35 stake holders were interviewed, and feedbacks were compiled for two questionnaires:

- The Priority Rating of Decision-Making Criteria
- The Relationship Matrix

1. The Priority Rating of Decision-Making Criteria

Decisions related to construction projects are taken by the Architect, the Builder/ Owner, and the Project Management Company (the stakeholders). An opinion from these stake holders was important to understand their priorities while selecting a cladding material. An extensive list of decision-making criteria [4] was formulated based on interviews conducted with an overall cross section of these stake holders specializing in residential, commercial, and corporate projects. The list included:

- | | |
|--|--|
| i. Contemporariness of the material | ix. Environmental Impact of Installation |
| ii. Aesthetic Appeal of Installation | x. Weatherability of Installation |
| iii. Availability of Material | xi. Maintenance Cost of Installation |
| iv. Cost of Installation | xii. Repairs Cost of Installation |
| v. Time Required for Installation | xiii. Life Span of Installation |
| vi. Ease of Installation | xiv. Ease of Disposal of Installation |
| vii. Structural Strength of Base Structure | xv. Recyclability of Installation |
| viii. Safety of Installation | |

2. The Relationship Matrix

The above-mentioned decision-making criteria cannot always be quantified directly for comparison. Some material properties and characteristics of the procurement and installation process might be needed to quantify the above-mentioned decision-making criteria. Comparison of the material’s performance on the criteria can be done once each of these criteria have a quantifying value. To understand the relationship between the material properties and characteristics with the decision-making criteria, a matrix had been formulated. Architects, Builders, Structural Designers, Project Management Consultants, Installing Agencies, Environmentalists and End Users were interviewed. During the interview with the respondents, the respondents were asked to identify the relationships and the strength of the relationships between the material characteristics and the decision-making criteria.

COMPILATION

Priority Rating of Decision-Making Criteria

The feedback from the respondents was compiled and a mode of their feedback for each criterion was taken. The results of the compilation are as follows:

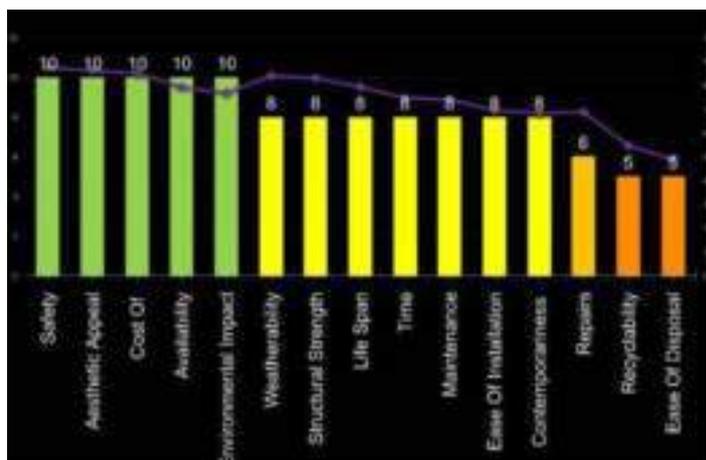


Fig. 02 - Prioritised ratings of Decision-Making Criteria

Relationship Matrix

The feedback from the respondents was compiled and a mode of their feedback for each criteria was taken. The results of compilation are as follows; where green boxes indicate strongest relationship, orange medium and red least, whereas grey indicates no relationship at all.

		RELATIONSHIP MATRIX BETWEEN MATERIAL CHARACTERISTICS AND DECISION MAKING CRITERIA																					
MATERIAL CHARACTERISTICS	DECISION MAKING CRITERIA	DESIGN/DESIGNER'S CONCERN					AESTHETIC APPEAL					AVAILABILITY OF MATERIAL					EASE OF INSTALLATION						
		DESIGN/DESIGNER'S CONCERN	DESIGN/DESIGNER'S CONCERN	DESIGN/DESIGNER'S CONCERN	DESIGN/DESIGNER'S CONCERN	DESIGN/DESIGNER'S CONCERN	AESTHETIC APPEAL	AVAILABILITY OF MATERIAL	EASE OF INSTALLATION														
MATERIALS	PROPERTIES	1	AVAILABLE SIZES																				
		2	COLOR AND TEXTURE																				
		3	COMPOSITION (PHYSICAL/CHEMICAL)																				
		4	CHEMICALLY REACTIVE TO																				
		5	WEIGHT																				
		6	MOISTURE RESISTANCE																				
		7	THERMAL CONDUCTIVITY																				
		8	SOLAR FACTOR																				
		9	DIMENSIONAL STABILITY																				
		10	IMPACT RESISTANCE																				
		11	ACOUSTIC PERFORMANCE																				
		12	RESISTANCE TO FIRE																				
EXECUTION	EXECUTION REQUIREMENTS	13	LOGISTICAL REQUIREMENT (TRANSPORTATION QUANTITY/ TRUCK LOAD)																				
		14	ELECTRICITY																				
		15	WATER																				
WEATHERABILITY	WEATHERABILITY OF MATERIAL & INSTALLATION	16	CRANES/ PULLEYS																				
		17	COMMON INSTALLATION MISTAKES/ OVERLOOKS																				
INSTALLATION	INSTALLATION	18	WEATHERABILITY OF MATERIAL & INSTALLATION																				
		19	INSTALLATION																				
PROCUREMENT	PROCUREMENT	20	INSTALLATION																				
		21	INSTALLATION																				

Fig.03 - Relationship Matrix between Material Characteristics and Decision-Making Criteria

COMPARISON

Creating a grading system to evaluate the material performances based on their properties and characteristics will enable compare different materials against different selection criteria.

Grading System

A standardisation tool in form of a grading system has been created to quantify the material data collected [1] from broucher reviews and interviews with installing agencies and end users. A rating system to evaluate the performance of the cladding materials with respect to the material characteristics has been formulated. This standardisation helps in effectively evaluation other cladding materials which may get introduced into Indian markets in near future. The rating system is a marking given to the materials from 10 to 0, '10' being the most desirable feature and '0' being least desirable.

MATERIAL CHARACTERISTICS	MATERIALS	EXTERNAL FINISHES/ WET CLADDING				DRY CLADDING- SINGLE LAYER OPAQUE						DRY CLADDING- SINGLE LAYER TRANSPARENT			DRY CLADDING- SINGLE MULTI LAYER- METALS								
		Concrete/ Fibre	Steel/ Fibre/ Cladding	Aluminum/ Fibre	Fibre/ Fibre/ Cladding	Steel/ Dry Cladding	Fibre/ Fibre/ Cladding	Engineered/ Wood	FRP/ Fibre/ Cladding	Fibre/ Concrete/ Fibre	Concrete/ Fibre	Glass	Steel/ Fibre/ Cladding	Polycarbonate/ Fibre/ Cladding	Aluminum	Aluminum/ Composite/ Fibre/ Cladding	Aluminum/ Composite/ Fibre/ Cladding	Steel	Copper				
PROPERTIES	1	AVAILABLE SIZES	4	8	7	7	4	7	4	4	8	8	4	8	3	8	4	4	4	4	4	4	
	2	COLOR AND TEXTURE	4	7	7	7	7	4	4	8	8	4	4	7	4	7	4	4	4	4	4	4	
	3	COMPOSITION (PHYSICAL/CHEMICAL)	4	7	8	4	7	4	4	8	8	4	7	4	4	7	4	4	4	4	4	4	
	4	CHEMICALLY REACTIVE TO	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	5	WEIGHT (K _g /m ²)	7	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	6	MOISTURE RESISTANCE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	7	THERMAL CONDUCTIVITY (W/m.K)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	8	SOLAR PERFORMANCE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	9	DIMENSIONAL STABILITY	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	10	IMPACT RESISTANCE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	11	ACOUSTIC PERFORMANCE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
	12	RESISTANCE TO FIRE	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
EXECUTION	EXECUTION REQUIREMENTS	13	LOGISTICAL REQUIREMENT (TRANSPORTATION QUANTITY/ TRUCK LOAD)	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
		14	ELECTRICITY	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
		15	WATER	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
WEATHERABILITY	WEATHERABILITY OF MATERIAL & INSTALLATION	16	CRANES/ PULLEYS	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
		17	COMMON INSTALLATION MISTAKES/ OVERLOOKS	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
INSTALLATION	INSTALLATION	18	WEATHERABILITY OF MATERIAL & INSTALLATION	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
		19	INSTALLATION	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
PROCUREMENT	PROCUREMENT	20	INSTALLATION	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	
		21	INSTALLATION	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	

Fig.04 - Material Characteristics Rating

ANALYSIS

The decision-making criteria are related to the material characteristics. Hence, the ratings of the cladding materials with respect to the material characteristics can be applied to the decision-making criteria based on the findings from the Relationship Matrix. The sum total of the rating of characteristics, which have a strong relationship with the decision-making criteria reflect the ratings of the cladding materials with respect to the decision-making criteria.

Following charts show the computation of material performances with respect to the various decision-making criteria.

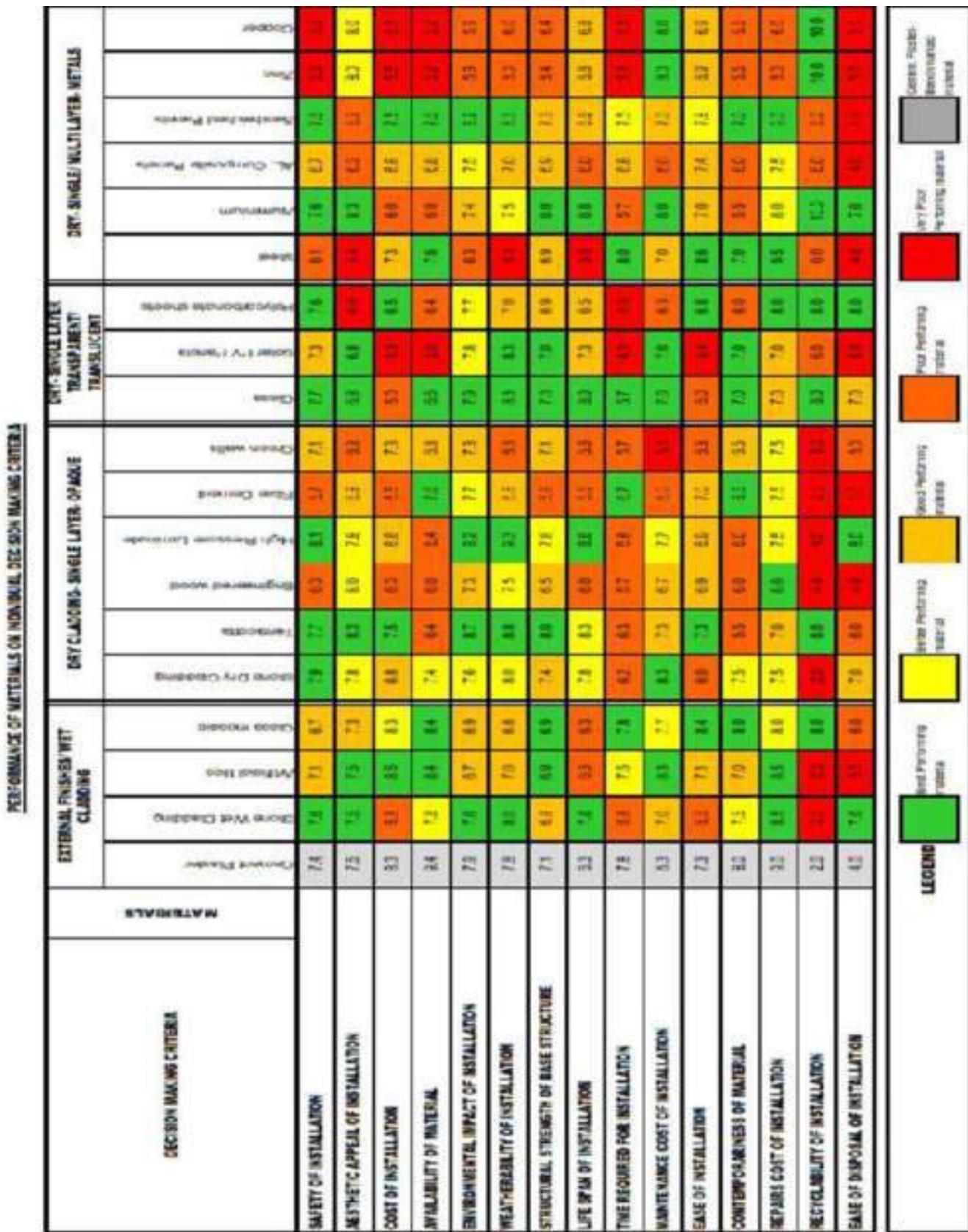


Fig.05 - Performance of Material on Individual Decision-Making Criteria

A weighted average of the criteria based on their priority in the decision-making process can be used to understand the performance of the various cladding & finishing materials. Following chart shows the materials performance against some pre-determined combinations of decision-making criteria.

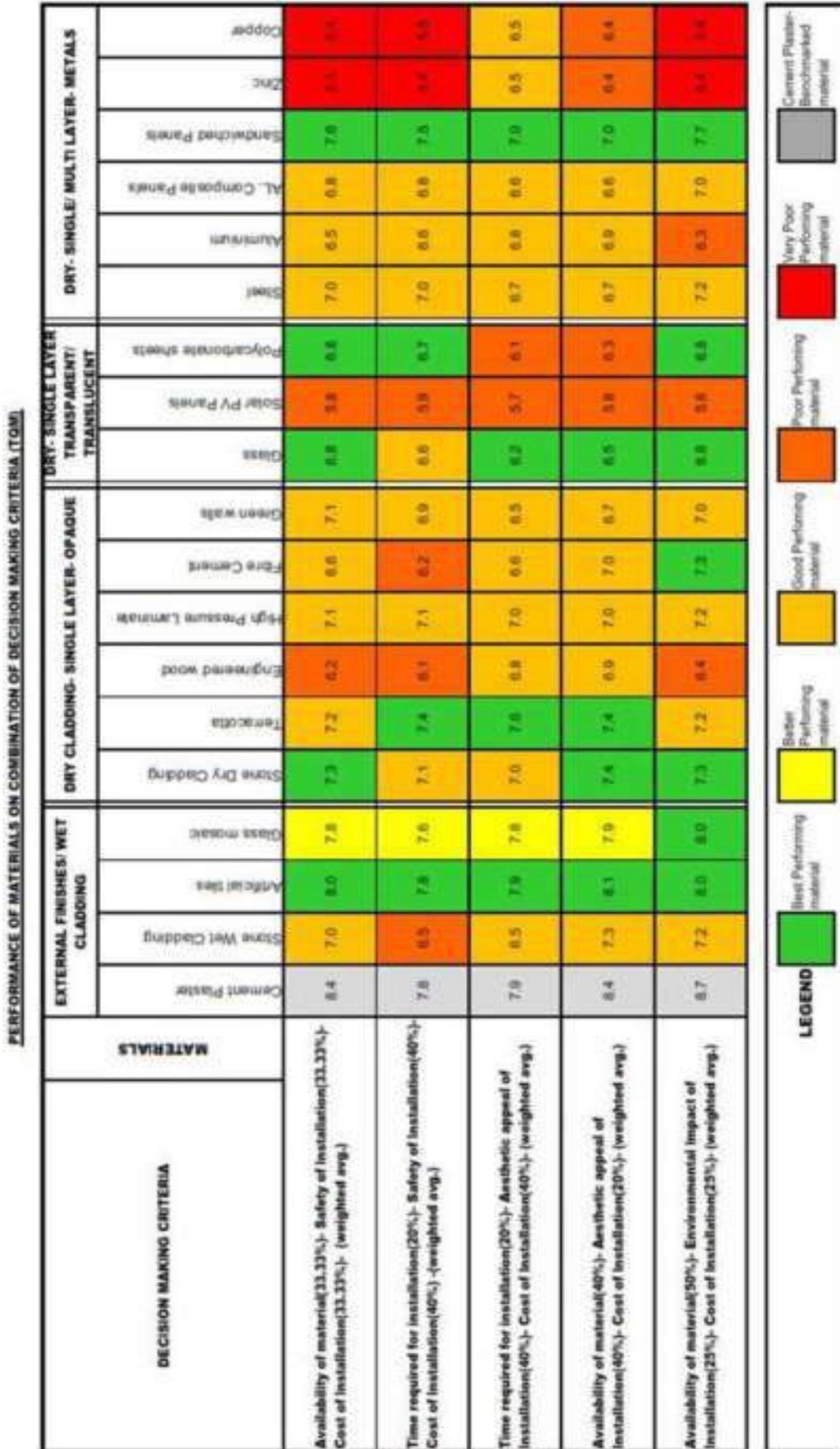


Fig.06 - Performance of Material on Combination Decision Making Criteria

CONCLUSION

Safety of the installation is the prime most criteria to be considered during selection of any cladding material, as it may turn fatal. Aesthetic appeal of a cladding is also just as important, because the very purpose of applying a cladding material instead of cement plaster is aesthetic upgradation. The cost and time of installation may or may not be a priority while selection of a cladding.

Following are building typology suitability suggestions for each material under study:

1. Stone Cladding and Terracotta tile cladding, dry or wet, can be used for self-owned residences, commercial and corporate buildings.
2. Artificial tile cladding and Glass Mosaic tile cladding can be used multi- family residences and commercial buildings.
3. Engineered wood cladding can be used for self-owned residences and corporate buildings.
4. High Pressure Laminate cladding can be used self-owned residences, commercial and corporate buildings.
5. Fibre Cement boards can be used for self-owned residences, multi-family residences and commercial buildings.
6. Green walls can be used as cladding for self-owned residences and corporate buildings.
7. Glass and Polycarbonate sheet cladding can be used for commercial and corporate buildings.
8. Solar PV Panel cladding can be used for self-owned residences and corporate buildings.
9. Steel cladding can be used for commercial buildings.
10. Aluminium composite panel cladding can be used commercial and corporate buildings.
11. Aluminium, Zinc and Copper cladding can be used for self-owned residences and corporate buildings.
12. Use of eco-friendly materials like recycled tetra Pak boards or bamboo mat corrugated sheets should be considered for external cladding.
13. Tensile Fabric cladding can be looked as a good option as a translucent cladding material.

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ROLE AND IMPLEMENTATION OF BLOCKCHAIN TECHNOLOGY IN CONSTRUCTION INDUSTRY

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ABSTRACT

Construction industry (CI) is going through revolution. Digital flows and partly a shift in business practices are necessary to improve productivity. Blockchain Technology (BT) has the potential to facilitate both changes and innovation. It promises vast benefits that could impact every aspects of human life. This paper is based on applications of digital technology transformation tools, techniques, and trends such as Automation, Internet of Things (IoT) AI, Cloud computing (CC), Machine Learning (ML), Block chain Technology, and Smart Contracts. Adoption of BT in CI with, definition, references, implementation, draw backs, benefits, inter operability, risk, challenges, and safety is greatly emphasized. The objective of this review is to understand and to provide basic concepts, current issues, challenges, and strategies of BT to adopt these emerging technologies in building construction and industry. The literature review is analyzed at depth with implications and limitations of BT with respect to business processes, and practices. This review is the first to offer an overview of empirical data on BT in Construction Management (CM).

KEYWORDS: Blockchain technology, Machine learning, Construction management, Artificial Intelligence, Cloud Computing, IoT.

1) INTRODUCTION

In any business, technology is a huge enabler. The construction industry in particular is experiencing a new & revitalized age through new application & technologies with the aid of technology. These applications are developed, planned, and implemented by tech startup companies. Blockchain(BC) are secured design. BT is used where keeping a correct record is important. BC can operate two models private and public. It is basically distributed framework of records shared a business networks where no one claims, anyone can include, and no one can delete it. And each transaction is secure and verified with appropriate visibility [41]. Blockchain Technology (BT) has great potential beyond the financial industry. There are many applications of this technology across many industries, most importantly in the AI & ML aspects in a shared ledger system. There are two patterns of ML use cases i) Silo machine learning or predictive models addressing a particular chain segment and ii) Model chains addressing a segment or the whole chain. The predictive model or silo ML is not different from what we do currently with available data. Model chains are however more complicated and should be able to learn and adapt quickly given the reliance on the chain [20]. BC has enormous potential to disrupt and change the world of money, business, and society. Blockchain, jointly with AI, ML, robotics, and Virtual and Augment Reality have potential to deliver transformative results & reshape digital business in 2018, and companies that have not begun the digital investment cycle are at high risk of being disrupted[14]. BC may provide promise on Internet of Thing (IoT) in the area of cyber security [7]. [19] explained better understanding of BT and its cognition in introducing such technology in university curricula. Recently, the top 10 strategic technology trends of 2018, [4] in context to ML & BT are extensively summarized. The digital transformation tools, techniques, and trends mold & reshape digital business in 2018 is elaborated in concerned to BT, ML, Robotic, AI & wireless Technologies [5].

Very recently, [8] explored the potential of blockchain in the UK. [47] explained the development of blockchain and highlights the progressive companies implementing BC innovation in construction, and analyzes the best practices and applications required to succeed in the development industry. [6], [15] gives a clear understanding about how the BT can impact the Construction Industry (CI), with a solution on payment, project management, procurement and supply chain management, BIM, and smart asset management. [32] quoted "make no mistake, blockchain offer immense opportunity for industry to become more effective, transparent productive and sustainable". Key trends such as digital transformation, the rise in automation, modern equipment systems, and proliferation of financial technology are influencing equipment models, and are expected to drive adoption of BT. Blockchain's penetration in the building construction is expected to gradually increase in the coming years, especially after 2022. Therefore, this paper sets out to explore the potential role of integrated digital transformation technologies approach of sustainable building design information management.

2) BACKGROUND AND RATIONALE

Modern technologies like AI, ML, Data Science and Big Data have become the buzzwords which everyone is talking, but no one understand completely. They appear complex to a layman. ML being the next level of evolution in automation. BC is evolving from a digital currency infrastructure into a platform for digital transformation. It is gaining attention because it offers the promise to transform industry operating models. Here are some questions to be answer to discuss this issue. These are:

- i) What are fundamental challenges with public blockchain?
- ii) How blockchain and construction will build a new world?
- iii) How blockchain helps construction industry?
- iv) How could block chain transform the ACE?

The main theme of the present article is to provide recent information about BT along with applications. Hence, the aim and objective of this article is to better understand the role and implementation of BC in construction industry, CM, and construction business in current scenario.

3) LITERATURE REVIEW

References collected are 2017 onwards however, the evolution digital transformation technologies occurred after 2015. The highest contribution of references is based on website, internet, followed by journals, books, survey/reports, theses and blogs (Figure 1 and Table 1). [46] extensively elaborated definition of BC, importance of open science, challenges and research potentials in their review based on implementation of BC in CI. They further concluded that the technology can have a significant positive impact on scientific work and its open ecosystems. Technical solutions for the problems like payment, work health, and safety management systems, supply chain management, BIM, smart contracts, effective carbon tracking pertaining to the CI in Australia particularly, are explained by [2]. Several organizations are already initiating test and prototype blockchain or data-related projects to assist the construction sector. Companies like Tata steel have initiated a BC pilot project with SAP, IBM and Maersk. Construction brings together large team to design and shape to built environment [12]. [22] in his article deals with 10 Exciting Construction Tech Startups which everybody should know. Several references are studied on the basis of ML and CI. A detail account on developing Intelligent Cloud with AI is given by [25]. Fundamental challenges are given along with public BC. [23]. [43] reported information on Blockchain Building Blocks and creation of a new world of opportunity for insurance from an evolving area of technology. [50] Out looked of BT for construction engineering management.

TABLE: 1 Year wise distributions of references on BT in CI

Source	Year				Total
	2020	2019	2018	2017	
Web-Site	1	11	9	10	31
Journal	1	3	2	3	9
Conference	-	3	1	2	6
Survey/report	-	1	-	1	2
Thesis	-	-	1	-	1
Blog	-	1	1	-	2
Book	-	-	1	-	1
	Total				52

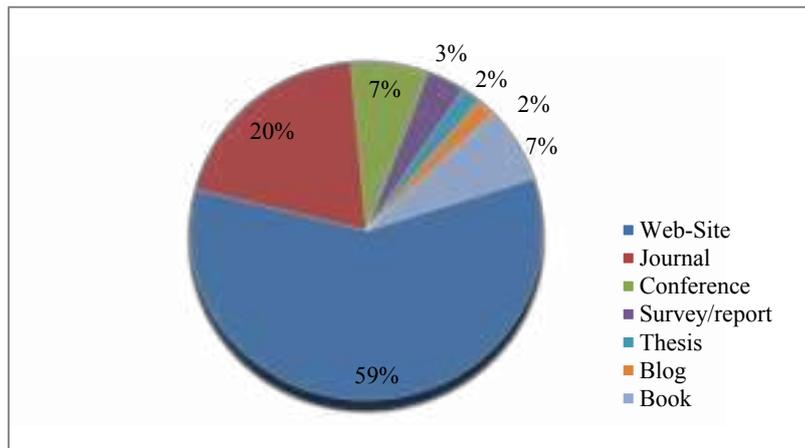


Figure 1: Distribution of References for use of BT in CI and CM

Remodeling of CI using BC is stated in review article by [16]. [27] analyzed the current applications and developing an emergent framework and Blockchain in the built environment. [40] explained how BC and construction will build a new world. What shall happen, if we combine BT & ML together in context to change business? It is very well explained by [17] & [20]. It is interesting to note that [9] reported 3 ways BC that will revolutionize digital marketing. The potential of BT for construction include study on information of BC in 2018, beyond the hype, [52], [7]. The truth about BC [18] and realizing the potential of blockchain are elaborated very well and they tried to put these issues to be operated in the construction management. [28] gave introduction to blockchain Technology (BT) and its integration with the emergence of ground breaking technologies such as IoT, Artificial Intelligence (AI), ML and financial/ Insurance products. [36] focused on access control in the IoT context by proposing a dynamic and fully distributed security policy. The trusted exchange of data lies at the heart of many processes in the fourth industrial revolution. BT or distributed ledger technology (DLT), promises to ensure the data is secure, decentralized & immutable [21]. [9] Signifies Blockchain, a step toward transparency, brand safety and accountability. Here are three ways in which BC that would transform: i) marketing online ii) Data Protection, and regulatory compliance & iii) Media Buying. Construction can be the next major breakthrough. One of construction’s major problems is to achieve better scale through better data management. By using the blockchain along with other rapidly advancing technology the CI could benefit from reducing cost by removing intermediates and through the transparency [34]. [45] published a thesis report based on exploring potential of BT for U.K construction company. BT; the technology upon is append-only (i)provides immutability(ii)can be readable by all companies involved(provides transparency)and (iii)is decentralized and not controlled by any one part(provides trust). BT can be applied to all stages of supply chain management – from design to materials procurement, incorporation and construction. Supply chain management include tracking the materials through shipping, customs and delivery to a site, then site inventory and incorporation of the materials into the structure along with the location of those materials with traceability [8]. [31] developed a BC based e-procurement framework for construction supply chain

Blockchain Technology is enabling infrastructure that will permit machine learning to reach its full potential [3]. The innovative creation of BT, or more generally the distributed ledger technology (DLT) offers new possibilities promising to answer that data is secure, decentralized & unchallengeable. An importance of blockchain in the built environment with CI is summarized in a systematic review written by [26]. “Briq the next building block in tech’s construction of the construction business raises \$ 3 million”. This statement is recently quoted by [44]. The construction industry shapes our world. In that context guaranteeing, the built environment works as importantly as possible as to retain the sustainability & successful human development [30]. He explained nine construction Tech Trends to watch in 2019. These are: i) Robotics ii) Exoskeletons iii) The connected jobsite iv)Autonomous vehicles v) Advanced materials vi) UAVs (Unmanned Aerial Vehicles) vii) Virtual & Augmented reality viii) 3D Printing, and ix) The Intelligent built environment [26]. The integration between BC and BIM as a key factor in construction sector to support the development and management in all phases of building construction [12].

Comprehensive and exhaustive information on applications of AI, CC, IoT, Big Data and other technologies is reported [37]. The author in her previous publication pointed out application of digital transformation techniques, tools and technologies in CI and construction

business. Further, she studied various applications of AI in CM [38]. Very recently, extended her study in digitalization in CI with respect to CC applications in CM [39].

4) ROLE OF BLOCKCHAIN IN CONSTRUCTION INDUSTRY

Proliferation of BCT in the management of construction engineering is possible [10]. They also emphasis on five major areas: cost, time, quality, transparency, and information security. Meanwhile they concluded that the BT has high potential therefore, more research is needed to be developed for further application in construction engineering management. BC and constructions may seem unlikely partners at first. Like so many other industries, however, construction relies on trust – driven communication with other parties and strong record keeping. Hence, assuming that the industry will adopt, blockchain will give the builders, the future significant value [40]. [48], [43] has explained the blockchain's significance and implications for the insurance industry as well as its rich and interesting history. [50] described the potential of applying blockchain technology in construction sector. Three types of BC enabled applications are proposed to improve the current processes of contract management, supply chain management and equipment leasing respectively. [51] Explained in their report various issues namely: executive summary, introduction, Blockchain architecture, BC in operations, forking, smart contracts, Blockchain categorization, Blockchain platform and BC limitations & misconception. BC is a computer-shared database. It works together to construct records in blocks, all of which are connected using cryptography. It allows for safe and reliable sharing of the data without the need for third party intervention [42]. Blockchain is proposed as a way to reduce transaction costs by removing the need for trust-building intermediaries as a requirement for an effective agreement [52].

4.1) Applications of Blockchain in Construction Industry

Blockchain is changing digital currency infrastructure to digital transformation. It is gaining attention because it offers the promise to transform industry into operating models. [26] and [29] submersed the following: i)To explore the use of DLT within built environment, the challenges and opportunities faces. ii)To develop a multidimensional emergent framework of DLT adoption within construction sector. [11], in their article reinvented some suggestions to boost productivity by 50 to 60 %. These are: 4 R's i) Reshape regulations ii) Rewrite contract. iii) Rethink design, and v) Reskill workers. The research, after careful consideration of current factors, leads to: a) improving the sourcing and supply chain, b) improving on-site excursions, and c) infuse technology and inventions. [33] Explained how BC is an emerging opportunity for surveyors and real estate and built environ sectors.

4.2) How blockchain helps constructions industry?

Blockchain is a technological tool. It documents the steps and conditions necessary to carry out a transaction in a decentralized manner. It gives us continuous records of these transactions [16]. [49] described some of the important points : i) CT has transform the industry ii) BC began with the famous Bitcoin crypto currency, enabling the transmission of digital information iii) BC is a registry of each transaction distributed by a peer-to-peer network iv)BT can be used to make ' smart contracts'. v) BC can work with :a)BIM platforms b) IoT.

4.3) Architecture, Engineering and Construction (AEC) & BT

National plans aiming to promote the digital transformation of the architecture engineering and construction (AEC) industry focus mainly on the adopting BIM. It is a digital tool to facilitate project management by providing a platform for sharing information, identifying problems and collaborating on point solutions. The innovative creation of the BT, or more generally, The DLT offers new possibilities promising to answer that data is secure, decentralized & unchallengeable. Today, DLT & smart contract are driving the development of business models in industries that really based on heavy financial transactions and the exchange of information. Research about the application of DLT in the AEC industry has barely started. It is a technology tool that programs organizational culture. [1]

4.4) Blockchain in the built environment and construction industry

The construction industry facing many challenges including low productivity, poor regulation and compliance lack of adequate collaboration and information sharing, and poor payment practices. Advances in DLT, also referred to as Blockchain are increasingly investigated as one of the constituents in digital transformation of the CI & its response to these challenges [13].

4.5) Understanding Blockchain Technology and how to get involved

The evaluation of the educational projects implemented by [17] will make possible conclusions for their extension in educational institutes, universities, and for specific recommendations related to blockchain technology adoption for the ministry of education. She believes that fresh perspective over BT, policies and projects written in her article would be useful for educational sectors and policy makers in taking concrete steps to explore and to integrate blockchain in institutional projects and curricula.

4.6) Three ways blockchain could unleash the full potential of Machine Learning

In an opinion of [3], Blockchain Technology as enabling infrastructure that allows machine learning to reach its full potential. He concluded that DLT has the potential to act as the backbone for AI infrastructure by commoditizing and tokenizing raw computational processing power to expand the development of AI. Using ML, advanced scenario analysis around inter weaving building codes and interdependent structural variables allowing users to create compliant design & regulatory-informed decision without having to ever encounter the regulations themselves. ([https://blockinterchange.com/tag/machine learning](https://blockinterchange.com/tag/machine-learning)). In the same year, [52] extensively elaborated potential of BT for CM.

4.7) Smart contracts on the blockchain to enhance efficiency

Smart contracts are one of the most exciting opportunities presented by BT, because through them a wide range of processes can be improved atomized and eventually become more effective. There is a key innovation which is brought to life by BCT the so-called smart contracts, which can execute its terms automatically when the predefined conditions are met (Table2). [25] Emphasized on (i) use of smart contracts. (ii)BC enabled applications that aggregate data into a shared project management dashboard(iii)A way to record all building outputs and assets, and(iv) Blockchain-enabled apps to track materials, testing and results against building codes and standards.

Table 2: Benefits of Using Smart Contracts in the CI.

Sr.No	Impact	Benefits
1	Accuracy	Contractual terms & conditions are perfectly registered on a smart contract; the execution and monitoring of conditions are highly accurate.
2	Compliance	Project information logged on blockchain, regulatory compliance easily demonstrated.
3	Transparency	Payment, transaction, business interaction and execution, registered on the blockchain lead the process transparent & followable.
4	Cost effect	Significant cost saving reached on overheads, administration & Project Control.
5	Risk Management	Ensure Transparency and reduced complexity for the whole construction procurement. The risk reduced.
6	Collaboration	Contractual collaboration supported & automatized with smart contracts, decrease significantly the number of claims.

Source: The potential of BT for the CI [6].

5) CONCLUSION

1. Blockchain is a transformative technology that can integrate with building construction and which can improve the productivity in business process that requires a trusted environment.
2. BC has the potential to revolutionize the way we run projects in future .It requires no intermediaries to run .This makes it much harder to abuse. The system is highly suited to keep continuously updated digital records.
3. A blockchain based ecosystem could help to solve several challenges by making it simpler for general contractors to verify identities and track progress across multiple teams. BT could also help and ensure construction materials ; sourced for the right places and are of the appropriate quality, while smart contracts may make it simpler to automatically issue timely payments linked to project milestones.
4. The full value of BC may be realized through the collaboration of different parties within the CI. Therefore, it is an advantageous to share best practices and implementation experiences through partnerships and common pilot projects.
5. In project and job site management BC provides the information in simple, transparent and economical way.
6. The research study reveals that application of BC will definitely improve market economical status in near future.

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IDENTIFICATION OF MATERIAL MISMANAGEMENT For Slum Rehabilitation Authority (SRA) Projects in Mumbai

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ABSTRACT

This study explores the various factors responsible for material cost overrun and the corresponding gap in the estimated and actual material usage in S.R.A Projects in Mumbai. These projects, often undertaken by Small to Medium sized Enterprises (SMEs), are heavily susceptible to an increase in cost from the estimated value leading to the SMEs not being able to arrange for the required additional funds.

KEYWORDS - *Material Management, Slum Rehabilitation Authority, SRA, Mumbai, Gap Analysis, SME Projects.*

INTRODUCTION

Background

The construction sector in India is comprised largely of Small and Medium sized Enterprises (SMEs). As opposed to large companies which have the capacity and capability to use sophisticated information and management technology to supervise and manage a construction project, SMEs are generally poorly equipped to implement such systems. Thus, improvements in labour and material efficiency are generally difficult to achieve.

Since SME's operate on low cash flows, the materials are generally ordered at infrequent and irregular intervals. Without proper management and site oversight, offloading, storage and tracking of materials is highly inefficient. The cost represented by materials fluctuates and may comprise between 60% - 70% of the total project cost and sometimes more [1],[2]. Hence, any ways to reduce wastage and improve productivity will have major benefits to cost and time.

Slum Rehabilitation Authority (SRA) projects in Mumbai are mainly undertaken by such SMEs. Any substantial increase in the estimated project costs—like those resulting from poor management of construction materials—is difficult for the developer to adjust for. This sometimes leads to projects being stalled for years, and in extreme cases, abandoned. Thus, proper management of construction materials becomes a highly effective strategy to substantially improve feasibility and reduce costs in a construction project.

Aim of the Study

The aim of this study was to recognise the various factors involved in management and handling of construction materials, and to study the factors responsible for the increase in the actual material usage as compared to the estimated usage.

Methodology and Scope

The scope of the study was to understand the procurement methods, logistics, storage, usage, and wastage of materials during the construction phase of the project. The materials selected for study were limited to Concrete (Cement, Sand, and Aggregate) and Steel, since they contribute primarily to the material costs in Reinforced Cement Concrete (RCC) Construction.

For comparison of estimated material usage and actual material usage, Gap analysis was done using S-curves. Construction protocols and actual on-site conditions were recorded and analysed using detailed questionnaires.

The focus of the study was limited to SRA construction projects in the Borivali East area of Mumbai, and limited to this area in terms of sampling and case studies.

MATERIAL MANAGEMENT

Definition

Material management is defined as planning, identification, procuring, storage, receiving and distribution of materials. Material management functions include “material requirement planning and material take off, vendor evaluation and selection, purchasing, expenditure, shipping, material receiving, warehousing and inventory and material distribution” [3].

Many factors contribute to poor material management in construction projects. Factors such as waste, transport difficulties, improper handling on site, misuse of the specifications, lack of proper work plan, inappropriate material delivery, and excessive paperwork, all adversely effect on material management [4]. It has been an issue of concern in the construction industry; 40% of the time lost on site can be attributed to bad management, wastage of material, lack of materials when needed, poor identification of materials and inadequate storage [5].

Impact of Material Management

Effective material management has a positive impact on

- Time optimization,
- Cost saving,
- Quality maximization,
- Productivity improvement, and
- Waste minimization

Ineffective material management, on the other hand, has a negative impact on project performance. Delays in project completion time due to untimely unavailability can cause increase in expenses and thus has an adverse impact on the potential feasibility of the project. Poor planning and procurement, as well as mishandling of materials due to poor material management can lead to increased wastage and thus, an increase in cost.

Poor material management can also affect the quality of the required project; materials not stored properly or used in a timely fashion decline in quality. Problems in material management also leads to a decline in labour efficiency, since they cannot work as productively as they can. Thus, we see that the impact of material management is cumulative in nature.

Importance in SMEs and SRA projects

An SME is project driven and is always battling to reduce costs and save money. They tend to win their work on low bid price, rather than superior technology. These bids are based upon resource estimating using knowledge and experience from previous projects, and are often their only guideline for project cost going into the project. Increased costs in the middle of construction can lead to adverse effects on their cash flow; This cash flow is crucial to pay suppliers on time to ensure future materials supply.

SRA project are a unique combination of budget housing for the rehabilitated occupants, as well as commercially saleable residential housing for people. Any developer interested in undertaking such a project needs to invest heavily, particularly in the initial stages of the project. The slum residents have to be accommodated off the construction site in transit housing, while the construction is undertaken within the existing complex. Thus, this unique nature of the project requires extensive as well as intensive management in all the sectors of construction.

Material management, a crucial part in any construction project has more sensitivity in this case due to the proximity of the site to the residents, more vulnerability due to the anti-social elements in the surrounding slum areas etc. It is essential therefore, that an improved material management system be adopted so that the project can be completed efficiently, be cost effective and complete on schedule.

CASE STUDIES

Three case studies were selected which were from Devipada, Borivali in Mumbai. All the projects are S.R.A projects and phase 1 has been completed in all the case studies.

Table 1 - Details of selected case studies

Description	Case Study 1	Case Study 2	Case Study 3
Total plot area in sqm	16,184.76	12674.34	3152.94
Ground coverage area in sqm	1980.00	1480.00	895.00
Building type	Composite	Rehab	Rehab
Height of buildings (mt)	23.8	49.9	23.8
Constructed area (sqm)	8156.27	13001.40	5940.50
Type of construction	RCC framework Brick partitions	RCC framework Brick partitions	RCC framework Brick partitions
Construction undertaken by	Developer (SME)	Developer (SME)	Developer (SME)
Estimated Construction Cost estimate (Cr)	9.67	13.1	7.92
Estimated Construction Period Phase I	26 months	45 months	24 months
Total Construction Cost Phase I (Cr)	11.65	16.8	9.78
Total Construction Period Phase I	42 months	78 months	35 months
Project type	Rehab + Sale	Rehab + Sale	Rehab + Sale
Proposed FSI	Phase I - 2.5, II&III - 3.0	Phase I, II, III-3.0	Phase I - 2.5, II&III - 3.0

Data

The below S curve analysis presents the gap between the estimated and actual quantity with respect to time, for all the materials in each case study.

Cement Consumption

Table 2 – Cement Consumption

Description	Case Study 1	Case Study 2	Case Study 3
Design Mix	M20	M25	M20
Estimated Qty (bags)	43000	70000	21500
Total Qty Used (bags)	52180	87935	25700
Deviation in Cement Qty	21.2%	25.6%	19.3%

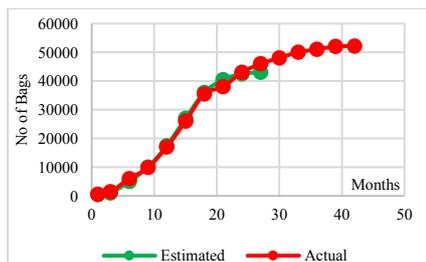


Fig 1.1 Case Study 1

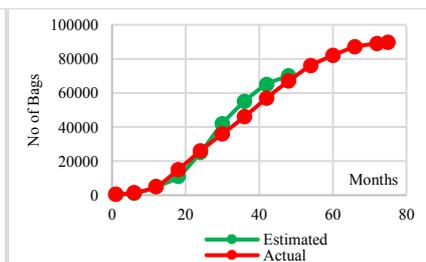


Fig 1.2 Case Study 2

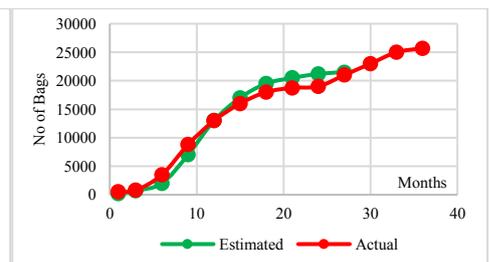


Fig 1.3 Case Study 3

Sand Consumption

Table 3 – Sand Consumption

Description	Case Study 1	Case Study 2	Case Study 3
Estimated Qty (ton)	1900	3920	940
Total Qty Used (ton)	2296	4925	1106
Deviation in Sand quantity	20.6%	26.7%	15.6%

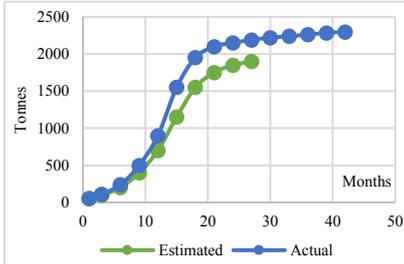


Fig 2.1 Case Study 1

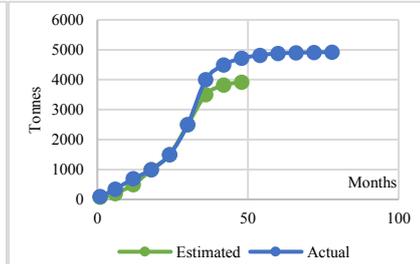


Fig 2.2 Case Study 2

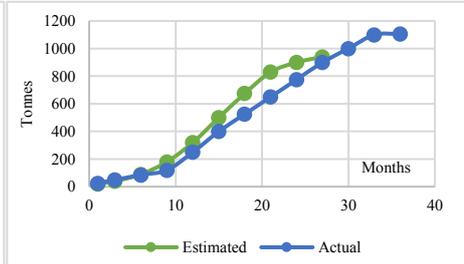


Fig 2.3 Case Study 3

Aggregate Consumption

Table 4 – Aggregate Consumption

Description	Case Study 1	Case Study 2	Case Study 3
Estimated Qty (ton)	3800	7840	1880
Total Qty Used (ton)	4592	9850	2212
Deviation in Aggregate Qty	20.7%	25.6%	15.6%

Aggregate Consumption

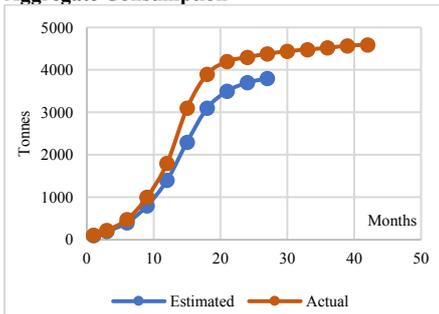


Fig 3.1 Case Study 1

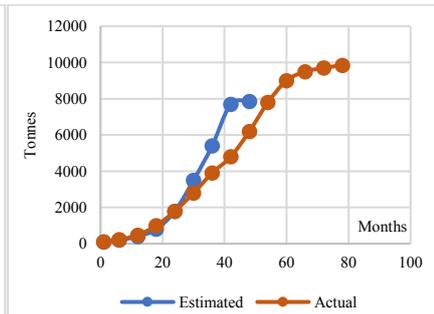


Fig 3.2 Case Study 2

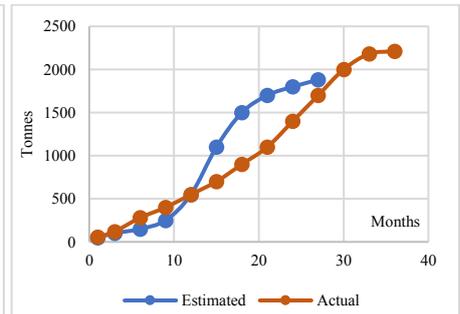


Fig 3.3 Case Study 3

Steel Consumption

Table 5 – Steel Consumption

Description	Case Study 1	Case Study 2	Case Study 3
Estimated Qty (ton)	650	780	320
Total Qty Used (ton)	802	957	406
Deviation in Steel quantity	24.6%	22.3%	23.7%

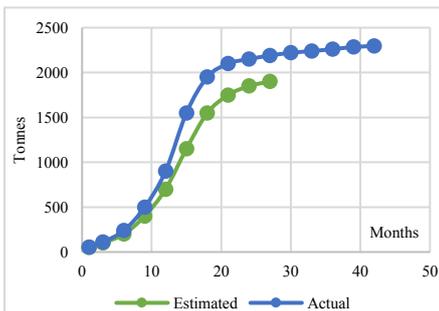


Fig 4.1 Case Study 1

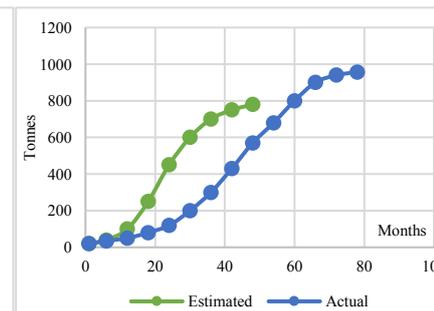


Fig 4.5 Case Study 2

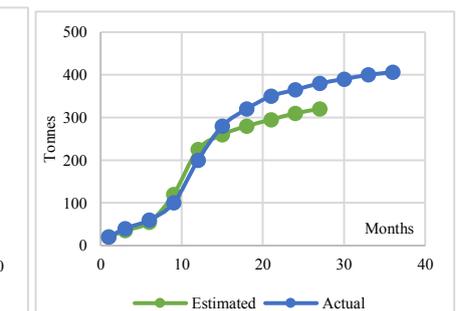


Fig 4.3 Case Study 3

Gap Analysis

From the selected case studies, data was obtained in the form of usage statistics and questionnaires to the personnel responsible for material management. The gap in material usage and its impact on the project cost is summarised in Table 6. The primary factors responsible for these variations were identified as wastage and Bill Of Quantity (BOQ) changes.

Construction projects as a whole and SRA projects in particular are prone to numerous changes in the plan specifications. However, the BOQ prepared before commencement of the project does not undergo periodic updating in spite of any changes in the plan.

The losses due to wastage were found to be approximately 3-5% of the material cost. The most common reasons were material shortage and subsequent overordering. This, coupled with late ordering and delay in delivery is indicative of a lack of organization and planning.

Table 6 - Actual material usage and cost overrun

S. No	Description	Case Study 1	Case Study 2	Case Study 3
1	Design Mix	M20	M25	M20
2	Total Cement Used (bags)	52180	87935	25700
3	Deviation in Cement quantity	21.2%	25.6%	19.3%
4	Total Sand Used in ton	2296	4925	1106
5	Deviation in Sand quantity	20.6%	26.7%	15.6%
6	Total Coarse Aggregate Used in ton	4592	9850	2212
7	Deviation in Aggregate quantity	20.7%	25.6%	15.6%
8	Total Steel Used ton	802	957.3	406
9	Deviation in Steel quantity	24.6%	22.3%	23.7%
10	Estimated Construction Cost(Cr)	9.67	13.1	7.92
11	Final Construction Cost actual (Cr)	11.65	16.8	9.78
12	Estimated Const. cost deviation	10% -12%	12-15%	10%
13	Actual Construction Cost Deviation	17%	22%	19%
14	Impact of the Increased Cost	Delay in completing project.	Profit margin reduced drastically	Delay in completing project.
15	Impact due to project delay – projected loss	10% of project cost	15 % of project cost	10% of project cost

The factors responsible for the material mismanagement can be summarised as shown in Figure 5

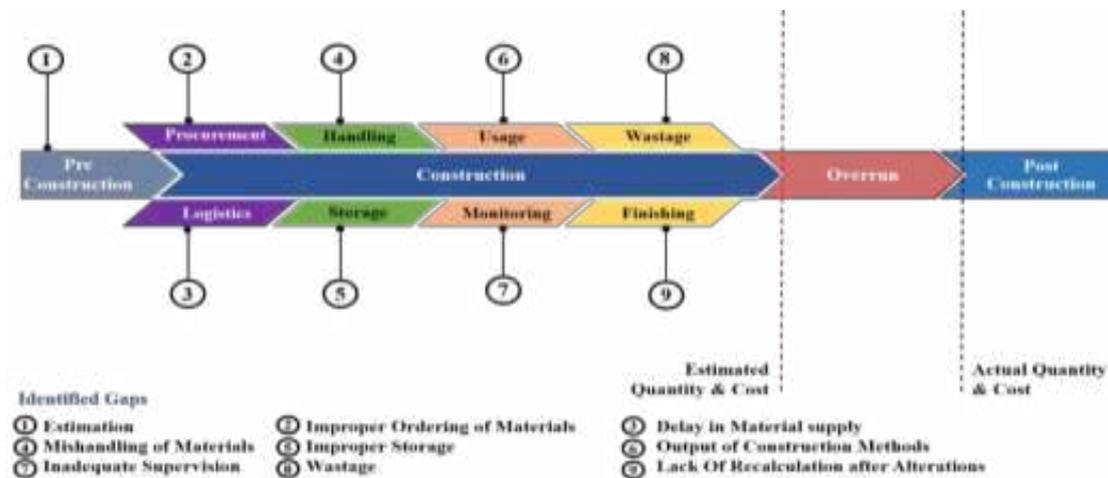


Figure 5 - Identified Gaps in Material Management

1. Estimation – The lack of a periodic update of the material quantity and cost lead to error in the initial estimate of the project. Alterations due to site conditions, often significant are ignored, and disturbs any planned material management.
2. Improper Ordering of Materials – Materials are not ordered in a timely fashion, nor are management techniques like Just-in-Time ordering and Economic Order Quantity (EOQ) followed. This leads to overordering of materials and subsequent wastage.
3. Delay in Material Supply
4. Mishandling of Materials – There is a general lack of discipline and set protocols for the different activities being undertaken during the construction phase. The lack of discipline towards the usage and handling of the materials can be attributed to the use of labour contract, as efficient use of materials is not a priority for the contractor.
5. Improper Storage – Storage facilities found were severely lacking. The scarcity of space, the nature of the location, and the surrounding antisocial elements present in the slums make the safe storage of materials a difficult task.
6. Output of Construction Methods – Inefficient techniques and technologies like manual bar bending machines and on-site concrete mixers lead to about 8-10% of material wastage which is often not accounted for in original estimates.
7. Inadequate Supervision - Adequate supervision by qualified professionals on the site is found to be sorely needed due to the lack of proper protocols and communication. Delays in performing inspections and testing lead to rework required on site, and thus increase in material and cost.
8. Wastage

9. Lack of Recalculation – Since due to the nature of SRA-projects it is impossible to do in-depth testing prior to excavation, there is a high possibility that an unexpected feature of the site can substantially affect initial estimate. In spite of easy and ready availability of Management Information Systems (MIS) and Building Information Management (BIM) software, there is no attempt to use these tools for the same, and the recalculation is not done with due diligence.

CONCLUSION

Material management is important to the success of a construction project, since material accounts for the majority of the construction costs. Slum Rehabilitation Authority (SRA) projects in Mumbai, mainly undertaken by SMEs, are thus highly susceptible to the adverse effects of Material Mismanagement. By looking at selected case studies of such projects, the primary factors of such mismanagement were identified as seen in Figure 1.

It is possible for an SME to tackle such mismanagement using suitable combinations of established management techniques. Periodic update of estimation can be done using BIM software. EOQ and JIT can be used to improve efficiency in procurement and logistics. ABC analysis of material management can be applied to the required materials in order to allocate storage and prioritize handling. Newer technologies can like Pre-Cut steel bars and Ready-Mix Concrete (RMC) can be used to reduce wastage. MIS software can be used to track and monitor progress of the project and accurately communicate information.

Thus, it is important to understand the impact that material management has on a project, especially those for SRA in Mumbai. The feasibility and timely completion of the project, which are primary concerns for a developer, largely depend on it.

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LEAN CONSTRUCTION - THE NEW APPROACH TO NON-MATERIAL WASTE MINIMISATION IN CAPITAL CONSTRUCTION PROJECTS - A Project Management Perspective

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ABSTRACT

With the construction industry at its boom in India, capital projects are now gaining momentum. Past research findings have highlighted the lacunae of conventional tools of project management such as critical path method, work breakdown structure etc. in dealing with modern day capital project challenges such as extensive design changes, complex flow management, rigidity, non-dependency between project phases and non-reactive approach etc., resulting in huge wastes especially non-material ones such as Transportation, Inventory, Motion, Waiting, Overproduction, Over-processing, Defects & Skills wastes. Such non-material wastes are most often never accounted for in the total project cost, when, as per past research, their contribution is indeed significant! The need is thus felt to relook at our traditional systems of project management to address such challenges of today's modern day construction projects. Lean construction principles offer a new way of handling these new-age project complexities. Within this lean framework, capital projects are now treated as 'production systems', albeit temporary in nature, through the entire lifecycle of the project. Further therein, based on the five lean principal principles viz. Value specification, Value stream identification, Flow, Pull and Perfection, system processes are identified, which when followed through, have yielded maximum profits for a capital project, by targeting fore mostly, the reduction in non-material waste. This paper is thus an attempt to discuss the attributes and processes of a lean approach to non-material waste minimisation in capital project, from a project management perspective.

KEYWORDS - *Lean Wastes, Production System, Lean Philosophy, Value Adding Activities, Lean Construction, Project Management*

INTRODUCTION

^[1] In India, the construction industry is the second largest contributor to the country's economy after agriculture. The construction industry in India is expected to grow at the rate of 7-8% per annum over the next 10 years. An estimated 35 million people are employed by the construction industry and is thus a significant driver of Foreign Direct Investment inflows. ^[2] Looking at the still largely untapped potential of India's construction sector, KPMG estimates India's construction sector to be the third largest in the world by 2025, behind only China and the US, with a total valuation of over \$1 trillion.

Capital Projects

^[3] With such unprecedented growth predictions, the focus on increasingly complex capital projects with reference to timely delivery within estimated costs and industry standards, will only intensify with time. Capital projects are typically characterised by their large scales and exorbitant costs, relative to other investments that involve less planning and resources. A large amount of financial and human capital is allocated by corporations to build and sustain such capital assets. Hence a great amount of planning and discussions are involved to arrive at the most efficient and practical plans for their execution. Such micro-management is significant given the resources and time being spent by corporations for the successful implementation of projects. In the given scenario, the role of a robust project management setup to ensure the smooth run of such large-scale projects with many layers of inter-dependencies, cannot be ignored. ^[4] Past research has confirmed that large, complex and fairly uncertain capital projects cannot be managed through the conventional ways and that fast-track projects with long, complicated supply chains involving many stakeholders and subject to multiple, extensive process design changes have failed miserably in the past (Ballard and Howell, 1994). As a result, the industry is traditionally characterized by delays and often cost and time overruns occur (Sorooshian, 2014).

Non-Material Wastes in Construction

^[5] Historical research has proven to show that a very high level of waste exists in construction. Construction is one field, that has a major and direct influence on other industries, either through purchase inputs or product outputs. Reducing waste in the construction industry could thus directly impact prices in other fields in a positive way, yielding great cost savings to the society at large. Recently, minimisation of waste in construction of capital projects has become a preferred area of interest for many researchers around the world. In most of these researches, construction waste is often spoken of, in its physical or material form i.e. either as organic or inorganic wastes. The tackling of such kinds of wastes have been widely discussed and debated upon, but the research on non-material waste is scattered and little. Recent data studies have highlighted the role that such non-material wastes play in contributing to the overall project losses. The scope of this paper, is thus to look at non-material wastes that occur due to modern day challenges of process flow failures, extensive design changes, poor communication & co-ordination between project stakeholders, that the traditional project management (TPM) systems failed to address due to their rigid nature.

Challenges of TPM Systems

An in depth analysis of previous research findings shows that TPM systems worked well in a static environment where construction project cycles followed a 'waterfall' or sequential cycle. ^[7] The focus on efficiency and productivity measures did nothing to assure the predictability of budget and schedule outcomes. With increasingly complex projects, these challenges only doubled!

An examination of TPM systems identifies two fundamental gaps with respect to non-material wastes. The first gap is that it does not account for the impact of the variability that affects all aspects of operations during project execution. One symptom of variability is the build-up of work-in-process at different points in a project, which can have unanticipated consequences for project execution - both in cost and schedule. The second gap is that TPM does not give project teams a means to control the execution of detailed project work activities in response to the day-to-day variability affecting project execution. Today, with increasingly complex projects on the rise, a more holistic and dynamic approach to minimising non-material wastes is needed.

Project as a 'Production System'

In response to the lacunae left by TPM systems in dealing with non-material wastes, the need to look at a more inclusive & adaptive system, was felt. In the 1940s, a newly adopted concept started to emerge in the construction industry, that called for a paradigm shift from the TPM systems to a more robust system, through the development and adoption of 'lean production' philosophies (Koskela, 2000).

[9]Lean is the concept of efficient manufacturing/operations that grew out of the Toyota Production System in the middle of the 20th century. In this approach, 'Projects' are viewed as a 'Production System', where focus is on project delivery, increased profitability – achieving business objectives with the optimum consumption of resources. It is based on the philosophy of defining value from the customer's viewpoint, and continually improving the way in which this value is delivered, by eliminating every use of resources that is wasteful, or that does not contribute to the end goal.

The Lean Philosophy

[11] Lean is the ability to distinguish between work that actually adds value to the clients and work that does not. This is done by empowering every individual stakeholder of the capital project to make his greatest possible contribution to the work systems and processes. Lean is a thus a culture of continuous improvement practiced at every level of the organization and by every team in the capital project. By eliminating waste, resources are freed to be devoted then to value-adding activity that further serves clients.

For the client, lean strives to maximize value delivery while minimizing waste in the process. Lean aims to maximize human potential by empowering workers to continuously improve their work. Lean leaders facilitate this goal through problem-solving training. They help workers grow professionally and personally, allowing them to take pride in their work.

Lean is also a work environment that assures the quality and safety of all work for both clients and workers. Lean is a focus on improving the work process and not on blaming people or creating fear. Lean is thus a culture of teamwork, shared responsibility and ownership that cuts through organization walls or silos.

Lean is also flow. Lean is an interruption free process that flows from beginning to end without interruption.

Lean is the thus the application of the scientific method of experimentation and study of work processes and systems to find improvements and minimise waste.

Inspite of the many efforts towards adoption of the lean approach into the construction sector formally, it was only in the mid-1990s that lean construction really began to finally take root in construction management and subsequently, in the practical sphere of construction.

Why Lean Construction?

[5] Since the construction industry plays a major role in every national economy and many other industries depend on the industry in terms of purchasing inputs and also providing products to almost every other industry; reducing or removing waste in the industry would lead to a great cost savings for the industry as well as the society.

It must be emphasized that throughout the life cycle of the project, 'value' is what the client is really paying for.

Lean Construction is an approach to design the system of production to reduce waste of time, materials, and effort with a specific end goal to generate the most conceivable amount of value (Koskela et al., 2002). Again, designing the system of production to attain the stated ends is only achievable through the joint effort of all project participants namely the client, the architect and engineer, the project managers and end users, among others, at early phases of the project. This goes beyond the contractual agreement of design or build or constructability assessment where contractors, and at times project managers merely respond to designs as opposed to involving and influencing the designs (Abdelhamid et al. 2008). Lean Construction makes this possible by integrating and engaging the efforts of all the project participants. Lean Construction seeks to maximize client's satisfaction through concurrent engineering (or design) which integrates various tasks executed parallelly by multidisciplinary teams with the aim of optimizing engineering cycles of products for efficiency, quality and functionality (Aziz and Hafez, 2013). Also, Lean Construction acknowledges the fact that desired ends influence the means to accomplish these ends, and that available means will influence realized ends (Abdelhamid et al., 2008). In order to ensure reliable and predictable production system flows on project site, there should be strong alignment of the whole supply chain in such a way that waste is reduced and value maximized. With such a wide scope, lean production or manufacturing tools and techniques have been most influential and exceptionally effective in dealing with wastes in supply chain delivery systems.

The 5 Lean Principles to reduce Non-material Waste

Analysing the project as a production system, the 'lean' theory can be applied to its various processes. The lean theory rests on five primary principles which when followed will reduce waste and maximize profits for a capital project.

These principles are:

- (i) Value specification: Precisely specify what creates value from the client's perspective;
- (ii) Value stream identification: Clearly identify all the steps in the processes (value stream) that deliver exactly what the client values and remove everything else that does not add value to the client;
- (iii) Flow: Take actions that ensure continuous flow in the value stream;
- (iv) Pull: Produce only what the client wants, just in time; and
- (v) Perfection: Always strive for perfection by delivering what the client wants and expects, through a continuous removal of waste. As value is specified, value streams are identified, wasted steps are removed, and flow and pull are introduced, begin the process again and continue it until a state of perfection is reached in which perfect value is created with no waste.

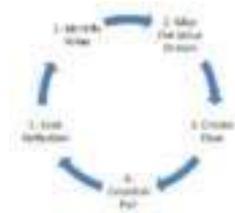


Image 1 - Lean Principles (Source: <https://www.lean.org/w/hatslean/principles.cfm>)

The 8 Wastes of Lean Construction



Image 2 - Lean Wastes (Source: Author)

[4] Capital projects owing to their very nature, are material and process intensive. The hallmark of well-managed projects is timely completion with least costs and good quality. However, unsystematic co-ordination between various agencies and deficient planning lead to waste generation - both in terms of time and cost over runs. [10] In a typical capital project, identifying the types of non-material wastes in the 5 phases i.e. Initiation, Planning, Execution, Monitoring & Controlling, Closure or Completion, is the first step in lean construction. TPM systems followed this approach. The Toyota Production System approach however, looks at the categorizing non-material wastes under the following heads viz. Transportation, Inventory, Motion, Waiting, Overproduction, Over-processing and Defects. The eighth waste of Non-utilized talent or Skills' of workers was later introduced in the 1990s when the Toyota Production System was adopted in the Western world. These 8 wastes

are commonly referred to as 'TIMWOODS'. These wastes are further categorised separately under 'on-site' i.e. project site and 'off-site' i.e. office wastes.

1. Transportation: ^[10]Waste in transportation includes movement of people, tools, inventory, equipment or products further than necessary owing to faulty working environment of the project site. Movement of materials in excessive can lead to damage of products and cause defects. In addition, excessive movement of people and equipment can lead to redundant work, greater wear and tear and fatigue. ^[4] Work process flow interruptions can significantly add to the costs of transportation. In the office, teams who work together often should be close to each other. Some of the countermeasures to transportation waste includes creating flow between processes and not over-producing work in process (WIP) items.

2. Inventory: ^[10] Excess inventory is very rarely considered as waste. In accounting jargon moreover, inventory is seen as an asset and many suppliers give huge discounts for bulk purchases. Inventory waste includes broken equipments sitting around, more materials than required at the given time and extra materials that take up work space. Being in possession of more inventory than required to sustain a steady flow of work can lead to problems including product defects or damaged materials, greater lead time in the production process, an inefficient allocation of capital, and problems being hidden away in the inventory. Excess inventory can be caused by over-purchasing, overproducing work in process (WIP), or producing more products than the customer needs. Excess inventory prevents detecting production-related problems since defects have time to accumulate before it is discovered. As a result, more work will be needed to correct the defects. ^[4] The problems associated with inventory may be due to quality problems with the production processes and may likewise be as a result of inadequate resource planning or uncertainty on the quantity estimations. In the office, inventory waste could be files waiting to be worked on, customers waiting for service, unused records in a database or obsolete files. Some countermeasures for inventory include: purchasing raw materials only when needed and in the quantity needed, reducing buffers between production steps, and creating a queue system to prevent overproduction.

3. Motion: ^[10] The waste in motion includes any unnecessary movement of people, equipment or machinery. This includes walking, lifting, reaching, bending, stretching, and moving. ^[4] This waste may be caused by poor work methods, lack of equipment or poor work area arrangement. Unnecessary movements may create or increase the level of injuries, accidents and their related costs. Therefore, jobs or occupations involving unnecessary movements ought to be examined and redesigned to minimize motion and its associated costs. In the office, wasted motion can include walking, reaching materials, searching for files, sifting through inventory to find what is needed, excess mouse clicks, and double entry of data. Some countermeasures for motion include making sure the workspace is well organized, placing equipment near the production location, and putting materials at an ergonomic position to reduce stretching and straining. Tasks that require excessive motion should be redesigned to enhance the work of personnel and increase the health and safety levels.

4. Waiting: ^[10] The waste of waiting includes people waiting on material or equipment and idle equipment. Waiting time is often caused by unevenness in the production stations and can result in excess inventory and overproduction. ^[4] Waiting occurs at whatever point products are not being processed or moving. The idleness is perhaps created during waiting for engineering, maintenance, raw materials, designing, quality assurance results, inspections, confirmation order, and so forth. Waste generated through waiting can be reduced drastically by connecting the processes together and sustaining the flow of the processes.

In the office, waiting waste can include waiting for others to respond to an email, having files waiting for review, ineffective meetings and waiting for the computer to load a program. At the project site, waiting waste can include waiting for materials to arrive, waiting for the proper instructions to start work and having equipment with insufficient capacity. Some countermeasures for waiting include: designing processes to ensure continuous flow or single piece flow, levelling out the workload by using standardized work instructions and developing flexible multi-skilled workers who can quickly adjust in the work demands.

5. Overproduction: ^[4] Overproduction is identified with producing more than required or producing earlier than should be expected. This regularly results in quantity and quality issues; an organization realizes that it will lose various units along the process of production so delivers additional to verify that the client request is fulfilled. This may result in misuse of materials, worker hours or usage of equipment. Overproduction issue can be handled by utilizing mistake proofing approach (Pokayoke - Mistake Proofing) and by understanding the equipment process capacities of the production machines. In an office environment, overproduction could include making extra copies, creating reports no one reads, providing more information than needed and providing a service before the customer is ready. There are three countermeasures for overproduction. Firstly, using a 'Takt Time' ensures that the rate of manufacturing between stations are even. Secondly, reducing setup times enables manufacturing small batches or single-piece flow. Thirdly, using a pull or 'Kanban' system can control the amount of WIP.

6. Over-processing: ^[10] Over-processing refers to doing more work, adding more components, or having more steps in a product or service than what is required by the customer. ^[4] Over-processing occurs in situations where processing or conversion activity does not add value to the product or service from the client's perspective. This is constantly created by the quality issue of the work done. The most evident example of over-processing is rework relating to surface finishes or works. In the office, over-processing can include generating more detailed reports than needed, having unnecessary steps in the purchasing process, requiring unnecessary signatures on a document, double entry of data, requiring more forms than needed and having an extra step in a workflow. Tools such as Statistical Process Control (SPC), 5 Whys, Pokayoke, among others, can be used to help identify and remove the causes of this waste. This waste can likewise be avoided by changing the technology used for construction. One simple way to counter over-processing is to understand the work requirements from the standpoint of the customer. Always have a customer in mind before starting work, produce to the level of quality and expectation that the customer desires, and make only the quantities needed.

7. Defects: ^[10] Defects occurs when the product is not fit for use or when the finished or half processed products are not up to the quality requirements.. This typically results in either reworking or scrapping the product. Both results are wasteful as they add additional costs to the operations without delivering any value to the customer.^[4] This is the common waste produced by the construction industry where segments or products made are not up to specifications. Defects may prompt rework or the use of poor or unnecessary materials to the building; for instance, extreme thickness of plastering works. The cost of product considered as defective is the same as it does to deliver a prize product.

Other than the losses, there are numerous different costs connected with rejects that make this an especially imperative classification of waste to minimize or eliminate. Defects can happen through an extensive variety of reasons, for example, poor specification and design, inadequate planning and control, inadequate qualification of the project/work team, poor integration of design and production, just to mention a few. New methods to handle defects must be used and checked. For instance, six sigma can be used for improving quality

through identification and removal of defects and reduction of variability in processes. Six Sigma is able to achieve process quality of 99.99966% that are free from defects (Alireza and Sorooshian, 2014). Here are four countermeasures for defects. Firstly, look for the most frequent defect and focus on it. Secondly, design a process to detect abnormalities and do not pass any defective items along the production process. Thirdly, redesign the process so that does not lead to defects. Lastly, use standardize work to ensure a consistent manufacturing process that is defect free.

8. Skills - ^[10] Even though it was not part of the Toyota Production System (TPS), many people are well aware of the eighth waste - the waste of human potential. The eighth waste is also described as the waste of unused human talent and ingenuity. This waste occurs when organizations separate the role of management from employees. In some organizations, management's responsibility is planning, organizing, controlling, and innovating the production process. The employee's role is to simply follow orders and execute the work as planned. By not engaging the frontline worker's knowledge and expertise, it is difficult to improve processes. This is due to the fact that the people doing the work are the ones who are most capable of identifying problems and developing solutions for them. In the office, non-utilized talent could include insufficient training, poor incentives, not asking for employee feedback, and placing employees in positions below their skills and qualifications. In construction, this waste can be seen when workers are poorly trained, they do not know how to effectively operate equipment, or when they are given the wrong tool for the job or when employees are not challenged to come up with ideas to improve the work.

CONCLUSION

This paper, through a comprehensive literature survey, sought to debunk the myths that traditional project management systems were well-equipped to deal with increasingly complex capital project work flows. These models in fact have not been able to control non-material wastes generated and as a result, have led to project cost and time over runs. By establishing the capital project as a 'production system', the paper has been able to look at construction projects from the point of view of lean construction - the new and latest approach to project management. The paper has also discussed the lean philosophy at its core, its principles and wastes in the industry based on the TPS.

Finally, the paper established that, the application of lean tools and techniques by project teams and industry's practitioners will minimize or eliminate waste, enhance performance and lead to a great cost savings for the industry as well as the society at large. It is expected that the fundamental knowledge provided by this paper will contribute to the knowledge and practice from delay control or waste elimination and also serve as a benchmark for continuous improvements of performance in construction industry.

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NATURAL FIBER COMPOSITES, ITS USAGE AND COMPREHENSIVE STUDY

Case Study on Bamboo and Jute, Analysis of Material and its Applications

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ABSTRACT

The ever-increasing environmental concerns and harmful practices used in the construction industry, prevails the use of alternative materials and methodologies which are eco-friendly, renewable and biodegradable. Nature being the best teacher and the provider of resources; makes one think of natural materials like Bamboo, Jute, Coir and so on., which have been seen and used in building construction in one form or other. Numerous researches had been carried out for many years to understand these plant fibers in terms of their mechanical and physical properties and results have shown that they perform better in stress and tensile forces as compared to other synthetic fibers. Studies provide an insight, which proves that usage of natural based composites have lesser dead load as compared to synthetic alternatives. Hence further research and development is done to convert them into forms like sheets, boards and much more which can be readily installed on the site, thus decreasing the required time of construction But before seeing the end product it necessary to understand these natural fiber composites as a material study, the processes involved into conversion to commercial products so that it becomes easy in application in perspective of construction industry. It's also necessary to understand the shortcomings of the fiber itself and steps taken to overcome.

KEYWORDS - Natural Fibers, Bamboo Fibers, Jute Fibers, Biodegradable, Eco-friendly, Bio composite

INTRODUCTION

Construction industry in India is growing rapidly and so is the cost associated with the building materials, thus leading to shortfall of traditional building materials. Considering the environmental impact like global warming, deforestation and so on, increases the importance of understanding and using the natural fibers (like bamboo, jute and many more) in construction industry. Diverse experiments and profuse testing of various natural fiber materials leads to better understanding of physical and mechanical properties; thus widening the scope of its usage in construction industry. These materials have been used since decades to build our shelters, but with changed times there is a need to convert them into forms which can be used in fast construction techniques, ecofriendly and cost effective. More possibilities of using them in various parts of the building – interior and exterior must be explored.

This research is divided into following parts – Study of fibers predominantly to understand their morphological structure, their physical and chemical compositions, overview of various processes/ tests carried on the fibers and understanding the processes involved in composite production. Further, along with advantages and disadvantages of the natural fiber composites, their applications are summarized. Vivid case studies provide an insight to understand various techniques of using these materials in construction industry and their availability in market. This research is limited only in understanding how and why these natural fibers are explored as alternative materials and application in building a structure after certain processes. Bamboo and Jute are selected for the case study and methodically investigated, amongst all other natural fibers aforesaid as an alternative to synthetic materials.

NATURAL FIBERS

Overview of the structure of a natural fiber

Bio composite is developed from a natural fiber which is from the plant origin. The other resources of the natural fibers are animal and mineral origin. However, plant fibers are mostly explored because of easier and wider availability [1]. The animal fibers contain proteins, while plant fibers contain cellulose.

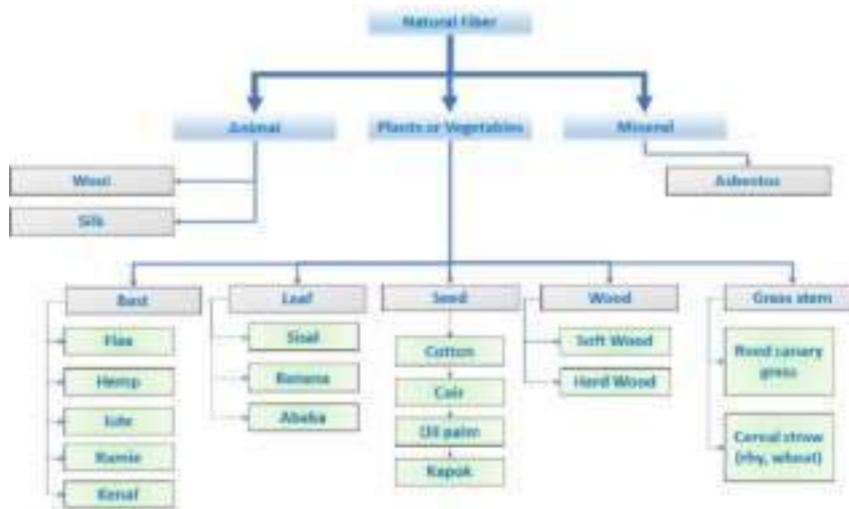


Figure 1 – Classification of natural fibers [1], [16]

Generally natural fibers are categorized into two types – Long and short fibers. These fibers are majorly composed of cellulose, lignin, and some water-soluble components and are surrounded to central core or cortex. The chemical composition of the plant fibers is very complicated. Cellulose in these plants is a natural polymer with high strength and stiffness per weight, and consists of long fibrous cells. These fibers are bundles of elongated thick walled plant cells and have microscopic tubes called as micro fibrils which absorb water and impart hydrophilic. The central lumen is responsible for water intake of the fiber and is made up of several layers. The structure, micro fibrils, cell dimensions, geographical locations and defects are the important factors, which affect the properties of the fiber [2] The tensile strength and young's modulus of fibers increase with increase with increasing cellulose content of the fibers while the orientation of the micro fibrils give stiffness to the fiber.[9]

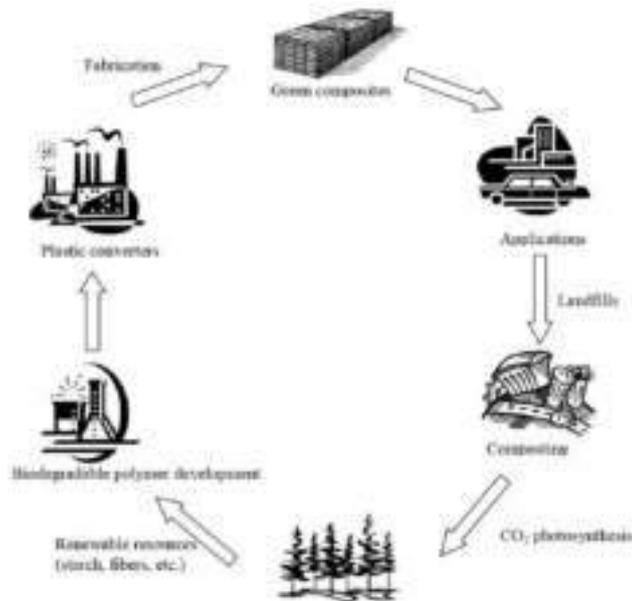


Figure 2 – Life cycle of natural fiber-based composite [3]

Natural Fiber composites or bio composites are capable of undergoing decomposition primarily due to the enzymatic action of microorganism to carbon dioxide, methane, inorganic materials and biomass in specific period and do not emit toxic gases after incineration. Hence, they are renewable, bio friendly and ecofriendly as shown in fig.2. [3] This is the biggest advantage of these natural fiber based composites as compared to synthetic fibers; because along with other environmental issues, one of the major issues is disposal of non-bio degradable materials. If they are buried, then it causes harm to the soil conditions and if they are incinerated then it causes air pollution.[13]

However, there are certain drawbacks like high moisture content, low microbial resistance, low thermal and fire resistance, and susceptibility in rotting. These qualities need to be considered while manufacturing of the products and their storage. The hydrophilic nature of these fibers affects the fibers and their properties in turn affecting the nature of the composites. It also leads to moisture absorption resulting in change of mechanical and physical properties if the materials. Another limiting factor is that due to the lignocelluloses fibers in composites leads to low thermal stability. Also, the variability and no uniformity of the fibers which affects their mechanical properties which otherwise is constant in synthetic fibers. These are overcome by doing certain treatments on the fibers which make them long-lasting. These treatments are done to so that upon conversion into composites, they do not absorb moisture; physical and chemical properties are enhanced. [4]

Bio composite production is determined by following factors, Agricultural production, fiber processing and fiber utilization. The farmer’s interest in growing these crops is primarily because they need less maintenance, compared to other crops as they attract less insects, have crop rotational qualities, only small amount of residue returns back to the soil after harvesting, as entire top crop is harvested.

The Process of Extraction of fibers from the plant

Extraction or retting process is separating the fibers in the stem region without harming their structure. After harvesting, the plant is kept in water for few days which helps in loosening the binding of the fibers to the core. The orientation of fibers and retting process usually helps in determine the mechanical properties of the fibers. [5] The strength of fiber increases by increased the volume of the fibers and hydrophilic property is removed by adding certain chemicals. Extraction processes and surface modification techniques help in enhancing the properties of the fibers. [9], [10] Both processes together help in in improving the physical and mechanical strength of the fibers and are done by two methods – mechanical and chemical process. During the mechanical treatment, usually resins are added which improves the adhesion of cells in the fibers. Chemical treatment includes various treatments like alkaline treatment; enzyme treatment which removes/ dissolves unwanted cells form the cellulose, breaks the hydrogen bonds, reduces their affinity towards water and improves the adhering properties of the fibers to each other. [9], [10], [11] The life cycle of a natural fiber is cultivation, retting process, chemical treatments to enhance the properties and then manufacturing into commercial products.



Figure 3 – Flow chart shows the steps of preparation for natural composites [12]

Brief description on mechanical and physical properties of natural fiber

These properties are affected by the growth environment of the fibers, harvesting time, post treatment of the fibers and vary as per density of the fibers. Bamboo has low density fibers but thicker as compared to other fibers like coir, banana, jute and ramie and so on. Cotton has the more moisture content and lowest tensile strength as compared to other natural fibers. Ramie is known for its stiff and long fibers while bamboo, coir is short length fibers.[16] The mechanical properties of these fibers are determined by taking cross sectional area of the fibers and values of Young's modulus are noted. Studies have shown that these fibers are good tensile stress as compared to plastic origin composites.[6] [7] These values also govern the mechanical and chemical extraction processes of the fibers, but it is necessary to set some standards which are specific to each fibers.

TABLE – 1: Tensile strength data [8]

Fiber	Tensile Strength (Mpa)	Young's Modulus (Gpa)	Density (g/cm ³)
Bamboo(steam explosion)	615 to 862	35.45	-
Jute	393 to 773	26.5	1.3
Flax	500 to 1500	27.6	1.5
Hemp	690	70	1.47
Kenaf	930	53	1.45
Ramie	400 to 938	61.4 to 128	-
Sisal	511 to 635	9.4 to 22	1.5
Coir	593	4.0 to 6.0	1.2

Brief description of various tests done on natural fiber

For the commercial feasibility of the natural fiber-based composites, various mechanical and chemical properties play an important role. The mechanical properties of these fibers are determined by taking cross sectional area of the fibers and values of Young's modulus are noted. Studies have shown that these fibers are good tensile stress as compared to plastic origin composites as they contain high amount of cellulose which acts as a natural reinforcement to the composites.[6], [7] These properties are determined on the basis of nature of the fiber and its orientation. Chemical resistance of the fibers is necessary to find their applications in wider industrial applications. It varies in various fibers according to the density and absorption of the acids. Water absorption test is weighing the fibers initially and then immersing them into distilled water for stipulated time. The weight of the fibers is measured periodically to understand the quantity of absorption of the fibers. It is one of the important aspects as most of the fibers are hydrophilic in nature; it affects their mechanical properties due to swelling of the fibers and moisture in the cells. Similarly moisture absorption test is done by keeping the samples in the humid environment and readings are noted periodically. Swelling test is done by immersing the composites in various liquids, acids to understand the affinity of fiber cells towards certain solvents. After the results precautionary measures are taken to improve the quality of composites. Void content and density of fibers, resins is measured separately. Usually lower voids in the cells indicate good bonding between the fiber cells. [4] The fibers, after treatment undergo various tests like tensile test, hardness test, shear test. [12].

From this point we further take "Bamboo" and "Jute" as case studies to understand the behavior of these fibers respectively.

SELECTED FIBERS FOR STUDY PURPOSE: JUTE AND BAMBOO

Introduction

Jute is a bast fiber which is mainly grown in India, Bangladesh, Indonesia and China. This plant has affinity for moisture and mostly grows in rainy season, needs warm and humid temperature and can also survive flood conditions. Cultivation of jute is fast and easy as it needs less maintenance. Varied types of Jute fibers are classified based upon their color, strength, and length of fibers [9]. Bamboo is fastest growing grass (matures in six to eight months) usually grown in the countries like China, Japan, India, etc. Similar to the jute, it is a perennial crop which mostly grows in monsoon season and its characteristics depend upon growth environment, water, soil and climate. Research has shown that bamboo is excellent in tensile strength. [6], [11]

Morphological and Chemical composition of Jute and Bamboo

Jute fibers are found in the bast region of the stem and mainly consist of cellulose and lignin. The fibers also consist of hemicellulose, waxes, oils and glucose which together give support to the plant by forming a network in the stem. The length, mechanical and physical properties of the fiber depends upon the growth environment, angle of the micro fibrils, defects if any and extractions process used. [9] Bamboo is a woody grass which is hollow from inside and has nodes at intervals. The number of nodes decides the age of bamboo and the vascular tissues present between these nodes gives strength to the plant. Physical properties of bamboo are determined by the fiber density which increases and starts tapering towards the top. Anatomical structure of bamboo is discussed in [11]. It also mainly consists of cellulose and lignin which is about 90% of the total weight, hemicellulose, proteins, fats, etc. which also determine strength, structure and flexibility of the fiber. Cellulose in the bamboo fibers keeps on decreasing with increasing age of the bamboo while lignin gives the color and strength to the fibers. [11]

Cellulose consists of glucose rings which give mechanical strength to the fiber. These chemicals in the rings react with water to form hydrogen bonds which absorbs water thus making it a water loving plant. Hence, cellulose is hydrophilic in nature while lignin is a natural polymer occurring in the present in the plant. [9]

Extraction Process of Jute and Bamboo Fibers

Hydrophilic nature of these fibers makes it poor performer in mechanical strength. Poor adhesion of the fibers to each other in the stem region affects their affects its mechanical, fire resistance and thermal performance resulting cracking of composites for tensile stress.

Mechanical processes for jute fibers include radiations which break down the chemical bonds of the fibers and changing the composition of the matrix, improving bonding of fibers, thus imparting better mechanical properties and increasing thermal stability.[9] Mechanical process of bamboo involves steam explosion method, retting, crushing the pulp and adding enzymes and then putting it into the mill to produce composites. Steam explosion method is used to crack the cell walls of the fibers converting it into soft pulp. Then it is washed to remove lignin and unwanted impurities. But heating also reduces the adhesion of the cells in the fibers thus reducing its structural and tensile strength which is later strengthened by surface modification techniques. Retting process is done by keeping the bamboo culms in water for certain period, beating it into pulp and scraping longitudinal or cross section wise. Studies showed that both methods yielded different results for strength of the fiber. Crushing is cutting the bamboo in smaller pieces and putting in roller crusher which extracts the

fibers. Grinding and rolling methods work on similar working principles with slight modifications in additives to be added to the fibers during the processes. These various methods are used per requirement of long and short fiber lengths. [1],[11]
 Chemical treatment includes alkali treatment is applicable to most of the fibers as it breaks the hydrogen bonds in the cellulose are broken thus reducing the hydrophilic quality of the fibers. It is noticed that adhesion of the cells increases by 30%. Another treatment is silane treatment is another one which reacts with hydrophilic bonds and cell bonds. Overall the chemicals help in changing hydrophilic nature of the fibers and increase the adhesion of the cells matrix in the fibers. Thus what remains is cellulose which gives good tensile stress to the fibers. The main advantage of chemical treatment/ modification is it yields results which are specific for industry applications. [4] Also these treatments help in dissolve/remove lignin, fats, water, etc. from the fibers.[1],[4],[5],[7],[9],[11] Fire resistance is improved by adding certain chemicals or applying nonflammable chemicals, resins to the fibers during manufacture of the composites. Overall, such treatments enhance the quality of fibers used for composite production making it strong and durable especially for load bearing structures. [9], [10], [11]

Manufacturing process of Jute and Bamboo Fibers based Composites

The manufacturing process of the composites comprises of selecting the right fiber, retting process, extraction of fibers, adding the resins and molding into required sizes. The process is similar to synthetic composites production. It is done by either by spreading the resin with help of rollers which is known as hands lay on technique or resin transfer molding in which resin is injected it into the fibers. Pultrusion is a method in which fibers along with resin are passed through dyes to produce thinner cross section of jute-based products. Extrusion is another method in which the fibers and resin are mixed disturbing the fiber orientation. But it ensures uniform distribution of the resin into the fibers. [9] Later pressure is applied to the composites which help in proper binding of the fibers with the resins and additives and thus a composite is produced. Various factors like moisture content in the fibers, fiber orientation is very much important as they determine the final qualities of composites. Care should for correct drying of the fibers to avoid bubbles which can bring porosity in the composites. Similarly, temperature control during the process of the manufacture is important as variation in temperature can cause damage to the fibers, degradation of cellulose in presence of oxygen. [9][11]

Applications of Jute and Bamboo Fibers based Composites

Jute is mostly grown for extraction of fibers which has wide applications construction, textile industry and automobile industry. In the construction industry, jute-based composites mainly find their applications manufacture of boards used for partition walls, windows, floor matting, ceiling panels, etc. [9], [16].

Bamboo is traditionally used in construction low cost houses, bridges, etc. Bamboo fibers are processed to make various construction components like bamboo reinforced boards, mats, laminates etc. It finds applications in interior designing; furniture and the list go on. Even entire prefabricated houses are built using bamboo mats, boards and corrugated sheets. [13][14][15][16].



Figure 4 – prefab house at IPIRTI [14]

TABLE – 2: Table below shows various applications of Jute bio composites in various industries [9]

Jute Bio-composites	Construction	Doors, Windows, Door frames, Roof tiles, Purlins
		Wall partitions, Ceilings, Floor matting
		Trusses, Purlins, Rafters
	Textile	Clothes, Rugs, Carpet, Bags
	Cosmetics	Cosmetic packaging, Brushes, Bottles
	Home furnishes	Tables, Chairs, Cabinets
		Wall papers, Surface Panelling, Furniture
	Kitchen Products	Kitchen cabinets, Forks, Spoons, Apron
	Medical	Hip replacement, Pins, Screws, Blood bags, heart valves
		Prosthetic sockets, Bone plates, Dental posts
	Packaging	Wrapping, Rigid packaging paper
	Automobile	Door panels, Cup holders, Dash boards

CONCLUSION

The above reference helps us in understanding that awareness is necessary for bio composites as a good alternative to synthetic fibers. The main advantage of these natural fibers is that they grow in abundance and require less care. However, in order to use them as an alternative to synthetic fibers, they have to be molded into various products. This procedure also gives chance to enhance their physical, mechanical properties and still making it durable, eco-friendly and biodegradable. Various researches have shown that they perform better in stresses as compared to synthetic fibers. Another advantage is that visual texture can be used to enhance the look of the space. Their less abrasive nature makes construction comparatively easier. Cellulose content in the natural fibers is the main reason for good tensile stress. However, it can be taken forward in the natural form but is modified using resins and certain chemicals. Overall just due to lack of awareness these fibers are still not the first choice of many designers in the fields of construction. But the scene is slowly changing as lot of data is available and many institutions are taking initiative to increase the awareness amongst the masses. In short there are wide applications of these natural fiber composites but to use them as an alternative to wood and synthetic fibers, we as designers should educate ourselves so that we can spread awareness.

There is lot of aspects to study these various types of fibers which can be done understanding their cultivation processes, harvesting methods, yield of the crops as per certain modification in the plant itself and so on. As we have seen that the fiber orientation is an important aspect of composite production, these crops can be cultivated to get the desired results. Understanding the construction methods, other supplementary materials required for the same and various possibilities in terms of designs can be further explored. To summarize, lot of study is being continuously done by various researchers and institutes and it's our responsibility to bring more and more products into commercial usage.

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DELAYS IN CONSTRUCTION

Theoretical framework for Cause - Effect Analysis of Delays

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ABSTRACT

Construction delay can be characterized as time overrun or extension of time to finish the site activity. Expansion delay is something that can't stayed away from any authority of organization in the country. Hence, delay is a circumstance when the real progress of a project is slower than the planned schedule or late finishing of the activities. The paper aims to evolve a theoretical framework for the Cause Effect Analysis of Construction Delays. Previous research is reviewed to identify the causes of delay and their effects. Further authors own empirical understanding of the construction project management also contributed in the identification of delays and their causes.

KEYWORDS – Construction management, Delay in construction, Delay types, time, cost, quality.

INTRODUCTION

Building projects in India are experiencing widespread delays. Due to a dramatic shift in the capacity and volume of the Indian construction sector over the last few decades, the need of a systematic analysis of the reasons of delays and developing a clear understanding amongst the industry experts are highly critical. (Hemanta Doloi, 2011) [3]

During design and execution of architectural projects, the works proceed at a different pace than planned, and delays frequently occurs because of various reasons. Their occurrence leads to additional cost generation, conflicts among project stake holders and in worst-case scenario it may lead to arbitration. (Atout, 2016)[2] The study needs to be done using survey and documentation as the research tool in order to determine the current level of use of TCQ management techniques in industry. The results may lead to assessment or evaluation of available contemporary TCQ management tools in order to manage projects more efficiently with regards to avoid the delays.

OBJECTIVE

The objective of this study to get the theoretical framework for cause effect analysis of delays in construction projects. The reasons of delay are gathered from literature and previous research. The consequence of this study is to make a future study about the cause of delays in construction industry and its possible mitigation strategies.

LITERATURE REVIEW

There are two kind of delays, non-reasonable deferrals and reasonable deferrals (Saleh Al Hadi Tumi 2009) [9]. A non-passable postponement is delay brought about by the temporary worker or its providers, through no issue by the owner. The contractual worker is commonly not qualified for help and should either get the ball really rolling through speeding up or repay the proprietor. In this way, non-passable postponements as a rule bring about no extra cash and no extra time being conceded to the contractual worker.

Excusable delays are divided mainly into two categories which are compensable and non-compensable delays. Compensable delays are instigated by the owner or the owner's representatives. As non-compensable delays are caused by other parties or occurrences beyond the control of both the stakeholders. These delays are generally called "acts of God" because they are not the liability or fault of any particular party. (Saleh Al Hadi Tumi 2009) [9].



Figure 6: List of delays (Source: Saleh Al Handi Tumi 2009)

Delay in construction projects has been a research topic for last few decades. Research conducted in this area is mostly focused on the delays happened during the construction stage. The research conducted is divided into two areas, one that causes delay during construction and second stream relating to delay analysis mitigation strategies. Some location specific work related to delay analysis reported by (El-Razek, 2008), highlighted the complexity on this issue across many countries. The first stream of literature focusing upon delay attributes during construction and mitigation strategies.

(Arditi, 1985) [1] reported the causes of delay on Turkish construction projects in the 1970s and 1980s by surveying public agencies and contractors involved in public sector projects. This study divided the identified factors into those that are influenced by national economic policies and those that can be controlled by the public agencies and contractors.

(Faridi, 2006) [10] investigated the factors causing delay in construction projects in United Arab Emirates. It was reported that over 50% of construction projects experience delay due to factors such as delay in approval of construction drawings, poor pre-planning and slow decision-making process. Comparing the key aspects of construction delay across UAE, the Kingdom of Saudi Arabia (KSA) and Lebanon, the research asserted that delay in approval, owner's slow decision making, and material shortages are common causes of construction delay

across the region. However, the conclusions that other high ranked factors in UAE had no substantial impact in KSA construction projects clearly emphasize the fact that factors causing construction delay cannot be measured common across the countries. There is a obvious need for crucial analysis and confirmation of these factors in Indian circumstances as well.

ANALYSIS

The framework is developed based on the three different researches to understand the ranking and grouping of the delay factors as highlighted below.

Delay factors	Assaf et. al	Ahmed et. al.	Alaghbari et. al
	In 2006, Assaf et. al. [4] categorized the factors to a delay group related to the construction field. Responsibility was rated among the various stakeholders that may be involved on a construction project like the owner, contractor, and consultant, external factor, project, materials, labors and equipment. The result of his study is as follows:	In 2003, Ahmed et. al. [6] groped the cause of delay by responsibility and type of delay. The result of the study are as follows:	In year 2007 Alaghbari et. al [7] has identified significant factors causing delay of building construction project. The study identified the reason for delay by the accountability of contractor, owner, consultant, and outside influence. The results from the study are as follows:
Financial factors	Financial difficulties and economic problems, Financial problems	-	Inadequate client's finance and payments at various stage Financial
Decision making	Delayed supervision and delay in decision making process, Delay in providing instruction Decision making.	Change in scope, Changes in Drawings, Changes in Specifications, Decision During Development Stage Shop Drawings Approval, Design Development, lack of communication between various stake holders.	Contractor's improper planning
Site level factors	Poor site management,	-	Contractor's poor site management,
Procurement factors	Unavailability of materials Supply, Delay in delivery of materials to site	-	Shortage in material, labour and equipment Supply
Human Resource factors	On site mistakes and rectification work	-	Inadequate contractor experience, The problems with subcontractors. Onsite mistakes.
Approval /legal factors		Building Permits Approval, Incomplete Documents and Inspections, Changes Laws and Regulations	

Table 1: Delay factors comparative analysis

The above studies have identified and listed the various causes of delay based on the various factors. The listing of delay and its causes leads to the delay categorization based on the nature and their impacts on the overall project. The categorization of delay factors not only limited to technical factors but also factors the tangible and intangible perspective from the aspect on involvement and influence if human attitude, skill and behavior.

Recently, the issue of delay in construction projects in India has been phenomenal. Its impacts were so significant that it tends to decelerate the implementation of future of all the stake holders. The improvement of delay factors not only limited to technical factors, but also focuses on the project management aspect of processes involved and the influence of human attitudes, mentality, skills and behavior.

The depth studies as to what extent the above-mentioned factors and variable can impact the projects construction and preconstruction phase based on their categories have listed below. Study based on these issues and problems had been conducted and delay framework has been proposed below.

List of delays:

Delay Accountability matrix:

Sr.No	Stakeholder	List of delays	Impact Category
1	Consultants delay	Delay in approving shop drawings and samples	Time
		Poor communication and coordination between all stakeholders	Time
		Inflexibility of consultant in design	Cost
		Conflicts between consultant and contractor	Quality
		Inadequate experience of consultant	Time
		Lack of coordination with contractor	Time
		Lack of consultant's site staff experience (managerial and supervisory personnel)	Time and quality
		Absence of consultant's site staff	Time and quality
		Mistakes in consultant's drawings	Time and cost
		Lack of practical (working) knowledge by the consultant.	Time
		Conflicts of consultant with design engineer changes in specification during construction by consultant.	Cost and quality
		Complexity of project design faced by consultant.	Time
		Delay in decision making process	Time
		Communication barriers faced by consultant.	Time
		Contract Modifications	Time
		Inadequate permission given to consultant to take decision	Time
		Delay in releasing the drawing due to late payment of consultants fees.	Time
Consultant's ability of leadership.	Time		
2	Owners Delay	Delay to provide and deliver the location or site to the contractor.	Time and cost
		Change in orders/specs. by owner during construction	Time
		Delay in revising and approving design by client	Time
		Delay in decision making process	Time
		Conflicts between ownership of the project	Cost
		Absence of incentives for contractor for finishing in advance of schedule	Time
		Contract modifications (variation in scope, material etc)	Time
		Contract Modifications	Time
		Late payment for completed works.	Time
Lack of understanding in technical dealing with vendors and contractors	Time		
3	Contractors delay	Difficulties in financing project by contractor	Time, Cost and quality
		Conflicts in sub-contractor's schedule in execution of project	Time
		Rework due to errors during construction	Time and quality
		Lack of working knowledge	Quality
		Disputes between contractor and other stakeholders (consultant and owner)	Quality and cost
		Poor site management and supervision by contractor	Time
		Poor interaction and management by contractor with other stakeholders.	Quality
		Improper construction methods implemented by contractor	Time
		Delays in sub-contractor's work	Time
		Frequent change of subcontractors because of their inefficient work	Time
		Poor qualification of the contractor's technical staff	Time
		Inadequate Planning & Scheduling	Time
		Underestimation of Productivity	Time
		Appointing and deploying suitable staff	Time
		Lack of coordination On-site	Time
		Improper project planning	Time
		Inadequate Review team for execution drawings	Time and quality
		Lack of awareness of upcoming technologies	Time
		Poor Managerial Skills	Time
		Procurement delays	Time
		Contract Modifications	Time and cost
		Lack of experience of contractor in decision-making.	Time
		Contractor's slowness in site mobilization.	Time
Inexperience of contractor with new technology.	Time		
Poor handling of project progress by contractor	Time		
Lack of risk identification & management by contractor	Time		
Untimely delivery of labour	Time		
Material related delay / Procurement teams delay		Shortage of material due to poor procurement planning	Time
		Changes in quality of material	Time and quality
		Frequent unexpected modifications in specification of material during construction.	Time
		Slow process of material selection	Time
		Poor material management	Time

		Material damage in storage	Time and quality
		Escalation of material prices	Cost and time
		Insufficient turnover & start-up resources makes project slow.	Time
4	PMC's Delay	Contract Modifications	Time
		Changes in site conditions	Time
		Unforeseen ground conditions.	Time
		Insufficient data collections & survey	Time
		Changes in site topography after design	Time
		Restricted access	Time
		Accidents on site	Time
		Problems due to existing structures	Time
		Unavailability of utilities in site area	Time
		Rework due to error in construction	Time
5	Statutory authorities delay	Work Suspensions by local authorities due to deviation in legal norms	Time
		Delay due to change in policies, development regulations, laws etc	Time
		Work suspension by government due to epidemic and pandemic.	Time
	Administrative delay	Suspension of work due to contractual issues	Time
6	Unaccountable delay	Fire Incident at site	Time
		Delays due to floods	Time
		Transportation Delays	Time
		Labor Dispute and Strike	Time
		Medical emergencies like Covid 19 etc	Time
		Delay due to external factors (Anti-social elements)	Time
		Delay due to extreme weather conditions	Time

Table 2: Delay accountability matrix

Delay, cause and effects matrix based on the impact categories

1. Delay, cause and effects matrix:

Delay category: **Time**

Sr.No	Dealy	Cause	Effects
1	Delay in approving shop drawings and samples	Dispute between client and contractor or consultant's inadequate manpower	This could lead to time overrun as the activities on critical path will have delay.
2	Poor communication and coordination between all stakeholders	Unavailability of stakeholders for project meetings	Delay in decision making process.
3	Inadequate experience of consultant	Consultants knowledge/exposure towards different types of projects	Delay in drawing deliverables.
4	Lack of coordination with contractor	Irregular site visits and unawareness about the site progress.	Delay in approving the shop drawings
5	Lack of practical (working) knowledge by the consultant.	Lack understanding of execution methodology.	Difficult detail which causes of more time for execution.
6	Complexity of project design faced by consultant.	Less exposure of the consultant's team for the type of project.	Delay in issuing the drawing.
7	Delay in decision making process	Limited authority with various stake holders.	Additional time required for getting the approval from the authorized person.
8	Communication barriers faced by consultant.	Ineffectiveness of the project coordinators or PMC team.	Additional time required to follow the project protocol.
9	Contract Modifications	Changes in delivery systems.	Additional time to discuss and negotiate the contractual changes.
10	Inadequate permission given to consultant to take decision	Inadequate knowledge of the consultants for the typology of the project or to control the cost variation due to design changes by consultants.	Additional time to required to clarify RFI/queries from contractor.
11	Delay in releasing the drawing due to late payment of consultant's fees.	Financial challenges at owners end or irregular payment made to the consultants.	This could lead to overall time overrun.
12	Consultant's inability of leadership.	Junior staff deployed for by the consultants for coordination.	More numbers of discussions required at the junior staff has get it verified from their superior.
13	Change in orders/specs. by owner during construction	Variation in requirements by clients/customer	This could lead to variation in cost and additional time for procurement of new specification.
14	Delay in revising and approving design by client	Lack of clarity in submitted drawings. Drawings not matching the client's requirements.	This could lead to hold on execution work due to absence of drawing clearance by client.
15	Absence of incentives for contractor for finishing in advance of schedule	Lack appreciation of contractor's effectiveness by client.	Less initiative by contractor to finish the work before time.

16	Contract modifications (variation in scope, material etc)	Revisions made by client during construction due to revised requirement.	This could lead to additional time for procurement and variation in cost.
17	Late payment for completed works.	Unsatisfactory completed work as per client and consultants Financial issues at client's end.	This could lead to procurement delay of further works, rework in existing works and negative enthusiasm from contractor's end.
18	Lack of understanding in technical dealing with vendors and contractors	Absence of technical resources at client's end.	This could lead to conflicts between client and vendors-contractors.
19	Poor site management and supervision by contractor	Lack of experience staff at site by contractor.	Delay in work progress.
20	Inadequate Planning & Scheduling	Absence of macro and micro schedule to abide by milestones.	Frequent changes timelines which lead delay in completion of milestone.
21	Underestimation of Productivity Improper project planning	Less knowledge of productivity and resources at planning or scheduling staff.	Idle labors during productive working hours due to ineffective planning.
22	Inadequate Review team for execution drawings	Drawing issued by consultants are directly sent to the site without third party review.	Site team comes up with a query during construction which requires additional time for clarification from consultants.
23	Lack of awareness of upcoming technologies. Inexperience of contractor with new technology	Inadequate resources to gather the upcoming trends in the market.	This could lead to extra time and cost to complete the job with conventional methods.
24	Contractor's slowness in site mobilization.	Absence of resources at contractor's end. Delay in issuing the mobilization advance from owner.	Change in project milestone due to late start.
25	Poor handling of project progress by contractor. Lack of risk identification & management by contractor	Inadequate resources to gather the site progress.	Unawareness and conflicts between related stakeholders which causes coordination delay.
26	Untimely delivery of labour	Shortage of labors due to irregular payment to labor contractor or labors.	This could lead to delay in daily activities on site which changes the micro schedule.
27	Changes in quality of material.	Sourcing the material by from unauthorized vendors to increase the contractor's profit.	Additional procurement time to source the approved quality material or poor quality of product.
28	Slow process of material selection	Absence of authority to consultants/stake holder for decision making.	Delay in delivering the material on site as per construction schedule which lead to idle labor in productive working hours.
29	Poor material management Material damage in storage	Improper storage space developed by contractor which could lead to material damage. Unavailability of storage space on site of nearby location.	Additional time for reordering the material or could lead to installation of damaged product.
30	Insufficient turnover & start-up resources makes project slow.	Absence of previous experience of large-scale project and financial support to cater the initial stage of the project.	This leads to slow mobilization and late procurement.
21	Changes in site conditions, Unforeseen ground conditions, Insufficient data collections & survey Changes in site topography after design	Unavailability of site strata and topographical levels during pre-construction stage.	This leads to changes in design due to site data which requires the revised approval of drawings from client.
32	Restricted access	Limited access to site due to anti-social elements.	This delays the mobilization process.
33	Accidents on site	Lack of risk identification and absence of hazards management.	This will lead to hold the ongoing work and additional time for hazard management.
34	Problems due to existing structures	Absence of foundation data for the existing structures.	Additional time required for removal of existing foundation as it was not known.
35	Unavailability of utilities in site area	Remote location of site.	Additional time in mobilization to provide utilities at site.
36	Rework due to error in construction	Absence of drawing review before execution.	Additional time to rectify the errors.
37	Work Suspensions by local authorities due to deviation in legal norms	Lack of awareness of legal norms and absence of periodical check by all the	This will require additional time to comply the legal norms and may

		stakeholders.	involve some rework at site as well.
38	Delay due to change in policies, development regulations, laws etc	Due to the absence of knowledge of possible upcoming changes by authority.	Additional time to comply the revised statutory changes.
39	Work suspension by government due to epidemic and pandemic. Medical emergencies like Covid 19 etc	Unplanned events like covid 19 requires closure of work as per stipulated time by local authority.	Overall shift in timelines and milestones by stipulated time.
40	Delay due to extreme weather conditions Delays due to floods	Stoppage of work due to extreme weather conditions such as cyclone etc.	Overall shift in timelines and milestones by stipulated time.
41	Suspension of work due to contractual issues	Additional demand for cost variation by contractor. Low performance issues with contractor Absence of delay and risk mitigation strategies from contractor.	Additional time required to solve and negotiate contractual issues and remobilization of site.
42	Fire Incident at site	Uncontrollable event which can be caused due to various reasons.	Site activity gets delayed for particular period.
43	Transportation Delays Labor Dispute and Strike	Strike due to various demands from the labours/resources.	It delays the procurement schedule and overall project schedule.
44	Delay due to external factors (Anti-social elements)	Unknown working methods of local area. Financial demand by anti-social elements from contractors to allow work in the area. Stoppage of material vehicles at various location by anti-social elements.	It delays the overall schedule and milestones.

Table 3: Delay, Cause and effect matrix - Time

2. Delay, cause and effects matrix:

Delay category: **Cost**

Sr.No	Dealy	Cause	Effects
1	Inflexibility of consultant in design	Lack of understanding of the consultants towards the need of flexible design.	It could lead to rework or additional time for construction.
2	Conflicts between ownership of the project	Disputes in management team. Acquisition of the project by different owner for various reasons like financial crisis at existing owners end.	Revision in payment terms with all stakeholders by new owner. Contractual modifications as per new owners' requirements.

Table 4: Delay, Cause and effect matrix - Cost

3. Delay, cause and effects matrix:

Delay category: **Quality**

Sr.No	Dealy	Cause	Effects
1	Conflicts between consultant and contractor	Disagreement on construction methodology	This could lead to poor quality finish due to change in methodology.
2	Lack of working knowledge	Deputation of inexperienced supervision staff during execution.	This could lead to mistakes during work progress which may have impact on the final finish of the product.
3	Poor qualification of the contractor's technical staff Appointing and deploying suitable staff Lack of coordination On-site	Lack of site exposure or previous site experience.	This could lead to poor quality of work.

Table 5: Delay, Cause and effect matrix - Quality

4. Delay, cause and effects matrix:

Delay category: **More than one effect.**

Sr.No	Dealy	Cause	Effects	Delay category		
				Time	Cost	Quality
1	Mistakes in consultant's drawings	Graphical errors of less information in drawings.	Mistakes in execution.			
2	Delay to provide and deliver the location or site to the contractor.	<ul style="list-style-type: none"> Late handover due to existing running facility. Legal acquisition is pending from owner's end. Limited access to site due to anti-social elements. 	This could lead to late mobilization by the contractor.	●	●	

3	Escalation of material prices	Unpredicted market situation could lead to price escalation.	Cost variation at later stage in the project could lead to contractual modifications.	●	●	
	Lack of consultant's site staff experience (managerial and supervisory personnel)	Deputing junior staff for monitoring the site progress.	Mistakes and rework in execution process.	●		●
	Absence of consultant's site staff	Deputation of consultants site staff for multiple location.	Mistakes and delay in execution process.	●		●
	Rework due to errors during construction	Absence of supervision staff during execution work. Drawings with errors or mistakes are used for the execution.	Additional time and cost required to rectify the mistakes.	●		●
	Procurement delays Shortage of material due to poor procurement planning	Change in specification during construction. Delay in processing the purchase order for vendors.	This could lead to delay in daily activities on site which changes the micro schedule.	●		●
	Conflicts of consultant with contractor due to changes in specification during construction.	Unavailability of material or higher cost of the specification.	This could lead to variation from approved drawings.		●	●
	Disputes between contractor and other stakeholders (consultant and owner)	Inappropriate working methodology used by contractor.	This could lead to poor finished product and negative cost variation.		●	●
	Difficulties in financing project by contractor	Due to the previous work record of the contractor. Financial incapability of contractor. Financial crisis in the industry which could resist investors/financers.	Financial issue could lead to delay in procurement as well as resources payment which could have impact on overall time frame and project tracking.	●	●	●

Table 6: Delay, Cause and effect matrix - Time and cost

CONCLUSION

Time and cost overruns have been identified as the main effect of delays, which are a recurring problem in various delay in construction and preconstruction stage of the project. Some of the researcher have also identified the similar finding such as Kikwasi (2013) [12] has identified that similar impacts on the project as some of the resulting effects of delays. All these delays have severe negative consequences on both the construction firm and the client. Al-Khalil and Al-Ghafly (1999) [11] also identifies the similar relationship between the schedule, work, and project conditions. They observed that any changes in one or more of these three items can affect the compensation level and time of completion.

It has been argued that it is necessary to create awareness for the various delays, causes and its effects in the project schedule, their occurrence rate and the extent to which they badly affect project completion. The general consequences of delays are loss of wealth, time and capability. Thus, based on the study of cause and effects of delay in this paper, it is obvious that identification and mitigation of various delay in construction and preconstruction stage of the project is the need of an hour. This identification and mitigation of delays may involve variation depending on the project typology, location and stakeholder's role. Additionally, stakeholders' roles and responsibilities should be clear at the initiation of the project to avoid listed delays.

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EVOLVING LEARNING SPACES

An Architectural response to changing Educational practices

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ABSTRACT

There has been a great evolution in education and learning style to which the spaces are trying to cater. Yet there are some areas where the architecture is not able to respond to the current educational needs. The existing classrooms are not able to cater to today's needs as the architecture is not responding. Thus, the process of teaching-learning is not able to evolve. The research concentrates on the study of the pre-university teaching-learning space (11th and 12th), as it is the threshold between school and university where the most crucial decision are taken by students for their further studies. Thus, the research focuses to find the factors which have affected these learning spaces and how effectively these spaces can be improved through design. Furthermore, the research focuses on identifying crucial aspects to design these spaces, keeping in mind tomorrow's requirements. The study was carried out by conducting various surveys and measured drawings of classrooms. An attempt is made in the form of recommendations for the development of the teaching-learning spaces.

KEYWORDS - education, evolution, teaching learning spaces, technology, spatial requirements

INTRODUCTION

Since we know the importance of education, it is also crucial to study the spaces where these activities are carried out. Educational Architecture is gone through various developments. The spaces are now different from what we had a few decades ago. Thus, the research deals with the study of these spaces and to understand their journey and how the factors have made these spaces change. For education, if subjects are the medium, then the classroom is the mode or the method. This thought provoked to study the teaching-learning spaces and how they have changed or adapted or whether they are the same.

Have you ever asked yourself, "Would I want to spend time as a student in my own classroom?" Perhaps this is the simplest question we can ask when considering all the 'elements' that goes into the physical and psychological elements of a classroom. We may all have varying ideas of what a classroom should look, feel, and sound like depending on our teaching style, previous experiences, or perhaps our principal's expectations. However, one thing remains constant for all students: the subconscious messages they receive upon entering the classroom by visually scanning the space.[2](Bennett September 22,2015)

What we are today is a gift given to us by our teachers and parents. The values, morals and all the learning have been blessed upon us in the temple called 'Classrooms'. We might not remember the logarithmic tables or the reactions of chemistry but today we do react to situations and scenarios by applying the knowledge we have learnt. Today we are standing on a platform where the education from our school is our foundation. And then comes a phase after school where one has to choose a career path, an important year in the life of a student, the gateway or the transit from schooling to becoming a professional - "The junior college 11th and 12th standard", an area where one makes crucial decisions for his career. The research focuses on the 11th and 12th standard classroom teaching-learning with students from Science, Commerce and Arts discipline.

Background

The Indian educational system has evolved through a great wisdom which has originated from the Vedas and has still kept our culture intact. From the study of our Educational system and architecture it is very evident that the transition from schooling to college, a student has to cross a threshold called as the Junior college, the 11th and 12th Standard. This threshold is a stepping stone between the schools where the foundation is built to the further university studies. The Research paper focuses on this threshold where a significant development is needed. The schools and the senior colleges are progressing in terms of development, but this pre-university phase where a student takes the most crucial decision for this career yet remains stagnant.

Today we see a lot of technological changes, Architecture also has evolved with time, but there are some spaces which have not changed remarkably as expected, the classrooms, where the future of tomorrow is getting moulded. Thus, my research focuses to find the factors which have affected these learning spaces and what can be done to improve these spaces and what aspects are crucial to design these spaces which can help a designer to create spaces for today, keeping in mind tomorrow's requirements.

Schools are influenced by political and social movements, new technologies and trends, the growing awareness of what makes us learn better and thus our notions of what makes a great school are constantly shifting and adapting to new ideas. Yet, we are still surrounded by the schools that matched the ideologies of over a century ago.[1](Baker January 2012)

EVOLUTION OF EDUCATION AND ARCHITECTURE

Literature Review: History of Education in India- J.P.Naik, Syed Nurullah [3](Syed Nurullah 1943)

The book explains how the educational journey from the Vedic age started. The main focus is on influence of the British policies made in the education system. According to linguistic states, more emphasis was given to the formation of universities during this period. Today the method of teaching-learning is mostly derived from this system formed during the British era.

The usual centres of learning were either some king's capital such as Kanauj, Dhar, Mithila, or Djayani, or holy places such as Varanasi, Ayodhya, Kanchi or Nasik and places like Nalanda, Gandhara and Takshashila. In addition to Buddhist Viharas (monasteries), there sprang up Hindu 'mathas' (monk's residences) and temple colleges, and agrahara villages (where spiritual and pedagogic functions are performed by learned Brahmins) in different parts of the country. It is noticed that the growth of temples in India was an indication of growth of education. [5]Thus, the table 2-1 clearly explains how the spaces have evolved with the changing educational pattern. This study gives a holistic understanding.

Essential of the classrooms today

For learning spaces to be purposeful and appealing, they should be designed around the things that are fundamental to all humans, their experiences and motivations. In addition, they should consider the unique culture of students and faculty on each campus. Within these spaces, the surroundings, furnishings and tools should work in concert to provide an optimal experience of learning and teaching, and should fluidly change as the needs of students and faculty evolve.[3](Miller 2015)

A classroom has to be sensitively thought, the need of the user how a small element can change the entire work flow or might just become a barrier in the entire process of learning. The visual stimulation, arrangement of furniture and natural light and ventilation is the basic need; this will promote more users to be in that space. The classroom has to become a memory which will help students recall the lessons learnt. Information technology is radically changing the ways that we build and conceive of schools, as traditional spatial configurations for

presentation are no longer as necessary as they once were, and technologies allow for new learning modes and practices. Major technological advances in energy-related building systems are being made every year, as the sustainable building industry grows and gains acceptance.[1] (Baker, January 2012)

Table 2-1 Explains the case examples selected range from 1885 to 2006 to understand the journey. The area of the classrooms and how they balance the number of students also is understood. The locations of the colleges also have different lifestyle and culture which has a different impact on the psychology of the students.

Table 0-1-Evolution of Education and Architecture (Source:-Author, Developed from literature review History of Education in India –J.P.Naik, Syed Nurullah)

Period	Teaching style	Space	Learnings and Methods	No. of Years engaged	Source Economic
Vedic Civilization (2000-800 B.C. period)	Gurukul and Ashramas 	Palmatus Conducted by Brahmins Acharyas at their residences.	Rigveda, Samveda, Atharvaveda, Yajurveda, etc. (based on the Upanishads)	The Education started from age of 7 and continued upto the students masters their subject.	The education was mostly taken by the affluent class of Kshatriyas like the kings, landlords. The Brahmins class contributed in imparting knowledge to these classes which helped them to earn a livelihood.
Gupta and Harsha Period (approx. 4 th -6 th century)	Similar like the Vedic age but with more importance towards education	Acharyas residence, universities for higher knowledge.	 Brahmin learning.	---	Talshabala international reputation. This institution included special institutions of law, medicine and military science. Significant advancement in the field of Indian sciences, mathematics and astronomy.
Indigenous Education till the beginning of 19 th century	Gurus Residence In form of a gurukul Gurus were invited to the house to select the student.	The spaces were defined according to the type of teaching.	School started early at 6 am. The first student to come is given an honor by the string of Goddess Saraswati on his hand. The students who were delayed were severely punished.	5-7 years or upto the wish of the students and his wish to learn.	The people with good financial condition could allow long term of teaching, others had to quit due to the financial issues. Even the money collected from financial Church that had to decay the condition of these schools.
Influence of East India Company 1813 onwards	 Drove to establish schools	Classrooms originated as a built space intention to spread Christianity.	Teaching of philosophical nature. The Origin of primary, secondary type system in India. Charity schools were built.	From the age of 7 and students were prosecuted to seek foreign education.	The Education focused the affluent class. While the missionaries focused on the primary education in their mother tongue.
1813-33	Education through local languages	Colleges and schools.	Formation of subjects with grouping science, commerce, art.	Age of 7 till 15	The British were more focused over ruling the country and spreading their ideals.
1921 onwards	The system was handed to Indians	Adopting the ideas of British and incorporating their system.	Primary, Secondary, Professional Colleges and schools, An Colleges.	---	To spread knowledge to all the users, this system was oriented towards rural. Formation of Aided and Un-aided institutes.
Establishment of universities	Influence of charity	Then the independence era and spreading education to all.	Similar pattern as used by the British	---	Importance given to all the lower classes and also to women. Currently, India holds the largest youth population Source: UN report 2014.

UNDERSTANDING OUR CLASSROOMS:-CASE EXAMPLES

Study of classrooms was carried out based on the parameters such as Physical Social and Psychological. The case examples were shortlisted from Pune, Maharashtra. The Author maintains due respect to confidentiality of the case studies and hence the names have not been mentioned.

Table 0-1- Statistical Comparison between the Case examples (Source:-Author)

	Case 1	Case 2	Case 3	Case 4
Reason of Selection	One of the renowned and old heritage school in Pune	An institute with good academic reputation but lacks infrastructure	School located in a cosmopolitan area established recently	A top IB school attempting to impart education adapting digital medium.
Establishment	1885	1986	2006	2006
Courses	Science, Commerce, Arts	Science, Commerce	Science, Commerce	Science, Commerce
Student Teacher ratio	1:100	1:100	1:80	1:20
Area of Classroom	108 sq.m	85sq.m	77sq.m	45sq.m
Area per student	1.08 sq.m/student	0.85sq.m/student	0.95sq.m/student	2.25sq.m/student
Possibility outdoor classroom	Open spaces need buffer if planning for outer.	No availability of space.	Space available but not utilised for outdoor learning.	Adaptive usage of transition spaces for outdoor classroom.
Acceptance for Technology	Yes, Use of LCD projectors.	They want technology to be a part of their classrooms.	Facilities not provided in the classes but can be well implemented.	Use of technology and also promote students towards e-learning.
Sample Size for primary survey	Two classroom consisting 100 students each and their concerned subject teachers	Two classroom consisting 100 students each and their concerned subject teachers	Two classroom consisting 80 students each and their concerned subject teachers	Three classroom consisting 20 students each and their concerned subject teachers

Case 1:-

The most renowned college with a great history which has moulded many great people for the society. The overall furniture arrangement is well spaced out; each student can see the board and the teacher comfortably. On asking the students about their class, they are comfortable with the overall environment. The light quality and the soothing colour scheme have helped them to settle into this new environment comfortably. Also, the student-teacher ratio is dealt by providing tiered seating where each one has a contact with their teacher. However, the classroom faces issues in terms of acoustics.

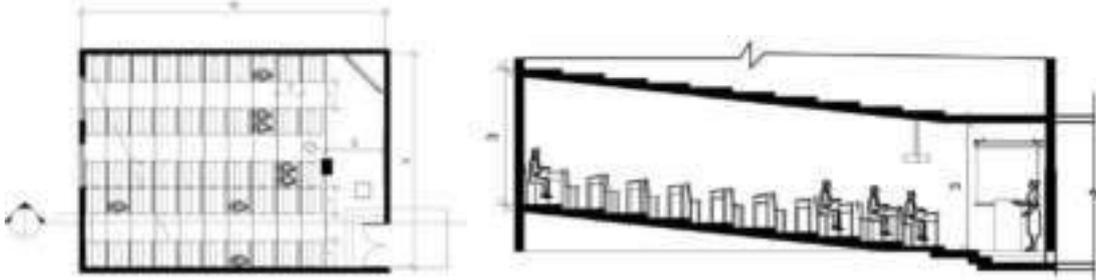


Fig.0-1- Plan and Section of Classroom Case 1 Junior college (Source:- Author)

Case 2: -

An institute which has a good reputation but unfortunately lacks infrastructure. The issue of the infrastructure is becoming a limitation for the teachers for adopting innovative learning methods. Even the students are getting demotivated as they are being subjected into an uncomfortable environment. There is no scope for light and ventilation as the classrooms are in an upper basement. The services haven't been thought for mechanical lighting and ventilation. The teachers find it difficult to manage the class.

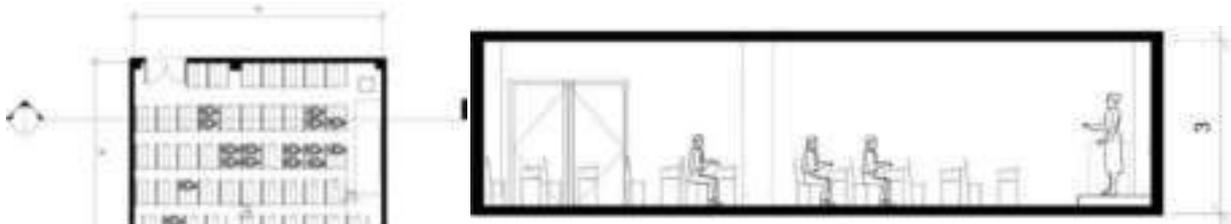


Fig.3 2- Plan and Section of Classroom Case 2 Junior college (Source:- Author)

Case 3: -

The institute dwells in the other part of the city with different culture and lifestyle (Pune camp.).The Classrooms lack good day lighting. The lecturer does not have any raised platform thus; the last benches get cut off from what is going inside the classroom. The students are also not happy with the overall furniture layout and commented that the classroom is not well ventilated. The Classroom is a typical layout which can be made into an interactive zone, but the student teacher ratio 1:80 becomes a limitation.

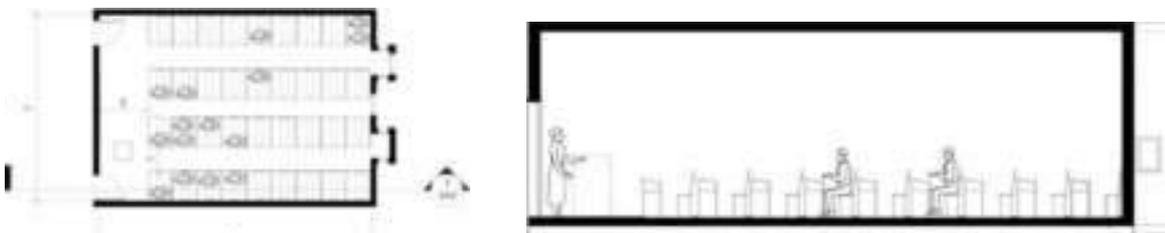


Fig.0-3- Plan and Section of Classroom Case 3 Junior college (Source:- Author)

Case 4:-

A top IB international school which has modern teaching learning styles still the roots are towards the traditions and culture of India. The success of this classroom is the student teacher ratio (1:20 max) which creates a bond with the teacher. This also helps the students in mental strengthening.

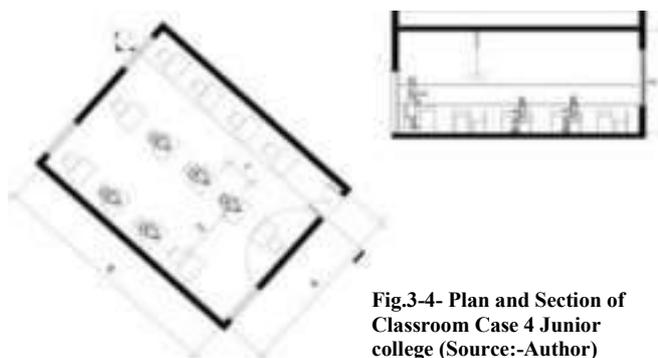


Fig.3-4- Plan and Section of Classroom Case 4 Junior college (Source:-Author)

An Overview

With 356 million people between the age of 10-24 years, India has the world's largest youth population according to UN report 2014. Thus, the colleges are trying to balance these ratios by in the existing infrastructure. An adaptive usage is done in the same space, which compromises on the learning process. The classrooms designed in the past are also trying to incorporate the new technologies which are becoming difficult. Due to the typical layout carried forward from years, the new learning skills have not been explored and the teaching and learning process have become mundane.

Users interpretations and opinion towards the whole scenario

The students and teachers were asked questions based on physical, social and psychological parameters. One of the questions asked was from the visuals below which would they prefer as their classroom and why?



Fig.0-2 Choice A (Source:-Artcobell)



Fig.0-3 Choice B (Source:-Artcobell)



Fig. 0-7 Choice C



Fig.0-8 Choice D (Source:-<http://www.collegemagazine.com/the-good-skip>)

The students and teachers mostly opted for A and C, the reason being the easy access to the teacher or vice versa. Many students also liked the A option as they had a direct contact with the teacher. The D option was least wanted as the users are irritated with typical arrangement. The B option was not liked even though the furniture is interesting because there is a disconnection between the student and the teacher.

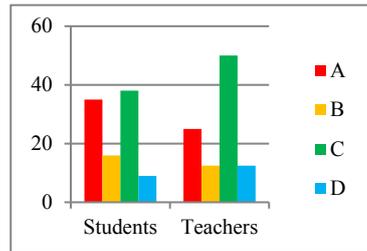


Fig.0-9 Showing the choice what the students and teachers made. (Source: - Author)

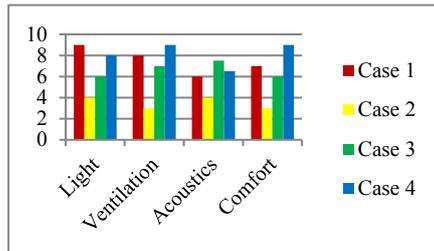


Fig.0-10 Showing the rating done by students for the above categories (Source: - Author)

student teacher ratio plays an important role. The light aspect along with acoustics plays the key role in building an environment for lectures or activities. The urge of teaching –learning is very much present, but the spaces sometimes are not promoting the exchange. The users are not happy with the current typical arrangement. The need for creative classroom is very vital only then can the temples of knowledge flourish!

OUTDOOR CLASSROOMS

The survey revealed that the students and teachers also were in for outdoor learning. The teachers were concerned about the disturbance which as a designer can be taken as a challenge to deal with and get an outdoor learning space. While some teachers went ahead with the suggestions such as the trees can become a support where they can put the board. According to author, it is a collaborative initiative where a designer can allow the space to be designed by the teachers and students which will create more attachment towards the space.

OTHER ASPECTS

Apart from the aspects of light, ventilation, acoustics; other aspects need to be understood are:-

- *Thinking (Teaching Style)*:-To meet 21st century expectations, educators therefore need to depart from the ideas and pedagogies of yesterday and become bold advocates to develop the sorts of learning dispositions needed for our learners and their work futures. This means spending less time explaining through instruction and investing more time in experimental and error-tolerant modes of engagement.
- *Seating layout and design*:-This aspect varies from a person to person. According to Author a layout where each student can concentrate on the board and can easily approach a teacher, has a proper visibility to the board. Even where the teacher can understand each student at a glance is an ideal layout. The furniture also has to be designed to match the ergonomics. The seating should be just adequately comfortable otherwise one will not stay alert during the lectures.
- *Objects and Decoration*: - Busy classrooms with a lot of posters and walls with articles can sometimes be of distraction, a balance between the two is very essential so as to obtain a harmony in the space.

ANALYSIS

- The important criteria while designing a classroom is the student-teacher ratio.
- For an Indian context, the tiered classrooms works very well in terms of visual connection and each student is able to see the board, thus creating no barriers in losing concentration.
- The limitation that comes with this configuration (tiered) is that the classroom cannot be used for informal activities. It also becomes a disciplined model.
- Tiers create a sort of discipline in the classroom.
- In the hall type configuration the raised platform creates a better connection between the student teacher, but a deep classroom doesn't work in this type.
- Apart from the physical aspects, the classroom works best when adequate amount of light, ventilation, and acoustical treatment is provided.

INFERENCE

- No Classroom can be designed and repeated as a prototype the strategy varies as per site and surroundings

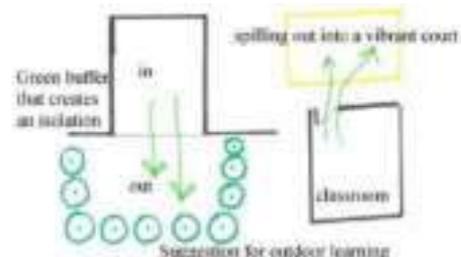


Fig.0-1 Conceptual ideas (Source:- Author)

- Circulations of the informal spaces need to complement so as to come up with an ideal learning space. The learning spaces of junior colleges should be various typologies, the fact that no two subjects are similar justifies that this.
- Learning process related to theory should be dealt differently while, subjects with analytical understanding should be planned for discussions, group activities.
- Technology provided should be maintained and used.
- The Learning space can be reinterpreting in the 12th standard context, a classroom for theory lecture that opens into another space exclusively for practical knowledge promoting innovative teaching policies.

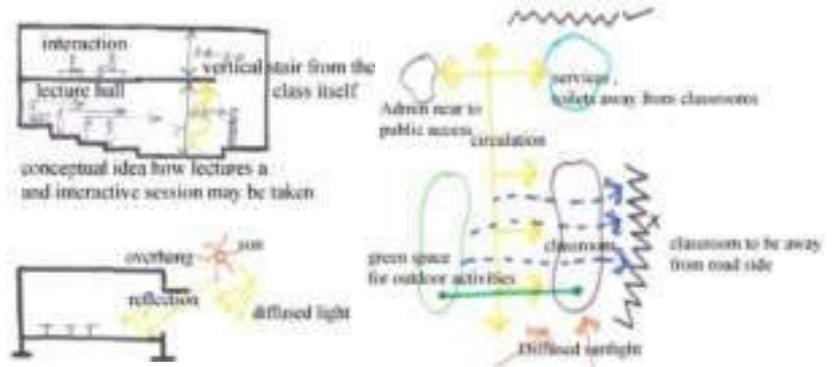


Fig.0-1 Conceptual Diagrams (Source:-Author)

Table 0-1 Do's and Don'ts for a designer (Source:-Author)

Do's	Don'ts
<ul style="list-style-type: none"> • Furniture arrangement such that all the students are able to see the teacher and vice versa. • Comfortable for seating. • Audio –visual learning should be promoted. • The wall needs to be painted with a soothing colour such as light tints of blue, ivory etc. • For interaction and group activities, experiments, for English skits, geography; hall is ideal 	<ul style="list-style-type: none"> • Isolated seating provisions create a disconnection during a lecture. • The seating should not have sharp edges. • The screen should be located such that the chalk board can also be used simultaneously. • Use of warm colours as they create a discomfort visually while learning. • Tiered classrooms for leanings of mathematics and similar theory subjects.

CONCLUSION

The research intended to study classrooms and the architectural response. The important consideration to our context is the intake of students, few institutes don't have enough space for expansion like Case 2 college, while few have controlled the student teacher ratio for better learning Example:-Case 4. It is not always feasible for all institutes to maintain these proportions due to factors like economy, student background, and intake demand. Thus few recommendations have been suggested to enhance these existing spaces. The relationship of discipline, teaching learning mode and space has a strong relationship that needs to be considered by the designer. In case of the 11th and 12th classroom teaching learning process has remained the same in spite of the discipline, yet the designer must consider changing mode of teaching with technology, and each demand that can be foreseen with the change of curriculum. A holistic approach needs to be given to design a learning space. One can understand the impact evolution of education on architecture from the Table 2-1. Most subjects might be taught in same classroom configuration, the interaction with students and teachers revealed that they want no generic modules. The old institutes need to adapt to new requirements for which they can take inspirations from the new institute. The new institutes can also understand the success of old ones for better development for future.

8.1 Some Recommendations

- From different case examples, the area per student should be 1.2-1.5sq.m per student in an Indian Context.
- The area of the classroom can be derived from the limit as explained in the figure 8-1
- It is recommended that one needs to consider the visibility of board from the last bench.
- With the developing technology, the need for designing classrooms is very essential; the time has come where architecture has to catch up. Only then can the learning spaces evolve sensitively and help India building its youth.



Fig. 8-1 Conceptual Diagrams (Source: - Author)

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DEMOCRATICALLY ADAPTIVE DESIGN EDUCATION

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ABSTRACT

The enquiry of this paper is to check the validity, of the Democratic approach our World has started to take through the use of Internet. Internet, a baby of Information and Communication age, is helping make the World a Democratic place, where People's opinions, knowledge and hence Consciousness matters[1]. We are approaching towards Singularity, because of three things- Artificial General Intelligence, Nano Technology, and Robotics. We will be living in Democratically Smart World, where all our forces, Humans, Nature and Technology will have to live symbiotically[2]. If that is the case, why is there a hesitation, fear and confusion of using Technology in the favor of Educators and Learners? The formulation of the stigma, that Design Education cannot transform from Formal to Non-Formal Education typology, is the result of the fact that there is no Methodology/ Framework for the same to happen. The paper will try to formulate a stage, based on which educators and learners will be able to transit to the true potential of this framework, because what is difficult is not the true state to achieve, but the process of transition. This paper, hence, tries to formulate a model for Design Education, which will be Adaptive, Democratic and Freely/ Easily Accessible by Everyone (Inclusive).

KEYWORDS

Democratic Learning; Adaptive Learning; Design education; Non Formal Education; Framework

INTRODUCTION

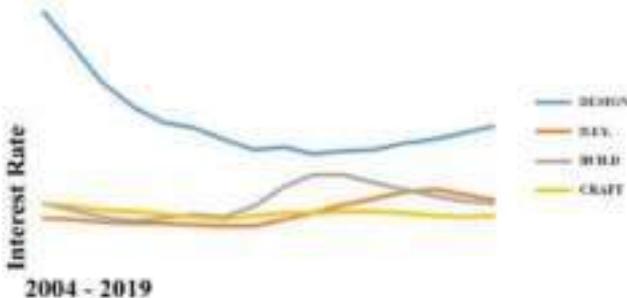
Education has been a challenge for our civilization, since the big bang of humans of any kind. But, what is the most striking factor about it is that we haven't seen a lot of innovations in this particular industry. We still are using Chalk and Blackboards to deliver our knowledge to the learners, are accessing the learners based on the same kind of assessment techniques etc. Especially when we are discussing about the design education, where Innovative and Creative pedagogies/ andragogies, Hands-on Exercises and the Hand-Eye-Brain relationship with the materials to name the few are crucial. Based on this introspection, one can find out that there are three typologies of Education system- Informal, Formal and Non-formal[3]. The first chapter discusses about the typologies, and categorize them based on their characteristics, advantages and disadvantages. It then analyses the trends of the typologies, based on the keywords which are related to each of the typology. The second chapter discusses and compare the Non-formal education and Democratic approach towards Education, which then lead to the definition of Adaptive Learning methodology. The last chapter is about correlating, formulating and predicting the framework, which is Democratic, Adaptive and Inclusive in nature, for Design Education.

CHAPTER 01, EDUCATION TYPOLOGIES

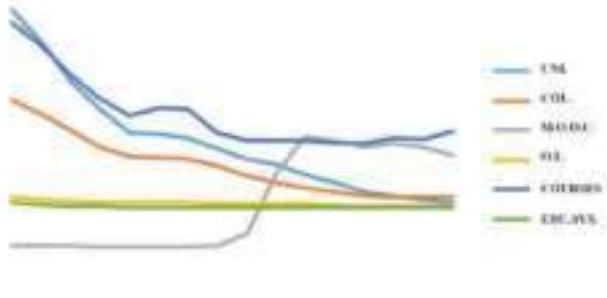
Majorly there are three typologies of Education system- Informal, Formal and Non-Formal. Informal Education system, exists since our inception as species. It is a methodology of transferring knowledge without any medium or setting in place. Informal education system, doesn't have any structure/ system or methodology of transferring knowledge, it happens organically based on the person who is transferring. The next system, the Formal Education system evolved which is based on Structure, Hierarchy and Efficient transfer of knowledge. The formal system got established to produce better employees/ workers post Industrial Revolution, as Efficiency and Mass Production were the two concepts which became common post revolution. Formal system has a Defined Structure, which is used as Templates globally, with tweaks here and there, making it really quick to adapt, easy to use and hence efficient in producing Employees. Informal system, wasn't organized enough to be Efficient, but Formal system is way too organized, having less room for Creativity and Innovation. Also, one of the biggest comparison factor between the systems is, Informal systems are almost Free or really Cheap, depending on what sort of Informal system we are talking about (apprenticeship is a form of Informal system, which can be costly sometimes). Formal systems are Expensive, as it involves having a Brick and Mortar place in time, it needs to have an organizational hierarchy, which involves Management at all the levels. The Formal system is the system which is still the commonly used, preferred and go to systems, throughout the Globe, especially for Design education. The reason why it has been globally adapted for Design Education, lies in the Pedagogy/ Andragogy of design education. The peda/ andragogy involves development of skills such as Drawing, Sketching Drafting, Crafting, Modelling etc because Design Education comprises Art and Science together. That means, it involves not just the process of Ideation but also Construction.

Next comes the Non-Formal Education system. With the advancements in Technology and awareness, our Education systems are also trying to adapt. We live in information and communication age and we have invented a thing, known as Internet. Internet, an inter connected networks, empowers us, the humans, to be connected, share thoughts, ideas, opinions etc from any corner of the World or is as defined by Ian Sample, theguardian.com, "...The internet is the wider network that allows computer networks around the world run by companies, governments, universities and other organisations to talk to one another..."[4]. The invention of internet lead to Social Media, where people express their views, and socialize. Amidst this rise of social medias, a concept known as MOOC (Massive Open Online Courses) started erupting. This was a Big bang for the Non-Formal Education system. A system, which is an amalgamation of Informal and Formal Education systems. Here, the transfer of knowledge can happen peer to peer, instructor to learner, teacher to student etc. In this system, we have the advantages of Informal as well as Formal system. The fact that learner can learn anytime, from anyone, being anywhere and at almost no price, is phenomenal. The biggest disadvantage of Non-formal system is the fact that it lacks Physicality, or it lacks a Space in Time where learners can go to and be in touch of. It all happens digitally. This has been the biggest challenge, due to which Design Education have been reluctant to move towards a Non-formal setting. Today, if someone wants to learn how to tie a shoe lace, they go to Youtube and learn it. The topics which are taught through this platform alone, are endless. The range of topics, are from understanding simple day to day things, to complex ideas and sciences such as quantum physics or biology. Youtube is not alone in helping people learn, but Youtube is unique as it has no gatekeeper and hence, anybody can teach anything, without any resources involved. But, that is also one of the reasons that just like Wikipedia one cannot know the reliability of the knowledge being transferred, as the source is not always legitimate (check TABLE-I at the end of the chapter for advantages and disadvantages of each typology).

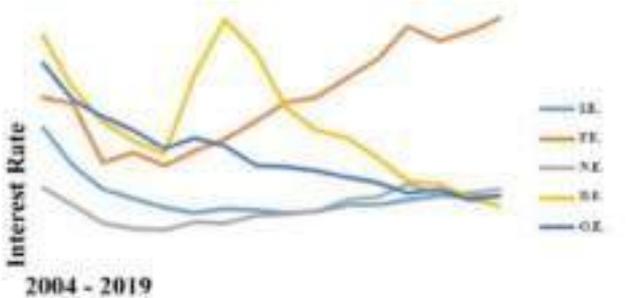
GRAPH- I



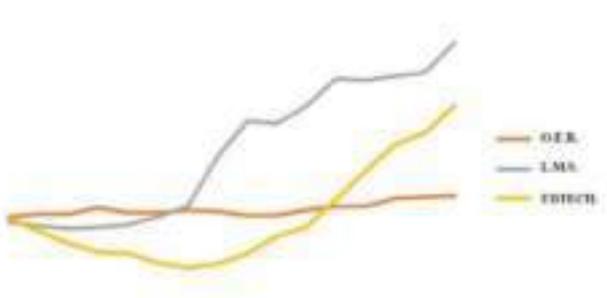
GRAPH- II



GRAPH- III



GRAPH- IV



GRAPH- V



GRAPH- VI



Based on these definitions, advantages and disadvantages let us try to analyze the trends, using the tool- Google Trends. This analysis is an Interest Rate/ Year Analysis, to check the interest of people over time, based on the searches they do on Google and Youtube. The Graphs I-IV uses the filters- Worldwide; 2004-2019; All categories; Web Search and Graphs V-VI uses the filters- Worldwide; 2008-2019 (Youtube got established in 2008); All Categories; Youtube Search. The terms used are- I.E.- Informal Education; F.E.- Formal Education; N.E.- Non-formal Education; UNI.- University; COL.- College; EDU.- Education; D.E.- Distance Education; O.E.- Online Education; M.O.O.C.- Massive Open Online Courses; D.I.Y.- Do it Yourself; F.S.- Freemium Software; O.E.R.- Open Educational Resources; L.M.S.- Learning Management System; EDTECH.- Educational Technology.

From the GRAPH- I, we can observe that over time of 11 years, people’s interest have increased for Design, D.I.Y., Build and Craft. But what is more important, is to see that people are searching for these terms 5x more on Youtube, where they can learn through videos, i.e. a Non-formal Education methodology. This clearly indicate that people want to learn more about Designing and Building. But, learn about it without going to University/ College (GRAPH- II). The increase in the interest towards N.E. has increased over time, as seen by the increased use of Youtube, to search for M.O.O.C., Online Learning and Courses (GRAPH- II). Another observation which can be made, from GRAPH-III, is that people have become more interested to learn about educational typologies, especially F.E., N.E and O.E.. Along with that, they are becoming less interested in D.E. which was a compromise between F.E. and N.E.. D.E. is not being sought after because of several factors such as the pedagogy of D.E. consists of taking the F.E. online, without changing the actual Peda/ Andragogy. The overall conclusion from all the observations, is the certainty that people are more interested towards learning about something through N.E., O.E. and M.O.O.C., especially in design education, than I.E. and F.E. In the next chapter, we’ll look into Adaptive learning and how it can become Democratic in nature.

TABLE-I

Education System Typology	Advantages	Disadvantages
Informal System	Ease of Accessibility; Feasible; Inclusive, Physical Connection;	Not Efficient; Non structured
Formal System	Efficient; Highly Structured; Physical Connection;	Exclusive; Expensive; Time bound;
Non-Formal System	Ease of Accessibility; Feasible; Flexible Structure; Efficient; Inclusive;	No Physical connection

CHAPTER 02, DEMOCRATICALLY ADAPTIVE

Adaptive learning, “..is the delivery of custom learning experiences that address the unique needs of an individual through just-in-time feedback, pathways, and resources (rather than providing a one-size-fits-all learning experience)”[5]. Educators used to be adaptive, that means when there were lesser number of students per batch, one was able to cater to the personal needs, emotions, learning curves, grasping power etc of a student, especially in an I.E. system. As the time progressed, the demand for the Employees increased, hence the Educator-

Learner ratio increased from 1:5 to 1:20. Along with that increase in demand, the transition from Informal to Formal had a huge impact on the Adaptive nature of Instructors, because of the highly organised, structured and cookie cutter designed educational systems. The flexibility shed out in the transition from Informal to Formal setting. That is why, Adaptive learning is now transitioning towards the Non-formal system, where we've the potential and scope of using the A.I. (artificial intelligence), to help cater each student's way of Learning. This can also be seen clearly, that after the hype cycle of Adaptive learning, now it is constantly growing in popularity since the year 2013. This framework of understanding and catering individually to each student, can only be seen possible in the Non-formal system. There are several sub models and categories under adaptive learning, but the core definition and meaning remains the same.

The next probing question which arises is, is this a Democratic approach? But, before going into that let us try and understand why do we require a Democratic approach towards Education. Democratic means, for the people, by the people. When dissected down to the core, informal and formal systems aren't that democratic due to its limitations discussed earlier. Non-formal setting is the best shot in front of us of taking a democratic approach towards education.

Today, using social medias we are enjoying the freedom of selecting what and when we want to learn/ educate, and from whom as well. Regarding the where, place just doesn't matter as the knowledge bank can be accessed anywhere, from the devices we've around us, such as phones, tablets, laptops, desktops, T.V.s, refrigerators etc. That means, the Non-formal setting, is the closest of being democratic in nature, as Internet gives us the power of accessing knowledge at the speed of the blink of an eye, whenever we require, wherever we are. The biggest challenge which is being discussed globally, is the how or the methodology if we want to have a democratic approach even in that. Now, look at the beauty of our advancements, because in Non-formal setting being able to become truly Democratic, the last piece of the puzzle which was missing, is the concept which we discussed in the beginning of this chapter- Adaptive Learning. By integrating Adaptive learning framework, along with the Democratic Non-formal setting, we can achieve a true Democratic Education system, where learners/ educators have a say in where, whom, what, when and most importantly how of delivering education and knowledge. How can we do it, and is it really possible, especially in Design education? We'll find answers to in the next chapter.

CHAPTER 03, THE FRAMEWORK

In the GRAPH- IV, L.M.S. (Learning Management Systems), O.E.R. (Open Educational Resources) and EdTech. (Educational Technology) all show a rise in popularity. The fact that there is an uproar of demand for L.M.S. and O.E.R., shows us that instructors are acknowledging the resources available on the internet. Let us try to understand these three terminologies and put them into perspective. L.M.S. are the systems where an instructor can manage the learning done by the learners[6]. It has database of learner's age, names, grades, progress etc which in turns helps in finding a pattern for a learner's progress in present and for the future. O.E.R., are the resources which are used for educational purposes and are open to use, without any gatekeeper[7]. This is unbelievable because as educators one needs resources which can be used to deliver the meaning, and if they are beyond the payment gates, delivering Free Quality Education will only remain a dream of our civilization. EdTech are constantly gaining popularity, and are softwares or tech-solutions which makes N.E. system Democratically Adaptive. This understanding leads us to formulate certain points which will help us develop a framework. Education of Tomorrow needs to be Accessible, Democratic; and Adaptive.

Now let us try and understand what are the reasons, the industry is not being able to transition from Formal setting into Non-formal Setting.

Here are few of the major reasons,

1. No Physical Connection between- Educators-Learners (E2L); Learners-Learners (L2L); Educators-Educators (E2E)
2. The educators and learners lack an Intermediate Platform for Transiting (GAP)
3. The Peda/ Andragogy to actually enable Educators transfer knowledge to Learners

The major drawback, even after being able to provide the physical stimulus is the fact that neither the Educators nor the Learners are yet fully prepared to transit, from Formal to Non-formal setting. We will require 10 years from today, if we really jump on the train of the future, today, to sustain and be able to Educate in the true sense. That means, if we start building the future education system, from today, i.e. in the year 2020 CE or I2020, then only can our future generations exist within non-formal setting in the year 2030 CE, which is just the year defined by United Nation's Sustainable Development Goals to achieve all the goals mentioned. One of the goal is to have Quality Education, for all[8]. To reach the true state for which we're aiming for, we need to at least start establishing the Transitioning State, through which the existing generations can also board the future train and reach the true station, along with the future trains' passengers. The transition will happen in Phases.

In Phase 1, we require to use Resources which are easily available and which are already being used. This will help people get accustomed to the platforms without wasting time, and without any friction. The users know the interface and experience of these resources, which is an advantage. We shall look into services, social media platforms, applications which will help us provide that platform, in terms of technology. For E2E and L2L interaction, we will use widely available, free applications such as Whatsapp/ WeChat/ Slack or other similar Freemium applications, where one can easily share texts, images, videos, documents etc for brainstorming and question-answers. This platforms are linear in nature and hence allow the parties to be able to do, what they've been doing, without any changes. E2L interaction where the actual learning is going to happen, can be done through the usage of the platforms, such as Youtube/ Skillshare/ Udemy etc along with platforms such as Skype/ Meet/ Zoom/ Cisco etc. These platforms enables sharing of knowledge, in the Video formats i.e. interactive in nature, which will help both the parties to deliver and gain knowledge easier, than the static information sharing platforms. This phase, will have fragmented usage of services available to everyone who has the access to internet, along with the help of an external Instructional designer/ Learning designer and Graphic Designer, and will include only 1 course, run in an Institute as a trial run. The amount of resources hence dedicated behind this phase is not really significant, and will not add extra burden on either of the parties. Instructional designer's job is to design the Instructions, specific for the platforms, help the Subject Matter Expertise (S.M.E.) visualize the knowledge they have, and act as a bridge between the S.M.E. and the graphic designer which will eventually make the resources, to be available on the platforms. Learning designer's job is to help curate the content, but not based on instructions rather learning theories, such as bloom's taxonomy, behaviorism etc[9]. This phase should be of 6 months, where 1 course every 3 months should be tested, i.e. per educator 2 courses in the duration of 6 months will be tested, and hence evaluated based on formative and summative assessment techniques and compared with the results of the same/ similar courses which was provided before through the formal settings. This phase is about getting things started and hence will act as M.V.P. (minimal viable product).

The Phase 2 will involve integrating E2L into L.M.S., where both the parties now will start getting used to the interface and the experience. E2E and L2L, doesn't need to change in this phase. Here, the same courses, already developed for the phase 1, will be re-used after

iterating, for different bunch of students to test and evaluate, giving us the possibility of getting the feedback and re-iterate for the next phase. This phase will run for the next 6 months.

In Phase 3, the same system as in Phase 2 will be developed further, for a broader audience, and will now incorporate the two segments left, which were E2E and L2L. This phase will include 2 more courses, per educator i.e. 4 courses per educator will be added on this platform, hence increasing the content present on the platform, to technically see its viability and its productivity. The major change in this phase is the change in code, and hence because L.M.S. is already in place, this phase will include Adaptive learning methodology, where students will have option of selecting the courses they want, when they want and from whom they want. This phase will run for the next 6 months.

Phase 4 is the last phase, where everything is in place, every segment is in the place i.e., E2E, L2L, and E2L, and all the subjects present in the curriculum will be added onto the platform and will be tested. This phase will run for 12 months, and hence the results will be gathered, compiled and compared of all the phases, and will be evaluated in comparison with the Formal setting's results. This phase will be more Democratic than the first phase, as now the available options, for both the parties are more in quantum. It will be adaptive, where each student's progress, attention, peak periods, strengths, weaknesses etc will also be available for analysis. And discussing about the Freemium, because this is happening in an existing Formal setting, for which they are anyways taking money from the learners, this system will not be charging anything to the learners, yet still being able to give all the premium features, making it a Freemium service. Overall, including all the phases, the transition will last for two and a half years in total and the next two and half year to reach the true state, leaving us with only 5 years, before we reach our target mark of ten years.

The main aim of this paper is to provide a Democratically Adaptive framework for Design education. The framework mentioned above is generic in nature and hence requires changes, to make it work for the Design education. Before going into that, understanding the difference between Design and other education system is crucial. Design education makes a student think three dimensionally, i.e. neither just Vertically nor just Laterally. Design education makes a student think in both the dimensions, simultaneously. This is the first difference in comparison with other education systems. Another major difference is the fact that Design involves the steps, such as Prototyping, Modelling, Execution and Iterations. These steps acts as the biggest challenge or pulls the formal setting from transiting towards non-formal setting[10]. That is the reason, for the Transition stage, until we don't have the Mixed reality totally developed, we require a Hybrid framework for Design education. This framework will be hybrid, as it'll use both the systems' best parts and merge it together. Design education's best part is the Physicality and the hands-on exercises involved. In order to deliver that in the transition stage, we would still require a Physical space in time. The theories will transit in totality to the Non-formal settings. The hands-on aspects, will have two things to take into considerations. First, learners will be able to book a Live Consultation with the educator, in the given time frame mentioned by the educator. Second, learners can visit the Studios and Workshops (place where they do hands-on exercises) at their own convenience, and will act as Incubators. This two additional settings will help both the parties to transit and where the system will be able to utilize the existing Built spaces as well. These steps would be futile if Educators will not be changing their thinking and peda/ andragogy. Instead of letting learners strictly access Physical world objects and environments, the methodology can involve certain steps to impart design education as efficiently as possible. Here are few suggestions in order to so-

1. Educators, while developing the framework needs to keep in mind softwares such as Google Sketchup Web version, Inkscape, Blender etc which are free for everyone to use. The softwares mentioned are few examples, using which Learners will be able to Interact, Prototype, Model and Iterate 3D Objects, quickly and easily. This will allow Learners to imagine, mold, craft and play with 3D planes, forms and places without having Hands-on in the Physical space.
2. Instructional/ Learning designers can use softwares such as Unity Game Engine, Unreal Game Engine which are yet again free for everyone to use, to develop a 3D Spatial Games, which can be played to learn about important spatial understanding.
3. Instructional/ Learning designers can use the technology of Augmented Reality, in combination of both the steps mentioned above, so that Learners can visualize the scale and proportions of the Digital Space in accordance with the Physical Space in Time.

CONCLUSION

We'll reach the true state, when all the existing institutes will integrate on the same platform. This will unlock a lot of aspects, such as

1. Educators can become an affiliated personnel not just at one place, but at all the places combined. This will allow, a learner to approach an educator from any place or institute, which wasn't possible before.
2. Educators and learners both can use the studio/ workshop places, without being limited by the place they are at, or institute they are enrolled in, as all the institutes are working together.
3. Educators can design courses, solely based on their expertise and not forcefully through scheduling.
4. Learners can select from the wide range of subjects, based on the recommendations given to them through the adaptive learning framework, leading them to pursue the degree in the manner possible for them.
5. The system will be a Freemium for the learners, as the overall cost of all the Resources- humans, built, information etc will drop down hugely, letting the institutes charge the educators for the exact amount of work they've done, not more, not less. Learners will be required to pay a small amount, which will be trivial in comparison with what they've been giving, for the use of the physical resources still in place.

The learner having the accessibility to the internet, can enroll to the Design education, without having a huge financial burden, on themselves or on their parents/ guardians. Overall, the finance will go down by 10 times it used to cost, for all the parties. It can be even lesser, if we consider that Governments, NGOs and NPOs perform a major role. The economics of this framework can be easily worked out, and can become a topic for research altogether. Considering the first limitation, of no physical interaction between E2L, E2E and L2L is a problem which can be solved using the Technology which we already have and is in constant upgradation. Mixed Reality (MR), is the technology where we are able to overlay the Virtual and Augmented Reality onto our Physical Reality. MR is not just about the Graphics or our Vision, we today have input devices integrating into the MR system, which helps us synchronize all our senses with MR- head gear transiting towards just a lens, for vision; wireless, miniscule earphones, for hearing; suit, for tactility/ motion. These are the things, which are there either available for commercial uses or in research and development. Only senses left are our Olfactory senses, i.e. Smell and Taste, which will also soon be taken care of and we'll have cartridges of smell and taste inducing chemicals, delivered to your nose and tongue, giving you an ultimate Physical Reality experience in Mixed Reality.

These are the highlights, of the fact that this framework can make the Design Education, Democratic, Adaptive and Inclusive for the majority of the population of the Globe and not just any particular country, and hence is a potential candidate of a successful framework for the Future Design Education topography.

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*The data for all the graphs are sources from Google Trends and made in MS Excel by the Author. The graphs are updated on 6th June, 2020 but doesn't consider the Year- 2020, due to ongoing pandemic COVID-19.

RETHINKING THE LINEAR PROCESS OF DESIGN

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ABSTRACT

The design process which is introduced to students at academic level and also in practice, is in most cases linear, and is dominated by the issues of problem solving for the function. The other aspects of design are it the structures, the form, materials, geometry enter the process at a later stage and remain subordinate to the function of the space. This linear method can be restrictive. Alternative Design Processes and methods of working can lead to better results. The paper discusses three projects undertaken as studio work at Aayojan School of Architecture and Design, Pune. These projects were aimed at integrating aspects such as form, structure and geometry at an early stage of the process of designing a space. The studio also aimed at integrating aspects studied as compartments under different subjects such as Basic Design, Building Technology and Architectural Design. The learning from these studios can help faculty and practicing architects to realign their respective design processes to achieve better outputs. Conclusions are drawn on basis of researchers’ perspective by comparing the output of the project based on criteria like methodology adopted, inputs by the faculty, exposure to design variations, etc. It is concluded from the study that the issues related to form and its effect on function or structural understanding can be focused through numerous study models leading to a final output.

KEYWORDS Design process, experiments, architectural space, structures, building forms.

INTRODUCTION

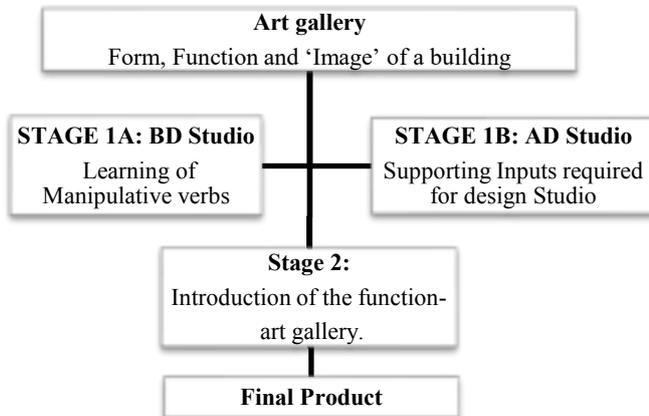
Towards the turn of the Twentieth Century, many set notions in the field of art and architecture were being challenged. The use of ornamentation, which was challenged by Louis Sullivan in his seminal work, Ornamentation in Architecture, was being put to practice by the likes of Adolf Loos, Walter Gropius et. al. Walter Gropius went as far as to declare ornament as a crime. With this change in attitude to architecture, function took precedence over all other aspects of design. Form was to follow Function; and with form all other aspects such as the materials, the structural system, geometry became secondary issues to be dealt with. This dominance of function, though was challenged by the later critics, continues to be unabated. Architectural Design till date largely follows a linear process, which begins with analyzing and understanding the function, allocating spaces of appropriate sizes for enabling the function to be carried out smoothly, applying the layers of climate, building services, structures, bye laws and others to the plan, giving a third dimension to the two dimensional design. It is at this stage when the third dimension enters the process that materials enter the scene.

Alternatives to this linear process have been experimented with and advocated by critics, academicians and practicing architects as well. Experimenting with this design process is easier at the academic level, as the final execution of the work is not a necessity. Such experiments also work better with fresh, non-rigid minds, yet untrained at following set norms. These experiments also help develop a creative outlook in the minds of students, which has the potential to affect the working methods of the coming generations of architects.

The paper will discuss the projects handled by students of ASAD, Pune; with respect to the objective and methodology adopted by the studio team and the output. The paper will also talk about limitations and shortfalls of the process adopted in four separate studios. Projects are the works of second year students in the academic year 2015-16 and 2016-17. The intent of all studios was to explore the processes of form derivation and space formation, in conjunction with one or more of the following aspects- function, geometry, material or structures.

Project 1: The design studio aimed at designing an Art Gallery with the objective of exploration various possibilities in deriving an architectural form in artistic manner. The studio objectives framed by the studio team (1) also included introduction to design considerations for a small scale public building. Establish a link between, Form, Function and ‘Image’ of a building. The faculty also intended to emphasize the importance of Light in the built environment. The studio methodology emphasized on experimenting with various possibilities to create a built mass starting with a strong form and its manipulation to suit a function. Following are some phrases in the Design Brief explaining the limitations and attitude with which students were expected to start the design process:

- The art gallery using derivatives of the ‘chosen form’
- Identity of the original form must not be lost.
- Form explorations through study models
- Main thrust of the project is on effective use of the Chosen form
- Evoke a strong image in the viewer’s mind



Methodology: The studio started with introduction to a basic design exercise encouraging the students to explore different methods while deriving different forms from a basic three-dimensional form. The students were asked to apply different verbs (like cut, rotate, twist, etc.) on a platonic solid in any sequence. A comparative analysis of the output by students was done to understand the various ways in which a form can carry a certain meaning and make a certain statement. Simultaneously students were exposed to other aspects of architectural design, to understand how an art gallery works, what are different art works that can be considered as exhibits in the art gallery. Study of various artists, their style and philosophies was also included. As an input to understanding the language of form in architecture, faculty presented examples designed by master architects. The examples included structures like San Francisco Museum of Modern Art by Mario Botta, Guggenheim museum, Louvre Museum, etc. The presentation focused on Art Galleries being an

art in itself and a visual treat for the visitors. Later the students were introduced to the function which the building will cater to. After this the students were expected to make a conscious attempt during the form exploration, keeping the function in mind. While making these attempts the form was further developed with factors like purpose of the built mass, lighting quality inside the building as well as the visual impact created on the viewer.

Student's work (Sample 1):



STAGE 1A: BD Studio Exploration of form In Basic Design Studio.

Aayush Tayal
 Second year 'Batch B'
 ASAD, Pune
 Academic year 2015-16
 Faculty- Ar. Manjusha Ukidve
 Ar. Priyanka Jadhav- Chavan



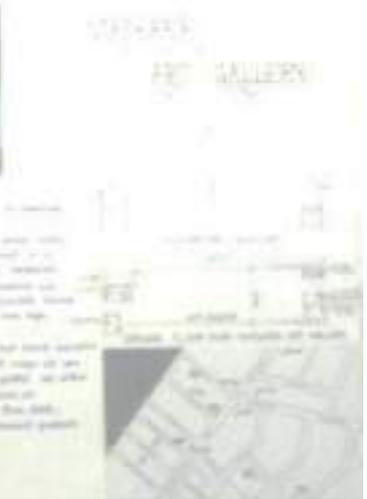
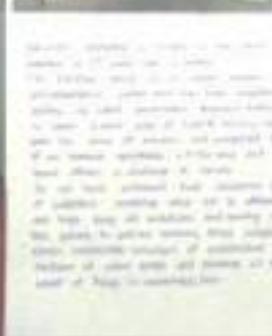
STAGE 1B: AD Studio- Understanding Artists: Styles & Philosophies and Understanding an Art Gallery

Pratiksha Upare
 Second year 'Batch B'
 ASAD, Pune
 Academic year 2015-16
 Faculty- Ar. Anand Ukidve, Ar. Shilpa Pandey
 Ar. Priyanka Jadhav- Chavan

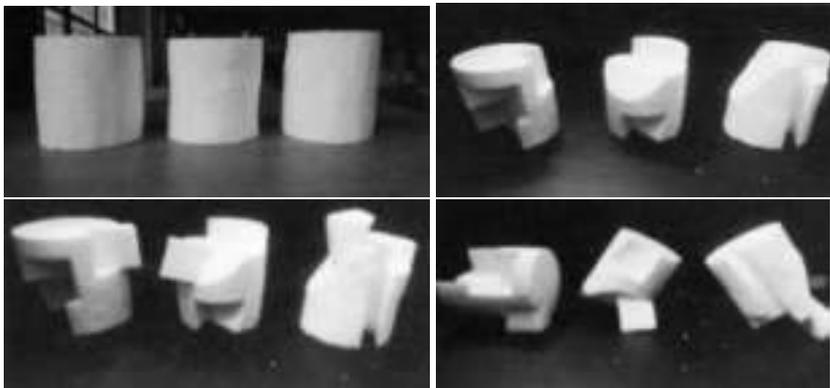
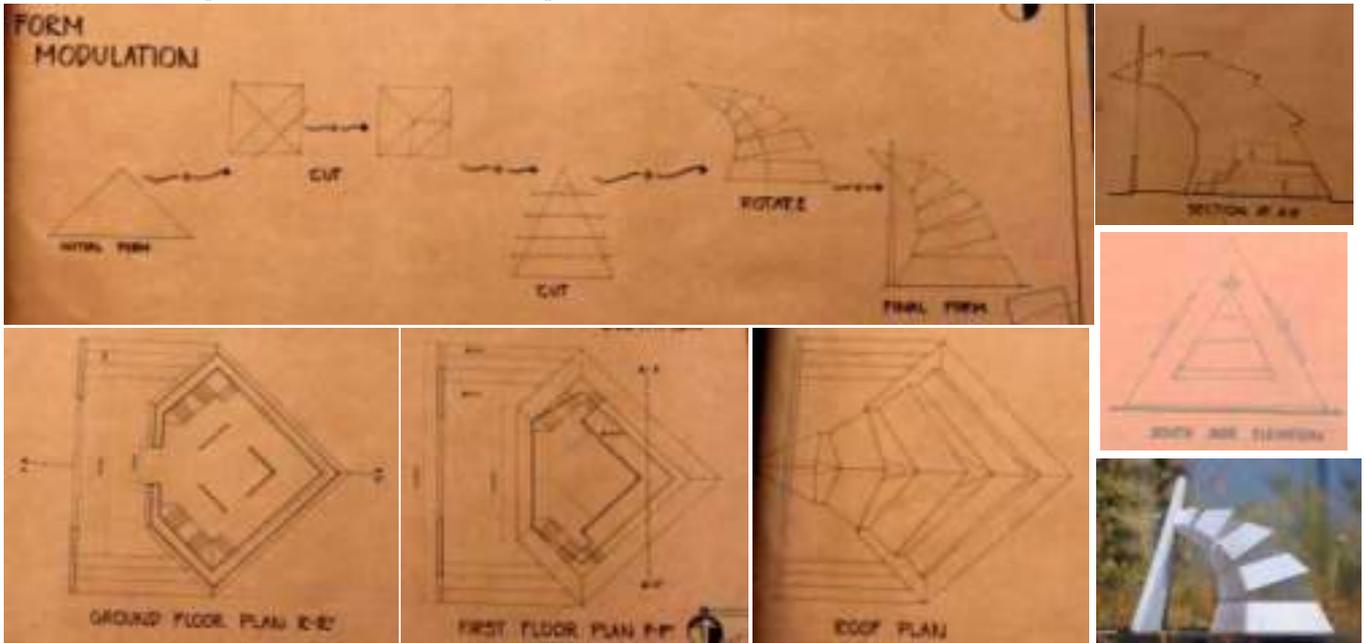


Stage 2: Exploration of form in Design after understanding the brief

Shreyasa Patil
 Second year 'Batch B' (Academic year 2015-16)
 ASAD, Pune
 Faculty- Ar. Anand Ukidve, Ar. Shilpa Pandey, Ar. Priyanka Jadhav- Chavan



Student's work (Sample 2): **STAGE 1A: BD Studio** Exploration of form In Basic Design Studio.



Shardul Chaskar
 Second year 'Batch B'
 ASAD, Pune
 Academic year 2015-16
 Faculty- Ar. Manjusha Ukidve
 Ar. Priyanka Jadhav- Chavan

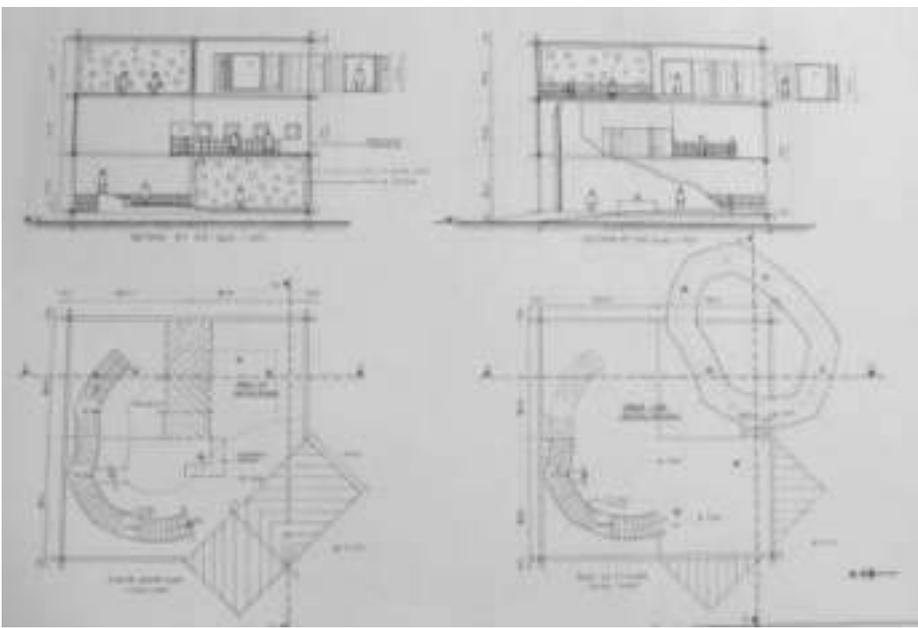


Stage 2 : Exploration of form in Design after understanding the brief

Varun Gupta
 Second year 'Batch B' (Academic year 2015-16)
 ASAD, Pune
 Faculty- Ar. Anand Ukidve, Ar. Shilpa Pandey, Ar. Priyanka Jadhav- Chavan



Final Product:



Observations and learning: Overall the studio was fruitful considering the experimentation done in process of exploring methods of manipulating a given geometric form to create interesting 3D composition. Due to introduction of the exercises stepwise, students were able to focus and grasp the learning from expected output of every step. The understanding of the process was reflected in the final output. Students tried to comprehend the relation between outer geometric composition of a form and its effect on internal usable spaces. They could successfully explore the techniques of designing spaces in 3D form and then transferring the same into 2D Drawings. Understanding of the stability of the structure in the build form was well established. Being a form based exercise, the final output could not do complete justice to the 'function' assigned to the

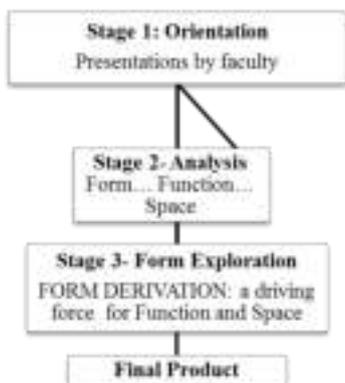
form. Many design aspects such as human scale, usable relation of indoor-outdoor spaces etc. took a back seat and were applied as an afterthought which did not prove to be successful.

Project 2: Nature Hub

The studio aimed at understanding various methods of form derivation with the aid of geometry. Form of any built mass has strong geometry hidden within it, the understanding of the play of geometry is very vital before making any attempt of designing a strong form. Thus, students were exposed to geometry as a guiding factor in form exploration. The studio methodology was designed by the studio team (2) with the intention of acquaint the students with various methods of dealing with geometry in designing a built mass; they could deal with geometry as from part to whole or whole to part. The studio also aimed at establishing a link amongst, Forms, Function and Space quality in a building.

Important phrases in the Syllabus:

- Various sources for inspiration for architectural design such as nature, history, geometry, etc.
- To comprehend Design as iterative process at various scales/ levels.



Methodology: The studio starts with a presentation by the faculty as an eye opener to understand geometry hidden in well-known structures from history to present day. Presentation deals with various processes of form derivations. It also explains how geometry can be a process to create a good design with understanding of its implications on form structures and space quality.

The presentation by faculty was dealing with numerous aspects of geometry. Omnipresence of Geometry was described with overview of Geometry in architecture throughout history- ranging from axes and fractals in Indian temples, golden ratio in Greek architecture. Structures guiding geometry in European architecture after the Romans were discussed with the modular man and application by Le Corbusier, to parametricism.

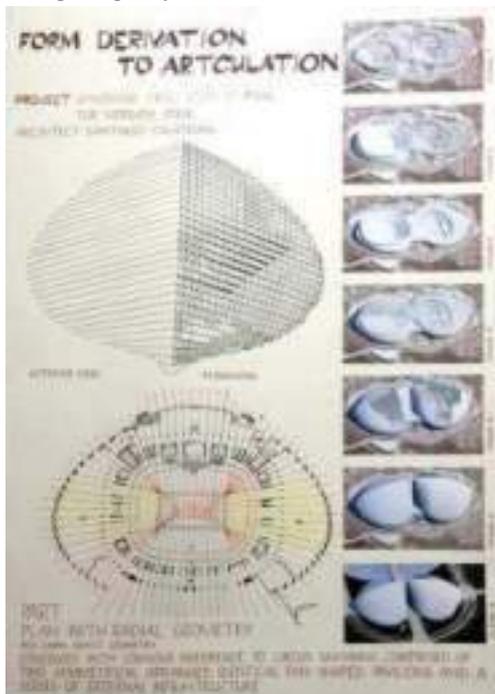
Various processes of form derivation with the role of function and geometry were highlighted with following examples:

Additive Forms- eg: Pantheon

Subtractive Forms-eg: Land Formation, Zaha Hadid

Assembly of Repetitive units-eg: Habitat 67, Moshe Safdie, Gandhi Ashram, Charles Correa

With this exposure to various aspects of geometry, it was expected from students to analyse and study a structure, which would add to the understanding of the geometry used for its form derivation. The exercise also facilitated students to relate form with the associated function and space quality achieved.



After the experiential learning, the students were introduced to the design brief. Working on alternatives that are guided by a pure geometric form helped students to explore the creativity within them. The form chosen would serve the purpose- though a simple one. Later working on alternative with knowledge of design requirements, a comparative analysis helped them to find a better solution and get the desired result.

Student's work (Sample 1):

Stage 2: Geometry- Analysis

Anand kunkulol

Second year 'Batch A' (Academic year 2016-17)

ASAD, Pune

Faculty- Ar. Sneha Deshpande, Ar. Amol Holey, Ar. Priyanka Jadhav- Chavan

Stage 3- Form Exploration

FORM DERIVATION: a driving force for Function and Space

Anand Kunkulol

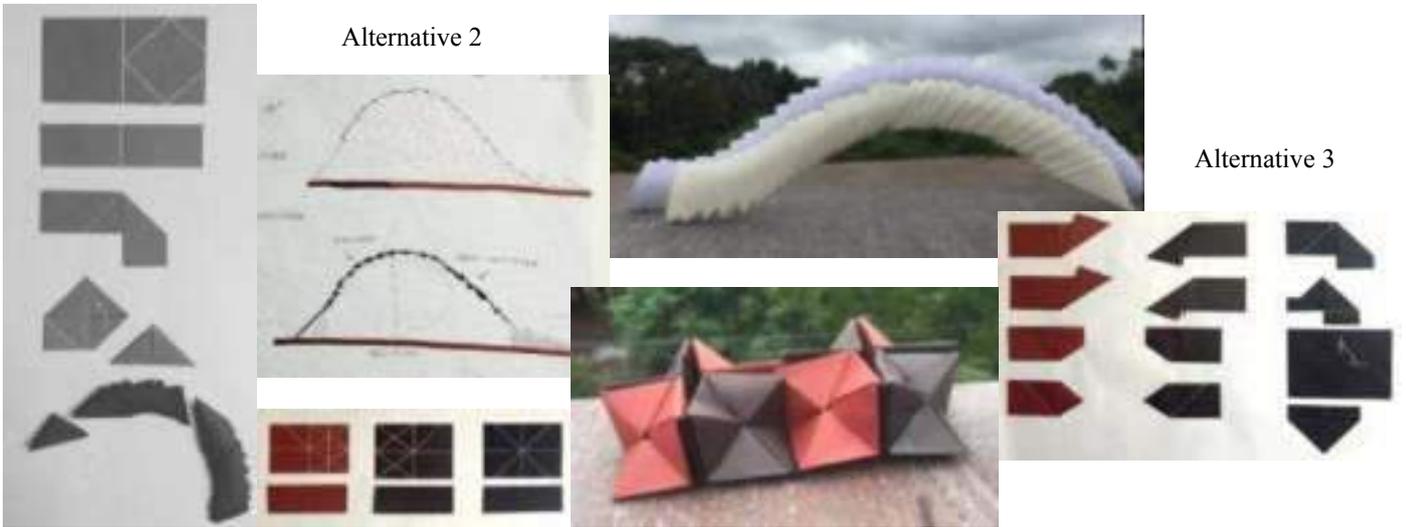
Second year 'Batch A' (Academic year 2016-17)

ASAD, Pune

Faculty- Ar. Sneha Deshpande, Ar. Amol Holey, Ar. Priyanka Jadhav- Chavan

Alternative 1



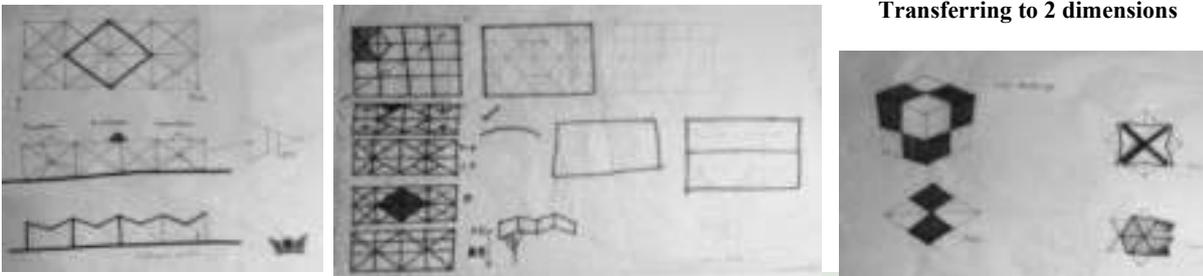


Alternative 2

Alternative 3



Transferring to 2 dimensions



Alternative 1

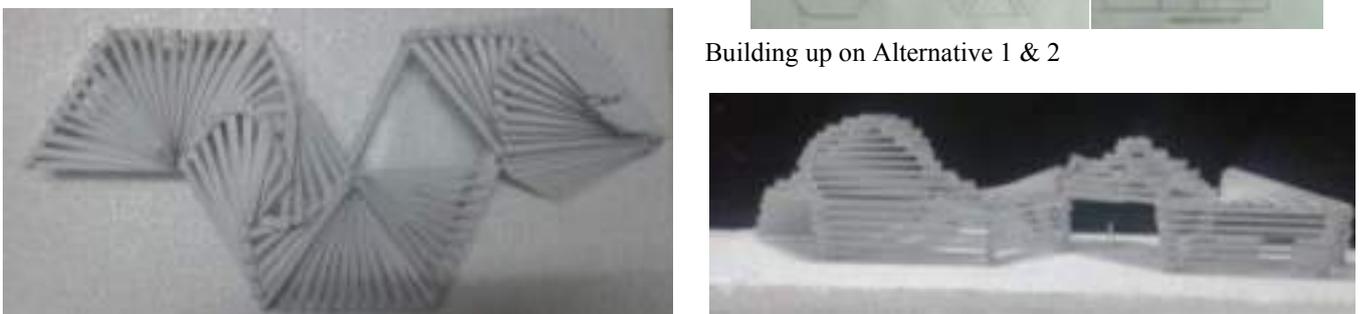
Student's work (Sample 2):
 Ankita Yeola
 Second year 'Batch A' (Academic year 2016-17)
 ASAD, Pune
 Faculty- Ar. Sneha Deshpande, Ar. Amol Holey, Ar. Priyanka Jadhav-Chavan

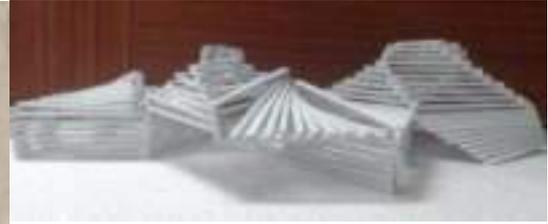
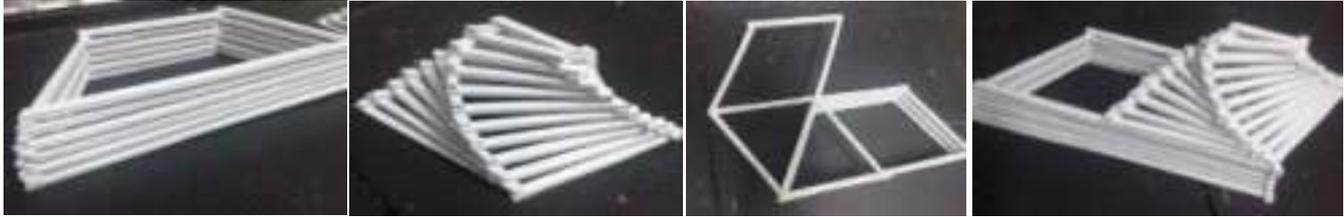


Alternative 2

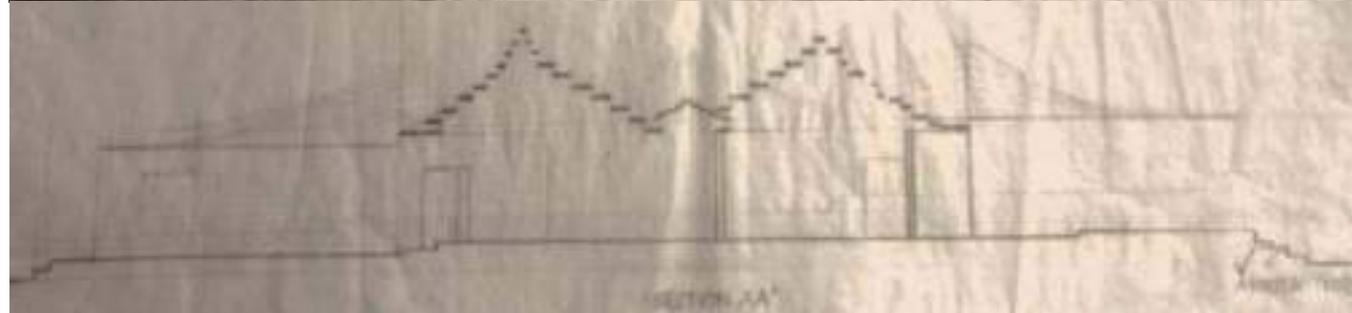


Building up on Alternative 1 & 2





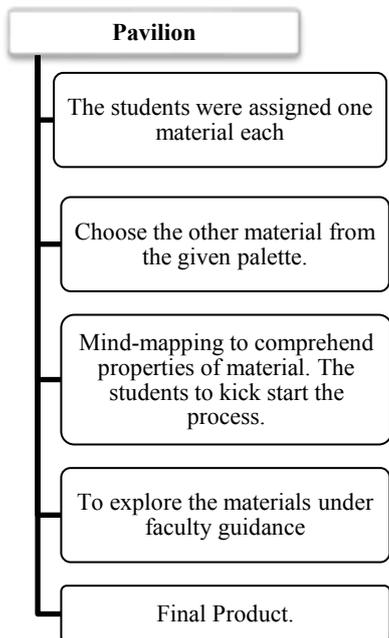
Transferring to 2 dimensions:



Observations and learning: The students were oriented towards the topic through presentations by the faculty, at the onset of the process helped in triggering the thinking process. Study of geometry in built structures aided students to explore several approaches to form derivation. Introduction of the function at an earlier stage had positive effects on space quality achieved. Hands on experiments with models and materials, either intuitive or rational, as demanded by the stage in the process were encouraged. Encouragement to work on alternatives guided students to explore the thinking process and get through creative options. Exploring and judging the options assisted them to select the best approaches, based on their selected criteria. Group discussions also helped in drawing comparisons across varied approaches. Role of geometry in the design process (Nature Hub) could be documented in a better way. Self-analysis of design by students would have helped them in better exploration in future.

Project 3: The main objective of the studio was to understand the material and design for the same. The design output was expected to be dominated by the properties of the material given/ chosen. The studio aimed at inculcating the habit of understanding the inherent properties of material and application in design thinking process in the students. The studio methodology also focused on understanding the behavior of material when used in conjunction with other materials. Thus, this aided in exploration of various materials helping students in design development. Important phrases from the Design Brief explaining the limitations and attitude with which students were expected to start the design process:

- A material gives the built-form a character.
- Play with two materials to develop a built form
- Understanding the strength and weakness of the material
- Relaxing place for the visitors
- Freedom of space formation and architectural expression



Methodology: The studio was planned as a two-day design project. A list of material was shared with students; the materials discussed resembled some construction material. It was made sure that the properties of model material resemble the building material. Every student was assigned one material. The materials used in studio are described in the chart.

Model Material	Structural material
Fabric	Tensile Fabric
High density Thermocol (regular module)	Bricks/ Blocks
Stone chips (irregular module)	Stone Masonry
Steel or aluminum wires	Structural Steel
Bamboo sticks	Bamboo
Skewer Sticks	Bamboo
Clay	Ferrocete
Nylon wires	Cables

The studio process started with a knowledge sharing session by the faculty. The presentation included visual tour of few designs constructed in said material. It also included relation of material property in developing the design language.



To kick start the thought process, students were encouraged to make mind maps to comprehend the properties and nature of given material. Based on the understanding students were given freedom to choose any complimentary material and start a hands-on exercise if exploring the design. The final output was hence cohesion of studying and accepting the material and intuitive hands-on exploration.

Observations and learning: The students handled different materials, thus developing an understanding of the strengths and limitations of the materials. Students were also able to develop a thoughtful realization about how materials complement each other. Time proved to be a limitation when it came to consideration of functionality of the space.

Inference: On comparing the final output by the students, conclusions are drawn about their understanding with respect to imageability of built mass, relation with function, smooth circulation and usable spaces. In all three cases the focus on development of form was strong. It is concluded from the study that the issues related to the scale and proportions of the spaces created, the image that the form carries, and their appropriateness for a particular user base and environment can be focused through numerous study models leading to a final output. The experience across the four studios shows that even though in first attempt students could not achieve the desired results, constant improvisations on earlier attempts are fruitful. Hands on experiments with models have helped in breaking the jinx of a linear process of designing, beginning from bubble diagrams to plans which are simply extruded to elevations. Striking the right chords and not letting the focus shift has to be a constant endeavor on part of the faculty, throughout the process.

Faculty teams involved in generating the methodology:

Project 1: Ar. Anand Ukidve, Ar. Shilpa Pande, Ar. Priyanka Jadhav-Chavan, Ar. Rajiv Raje, Ar. Sanjeev Kulkarni, Ar. Nilesh Pore Ar. Sonal Nirmal, Ar Amol Holey, Ar. Unmesh Vaidya

Project 2: Ar. Priyanka Jadhav-Chavan, Ar. Amol Holey, Ar. Sneha Deshpande, Ar. Sonal Nirmal, Ar. Anjali Biwalkar, Ar. Sukhada Dixit Ar. Sanjeev Kulkarni, Ar. Unmesh Vaidya, Ar. Kalyani Junnankar

Project 3: Ar. Priyanka Jadhav-Chavan, Ar. Amol Holey, Ar. Sneha Deshpande, Ar. Sonal Nirmal, Ar. Anjali Biwalkar, Ar. Sukhada Dixit Ar. Sanjeev Kulkarni, Ar. Unmesh Vaidya, Ar. Kalyani Junnankar

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IMPACT OF GLOBALIZATION ON ARCHITECTURAL EDUCATION

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ABSTRACT:

The change of Globalization has unfastened up the barrier between globe and people came to know the information and cultures all around. With changing of time and development in technology every scenario of life is shifting particularly with globalization, be it a language, culture, communication, lifestyle, entertainment or education. It is converting the overall world scenario and India is no exception to it. Including many different sectors, Globalization has also influenced the overall Architecture and its education in developing countries like India. Architectural education day by day is becoming an important factor in the re-thinking and growth for the new generation buildings and cities. There is huge increase in population and urbanization with the passing of time. It has become a need of educating professionals with an integrated knowledge of local as well as global values.

Architecture is the factual representation, manifestation and material recognition of collective features and community cultures. The built environment and human settlements together suffer because of context deficiencies like deteriorating weak urban, social, economic and political structures. The paper emphasizes on the globalization and its impact on architectural education in developing countries like India. The paper also focuses that the architectural education is a core section of society, and the groundwork of independent choice and the large difference in prospects in education between countries creates the global inequalities.

KEYWORDS: *Globalization, Architecture, Architectural education, developing countries, impact.*

INTRODUCTION:

Mystified architectural expressions and weakening urban environments are identical with cultural variance and related insufficiency and conversion. The Globalization, theoretically and physically overpower the systems in developing countries. In accumulation to this the challenges of transforming existing conditions, to attain societal goals and objectives, "Globalization" is arguably playing as a catalyst. Architectural growth, practice and education altogether face the mentioned clash to its core, and display it in its features and outcome. Architectural schools in developing countries, tries to follow different models of education from the outset. Most are still trying to stay adjust to modern trends and changes.

From Indus Valley Civilization to Colonial Architecture and towards Modern Architecture, India has practiced and encouraged all forms of Architecture. Maintaining the essential values of tradition and culture it has always made the efforts to make effective use of the available resources and keep up with the changing times.

Architectural school's curriculum is perpetually influenced by different country's pedagogical philosophies, belief and practices. Though there is rising consciousness among the middle and younger generations of local academics, the education forum is still influenced by global doctrines, and Western structures, contents and different statutory regulations. This helps in jointly producing architecture graduates who are able to work in developed settings, for different communities, with diverse resources and lesser limitations and constrain. The outcomes are consistently unconnected from the real world, planned for virtual communities and mainly faceless, average and unfamiliar to development contexts.

The existing political constitution and practice together with communal traditions, values and cultures negatively add to the burden on architectural Education. These impose analytical criticism and serious thinking and stifling innovative talent, abilities and intellectual search.

GLOBALIZATION AND ARCHITECTURE:

Globalization has been recognized as boasting a number of developments, like greater mobility of merchandise, economy, people and increase in information flow. This mobility is a result of developed technology and infrastructures, which raised greater international cultural exchange and diversity. This gave rise to a new global culture worldview that has changed the form of communities and the significance of the independence of nations and to provide better economic prospect for all.

Financial growth of Globalization has encouraged the course of both information and people. Communication technology and internet has also encouraged the process of globalization and compression of time. This raises a question that in what way does the impact of globalization affect the role of architecture, and how it should be understood morally? Which needs to be thought with a greater concern. However, cultural identity of a country is closely linked to its nation's identity and because both are by nature not stable, it is resulted in the formation of unstable associations and the formation of dilemma for the moral role of architecture.

It is observed, globalization has become a major apprehension for nations around the world in a number of areas. Globalization have resulted in causing a rapid development in information flow, the movement of people, and goods and services. Regular habits of citizens and their lifestyle are widely affected by this. As a result, nations are beginning to understand the importance of working together to beat global problems.

Architecture is the most important constituent of the built form in urban areas. It has an important role in influencing the transformation that globalization will endorse. Globalization has led to many changes in architecture today. It has allowed a new style to emerge worldwide which involves adjustment, practicality and modern styles in buildings. These similar elements in buildings worldwide are seen as cultural standardization as many thinks that each countries architecture is becoming more and more analogous. While some would argue that it has led to cultural hybridization and has allowed a country's architecture culture to flourish and stay unique.

It can be considered as an issue of importance that relation of architecture to this important phenomenon and the formed culture needs to be investigated. The investigation should lead to answer that how is globalization impacting role of architecture and its interpretation. Many find it as a conflict between the class of people who want to protect tradition and people who promote innovation and globalism. Architecture has an ability to build relationships with, or be part of, culture, society and technology, hence, plays an important role in the changes applied due to globalization. Symbolism of forms is occupied in a deeper sense with memories of people and the process of identity formation, it can be stated that architecture is not distinct from the way people live. Designing of a building and its construction has to be bound in the difficult web of social and political concern.

Architecture can be considered as demonstration of social values and social behavior and the expression of the very soul of societies. It sometimes takes the authority to command and forbid. Its interdisciplinary nature makes the study of the impact of globalization on architecture and the resources through which that impact is developed is a complex task. Any built form is an outcome of architectural practice, along with construction technology and materials, changes of built form stem from the belief established in practice which is

directly related to the education system. The architecture is a vital part of local culture and its uniqueness which is the result of the design of individual buildings made by architects who are educated with the current system.

Globalization has promoted technology and vice versa. Both ways, technology plays a role of important element of this impact, since it has played an important role in transforming architecture throughout its history and thus, the way architecture is taught. Since architecture is directly linked to technological and industrial development, the developments in construction technology has benefited other kinds of study which, conventionally, was not a part of the discourse of architecture.

IMPACT OF GLOBALIZATION ON ARCHITECTURAL EDUCATION:

Globalization can be considered as a term that refers to rising global connectivity and its dependency in terms of money, society, technology, culture, architecture and ecological subject. It is a process that includes many sub-processes, such as enhanced economic interdependence, improved cultural influence, speedy advances of in technology. Cross border integration has vital capacity in Cultural, economic and Social, supporting along with educational incorporation.

India has been a major place of learning for decades. Presently, India possesses a highly developed architectural education system. It offers education and training in all aspects of creative and intellectual endeavors of human.

Design is assumed to be the core subject which is considered to understand the capability of an architect which makes him stand differently in the society. Developing skills in individuals was lacking in architecture education. Thus, the gap between the diverse skills of India and architecture education in India is filled due to the globalization. There is a concept shift in the field of architecture education in India, which has reciprocated in increasing connectivity between the profession and society and different countries which is bridging the gap between fading architecture and industrialization. This has led to an irreversible change in architecture education. An ideal frame for the architecture education is a balance between different components of architecture education which is achieved with a change occurred due to globalization and the knowledge to apply its focus positively.

PRESENT-DAY VIEWS ON PRINCIPLES AND ARCHITECTURE EDUCATION:

At the moment, iconic architecture and pioneer architects pilot the modernization and revolution process, and the regular practice of architecture leads the advance stabilisation process using the differentiation and integration movement. Architectural theory, on the other hand, advances the use of the interpretation/reinterpretation dynamic in architecture, which helps to destabilise meaning in architectural language that, when transformed to real world architecture, can result in alienating the physical horizons of cities and thus in the alienation of people.

CONCLUSION:

The development of globalization knowingly or unknowingly has involved all the countries around the world. Developing countries such as India, China, Africa, Iraq, Syria, Lebanon and Jordan have been affected by globalization, and whether negatively or positively, the architecture of these countries has improved under the influence of globalization. Even though if we agree that globalization has many disadvantages, at the same time we cannot contradict that globalization has brought many more benefits than the damages in the developing countries. We believe that education is one of the key local factors that can be used to restrained some impacts of globalization from negative to positive and convert threats into opportunities for the development of individuals and local community in the inevitable process of globalization.

Globalization has influenced largely architectural practices and architectural education which has changed the overall system in many ways. It replicates the culture of modernization and systemic standardization of functional logic. It also portrays cultural integration, organization of spaces and universal consumerism. Yet, at some levels, it is considered that the effect of globalization on architectural education act as breach over individuality and cultural identity. Nevertheless, globalization has also improved localization through vernacular designs teaching techniques. It is also stated that globalization has replaced the individual aesthetic and cultural individuality. Moreover, it can be suggested that globalization has benefited more through creative and functional architectural styles and education system.

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A CRITICAL EXAMINATION OF ROLE OF ENGINEERING IN THE CONTEXT OF ARCHITECTURAL EDUCATION

Qualitative understanding of Engineering through Integration with other subjects

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ABSTRACT

In the field of architecture, an ever changing scenario with shrinking project timelines and extensive networking will work actively to integrate the three disciplines of design, engineering and construction. However, this will be more from the viewpoint of market deliverables and integration of building performance systems rather than design innovation. Creative Innovation in architecture requires engineering to align with design and construction at a theoretical level first. This process begins from academics. Increasing digitization of processes, computerized form finding and entry of Artificial Intelligence in profession is taking attention away from the basics of engineering theory. Engineering is looked at as a subject of calculations and number crunching that will eventually end in the form of a machine that delivers solutions. Qualitative aspects of engineering are at the heart of creativity. They need to be interpreted, understood and effectively used if an architect wants to control the process of integrated design. They provide a plane from where explorations can take off. Quality engineering can elevate a design to great heights.

This paper examines the situation and suggests methods that can be used to improve the understanding of qualitative aspects of engineering at an academic level through its integration with other subjects. It looks at establishing an academic work culture that furthers the cause of better collaboration between architect and engineer in practice. The foundations of professional work culture are built by learning methods of education.

KEYWORDS - Architecture, Engineering, Qualitative, Integration, Collaboration, Resolution

INTRODUCTION

Disciplines in Architecture:

Architecture as a practice in the present times encompasses three principal disciplines, namely: Design, Engineering & Construction. These disciplines work together to make a structure for human living and functioning. A structure is a product of architecture. As such, architecture is a holistic word that represents both - a cohesive process and a resultant product at the same time. In design, a structure represents a 'preferred direction' taken among the limitless explorative paths offered by creativity of mind. In engineering, a structure represents a 'definite conclusion' arrived at in response to the conscious choice made- among many solutions afforded by application based theory. In construction, a structure represents a 'physical realization' within the limitations of technology adopted. What brings together the three disciplines is the process.

Engineering-Empirical Methods to Scientific Theory:

In fact, not so long ago, in the timeline of history of architecture, the disciplines of design, engineering and construction were unified under a greater whole that had assumed sacrosanct dimensions owing to its integrated complexity. It required detailed understanding of the physical behavior of materials in structural arrangements and making those arrangements possible. This was in addition to skills of planning and structure aesthetic. This understanding was rigorously built up on empirical methods that used scaled down practical experiments, actual scale field trials and incremental scale progression of successful results. It was then documented for contemporary & future practitioners.

[1], [2] The oldest preserved treatise on the subject is titled 'De architectura-The Ten Books on Architecture' and is written by Marcus Vitruvius, a celebrated ancient roman architect. Vitruvius was definitely not the first architect but the only one till date whose intensely descriptive documentation work has survived times. It has given a valuable glimpse into the thinking of the past which is not always explicit in the vocabulary of the built that survives. His reasoning abilities are exemplified in his theories on architecture. The universally famous one is the 'Vitruvian Man' in which he appropriates human body to pure geometry and justifies designs based on human proportion and axial symmetry. Equally well known within profession is the 'Vitruvian Triad' in which he argues that buildings should strive for three qualities: firmitas (strength), utilitas (utility), and venustas (beauty). His works help us construct the situation of those times when architecture was an all-inclusive bridging science of building. And specifically, with the triad in which he succinctly merges virtues of design (art, structure aesthetic & planning), construction (materials & technology) and engineering(empirical) in accordance to the times. [3] Construction of structures in the past was achieved majorly through masonry and carpentry right until the second industrial revolution, when the potential of steel was realized through industry. Aspiring professionals till then had to understand the crafts of construction first and then rise up through apprenticeship to the coveted position of a master builder. A master builder had to have a command over the process of construction in addition to comprehensive knowledge of design, engineering methods of those times and even broader knowledge of arts. The image of a building was controlled by theories of artistic composition. [4] The word 'Architect' is derived from the Latin 'Architectus', which derives from the Greek 'Arkhitekton' which means chief builder. Structural theory was rigorously applied much later in building history and called for a dedicated discipline that could focus on the practical application of science.

[5] In 18th century, engineering formally separated from architecture in academics when it was established as an independent subject in university curriculum. [6] Quantum leap in scientific theory related to physical sciences in 17th century was directly responsible for this shift. The path breaking contribution of the likes of Galileo, Newton and Euler ensured that scientific theory became an inevitable direction for practice and education in architecture. Innovation was not resisted but questioned on the basis of resource efficiency and structure safety. Engineering was now a formidable subject of calculation intensity and numerical accuracy. It simply meant that there was no scope for the accepted until it was 'proven'.

Integrated Design:

In the course of time: design, engineering and construction within themselves have branched out further to handle the evolution and complexity of human needs pertaining to building construction (Fig 1). New areas of specialization are emerging to handle new scopes, as buildings are transforming into complex and responsive technological machines with a high degree of accountability. The image of a building is increasingly being influenced by technological directions. The role of a master builder as a universal designer is obsolete. The vast scope of integrated architectural design is shared by specialists under the lead of an architect who controls the process. A specialist is a trained individual in any of the three disciplines or in a specific area within those disciplines. An architect is thus a specialist of design. Architect sources consultancy from other specialists and integrates it with his scope of design under the umbrella of Integrated Architectural

Design Services. This is achieved through collaborative working and improves with early teaming. Design is definitely the core discipline which initiates and integrates the process. The basic knowledge of the three disciplines is required to make the elementary habitable shell of a structure from scratch. Areas of specialization make the structure respond to specific requirements and improve its performance as a modern day machine. [7] Integrated design is a comprehensive holistic approach to design which brings together specialized areas that are usually separate. It thus comes full circle to the Vitruvian idea of an all-inclusive science but with a complex interlinked structure of disciplines and areas of specializations. It's a deliberate approach of division for focused working and integration for seamless delivery.

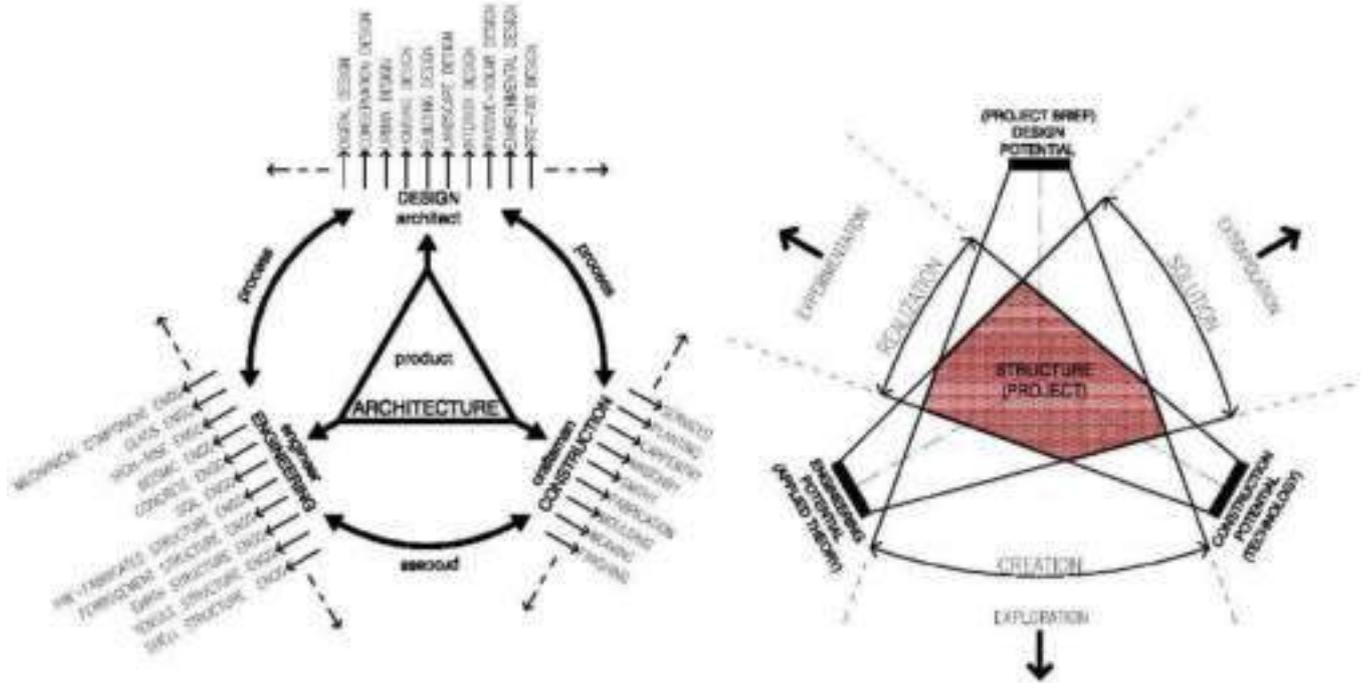


Figure 6: Integration of Disciplines & Specializations-illustration by author **Figure 2: Integrated Design-Project & Beyond-illustration by author**

For a given project, the disciplines begin with a potential which is essentially a function of respective resource available and scope of the project as ascribed to each (Fig 2). They then expand on this potential based on factors of time, cost and working freedom. This expansion is much higher for design than engineering and least for construction as factors get more compact. A defining area overlap of the three regions is where the project ‘sits in’ as a product of the concluded process and for the given situation. However, the greater goals of each discipline are constantly moving forward in their direction and ready to be used in future. This is a discussion that seems irrelevant to architecture students but is of great importance in developing an understanding of transitioning into professional practice.

Interpretation in Academics:

In architectural education at an undergraduate level, the disciplines of architecture become core subjects and handle the scope of basic knowledge. Some of the areas of specialization become allied subjects that move together with the core subjects. The choice of allied subjects is based on the undergraduate level requirement stated by the course outline. A syllabus document defines their role, content and broad methodology of teaching. However, the process of their integration is not explicitly detailed in the syllabus and is left to the interpretation of the teaching faculty. In a sense, it has to be orchestrated by the teaching faculty to mimic the situation in professional practice. This flexibility allows an institute to improvise on the teaching methodology of each subject and in the integration of relevant subjects at appropriate stages of joint working. It helps an institute to develop an approach to teaching which is essential in a creative field. At the same time, it risks inadequate or absolute lack of integration wherein each subject works within itself and fails to connect to the rest. A gap in this cohesive integrated working leads to disconnection of process.

AIMS & OBJECTIVES:

This paper examines methods adopted for the integration of engineering with design, construction and other subjects in architectural education. It looks at current methods within the scope of academics and attempts to identify the lacunae. It also suggests ways to enhance the approach by way of improvising on the current methods, by introducing new methods and by planning independent initiatives outside of regular academics. The immediate objective is to gather a constructive response from students that translates into a better performance in academics. In the long run, the aim is to strengthen the cause of integrated learning of engineering and take it further into practice.

RESEARCH BACKGROUND:

The research is based on my experience in academics. As a teacher at an architecture institute in Pune, I am a part of design and construction subjects. In the course of teaching, I was entrusted with the task of conducting an elective subject by the name ‘Structure & Form’ that looks at qualitative application of areas of specialization in engineering. This was due to my work experience prior to teaching. Working with an engineer specializing in spatial and tensile structures had helped me to understand the technicalities and working overlap that is needed between architect and engineer to realize special engineering based designs. I have also been conducting hands-on construction workshops for students at various other institutes in which tensile structures of sizeable scale are erected with cost effective materials in a short time frame. After a few years of this cumulative experience, the academic wing of the professional body of architects in India (COA-TRC) has engaged me in training sessions for teachers on qualitative application of engineering. This has expanded my reach to a varied audience and helped me acquire a wider feedback to construct my viewpoints.

SCOPE & METHODOLOGY:

The scope of study is focused on the qualitative aspects of engineering and not strictly on quantitative aspects. In the course of practice, architects are focused on qualitative understanding of engineering concepts acquired by studying the behavior of elements in a structure. This can be used to evaluate design options and streamline thinking directions even before interfacing the engineer. The quantitative aspect

by way of scientific theory, numerical calculations, simulation, testing etc. comes later and most definitely to achieve veritable clarity and obtain applicable results. Integration of engineering with design and construction from the perspective of an architect is not directly related to the quantitative aspects but through the application based inferences derived from it. Hence, this paper does not cover the subject of 'Theory of Structures' but borrows from it in part specific to application. The methodology of content presentation discusses each point without bias for its merits and short falls. It follows that analysis with measures that could be taken to improve on the short falls.

ESTABLISHING CONNECTIONS:

Theory of Structures (TOS) handles the scientific theory and quantitative aspects associated with engineering. It does not necessarily develop the qualitative understanding or guide an individual on architectural application. Application in architecture is not simply based on structural behavior alone but on parameters of function, building aesthetic and cost. TOS also fails to connect to related parts in other subjects of architecture as it is borrowed from engineering courses and is taught by an engineer. Engineering courses do not understand architectural applications based on creativity but objectively justify them on theoretical reasoning and problem solving. TOS gradually gets disconnected from other subjects despite the need for its application. The responsibility of making connections of TOS to architecture has to be taken up by other subjects by highlighting those connections when they emerge (Fig 3 & Fig 4).

If we consider history, then engineering too has a history just like design and construction. But it is appreciated and remembered only if it gets connected to the other two disciplines. For e.g.: Gothic movement in the subject of history can connect to force diagrams, structural theory and construction method of pointed arches, intersecting vaults, flying buttresses etc. This has to be an initiative beyond syllabus definition. It will dilute boundaries between subjects at certain points and make learning a fluid process. Understanding the structural working and construction sequence is a very important part of comprehension. Each year of academics can move ahead as an unfolding storyboard in which architectural events such as landmark structures or movements based on engineering technology are chronologically connected to engineering concepts. This would reinforce the importance of engineering as the principal contributor to architectural evolution. The storyboard could trace the path of building construction right from primitive times to date & establish a narrative. Similarly, other subjects can establish connections to TOS so that it gets integrated for its qualitative content. These connections should surface as brief plug-in modules of application based lucid theory and minimal relevant equations needed to reinforce that theory. They will also be a welcome change to break the monotony of a subject.

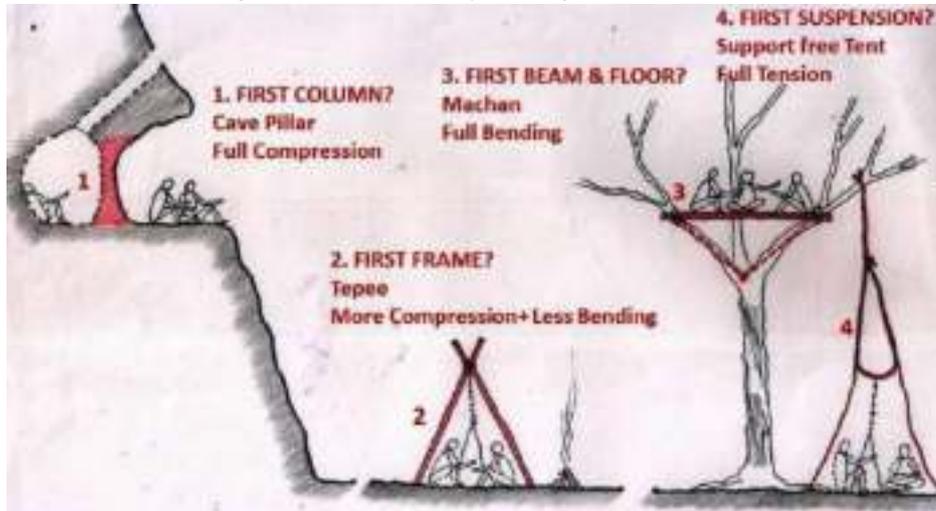


Figure3: Establishing Connections-Forces in Elements-Design & Structure
Illustration by author

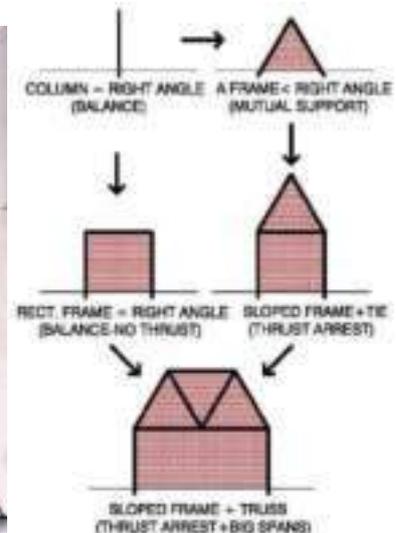


Figure4: Geometry of Frames
Illustration by author

CREATING A NARRATIVE:

Theories are best comprehended through a graphic narrative. Students in architecture get inclined towards graphics which becomes a medium of communication for most subjects. In stark contrast, textbooks of engineering tackle heavy scientific theory with objective brevity and minimal graphics. They do not have any introductory preface connecting to architecture. They are borrowed from engineering courses as architecture in itself doesn't have customized engineering textbooks. Extensive text and rapid calculations dissuade motivated learning for a mind that is getting trained in graphics. A storyboard narrative with graphics becomes a memory tool to retain the understanding even if the specifics of calculations are lost to time. A narrative in engineering can also be created on a speculative or fictitious ground as long as it acknowledges the basics of theory (Fig 5 & Fig 6).

It can use humour or exaggeration to get the point across and an intentional drift into the related trivia to slow the pace. This is particularly helpful to introduce the subject and its significance to the fresher. The skills acquired in generating a narrative are similar to those used in defining the engineering problem.

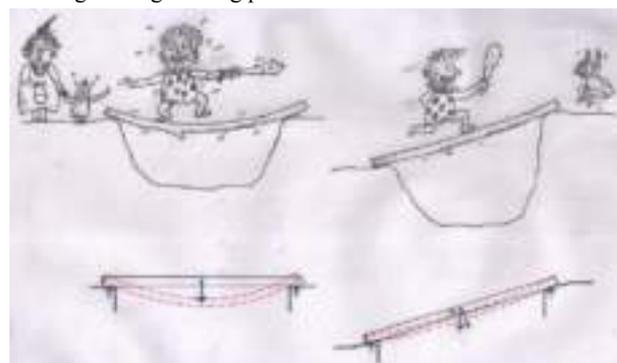


Figure5: Behaviour of beams-Axial & Bending loads
Illustration by author

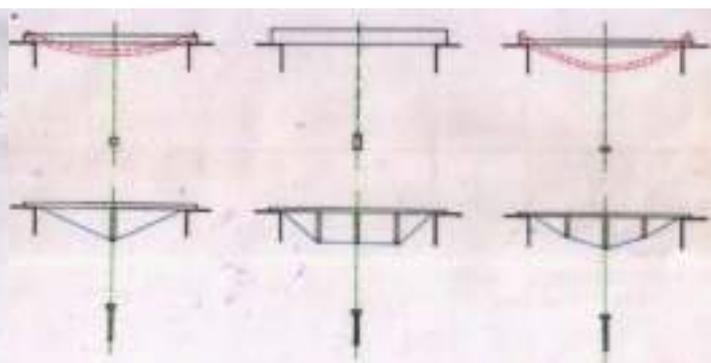


Figure6: Optimization of Beam using Tension
Illustration by author

DEFINING THE PROBLEM:

[8] "Engineering problems are under-defined, there are many solutions, good, bad and indifferent. The art is to arrive at a good solution. This is a creative activity, involving imagination, intuition and deliberate choice".-Ove Arup-Engineer
 An architect has to define the scope of expected solution hinting to an area of specialization within engineering. In the absence of this definition, an engineer may invest energies on providing a solution contrary to the requirement of the structure or still worse choose an indifferent solution that is based on ease of working. If the definition is vague then it simply means that the architect and the structure are both unprepared to handle the solution. Conversely, an architect has to be open to constructive suggestions and a possible overhaul of concepts by the engineer without placing ego in between the process. In such a case, the engineer is helping the architect to define the problem. The above requires an architect to interact actively with the engineer and develop a mutual understanding for effective co-working. In academics, a student interacts with the engineering teacher who plays the role of a professional consultant. This is worked out through voluntary meetings initiated by the student or more effectively by way of special sessions in which the engineer is invited to the design or construction studio for interaction. However, what is lacking is a format that systematically defines the problem from the viewpoint of engineering. It should present the reasoning for structural choice from within the options considered w.r.t design, construction limitations and preliminary graphical resolution inferences (Fig 7). It should also tabulate structural section & sizing data of similar case study examples in relation to spans. This makes it possible to represent the solution proportionately in architectural drawings. If the problem definition is not clear then it will lead to an indifferent solution that repeats the stereotype.

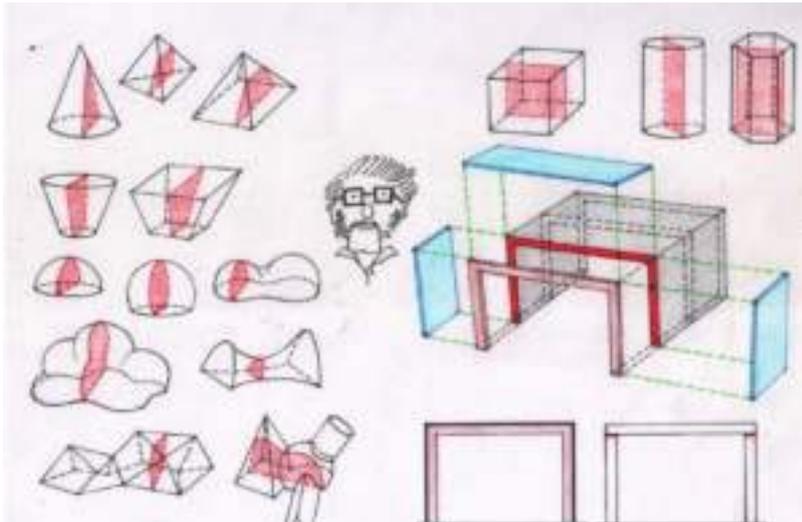


Figure7: Defining the Problem-Study of forms w.r.t Section
 Illustration by author

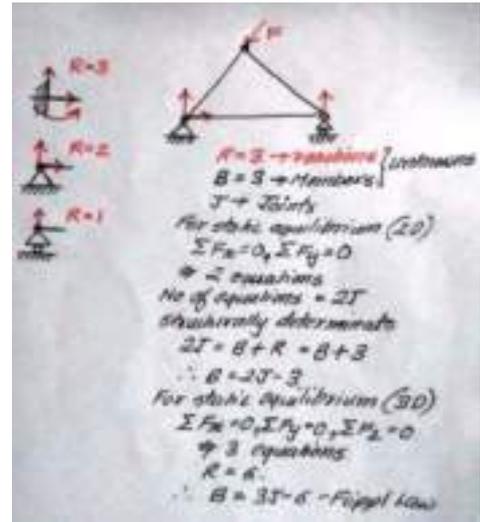


Figure8: Diagrammatic Derivations
 Illustration by author based on Foppl theory

ESSENCE OF THEORY:

Diagrammatic derivations:

A student should be able to carry forward the essence of theory even if the specifics of problem solving are lost to passage of time. Simple methods can be retained as they form the basis for complex understanding. Complexities beyond a point are definitely handled by the engineer in practice hence need not be laboured upon. This revisiting of derivations has to be done either through other subjects or by way of a concluding elective on TOS application. It helps consolidate the theory which is the essence of problem solving. Consider the following: The skeleton of a structure is achieved through framing. Diagrammatic derivations using simple rules of static equilibrium (Sum F=0, Sum M=0) are effective in strengthening the qualitative understanding of a lot of statically determinate structural framing systems. They become even simpler when support conditions are designed for least resistance (reactions) and the joints are assumed as moment free pins (Sum M=0-does not apply). The static equilibrium is now fulfilled by Sum F=0 and is the easiest to comprehend. These equations are applied in engineering but forgotten or underrated in their ability to qualitatively explain framing systems in design. For eg: The above can be effectively used to explain the working of planar (2D) frames and taken further space (3D) frames (Fig 8).

APPLICATION OF THEORY:

Graphical resolution of structural systems:

This method uses diagrammatic derivations based on static equilibrium to graphically resolve the working of a structure. It is a standard procedure in engineering as it is essential to begin problem solving. In design, this method is used for problem definition. It helps in understanding the elementary working of the structure geometry and the design arrangements that need to be made to hold it in place. Students do not use force diagrams in design as they consider it an engineering scope. They miss out certain key elements of the geometry that are needed for static equilibrium or at times add redundant elements despite having reached that state. An under designed structure would be corrected by an engineer by way of addition but with the possibility of little consideration to architect's creative vision. An over designed structure would not always be corrected by an engineer as it does not face stability concerns but it's a choice that goes against scientific theory and resource optimization. A lot of this resolution is best done at design stage from an architects end. In practice and with experience, it may be an internalized process for simple arrangements but definitely needs graphical working to handle complexity. Graphical resolution of structures is a very important subset of engineering problem definition. It should be included in design studio requirements for form making as actively as structural grids are for planning. Graphical resolution is not just a tool of correction but an instrument of working theory backed innovation for creative structural systems.

LEARNING ADVANCED THEORY:

Structurally efficient designs:

Structures whose working is resolved using axially loaded members and further on using more tension carrying elements become efficient in material. Such structures are extremely effective in learning advanced theory that becomes communicative through working models. They also expose students to planning strategies required to integrate such structures with design.



Figure9: Form Finding using a reverse model
 Model & Photo by ACOA students
 CONSTRO GATE-Pune-Design Competition-2007- Author with ACOA Fourth.Year ‘Structure & Form’ Elective Students

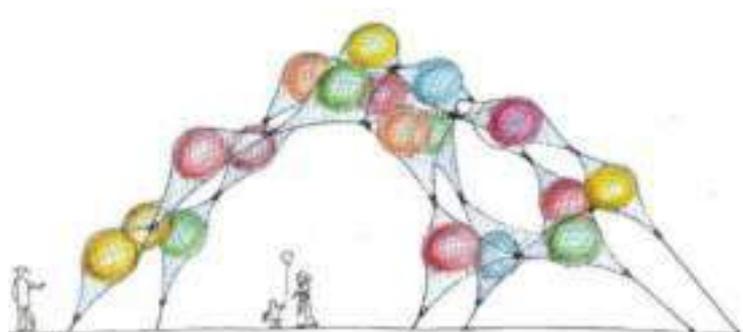


Figure10: Sketch elevation drawn based on photo of reverse model
 Illustration by author

Integrated structural designs:

A branch of ‘form finding’ in which extremely elegant but optimized forms are achieved using reciprocal logic of reversal of loading conditions. They use tension elements like catenary models or tension networks like thread models. Here, the structure gets integrated with the design as one and is known as funicular structure. The only way to decipher the working of such a structure is to do a working model and reverse the form. Such techniques are helpful in exploring resultant forms (Fig 9 & Fig 10).

EXPANDING THE SCALE:

Large scale structures using cost effective materials are built from scratch by students under the guidance of experts. Scale makes a person serious about the responsibility of building, where no glue can withstand the force of gravity! Use of tension elements such as ropes introduces criticalities of structural working which has to be activated with manual tensioning. The structures are built in a limited time and with a listed inventory of materials to enact a real life situation. Each student at the conclusion of the workshop presents a paper using photos, illustrations and diagrams.



Figure9: PVP COA-Pune-2014
 Christmas Tree on Eve



Figure10: PVP COA-Pune-2014-Inside View
 Christmas Eve on Eve



Figure11: BVPCOA-NaviMumbai-2014
 College Fest-Photo by student



Figure12: ACOA-Pune-2007
 ISOLA Landscape conference



Figure12: KMEACOA-Kerala-2015
 Gandhi Jayanti-Tribute to India Flag



Figure13: GCA-Goa-2016
 Retractable Structure for Elective Course

Figure9 to Figure13: Bamboo & Fabric Structures using Tension Concepts - erected across various colleges in India by Author. All photos by author except those mentioned.

COLLABORATIVE WORKING:

Design, engineering and construction can actively collaborate in an integrated design studio. Here, a small design exercise is taken up for engineering calculations and followed by construction drawings. The studio begins after design completion and preliminary graphical resolution. As such, the engineering problem has been defined and open only to engineering based minor revisions. The studio is headed by TOS subject team and assisted by the Design & Construction subject teams who have been involved in the design working. Their joint presence mimics the real life situation of an architect, an engineer and a craftsman teaming together. Small scope allows the three disciplines to come together and fulfill their respective areas within the academic schedule. Complexities in design can be worked out to individual capacities of students. Here, the engineering working and construction drawings are given importance over design evaluation.

CONCLUSION:

Engineering needs to be integrated with other subjects in architectural education to improve its qualitative understanding. Theory of Structures gets occupied with scientific theory and problem solving. Application of theory needs separate methods that are handled by other subjects and integrated with design and construction. The methods used to achieve that integration need to be effective and fluid. They should reach out to the creative minds by way of exercises that have appeal and thrust at the same time. They should be conducted over the years and revisit basics of engineering by establishing connections across subjects. Initiatives by way of collaborative working sessions and hands-on workshops on advanced theory should scale up the experience of learning to enact real life situations. Engineering needs to be made exciting for architects.

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INFORMATION SEEKING BEHAVIOUR OF ALLANA COLLEGE OF ARCHITECTURE FACULTY (PUNE): A CASE STUDY

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ABSTRACT

This paper is an attempt to study the information needs and seeking behaviour and use of information resources by faculty members of Allana College of Architecture. The analysis of information seeking behavior and preferences of faculty help Library and Information Science Professionals to design and develop the library and information services according to users' needs. For evaluating the study a questionnaire was constructed and distributed among the faculty members. The present paper discuss about faculty's purpose of seeking information, sources of information, preference over print v/s electronic etc.

KEY TERMS: *Faculty Members, Information Seeking Behaviour, Information Needs, Information Use Pattern, Satisfaction Level.*

INTRODUCTION

Girja Kumar (1990) states that information seeking behavior is mainly concerned with who needs what kinds of information for what reasons, how information is found, evaluated and used. Wilson (1999) considers information behaviour are those activities a person may engage in when identifying his or her own needs for information, searching for such information in any way and using or transferring that information.

Now information has become an important resource and commodity for development of a society. To provide right information to right users at right time we must understand information seeking behavior of faculty members for improving existing information system and for developing new services for meeting up the information needs of the faculty.

Allana College of Architecture is an eminent college located in Pune, offers bachelor and master degrees in architecture. The library has a good collection of books, journals and database subscriptions. This study examines the needed information of the faculty, which resources they prefer, whether they are satisfied with the library services etc.

OBJECTIVES OF THE STUDY

- To study the faculty's purpose of seeking information.
- To find out what resources the faculty member are familiar to access information.
- To discover the faculty's preference to electronic and print information resources.
- To assess the level of satisfaction of the faculty toward the library resources.
- To find out the problems faced by the faculty while gathering information.

METHODOLOGY

Survey method of research has been used to fulfil the objectives of the present study. The data was collected using questionnaire among the faculty members of the Allana College of Architecture (ACOA), Pune. The responses received from 29 faculty members has been analyzed and presented as a result.

LITERATURE REVIEW

Lucy Campbell (2017) disclosed that traditional information resources remain important to the architecture discipline and many faculties continue to subscribe to print journals and physical books. Faculty members are most frequently looking for inspiration or current trends when seeking information.

Ngozi et. al. (2015) revealed that books (online and print) were the most used sources of information seeking behavior of faculty members in Nigerian University. Google and other online resources were the most bases for information to meet their needs.

Imran Khan (2014) study brought forward that Internet and online resources were found to be the most preferred channel among faculty members and students. A large number of faculty members were also found to first consult their personal collection for their information needs.

Singh & Rani (2013) disclosed that majority of faculty members seek information from different sources for updating themselves with current development in concerned disciplines for research work. ICT's particularly Internet have made significant role over information seeking behavior of teachers.

Meenal Oak and S. K. Patil (2014) indicated that ICT has a tremendous impact on the information seeking behaviour of the faculty members of MES. Faculty members prefer remote access to the information resources and also using both printed as well as non-print information resources.

Gupta Ranjana (2004) concluded that information needs of teachers are different. They get information from textbooks, thesis etc. Teachers doing research, visit library more frequently than others, Majority of teachers who are not using library is due to inadequate collection.

Jayadev Kadli (2011) mentioned that ICT environment is affected the information-seeking for the majority of users. The findings of the study showed that the faculties were in need of information on print as well as in electronic form even in changing ICT environment. It is observed that too much information on internet is the problem often faced by users. They required information search skills to use online resources effectively.

Rafiq and Ameen (2009) showed that respondents used a variety of both print and digital information sources to satisfy their information needs. Books are still the most preferred information source for teaching and research followed by communication with colleagues and journal articles. The use of electronic or digital resources is well-established and respondents urged NTU Library to enhance access opportunities to e-resources to meet users' academic and research needs.

Jayaraman S. and Subramanian B. (2013) reported that faculty members used a variety of information sources for teaching and research. Books, thesis and journals were considered more important. The faculty members used IT based library sources and facilities less frequently compared to print sources.

Patel and Chaudhari (2015) revealed that internet is the best source for updating the knowledge and important source for information seeking. The study found that their purpose of information seeking was to keep up with latest development in the field and evolving innovative ideas/ technique. Textbooks are the important sources for teaching and e-journals are important sources for research. There is a significant difference in the use of information sources for teaching among the faculty members belonging to different academic positions.

Balaji and Ragavan (2016) revealed that the faculty members and research scholars seeking the information for research, writing papers and to update the general awareness and knowledge. They also revealed that internet, online journals, print journals and books are the main formal sources for seeking information.

SURVEY FINDINGS

FIGURE 1: Faculty Members at ACOA: Designation

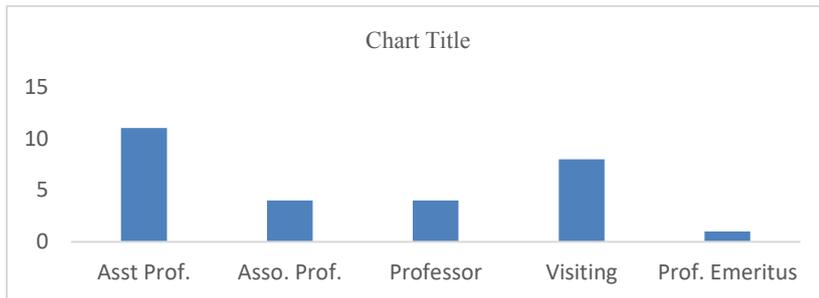
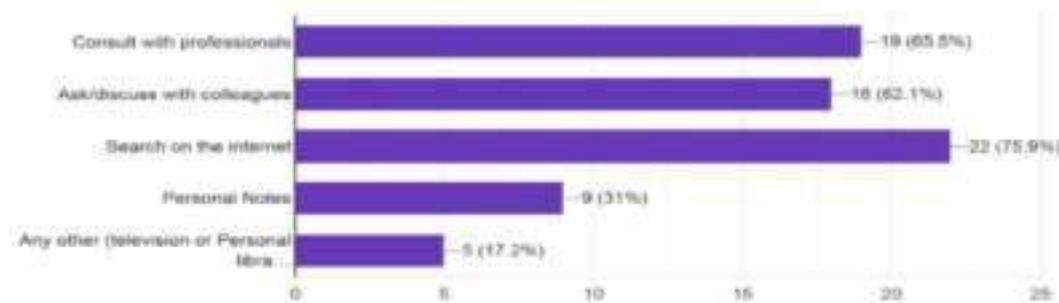


Figure 1 shows that majority of respondents, 23.40% comprised of Asst. Professors, nearly 8.51% faculty members were serving as Associate Professors and Professors and 17.20% faculty were Visiting, 2.12% had the status Professor of Emeritus.

FIGURE 2: Faculty Members at ACOA: Sources of Information used



On analyzing the data it was found that nearly 75.9% use the Internet to access information for different purposes. 65.5% prefer to consult with professionals to enhance their knowledge, 62.1% discuss with colleagues. Around 31% depends on personal notes, 17.2% respondents seek information from their personal library. This means that internet greatly influenced information seeking behaviour of faculty members.

FIGURE 3: Faculty Members at ACOA: Frequency of Library Visit

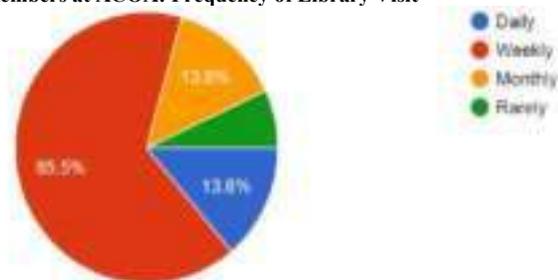
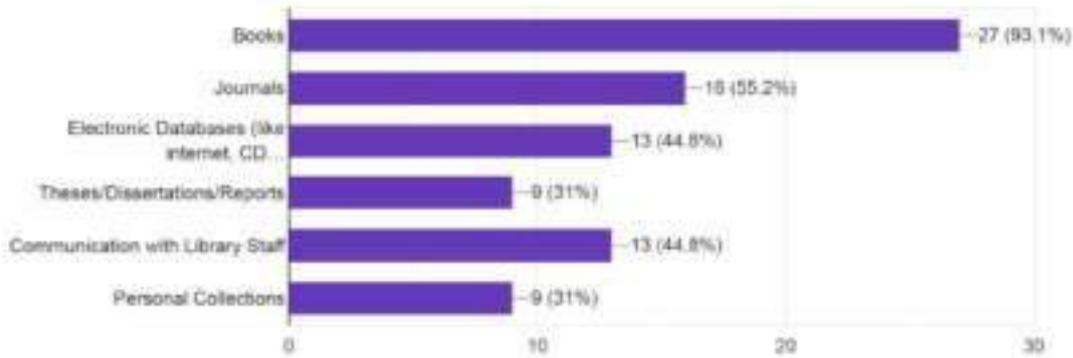


Figure 3 shows that majority 65.5% of faculty members visit the library weekly, 13.8% faculty visit daily and monthly. It means that most of the faculty is dependent on library resources to get desired information. Majority of faculty members visit the library to complete their task. This means that most of the Faculty visit Library for some purpose regularly.

FIGURE 4: Faculty Members at ACOA: Sources of information



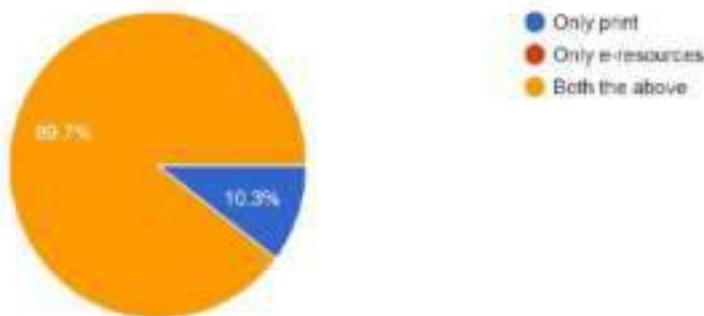
As observed from figure No. 4, 93.1% respondents use books, 55.2% use journals, 44.8% refer electronic databases, 31% use thesis and dissertations, 44.8% communicate with library staff, 31% use their personal collection to get desired information. It means that with e-resources faculty still use traditional sources of information like books and journals.

FIGURE 5: Faculty Members at ACOA: Purpose of Information Seeking



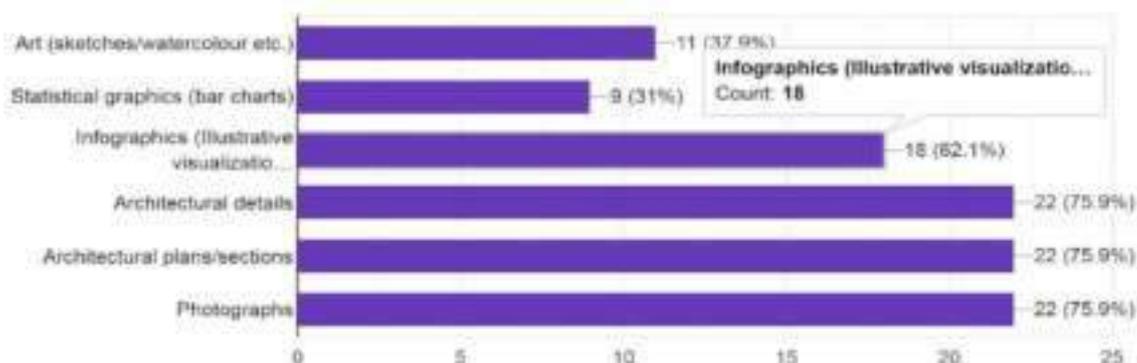
On the analysis of the data, it was found that the faculty members are mostly seeking information for teaching and guiding research students with a response rate 86.2% followed by 62.1% for keeping themselves update. About 41.4% seek information for writing book, article and research papers, 31% for workshop and seminar presentations, and 62.1% for creative inspiration. It means that most of the faculty members seek information for teaching and guiding students and they are using library sources to keep themselves update.

FIGURE 6: Faculty Members at ACOA: Preference over Print v/s E-Resources



It is clear from figure6 that most of the faculty members 89.7% like to use both print and e-resources to access information. Whereas10.3% prefers to use print information resources over electronic resources. It means that although faculty give importance to both the Medias some of them are still prefer print resources.

FIGURE 7: Faculty Members at ACOA: Importance of Image Types



When they asked what they find important in the media they got. 37.9% give importance to Art such as sketches and watercolors in the media they got. 31% find statistical graphs important in the media they got.62.1% find info graphics in the resources they got.75.9% give

emphasis on architectural details, architectural plans and sections and photographs in resources they got. It shows that types of images also influence the information seeking of faculty.

TABLE 1: Faculty Members at ACOA: Level of Satisfaction

Services	Fully Satisfied	Somewhat satisfied	Not satisfied
Issue/return of books	59.57%	4.25%	-
Open access system	59.57%	2.12%	-
OPAC	51.60%	4.25%	-
Notification of new arrivals	57.44%	2.12%	2.12%
Article alert	53.19%	2.12%	2.12%
Digital Library	42.55%	10.63%	2.12%

It appears from the figure 10 that 59.57% of them are fully satisfied and 4.25% are somewhat satisfied with issue/return of books. 59.57% are fully satisfied and 2.12% are somewhat satisfied with open access system. 51.6% are fully satisfied and 4.25% are somewhat satisfied with OPAC. 57.44 are fully satisfied and 2.12% are somewhat satisfied and 2.12% are not satisfied with notification of new arrival. 53.19% are fully satisfied and 2.12% are somewhat satisfied and 2.12% are not satisfied with article alert services. 42.55% are fully satisfied and 10.63 are somewhat satisfied and 2.12% are not satisfied with digital library services. It means that Open access system greatly influenced information seeking behavior of ACOA faculty. They are also satisfied with the book issue/return services of the library. It also shows that some of them are not aware of the services provided by library.

SUGGESTIONS

Faculty members have given various suggestions for improving the College Library services.

1. They suggested to improve digital library services.
2. One of them has suggested to organize book review completion to increase reading habits.
3. Three of them suggested to display new arrivals in a better way.
4. They also suggested to subscribe e-journals from publishers like Elsevier, Springer etc.
5. One of them also suggested to arrange computers for students and staff in the library to access e-library.

CONCLUSION

This study looked at information seeking through very specific lens of architecture faculty within the Allana College of Architecture, Pune. By this study it is observed that faculty working in the ACOA comprised Bachelors and Masters in Architecture. It is also observed that for ACOA faculty use books as a most preferred information source but they also use electronic databases while getting their desired information. The finding further reveals that most of the teachers depend largely on books and also to a certain extent on journals as source of information but they also use e-books-journals and other electronic databases. Architectural plans, details, photographs are the most important image types. Most of the faculty members seek information for teaching and guiding research students. They also search information for keeping themselves update. About 75.9% faculty members accepted that Internet have influenced their information seeking behavior but this has not lessened the significance of the library. Some of them seek information for writing book, article and research papers, and for workshop and seminar presentations, Creative inspiration is also one of the purposes to seek information. It is also observed that books are the most widely used sources of information but this has not lessened the significance of electronic databases. Therefore, good collection development should be the top most priority of the institution in order to achieve their academics objectives. To access information, faculty members use both print and e-resources. Most of them are satisfied with library and information services they are getting. The present study also reveals that orientation to faculty members could be useful venture in promoting the use of library.

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THEORY OF MUTATION FOR SPATIAL DESIGN EDUCATION

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ABSTRACT

Defining spatial design, is difficult, as it is ambivalent in nature. To call spatial design as just an Art, will be a biased perception, as spatial design is the Art of Building, and to build anything one requires the knowledge of Science and Technology. That is why, spatial design is an Art and Science of Building. Due to this ambivalent definition, Institutes around the globe find it difficult to design a Curriculum, which can design better Spatial designers. Spatial design, is an art and science of Building Places, or Crafting/ Narrating Spaces in Time to Build Places out of them. Due to this factor, it tends to involve a lot many subjects, making it hard to for learners to manage them all. This is done, generally within Two types of Structural Methodologies- Linear and Spiral. This paper discusses and proposes a Double Helical Framework, which can Mutate as per the Learner's adaptation towards the Instructions and should be based on now a commonly accepted framework known as- Adaptive Learning [1], which can integrate Constructivism & Connectivism Learning Theories. The mutation is not limited at learner's level though, but also will act as a key for iterations required for a curriculum to survive the brutal time continuum.

KEYWORDS

Mutation in Curriculum; Double Helical Curriculum; Adaptive learning; Learning design; Spatial Design Education;

INTRODUCTION

A Spatial Designer requires the knowledge of Designing and Building Structures which are habitable or useable by living beings. It is an articulation of space in time, to create a place which can have experiences, and hence be able to get converted into memories. Spaces, in time, become Places only when there is an attached value of Memories [2]. In order to do so, the architectural education or spatial design education (spatial design includes architecture, interior design, urban design, landscape design. The broader name will be considered here, as all of these fields are nothing but spatial design or articulation of spaces in time, or place making), tries to include a lot many subjects, ranging from being able to understand humans, till the technological understanding of building the next Burj Khalifa. It involves an understanding about plants, as well as the kinetic skin of a building. The arrangement of subjects, to be completed in the total duration of time (on an average 4 years, maximum up to 5 years in countries like India), based on the daily, weekly and monthly objectives, is what a curriculum means. Spatial design curriculum, has been facing a challenge since a very long time, because the more we understand what spatial design means, the more subjects we tend to add to the curriculum, or the more we analyze the future needs of a spatial designer, we tend to add more subjects, eventually creating a havoc on learner's end. This paper aims at proposing a curriculum structure, which will be double helical in its structural form and will be able to mutate as per the learner's theories of learning, and the future demands of the field. The paper is divided into three chapters, chapter 01 is where we'll analyze the existing curriculum's structure by taking sample curriculums throughout the globe, chapter 02 will be about extracting the components of double helical structure and the possibility of mutation from our own DNA and the last chapter will be about designing a curriculum's framework, for spatial design education which can mutate.

CHAPTER 01, THE FOUNDATION

Spatial design's curriculum is challenging in nature, because of the reason that the term Space is difficult to grasp. Due to this, the curriculum started by being as vague and general as possible, and hence the curriculum's structure started with being Linear. When we label the curriculum linear, it means that it follows a certain type of hierarchy, in a certain direction. If we look at the curriculum, before World Wars, it didn't contain a lot of aspects required as a designer. This allowed the curriculum to focus solely on one direction, i.e. the Art of Space. The linearity hence obtained, directed the articulation of Spaces as an Art, and Science was considered and treated separately. This led to two different school of thoughts, one which solely considered Spatial design as Art of Placemaking and another Science of Placemaking. This division of thoughts, made the curriculum straight forward, produced static results and hence had no room for improvisation by educators. After the World Wars, the scenario changed drastically with the emergence of Bauhaus movement. Bauhaus, German word which means, Construction of House. Even though the meaning of the word is linear, the direction taken by Walter Gropius and other was non linear. Bauhaus curriculum, for the first time made the Design or Art of Spaces, as the Center, and made the Science of Spaces revolve around it. The curriculum was Concentric in nature, where all the subjects revolved around the main subject of design, giving importance to a lot more subjects related with the science of building and the economics of design [3].

This soon started to be an emerging style of curriculum, spread across the Globe under the name of International Style. Once this iteration went out, and generalizations again started taking place, the next step in the evolution of the curriculum's structure doesn't come as a surprise. The next structural model, currently being used almost everywhere, is the Spiral model. Spiral model brought the Linearity or the sense of direction in the concentric model. An important thing to note is, even though the models had a few iterations, up until this point the way the instructions are and were delivered, didn't change much, nor the way the learners learnt. The entire curriculum was and still is dependent on the Behavioristic Theory of Learning, where the curriculum focuses on how learners behave, based on the inputs given and how that behavior can be controlled (this particular factor can be seen in many pop culture's references, such as in movie The Wall, by Pink Floyd). This was the case because the learning theories such as Constructivism and Cognitivism, was difficult to be introduced. That is not to negate that, Spatial design does have Constructivism theory of learning incorporated at several places, if not throughout the curriculum, under different names such as Learning by Doing; Hands-On Exercises; Problem based Learning etc. But in the totality, the theory used and accepted is still Behaviorism. This also reflects the inability of being able to use the tools, to deliver and design instructions, which can be found in most of the countries. Overall, we've over the time seen three major iterations, from linear, to concentric to spiral in terms of the structure and a minute change in the attitudes of accepting other learning theories, except Behaviorism. But, none of the iterated structures have a potential of mutating on its own over a period of time, nor has an opportunity to adapt to the learners. The next chapter discusses this search of being able to find out a way, from Nature, as nature is the best Spatial designer of the planet.

CHAPTER 02, THE DOUBLE HELICAL MUTATION

Sir. Charles Darwin's theory of evolution [4] has been a remarkable contribution in our ability of understanding the nature we live in. Evolution can be defined by the ability of adapting to the newer environments, by mutating over time, through the passage of information using DNA which is nothing but a code. This code, contains the information of the past and helps the future generations to cope up with the

challenges the past generations faced, by giving them a hack. The code mutates as per the time and the requirement, hence helping the next batch of codes to be based on the newer mutated code. Mutation is adaptability and flexibility, provided directly through the code. It is a shortcut in time, to survive and overcome challenges, so that the next generations don't have to go through the same adaptation to survive, but be able to start from next level and then build upon it. It is about a method of using the past information, analyzing the information, tweaking it for the present and providing/ proposing solutions for the future. The solutions hence obtained are not guarantors of success, but gives permutation and combinations, which would help increase the chance of success [5].

This is the main reason, why the curriculum needs to be able to Mutate, so that it'll not remain Static and have the potential of iterating itself, using the past information, and dynamically suggest the solutions to overcome the problems which were faced before, to increase a chance of success in the present and future. The DNA's structure, i.e. Double Helical structure is the best option for Spatial design curriculum, for it to have the ability of mutations and be adaptive to learners. The double helical structure, along with the four bases which helps code the DNA- A, T, G, C [6] will help give it a ladder approach, along with the properties of afore mentioned structures, such as linear, concentric and spiral. It'll also help one of the biggest challenges, of being able to balance the Art and Science of Spatial design. The last chapter will discuss thoroughly the Structure, its advantages, and how can it work in real life.

CHAPTER 03, THE PROPOSED MODEL

The proposed model, for Spatial design education system, is as follows:

1. System

1.1 “..DNA or Deoxyribonucleic Acid, is a long molecule that contains our unique genetic code. The structure is made up of Double helical strands, and has protein binding the two strands, which are known as bases, namely Adenine (A), Cytosine (C), Guanine (G) and Thymine (T). The base pairs bond together using hydrogen. A-T and C-G are the pairs, which will always go together. The strands are 5 prime and 3 prime, and both the strands are running parallel and opposite to each other.”[6]. “..the two strands, which acts as the backbone, are made up of Sugar Phosphate..”[7]. The DNA transfers all the necessary base information, which are mutated with time, environment, race, caste, etc, and contains the family information, stored in two manner- cell DNA and mitochondria DNA. The best part of our genome is the fact that, 99% of the genomes are same for all the humans, and whatever variations which can be seen is in the rest 1%. The sugar phosphate strands will become the main subjects- Design and Technology (which'll run parallel to each other), and the A, T, C, G will be replaced by the 4 major scales of spatial design- Interior Design (I), Architecture (A), Landscape (L) and Urban Design (U).

1.2 Each run of the structure, will contain maximum of 4 base pairs, and will represent One Semester. This means that, each semester will have 6 subjects- Design, Technology and 4 subjects which will be the iterations of I, A, L and U. The scales, I, A, L and U will act as ingredients for the recipe of a subject.

1.3 The next important part of the curriculum, is the time required for completing each semester, and hence the entire curriculum or the education. This system gives freedom to the learners, to finish and do it at their own convenience, and time, giving them opportunity to take less or more time depending on their own learning and forgetting curve. That means, the time doesn't define the boundaries of semester or for the curriculum in totality, liberating the learners from the pressure of finishing in time.

2. Duration

2.1 The curriculum is designed for minimum of 8 and maximum of 10 semesters

3. Curriculum

3.1 The curriculum is divided into 2 segments-

3.1.1 First Segment will be called MITO. The MITO will consist of the first 6 semesters, 40% of the strategy for which will be derived from the existing Formal settings Globally (Alpha Phase). The MITO will be as follows-

3.1.1.A The 1st semester, will be called as the Core, where the 4 subjects except the two core subjects (Design & Technology), will act as the Introduction to I, A, L & U. After the end of the 1st Semester, first time the window will open for learners, which will be an equalizer consisting of the bases (I,A,L,U), where they will have liberty to select the amount of each subject in percentage for the next Semester, for 4 Subjects they'll take in the next semester. Based on these results, plus the results of Assessments, the A.I. will present the learners with subjects, from a pre-defined pool of subjects, out of which learners will select 4 subjects.

3.1.1.B From the 2nd semester onwards, the Subject EQ (equalizer) will be offered after finishing every 2 subjects, which will be known as Mid Semester, and at the end of the semester, i.e. finishing of 6 subjects, and hence the suggestions of the 4 subjects for the next semesters will be given, based on the performance of the learner in various aspects, and not just assessments. The parameters of Evaluation and suggestions will be discussed later in segment 4 and 6 of this chapter (Evaluation- MITO and Successful Submission of Final Report- ARM).

3.1.2 The second segment will be called, an ARM, which will consist of the next 2-4 semesters, depending on the learner. Before the learners will jump ahead towards ARM from MITO, they'll need to submit a Report, which will summarize their understanding of MITO, and will involve submitting a draft for their Proposal, for the Expertise they'll be doing in these semesters. Once the proposal and their summarization will be accepted, they'll move into ARM, which will be as follows-

3.1.2.A In these semesters, the learners will have the option of equalizer only once, in the mid of 7th semester, where by based on their proposal, they'll be suggested subjects from the pool, and will also unlock the potential for learners to Propose their own subjects, based on the expertise they want to achieve.

3.1.2.B The learners will have two windows to submit their Thesis/ Dissertation/ Research, one at the end of the 8th Semester and another at the end of the 10th Semester. The reason of having two windows is the fact that, during their time in ARM they'll have selected 16 subjects, for 4 semesters and hence will allow them to learn more subjects, if required by them to support their report. Option of EQ will be closed, but now the A.I. have enough data and information of the learner, that the code can be trusted to suggest the apt subjects according to the Expertise of Report, and hence will always be there after every semester to guide the learner, in accordance of being able to select a new subject.

4. Evaluation- MITO

4.1 The Evaluation will happen in terms of-

4.1.1 Formative and Summative Evaluation, are the evaluation types which will happen for each subject. Formative evaluation will happen in the mid of the subject's progress and the summative evaluation will happen at the end of the subject.

These evaluations are done not for the learners, but for the educators to check their pedagogy/ andragogy’s efficiency and efficacy, learn from the input given by the learners. (MITEVA.1)

4.1.2 Mid and End Semester Evaluation, Mid semester evaluation will happen after completion of 2 subjects and End semester evaluation will happen after completion of 6 subjects. These evaluations will be evaluations, where the learners will need to overcome Practical Challenges, based on the concepts learnt from the subjects. After finishing each challenge, which they’ll need to do in the allocated Workshops, under the guidance of an Educator, they’ll be awarded “Lifelines”. (MITEVA.2)

4.1.3 Daily Evaluation, will happen daily before they log out of the system. This evaluation is required to help learners retain as much information and knowledge acquired throughout the day, so that it’ll help them use the same for the next day. (MITEVA.3)

4.1.4 Module Evaluation, will happen after the completion of every module. This will be done in accordance to check the amount of information/ knowledge retained as well as concepts learnt or unlearned. (MITEVA.4)

4.1.5 Cognitive Evaluation, is an evaluation which will happen after the end of every 2 semesters. This evaluation is to understand the development of the learner’s cognition. It will be done, through the submission of a Report, where the learner will explain the 2 semester’s understanding, and will try to solve a Real Life Problem using that understanding. The real life problem, will be selected from the pre-defined pool, which updates every 2 months, automatically using the A.I. The cognitive evaluation also awards the learners Lifelines. (MITEVA.5)

The evaluations are happening for reasons- to check the ability to retain knowledge; ability of putting their knowledge into test through Practical Challenges and Real Life Problems; efficiency and efficacy of the Pedagogy/ Andragogy used, and not to create a competitive environment [8], as all the learners are competing with themselves, and no one else. Each learner has a different approach, timeframe and objectives throughout the curriculum and hence evaluating them based on same parameters as everyone, doesn’t justify the evaluation system. Also, the evaluations will be subtle, in order for learners to not get hyped about the evaluations, but be excited towards the knowledge they gain.

The evaluation at no time, tries to quantify the learner’s performance. Instead, it uses the concept of Gamification and helps the learners to approach the education, just as how they would while playing games. That is the reason that they will be earning Lifelines, after finishing each Practical Challenge and Cognitive Evaluation. The use of Lifelines, will be discussed in the next segment, The Lifeline.

5. The Lifeline

5.1 The Life lines, will help them to-

TABLE-I

Rewards	Lifelines Used
1. Skip 1 Practical Challenge	500
2. Gain an extra consultation session with an educator of their choice, at the availability and consent of that educator	500
3. Propose a Practical Challenge for everybody, which will be open for voting by educators	500
4. Propose a Real Life Problem for everybody, which will be open for voting by educators	500
5. Propose a new subject in the MITO segment for themselves (valid only for 5 th / 6 th Semesters), which will be scrutinized by the educators	1000
6. Skip 1 Subject, except the Core subjects (valid only in 5 th / 6 th Semesters)	3000
7. Skip 1 Semester (valid only in 5 th / 6 th Semesters)	5000
8. Receive Partial Scholarships	4000- 7000
-Level 1	4000
-Level 2	7000
9. Receive Full Scholarship (scholarships will be awarded only once throughout the course of completion of the curriculum per learner, and full scholarships are only available to the first 5 learners per year)	15,000
10. Enroll in Extra Courses	50- 100
-2 months duration	50
-4 months duration	100

5.2 Here is the guide, to obtain Lifelines (lifelines stops increasing, after completion of MITO)-

TABLE-II

Parameters	Lifelines Gained
1. Practical Challenge (each challenge)	50- 200
-Poor	50
-Average	70
-Excellent (streak of 2, 4, 6 challenges)	100, 150, 200
2. Cognitive Evaluation (each evaluation)	50- 200
-Poor	50
-Average	70
-Excellent (streak of 2, 3 challenges)	100, 200
3. Everyday Learning Objectives Completion (per day)	2
-Streak of 1 Week	20
-Streak of 1 Month	150
-Streak of 6 Months (streak cycle will restart after 6 months)	1000
4. External Courses	100- 200
-2 Months duration	100
-4 Months duration	200
5. Seminar/ Webinar Participation	500- 1000
-Micro Scale (10-100 participants)	500
-Macro Scale (100-1000 participants)	1000
6. Workshop Participation	1000- 1500
-Micro Scale (5-20 participants)	1000
-Macro Scale (20-50 participants)	1500
7. Conference Participation	500- 1000
-Micro Scale (10-100 participants)	500
-Macro Scale (100-1000 participants)	1000
8. Speaker	1000- 2000
-Micro Scale (10-100 participants)	1000
-Macro Scale (100-1000 participants)	2000

9. Research Assistant (per research)	2000
10. Research Author (per research)	3000
11. Project Assistant (per project)	2000
12. Project Author (per project)	3000
13. Accepted Proposal for Practical Challenge (per challenge)	1000
14. Accepted Proposal for Cognitive Challenge (per challenge)	2000
15. Accepted Subject Proposal (per subject)	3000
16. Assistance to Educator (per session)	1000

6. Successful Submission of Final Report- ARM

6.1 The first purpose of ARM is to check the Depth of Interest, and Depth of Researching capabilities of the Learner. To check the two aspects, Evaluation 1 (ARMEVA.1) will happen based on-

6.1.1 The parameters for evaluation are, Amount of Dedicated Time behind the report (10%); Motivation Statement (15%); Research Rate (5%); Referencing Methodology (5%); Information Management (15%); Uniqueness of the Topic (10%); Future use cases of the Research (20%); Impact Factor of the Research towards the Fraternity (20%).

6.2 The second purpose of ARM is to check the Expertise of the Learner in a certain Topic/ Subject, and is done through the Evaluation 2 (ARMEVA.2)-

6.2.1 The parameters for evaluation are, In Depth Knowledge of the Subject (40%); Ability to find the Gap in the subject’s Knowledge (15%); Ability in Providing a solution for the Gap (15%); Collaboration with Fraternity members (15%); Volunteer Contribution towards the Fraternity (15%).

6.3 ARMEVA evaluations will be evaluated by both, A.I. and Educators, the unit of which is “ams” –

TABLE-III

ARMEVA	ams
1. ARMEVA.1	50- 100
-Poor	50
-Average	70
-Excellent	100
2. ARMEVA.2	50- 100
-Poor	50
-Average	70
-Excellent	100

7. Completion of Curriculum

7.1 For the successful completion of the Curriculum, learner needs to-

7.1.1 Have a balance of minimum 2000 Lifelines

7.1.2 Have a balance of minimum 120 ams

The ams, will get converted into lifelines after the completion of both MITO and ARM- 1 am = 50 lifelines, hence will give the learner a total of 8000 lifelines at the end of the curriculum (minimum).

7.2 The learner can obtain-

7.2.1 a Proof of Completion - Master of (Subject Name) - 8000 lifelines

7.2.2 admission to the PhD - 20,000 lifelines

7.2.3 partial scholarship for PhD - 30,000 lifelines

7.2.4 job as an Educator Assistant - 40,000 lifelines; as an Educator - 60,000 lifelines

7.3 After finishing the curriculum, except if the learner wants to be attached with Education system, the lifelines will get converted into EdCurrency (EdCur.), which can be used any time, anywhere for the Education as well as Professional purposes. 1 EdCur. = 1000 lifelines. The inter web functioning of EdCur. and lifelines, can be studied in whole different paper.

CONCLUSION

The fact that the information carried over generations to generations, so efficiently, still giving us the flexibility and the adaptivity, makes us ponder as to why shouldn’t our Education system, especially Spatial Design education be inspired from our own DNA composition. Spatial design education, needs to be adaptive, reactive and mutable, as it requires learners to think not just vertically or laterally, but 3 dimensionally. Also, the fact that, spatial design has two pillars, or fundamental streams- art & science which is nothing but design and technology, makes it perfect for having a Double Helical structure, which is a combination of Linear, Concentric and Spiral structures.

The system hence proposed above, is an amalgamation of the best of all the Worlds, where we use A.I. and real time Educators, in synchronization, to help achieve the desired results. The A.I. helps in making the system Democratically Adaptive and Mutable, where the role of A.I. can be defined at several stages-

1. Learner Level- A.I. being constantly present, monitoring the performance, discipline, regularity, interest, moods etc helps the curriculum be flexible and adaptive enough, so that learners can study at their own convenience, and time. This uplifts the pressure on learners which is usually present in the Formal setting i.e., learners need to finish the curriculum in a certain amount of fixed time. The first liberty learners are getting due to A.I. is this freedom of Time. The next advantage of using this technology is the fact that once the learners play with the equalizer, the A.I. will suggest the next steps, along with the potential subjects eligible for that particular learner. This active, curated suggestions play a vital role in the selection of the subjects, learners have.

2. Educator Level- the technology will unlock the potential of educators to help each learner, based on their individual paths taken, and hence A.I. will also enable both the learner as well as educators to select their own preferences which they can select, in accordance with the selection of the learners. Another important advantage of this system will be the fact that, unlike the formal settings, Educators will be more like Facilitators, providing more pin point knowledge to each learner, and hence will be able to help guide the learners, instead of forcing them to walk on a certain path. Also, the MITEVA.1 will greatly help the educators to reflect on their pedagogies/ andragogies and iterate throughout the curriculum and even after that.

3. Curriculum Level- this system hence proposed will enable the curriculum to have insights such as how much time, on an average learner took to complete a certain subject, and correlate it with other factors such as pedagogy/ andragogy, interest rate of learners, time of the day etc. This correlation of data and information, at a Curriculum level will immensely help the curriculum to be adaptable and mutable. Another advantage will be the fact that, before starting the curriculum again the system will average out the average subjects taken, average time taken by learners and enable us to take a decision of re-iterating the curriculum based on this past information. Overall, at the

curriculum level, entire dataset will be linked, including, the demographics of Educators and Learners, the amount of time dedicated towards the curriculum by both the parties, the amount of time taken for each subject on an average, the types of subjects selected in each semester, the types of other external courses, seminars, workshops, conferences, research etc can be analyzed.

Once we start with Alpha phase of the curriculum, which had 40% of the learnings from the formal settings, because the system is Mutable and Adaptable, the curriculum will keep on evolving and re-iterating itself, giving the educators and learners, with upgraded knowledge and system, which will be based on the last time it had a run. Hence, Alpha phase will have 40% of the Formal setting's information, Beta will have 20%, and then forward, the Natural Phase will start, which will totally be dependable on the Educators' and Learners' response in the first two phases as well as real time data inputs. This system can be put into effect more efficiently, especially if we let the Curriculum become Democratically Adaptive [9] in its nature, where the Curriculum follows the Non-formal education system, and uses the current technology to transit from Formal to Non-formal setting.

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THE STUDY OF INCREASED SOCIAL INTERACTIONS IS THE KEY TO ARCHITECTURAL PROFICIENCY

with emphasis on the Student of Architecture, Academicians and practicing Architects

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ABSTRACT

To be understood and to understand others is the basis of all human needs. Social interactions are a fundamental need for students studying architecture or a practicing architect. As education in all fields' races for new changes every year, the study of designing spaces is now incomplete without involving the study of people. All people tend to socialize and are involved in interacting with one another. This paper tends to probe the future of architecture concerning the study of social interactions for the end-user. It seeks to emphasize that the competent architect needs to employ the activation of all his senses during the designing of spaces including his intuition and that can be best done with the study of social interactions.

The author in the research paper has suggested that to design spaces for productive and effective social interactions calls for effective and productive social skills of the architect. This paper tends to probe the future of work-life social interactions and family life social interactions along with friendships in an era dominated by digital systems. Understanding social interactions for the competent architect is important to be looked at closely, not merely concerning spaces of occupation but also from the vantage place of the social interactions of the men and women who will occupy those spaces.

The author in the research paper has suggested that the accelerative thrust that we will now experience in the future in our work and personal lives has sociological as well as psychological consequences and the study and understanding of social interactions will greatly enhance the emotional quotient of the student studying architecture.

The paper also tends to, in its small part, attempt to explore systematically the effects of this accelerative thrust with the elements of social interaction and contends with the fact that this study is an idea whose time has come

A study of the elements of social interaction mentioned above as in the research paper in depth will then help us to grasp not just its importance but also the need for the inclusion of these studies in architecture education. It will help us comprehend that the competent architect needs to start inculcating these very social skills in him at a rapid pace if he aspires to design spaces for the work and life of the future individual.

KEYWORDS

Social Interactions, Social Stratification, tangible and non-tangible elements, social values, deceleration initiatives, language and symbols

INTRODUCTION

The Education Journey of a student studying Architecture is a conglomeration of many experiences that come his way over a few years. These experiences jointly are actually what shape his very foundation towards his architectural proficiency and social interactive capabilities. In this interesting journey, especially in the classes that lead up to the graduation level, there is a basic foundation of skills that is established, which is required after they enter the professional world and start their careers. Some call it adulthood. These skills are responsible for building their knowledge and enhancing their social structures. Friendships and camaraderie are formed that usually last long into their adult lives.

It is well known that modern architecture education does deal with social spaces and workplace strategy as subjects. Much attention has been drawn to designing spaces keeping in mind the social interactions of those who would potentially occupy them. But what is often ignored by the academic community as a whole and consequently the student community is relationships and relationship building. A simple fact tends to be overlooked often. If an architect needs to design spaces for effective and productive social interaction then his social skills have to be just as effective. Three, very prominent kinds of people are observed when you are trying to study the architecture community. Firstly, the architecture student himself. Then is the academician who is an architect and teaches the ones who are studying and then you have the ones who are practicing architects either entrepreneurs or working with an organization in an official capacity.

An observation that surfaces every time is that except for a few, most of those who represent these three stages described above need to drastically enhance their social interactive skills much beyond usual professional competencies and language skills.

Aim and Objective:

This research paper aims to convey and convince that the role of the modern architect and his success in today's times is very closely related to the efforts he takes towards effective social interaction with others. It intends to demonstrate that a competent architect should be one who practices increased social interactions with a myriad of people from different backgrounds.

It further aims to demonstrate that the development of these skills in the student of architecture will radically improve his observation power and his emotional intelligence. This then subsequently will develop his creative response to enhance his design skills and help him to philosophize adequately at different stages of his professional life

Relevance and Significance:

Social rationality has always taken precedence over individual rationality and this, in turn, depends on the social interactions between people in the same environment or differentiating ones. Rapid Urbanization, demographic conflict, migrating population and crime are just some of the things that come to mind when we think of fast-paced changing systems in today's society. To try and comprehend, if while designing spaces, the increase in the study of social interaction will greatly help in the future of the people occupying these spaces. This study of effective social interactions and its effect on the design of spaces is of great importance to students of architecture, the academicians teaching architecture and the practicing competent architect.

Scope and Limitation:

The research paper emphasizes the need to pay attention to the skills of social interaction that an architect needs to study.

The research attempts to showcase the different sides of social interaction and the various elements associated with it. It does acknowledge the tremendous benefit to mankind due to competent architecture designs all over the world and wishes to draw attention to some of the issues that may be faced in the future if the students or architecture or the academicians or the practicing architects do not pay attention to the fine art of learning social skills. This research paper though logical is mildly speculative and understands that increasing the capability to socially interact is just one of the aspects that the competent architect needs to work on. It recognizes that the only increase in the capability to have effective social interactions is not adequate in the field of architecture and basic proficiency to design is paramount.

WHAT IS AN INTERACTION?

An interaction is loosely defined as an action that occurs between two or more objects when they come nearby. All these objects need to affect each other if the event has to qualify as an interaction. A one-sided effect can be a casual effect and may not necessarily qualify to be an interaction. In today's VUCA world, all objects that have an interaction with each other need not be very close but they need to be connected.

We will try and explore this aspect of interactions limited to the architecture fraternity for the sake of this research paper.

Social interactions are the process of stimulation or response in reciprocity between two or more people. Most social interactions are responsible for developing competition, influencing social roles and statuses and encouraging people towards developing healthy relationships with one another. The basis of the whole social order can be linked to social interactions. It is the foundation of all structures, social groups, social processes, and functions. Also called as a stimulus-response condition in humans, it is the result when 2 people talk to each other or correspond physically or the internet or electronic means of communication. A child suckling milk, a doctor attending to a patient, a customer buying from a storekeeper, a movie ticket being bought are all examples of social interaction. It's more of a social relationship.

- Dawson and Getty - It's a process by which men interpenetrate each other's minds
- Merrill - It is the general process whereby two or more persons are in a meaningful contact, due to which, the result of which their behaviour is modified however slightly
- Corkiness - Social interaction is such a process to influence the overt behaviour or state of mind of individuals

Elements of Social Interaction

- The need for 2 or more people to be a part of the social interaction
- The need for a relationship to be reciprocal
- The influence of the social interaction on the behaviour event and brain of the people involved in the interaction.



Image no. 1: The cycle of interpersonal relationships in social interactions (Source: www.slideshare.net)

THE IMPORTANCE OF EFFECTIVE SOCIAL INTERACTIONS FOR ARCHITECTS

The art of conceptualizing a space by an architect in advance before that space becomes a reality is one of the crucial differentiating factors between architecture and other professions that define space say engineering services. The competent architect while designing a space needs to envisage the people occupying the space with 2 references.

Recognizing Social Spaces and Public Spaces:

All public spaces are social places but all social spaces need not be public spaces. A competent architect who has operated in both the spaces as the end-user will then be able to effectively design them. His unique sense of sociability will help him to evaluate the spatial organization in urban patterns. The most likely and noticeable feature of spatial organization is income differentiation. Recognizing these patterns with the context of social interactions in designing these spaces will be very helpful.

When you try to bring together different forms and shapes to provide a cohesive design to the structure then a sense of the people who will occupy these spaces is paramount for the competent architect.

Understanding Tangible and Intangible experiences:

The environment designed by the architect in which any tangible or intangible experience to the end-user is delivered is important as it boosts the satisfaction of the end-user. If the architect has himself operated in these environments it becomes easier for him to design the experiential elements created by scents, lights, colours, music, etc. These design variables tend to boost the satisfaction of the end-user occupying that space and have a special effect on their senses if perceived properly with sociability. Both tangible and intangible elements of design contribute to the well-being and independence of the end-user, for example - the design of a high-end resort or a hotel.

Besides this, an increased effort by the student of architecture or the practicing professional to study social interactions concerning living and non-living constituents, physical and nonphysical elements will be very essential. It will also help him to understand spaces concerning different experiences for the end-user at different times in a day or a year for that matter.

DECCELERATION AND ACCELERATION INITIATIVES BY ARCHITECTS TO GRASP THE IMPORTANCE OF SOCIAL INTERACTIONS

The very basic building block of Sociology is social interactions.

To begin with, if an architect needs to start understanding the very art of social interactions he must start going in the opposite direction of fast-paced acceleration in life as we know today. This can be done simply by the future architect or the professional architect conceptualizing enclaves of the past. Over the next several decades all environments racing towards turbulent digital futures will not be able to do so without centres of specialization in which pace of life is decelerated artificially. These spaces are to be visualized as places where novelty, choice, and turnover are purposefully limited. In these carefully designed spaces, people can escape the pressures of senses being over stimulated for extended periods. Conceiving these spaces as an architect will automatically set the student or the professional on a journey of self-realization through the drawing board. These decelerated communities will ask them to design a more relaxed and less stimulating existence for individuals. Here is where the architect needs to look into space where people are slightly cut off from the surrounding society. Vehicular access is limited and so is access to media, either electronic or print. Except for special emergency services, everything in this space spurs and encourages social interaction. When one starts to design and think of these spaces of deceleration, he automatically starts on the journey of self-discovery of his ability to interact socially with others.

The architect post this visualization can also then spend some time in a village in the mountains with people who still are a bit untouched by the acceleration of technology and start his experiments with social interaction there.

After this phase is done the architect should then start conceptualizing just the opposite that is spaces of acceleration. This will be spaces where the experiential simulation with the help of virtual reality will be at its peak and the individual who likes to pre adapt to his senses will not merely hear and see, but also smell, taste and touch the environment which he will be occupying. In this atmosphere, an architect can design places where a person can very vigorously interact with people in his future and will be able to undergo carefully curated experiences specially designed to alter his mechanism of coping.

By positioning himself in the middle of these two conceptual spaces the architect of the future can then start to comprehend in a very rapid manner the importance of social interaction both the sides. He will then begin to realize the immediate need for him to super specialize in social interactions to be able to even remotely think of designing these spaces.

POSITIONING SOCIAL INTERACTION INTO CATEGORIES BY THE COMPETENT ARCHITECT

Social interaction categorization is hardly airtight. Most of us can cite some relationship we have had in our lives be it working or personal to have lasted longer than some other relationship we had. Some of us can cite several long-lasting relationships we have for example going to the same doctor or dentist for years. Most of these relationships are spurred by the interactions we have with those individuals and what makes them exceptional is the very durability of those ties.

Let us look at a bit of categorization of these social interactions.

Verbal and Non-Verbal interactions:

When one uses various sounds and language to send a message across, the interaction is said to be verbal. It is a vehicle for us to express our desires and is very important to the processes of learning and teaching.

Language is the method of pure verbal interaction that human beings employ to communicate within themselves.

Interaction through postures, facial expressions and gestures are said to be nonverbal interaction. A mother practices verbal as well as nonverbal interactions with her new born child who is quick to pick up what she has to say from a very early age. In organizations, schools, and household's nonverbal interaction takes place on an everyday basis. The employee who walks late to the office understands that the boss is not happy by the frown on the superior's face. Similarly, he also knows if he is going to be spared that day if he sees the boss happy with some good news around him. One stern look from the teacher is enough to make the whole class go quite if they are in a boisterous mood more than shouting and scolding.

A husband or a wife who comes home to a scowling spouse realizes something is amiss before it is said.

This highlights that in real life nonverbal interactions get precedence over verbal ones since they form the first impression through confidence and body language. They gain ascendancy over verbal interactions since most interactions begin this way without words or sounds.

Physical and nonphysical interactions:

- Physical or Direct - Physical action between two individuals has to be involved. For example - Handshake, a hug, a kiss or a pat on the back
- Symbolic or nonphysical - This involves the use of language and symbols. It is the most common method in most societies. Human beings mostly convey their ideas by language and that is reciprocated. Various instruments like the phones and smart phones, the world wide web, the postal system, railways, road and sea services, for example, are used to facilitate this.

Individual to the Individual:

At least two people need to interact. The doctor and the patient. The mother and the child etc.

Individual to the Group:

From one person to more. A teacher teaching a class. A speaker addressing an audience.

Group to Group:

Two teams playing against one another. Two delegates debating a topic.

Between Individuals and Culture:

When people listen to TV or the radio or the internet or read a newspaper, they are in effect subscribing to a culture. TV, Cinema, Exhibitions, Theatre, Drama are socio-cultural activities and are included in the culture of a society.

The study of culture is of great importance to the architect in his pursuit of the knowledge of social interactions.

A group of people spends a way of life which is a mixture of languages, beliefs, values, and norms.

Let us look at some elements of cultural imperative to study social interactions.

(i) Language:

Individuals in a group need to communicate. Language is a means for that purpose. Different cultures have different symbols, sounds, and gestures. It is fundamental for a person to learn the language of his culture to acquire the requisite social skills.

(ii) Norms:

Another vital element of culture are norms. They are the cultural expectations of an individual by society. Fast food restaurant lines for example. Furthermore, norms are divided into two components, mores and folkways. Folkways are the general standard behaviors of the general standard followed by individuals who are called folkways. For example, the way of preparing food, greeting guests and dressing. The ethical and moral behaviours followed by individuals are called as Mores.

(iii) Beliefs:

A society shares some collective ideas over true and false and right and wrong often called as beliefs. All beliefs have their origin in values and norms. Atheism or spirituality for example.

(iv) Values:

Beliefs and values are intertwined. The abstract standards of a culture or their ideologies are called values. True cultural cohesion or cultural conflict has its birth in social values.

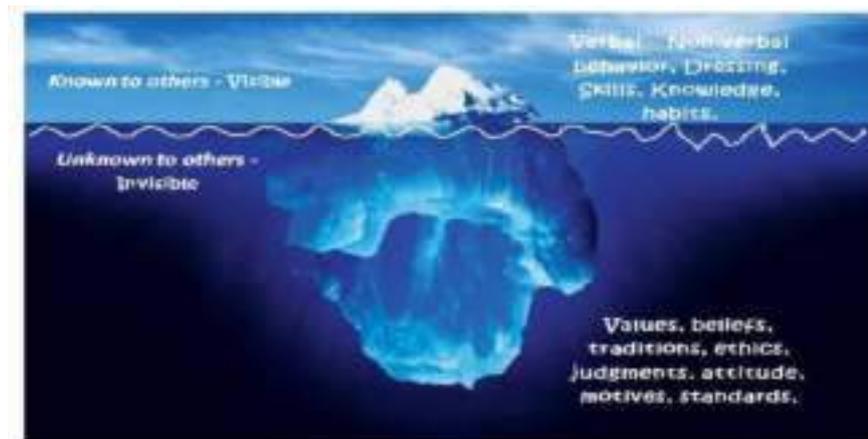


Image no. 2: Sigmund Freud's Iceberg model depicting social behaviour (Source – www.futureconsiderations.com)

THE UNSEEN CONNECTION BETWEEN SOCIAL BEHAVIOUR AND SOCIAL STRATIFICATION

The hierarchical social standing of people in society is called as social stratification. A typical hierarchical system has some people standing at the bottom of the social ladder, some people stand on the top and some right in the middle. Many factors determine this. Power, cast, upbringing, wealth, occupation being just some of them. Different layers of people make up the social stratification of a society. Resources are usually distributed unequally with a typical stratification comprised of the ones with more resources at the top.

A competent architect or student of architecture can do good with this knowledge as he knows how to utilize this in a very effective way.

Every society has social classes existing within it and the whole society then tends to reinforce them from time to time. If the architect learns to increase his social interaction with all these strata of society, he will be very powerful in the knowledge of designing spaces for all members who belong to all these sections. Prestige and wisdom are given precedence in some social stratifications and wealth in some.

This understanding of social stratification can also be extended to the study of social values when the student of architecture starts comprehending and studying social interactions. The cultural criteria to differentiate between the moral and the immoral, the good and the bad and the desirable with the undesirable loosely constitute social values.

CONCLUSION AND SUGGESTIONS

All Architectural projects are by-products of social initiatives and social interventions. The psychological understanding and the evolution of thinking ability has enabled us to come closer to each other as social beings. Today architecture education has advanced with leaps and bounds to cover many aspects of design but a crucial aspect of design which is end-user research concerning social interactions is avoided.

A fast-paced digital world propelled by the insecurities of social media is hugely responsible for the student of architecture to be lacking in the art of social skills due to the immense desire to operate silo or huddle in groups. If he needs to incorporate the elements of social interactions in his design and improve his creative response then he needs to comprehend that his capability for social interactions has to be very fine.

Further research into the study of social interactions with respect to the student of Architecture will greatly enhance his architectural proficiency and will help him to incorporate the right amount of emotional intelligence into a project for maximum efficiency.

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The National e-Conference on Empirical Theories in Architecture, Planning & Construction Management NCET-2020

The e-Conference was conducted on Friday 7th August 2020 & 8th August 2020 and streamed LIVE at our official Facebook channel. The audio-video recording of the Conference is published at our official YouTube channel also after the Conference.

The event happened to be one of the first virtual, e-Conferences conducted in the country, especially during the pandemic environment and constraints. Thank you so much Team ACOA-NCET-2020!

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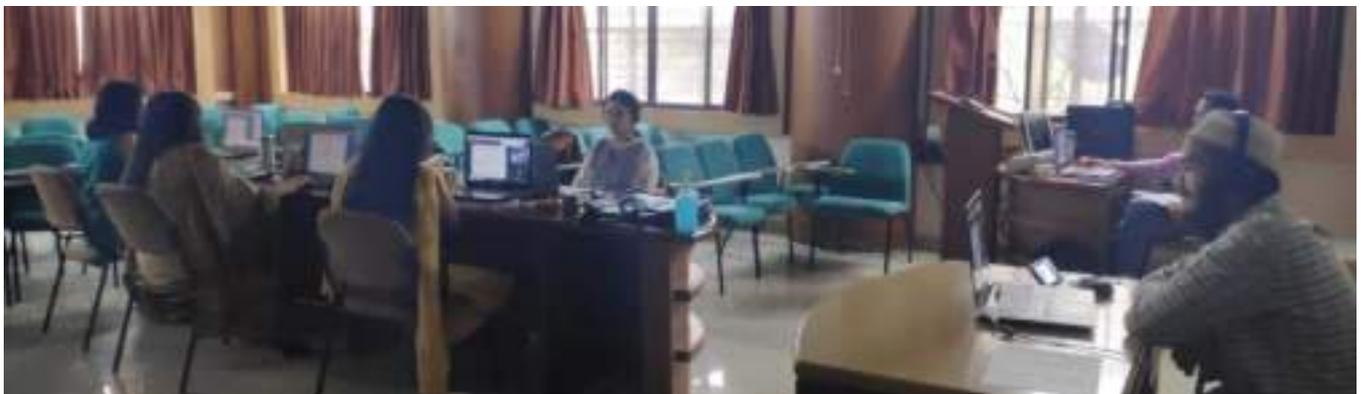
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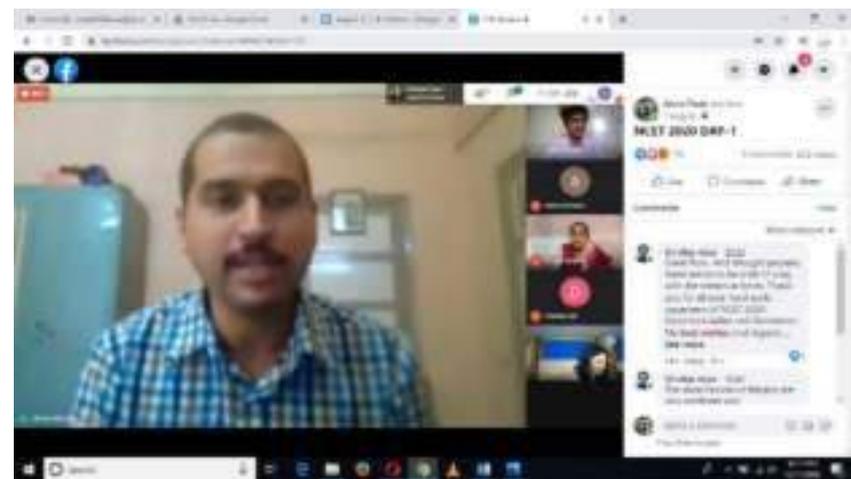
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**Inauguration of e-book or proceedings of NCET-2020 on 17.12.2020
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Conference Days Team ACOA-NCET-2020





ACOA-NCET-2020

DAY-2

ARP -PANEL







**National Conference on Empirical Theories in
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7th & 8th August 2020 at ACOA, Pune**

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regarding Research Papers received, selected, presented, appreciated, to be published

The first e-Conference NCET-2020 by Allana College of Architecture, Pune in association with Council of Architecture, New Delhi & Indian Institute of Architects Pune Centre has been executed with great success & appreciation, using Google-Meet application & streamed LIVE at Facebook page "Acoa Pune" as per schedule.

116 Registrations via Google form, 100 Research Papers received, 73 selected for publication.

UG-Panel (Under-Graduate students): 38 Research Papers received, 27 selected for publication

PG-Panel (Post-Graduate students): 20 Research Papers received, 16 selected for publication

ARP-Panel (Academician-Researcher-Practitioner): 42 Research Papers received, 30 selected for publication

Best Research Papers in 3 categories:

(page 1 of 2)

Author/s	Title of Research Paper
UG-Panel:	
Netrali Bhagwant Adhav, Vaishali Mangesh Anagal	THE EFFECT OF NEIGHBOURHOOD CHARACTERISTICS AND AMENITIES ON THE PROPERTY VALUE
Drishhti Jain, Vaishali Anagal	A SURVEY ON PEOPLE'S OPINION ABOUT SMART CITY INITIATIVE IN AUNDH AREA
PG-Panel:	
Deepti Rajendra Pratap Shaahi, Bhagyashree Apte	RESEARCH ON PROJECT MANAGEMENT FOR CONSTRUCTION OF RESIDENTIAL BUILDING (G+3) IN "SUSTAINABLE FERROCRETE CONSTRUCTION TECHNOLOGY" FERROCRETE TECHNOLOGY-PROJECT MANAGEMENT OF SUSTAINABLE RESILIENT TECHNOLOGY FOR FUTURE...
Manisha Atul Patil	IMPACT OF USAGE OF BATHROOM PODS IN HIGH RISE OR MASS RESIDENTIAL HOUSING PROJECTS, Review & evaluation of bathroom* construction systems in contemporary India
ARP-Panel:	
Mukta Gokhale -Kulkarni, Avanti Gole	RE-CONNECT WITH NATURE, The first step for sustainable living
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Dipti Sameer Bapat	SOIL AND PLANTATION MANAGEMENT FOR LANDSCAPING OF RESIDENTIAL PROJECTS IN AND AROUND PUNE (Site area 10 - 40 Acre)
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Somdatta Das, Naziya Mistry	PRESERVING THE HARI MANDIR OF THE PRARTHANA SAMAJ AT PUNE
Kaustubh Revindra Dixit	ANALYSIS OF CHANGE IN HOUSING TYPOLOGY (A SHIFT – RURAL – TO SEMI URBAN – TO URBAN CONTEXT) IN POST INDEPENDENT BHARAT FROM 1947 TO 1969 BY OVERVIEW OF BHARATIYA CINEMA
Atul Ashok Katariya	EXECUTION PARTICULARS OF CONSTRUCTION OF A PRIVATELY OWNED JAIN TEMPLE, Documentation of small scale temple construction at Pune
Shridhar Aiyer	THE STUDY OF INCREASED SOCIAL INTERACTIONS IS THE KEY TO ARCHITECTURAL PROFICIENCY with emphasis on the Student of Architecture, Academicians and practicing Architects

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Bhavana Anil Chhajane, Prof. Sushama Parashar	ASPECTS OF SPACES AND AUTISTIC KIDS
Shivani Bhandari, Parag Narkhede	FACTORS AFFECTING ARCHITECTURE OF AN ADMINISTRATIVE BUILDING
PG-Panel:	
Asmita Patwardhan, Asawari Sohani	ANALYZING FACTORS, THAT LIMIT THE PERFORMANCE OF SOLAR WATER HEATER SYSTEMS, DUE TO EXECUTION INACCURACIES, IN PUNE
Gazala Asrab Tamboli	ANALYSIS OF INTELLIGENT LIGHTING SYSTEMS IN WASHROOMS IN COMMERCIAL MALLS: Case studies: Amanora Mall and Seasons Mall, in Hadapsar, Pune
Shubhra Pathak	Planning of Warehouse with Respect to Today's Requirement of Market
Manjiri Deshpande, Laxmi Salgia	BEHAVIOUR BASED SAFETY APPROACH FOR FIRE SAFETY IN HIGH RISE RESIDENTIAL BUILDINGS - Case Study of Pune
Neha Chandrashekhar Hiremath, Prachi Aiyer	Feasibility of Including Water Recycle Plant - A Case Study for an Existing Residential Project at Solapur
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Sapna Bang	ALTERNATIVE EXTERNAL FINISHES AND CLADDING SYSTEMS IN PUNE, Comparative Analysis for Decision Making
Sneha Bhosale	NATURAL FIBER COMPOSITES, ITS USAGE AND COMPREHENSIVE STUDY, Case Study on Bamboo and Jute, Analysis of Material and its Applications
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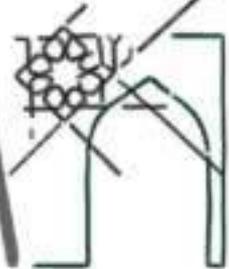
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