STRUCTURAL ENGINEERING

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OF

STRUCTURAL ENGINEERS

ISSE

VOLUME 25 - 3

JULY - AUG - SEPT 2023

GEM 37: PROF. N.E. SHANMUGAM, EXPERT IN STABILITY AND DYNAMICS OF STEEL PLATED STRUCTURES - see page 3

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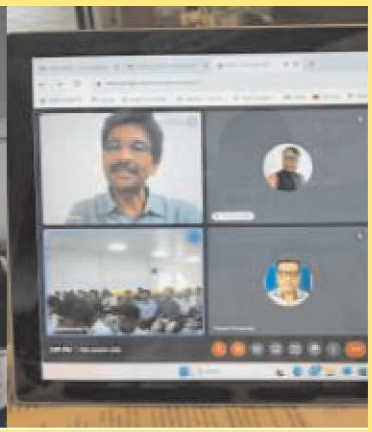
LET US BUILD A STRONG STRUCTURE OF INDIAN SOCIETY

NEWS AND EVENTS DURING JULY TO MAR 2023



15 Jul 2023

ISSE student chapter at Maharaj Institute of Technology, Thandavapura, Mysore was inaugurated in hybrid mode. Hemant Vadalkar Secretary ISSE delivered lecture on Sustainable development and civil engineers.

9 Sept 2023

Inauguration of Amravati local centre of ISSEAmravati local centre of ISSE was inaugurated by ISSE Trustee Madhav Chikodi, Paresh Unnarkar and Ranganath Satam. Event was supported by Ultratech Cement Ltd

15 Sept 2023

Inauguration of Kalyan Dombilvi Local centre of ISSE Indian Society of structural Engineers, Kalyan Dombivli Local centre (ISSE-KDLC) was inaugurated on the auspicious day of 15th Sep, 2023 which is celebrated as Engineers Day. The day is celebrated all over India to commemorate the great civil engineer Bharat Ratna Sir Visevesvaraya.

INDIAN SOCIETY OF STRUCTURAL ENGINEERS

ISSE

VOLUME 25 - 3, JULY - AUG - SEPT 2023

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Contents

Editor : Hemant Vadalkar

AIMS & OBJECTIVE OF ISSE

1. To restore the desired status to the Structural Engineer in construction industry and to create awareness about the profession.
2. To define Boundaries of Responsibilities of Structural Engineer, commensurate with remuneration.
3. To get easy registration with Governments, Corporations and similar organizations all over India, for our members.
4. To reformulate Certification policies adopted by various authorities, to remove anomalies.
5. To convince all Govt. & Semi Govt. bodies for directly engaging Structural Engineer for his services.
6. To disseminate information in various fields of Structural Engineering, to all members.

FIELD OF INTEREST

- ❄ Structural; Designing & Detailing
- ❄ Computer Software
- ❄ Materials Technology, Ferrocement
- ❄ Teaching, Research % Development
- ❄ Rehabilitation of Structures
- ❄ Construction Technology & Management
- ❄ Geo-Tech & Foundation Engineering
- ❄ Environmental Engineering
- ❄ Non Destructive Testing
- ❄ Bridge Engineering & Other related branches

Fraternity News

WELCOME TO NEW MEMBERS

(APR - MAY - JUNE 2023)

2335	Akshay Prakash Kalgutakar	2355	Pradip Shankarao Lande
2336	H. N. Renuka Prasad	2356	Rajesh Anantrao Thakare
2337	Naredra Kumar Kumawat	2357	Suriya Narayan K.
2338	Narsimha Deepaksarama Karlapalem	2358	Shaikh Muzammil Atif
2339	Souren Pal	2359	Mohammad Shahezad Mohammad Sabir
2340	Minal Deepak Bhongade	2360	Gajendra Vasantrao Khot
2341	Kalpana Milind Patil	2361	Sudarashan Ajay Bhansali
2342	Shivani Soman	2362	Ameerhusain Suhelahmed Jamdar
2343	Surajkumar Babasaheb Patil	2363	Gopal Manohar Bennur
2344	Vishal Dilip Shah	2364	Rashmi Vasantrao Jadhav
2345	Arul Jothi Ramalingam	2365	Mahendra Gajanan Rozekar
2346	Saurabh Raju Ingole	2366	Sujeet Bharat Ghadge
2347	Karan Ajay Verma	2367	Mayur Laxman Patare
2348	Chirag Hemprakash Patil	2368	Paresh Jauhri
2349	Subodhkumar Vitthalrao Dhoke	2369	Hitendra Ganesh Khachane
2350	Anurag Virendra Tiwari	2370	Adinarayana Darapureddi
2351	Yuvraj Dattatray Patil		
2352	Sri Bapi Birbanshi	JM 74	Krushna Tulshiram Ahire
2353	Sagar Dadarao Dhengle	IM 07	Government Polytechnic
2354	Srinivasa Rao Vangara	OM 37	The India Cement Ltd

Patrons : 38
Members : 2370
Student Members : 444

Organisation Members : 37
Junior Members : 74

Sponsor : 8
IM : 07

TOTAL STRENGTH : 2,978

GEM 37: PROF. N.E. SHANMUGAM, EXPERT IN STABILITY AND DYNAMICS OF STEEL PLATED STRUCTURES

Dr. N. Subramanian, Ph.D., FNAE

Prof. N.E. Shanmugam(Aug.12,1941- Nov. 18,2022)

Prof. Nandivaram Elumalai Shanmugam, B.E., M.Sc.(Engg.), Ph.D., F.ASCE, FIE(I) is a global leader in Steel Structures and a former Professor of Civil Engineering at The National University of Singapore (NUS) and The National University of Malaysia (UKM). After 50 years of teaching at graduate and undergraduate levels in several top class universities in the world, he retired a few years back from the National University of Malaysia. Professor Shanmugam was actively involved with research in the area of stability of steel plated structures including cold formed structures for several decades. Prof. Shanmugam has published more than 200 journal articles, is a winner of several awards and a member of the Editorial Board of several International Journals. Professor Shanmugam was such a positive inspiration with his kind smile, mild-mannered and well-intentioned towards others. Those who had the opportunity to interact with him are grateful for the memories and the values he had passed on.

Early Life and Education

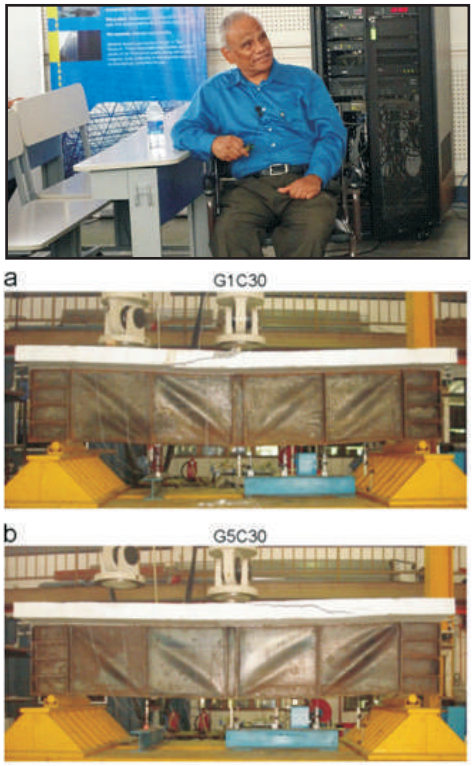
Mr. Shanmugam was born on 12th August, 1941, in Nandivaram, Guduvancheri village, Chengalpattu district, in the southern Indian state of Tamil Nadu, as the youngest of nine children. Rather than continue down the traditional family business as an artisan, his family guided Mr. Shanmugam down a path of focusing on his studies. Coming from a humble background, he had to walk long distances every day to and from school. He did so well at school that he ranked amongst the highest in the state, and earned a scholarship to study Civil Engineering.

Widely known in academic circles as “Shan”, Prof. Shanmugam obtained both his Bachelors (B.E.) in Civil Engineering and Masters Degree (M.Sc.(Engg.) in Structural Engineering respectively, from the College of Engineering, Guindy, University of Madras (Now, Anna University) during 1960-1968. After getting married and starting a family, his achievements earned Mr. Shanmugam the opportunity for continuing his PhD studies in the United Kingdom in 1976, becoming the first in his family to travel abroad. He obtained his Ph.D. degree in Structural Engineering (Steel Structures) from the University College, Cardiff at the University of Wales in 1978.

Teaching Experience

Prof. Shanmugam started his teaching career in College of Engineering, Guindy (University of Madras), Delhi University, University of Wales (Cardiff) and Polytechnic of Wales. After completing his doctorate, his family moved to Singapore, where he progressed through his career as a Professor at the National University of Singapore. From Dec. 1981 to June 2005, Prof. N E Shanmugam worked as a Professor at the National University of Singapore, Singapore, teaching at graduate and undergraduate levels, and engaged in Research and Educational Management. From June 2005 to June 2014, he was engaged in teaching and research at the Universiti Kebangsaan Malaysia (National University of Malaysia). After 50 years of teaching at graduate and undergraduate levels he retired a few years back from the National University of Malaysia. After spending a few more years in India, Prof. Shanmugam moved to the USA, as he wanted spent his retired life close to his children. His research interest includes steel plated structures, steel-concrete composite construction, long-span

structures and connections, cold-formed steel structures, and elastic and ultimate load behaviour of steel structures.



M.Y.M. Yatim, N.E. Shanmugam and W.H. Wan Badaruzzaman, "Tests of partically connected composite plate girders". Thin-Walled Structures, June 2015

Professor Shanmugam has guided several Master and PhD students throughout his career. All of them now occupy various important positions both in industry and academia across the globe.

HONORS AND OTHER PROFESSIONAL ACTIVITIES

The outstanding research and accomplishments made by Prof. Shanmugam were recognized by several National and international bodies with several awards and accolades and some of them are listed below:

He was a co-recipient of the George Stephenson Medal from the Institution of Civil Engineers, London. He was a member of the editorial boards of Journal of Constructional Steel Research, Journal of Thin-Walled Structures, International Journal of Structural Stability and Dynamics, Bridge Engineering – Proceedings of the Institution of Civil Engineers (2000-2006), International Journal of Steel Structures, International Journal of Steel and Composite Structures, and The Institution of Engineers India's (IES) Journal A Civil and Structural Engineering.

Member of editorial boards for...

Professor Shanmugam is a Chartered Engineer, Fellow of the Institution of Structural Engineers, Royal Institution of Naval Architects, American Society of Civil Engineers, The Institution of Engineers, Singapore and The Institution of Engineers, India and Honorary Fellow of the Singapore Structural Steel Society. Few academicians excel in teaching and research; Professor Shanmugam is one among them.

PUBLICATIONS

Prof. Shanmugam has published more than 200 research papers in International refereed journals, conference proceedings and contributed chapters in Civil Engineering Handbook, Structural Engineering handbook and Bridge Manual. He is a member of the Editorial Board of a number of International Journals.

Books

He has published extensively on steel and steel-concrete composite structures and edited two books on Analysis and Design of Plated Structures – Stability and Dynamics besides three conference proceedings.

• N.E. Shanmugam & C.M. Wang (Editors), Analysis and Design of Plated Structures : Stability, Woodhead, 2006, 480 pp.

• N.E. Shanmugam and C.M. Wang (Editors), Analysis and Design of Plated Structures: Dynamics, Taylor & Francis, 2007, 508 pp.
• N.E. Shanmugam, J.Y.R. Liew, V. Thevendran (Editors), Thin-Walled Structures Vol.2, 2nd Intl. Conf., Elsevier, 1998, 826 pp.
• S.L. Lee and N.E. Shanmugam(Editors), Composite Steel Structures: Recent Research and Developments, Elsevier Applied Science, 1991,204 pp.The complete proceedings is available in three volumes: Steel Structures, Aluminium Structures, and Composite Steel Structures.

Selected Journal Papers

Only a selected few papers of Prof. Shanmugam are listed here.
• N. E. Shanmugam and M. Arockiasamy, "Local buckling of stiffened plates in offshore structures", Journal of Constructional Steel Research, Vol. 38, No. 1, May 1996, pp. 41-59.
• Shanmugam NE., Thevendran, V., and Tan, YH. Design formula for axially compressed perforated plates. Thin-Walled Structures, 1999, 34, 1–20.
• Shanmugam NE, Baskar K. Ultimate load behaviour of webs in steel–concrete composite plate girders. IES Journal Part A:Civil/ StructuralEngineering 2008;1(2):123–40.
• Shanmugam NE, Basher MA, Khalim AR. Ultimate load behavior of horizon- tally curved composite plate girders. Steel CompositeStructures International Journal, 2009;9 (4):325–48.
• Shanmugam NE, Baskar K. Design of composite plate girders under shear loading. Steel Composite Structures International Journal,2006;6(1):1–14
• Darehshouri SF, Shanmugam NE, Osman SA. An approximate method for shear strength of composite plate girders. In: Proceedings of the 7th international conference on steel and aluminium structures, 2011, pp. 215–20.
• Darehshouri SF, Shanmugam NE, Osman SA. "Collapse behavior of composite plate girders loaded in shear"Journal of StructuralEngineering, ASCE 2012;138(3):318–26.
• Darehshouri SF, Shanmugam NE, Osman SA. An analytical method for ultimate shear strength of composite plate girders with web openings. Engineering Structures, 2013;56:610–20
• Yatim MYM, Shanmugam NE, Wan Badaruzzaman WH. Behaviour of composite plate girders with partial interaction. Journal of Civil Engineering Management, 2013;19 (Suppl. 1): S1–S13.
• Basher M, Shanmugam NE, Khalim AR. Horizontally curved composite plate girders with trapezoidally corrugated webs. Journal of Constructional Steel Research,2011;67:947–56.
• Aliakbar Hayatdavoodi and Nandivaram Elumalai Shanmugam, "Web buckling and ultimate strength of composite plate girders subjected to shear and bending", International Journal of Structural Stability and Dynamics, March 2015
• M.Y.M. Yatim, N.E. Shanmugam and W.H. Wan Badaruzzaman, "Tests of partially connected composite plate girders", Thin-Walled Structures, June 2015.

FAMILY

Prof. Shanmugam married Ms. Santhi Shanmugamin 1968.
His oldest son Panneer Selvam (Civil Engineer), daughter-in-law Theresa and their 4 children live in Florida, USA. His daughter (IT, Mechanical Engineer), son-in-law Surendhar (IT, Computer Science) and their 2 children live in Virginia, USA. His youngest son, Venkatesan (Computer Engineering), daughter-in-law Komal (Optometrist) and their 3 children live in Dallas, Texas.

TAMIL LANGAGE

Professor Shanmugam, though lived abroad, had love and devoted for his mother tongue, Tamil.He promoted Tamil-writing books, attending conferences and always enthusiastically promoting it wherever he went. He was also interested in Śaiva-siddhānta. He, with the help of his friends organized competitions, easy contests, etc. in 'Thirumurai' in various temples of Singapore. (Thirumurai is a twelve-volume compendium of songs or hymns in praise of Lord Shiva in the Tamil language from the 6th to the 11th century CE by various poets in Tamil Nadu).

Eulogy

Professor Shanmugam led a full and complete life, experiencing all that he had desired. He had an outstanding academic career, with a passion for continuous learning, mentoring his students, and contributing to books/research papers. Most of all, he was driven by his family and enjoyed being with his family, especially his grand children. Professor Shanmugam was a caring, devoted, loving husband, father, and grandfather (Thatha in Tamil). His family is very proud of the life he led and his achievements.

He passed away, on Nov. 18, 2022, at his son's residence in Texas, USA, after a brave fight against cancer. He had his family by his side during his final moments. He was 81 years old. He leaves behind his wife of 54 years, sons, daughter, and 9 amazing grandkids, ranging from a college senior to 1st graders. Apart from his family, Professor Shanmugam leaves behind a rich legacy of a whole generation of students he mentored for over half a century, all of whom are greatly indebted to the careers that he had crafted for them, providing wise counsel, and being a source of inspiration and moral support in times of need.

During a lecture at IITH, with his classmate Prof. A.R. Santhakumar (Second row, 4th and 5th from left)

Prof. N.E. Shanmugam with Prof. Mahendrakumar

Dr. Mahendrakumar Madhavan, a professor at IIT Hyderabad, himself an expert on cold-formed steel and steel structures, writes: "I had the privilege of being his graduate student at NUS, working towards my M.Eng. from 1998-2000 and have immensely benefitted from research guidance and knowledge in Structural Steel. I was fortunate to have learnt two important courses Advanced Structural Steel Design and Stability of Structures at NUS - both of which have deeply enhanced my knowledge and provided a strong foundation for my career in academia. For the past 25 years, Professor Shanmugam has been my friend, philosopher and guide. I am greatly indebted to him for all that he has done to me and molded me into who I am today. With his passing, I lost a father figure who cared more about my career and overall well-being than myself."

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1. Mahendrakumar, M. "Obituary note for Prof. N.E. Shanmugam", Thin Walled Structures, Vol. 184, Mar. 2023, https://www.sciencedirect.com/science/article/pii/S0263823122010084?via%3Dihub

2.https://www.youtube.com/watch?v=0OsJRAnb1Vg

About The Author

Dr. N. Subramanian,

Dr. N. Subramanian, Ph.D., FNAE is an award winning Author, Structural Engineering consultant and Mentor, currently based at Maryland, USA, with over 45 years of experience in Industry (including consultancy, research and teaching). He was awarded with a 'Life Time Achievement Award' by the Indian Concrete Institute and many other awards for his contributions towards Structural Engineering. He is the author of 26 books, including the famous books on 'Design of Steel Structures', 'Design of RC Structures' and 'Principles of Space Structures' and the recent 'Building Materials, Testing and Sustainability'.

(email - drnsmani@yahoo.com)

THE REDEVELOPMENT CONUNDRUM

By Er. Siddharth Tipnis

The failure on the part of the builders in Redeveloping dilapidated buildings or those that have overlived their existence in the City of Mumbai and its Suburbs or for that matter in the rest of the MMR region, basically falling under Reg: 33(5), 33(7), 33(9) & 33(10) of the DCPR 2034, has assumed gigantic proportions, leaving well over a lakh of occupiers on the roads.

The DCPR – 2034 which was finally sanctioned on 12th Nov 2018 has undergone changes quite a few times thereafter with supporting GRs from the Govt. This exercise undertaken to facilitate and incentivise the Builders to achieve the completion of the projects, left half done, also fell well short of expectations. The reasons for failure may have been many but non-availability of funds in the markets and more so the arrest of all black money transactions effected by the Central Govt through demonetisation and introduction of GST has broken the backbone of the Builders who had a measure chunk of Govt and semi – Govt residential projects in addition to the private ones. This led to the financial calculations of almost all the Builders going haywire and the projects coming to a standstill leaving lakhs of people to fend for themselves without finding any solace either from the Govt nor the Builders themselves.

The main source for arranging finances through Banks is also not that friendly anymore. Builders, especially the midsize ones or those whose primary business is development / redevelopment under the Regulations mentioned above have felt the pinch most, as inventory collaterals, due to non-performance, have dried up and it seems like the end of the road for them. Therefore, the collapse has become inevitable due to lack of funds and any concessions offered in terms of extensions in completion time and handholding by the local Govt is not helping in improving the matter any further.

Introduction of RERA has not helped the Builders cause either. In fact, the burden has increased four folds under RERA, calling for strict adherence to rules and regulations. The cascading effect of RERA stands easily verified by the reports in the newspapers, almost on daily basis regarding penalties levied or action taken under this act or that. Builders being asked to return investments by buyers, with accumulated interest, for delay in handing over the flats or non-performance. The latest shocker being the news item in a Marathi Daily (Loksatta) dated 23rd Sept 2023 pg. no. 8, stating that Builders of 5,000 residential projects to lose their registrations for non-adherence to Section 7 of the MAHARERA act which came into force on the 1st of May 2017. The same page carries another article on MHADA increasing the NOC fees from Rs. 10,000/- to Rs. 10,00,000/-. These disturbing trends are detrimental not only to the buyers (recognised by RERA) but also to the old occupiers who are forced to leave their residences on false promises given by the builders. In addition to the woes caused by the Builders, the innumerable and time-consuming delays, in getting justice, through RERA or the Appellate Tribunal or the Courts are also very disturbing.

All in all, it would not be wrong to conclude that the **Builder Model,** except in case of few corporate builders, is definitely not working in the given environment and new ways need to be explored. The immediate solution would be the **EMPOWERMENT** of the common man by the Govt. If the Govt is really serious about eradicating the hardships caused to the common man, then it needs to bring in professionalism of the highest order in the residential buildings construction sector. It should show the will for discarding the **Builder culture** and move from **Builder Centric** development to Client Centric development.

It is quite obvious that ability for arranging FUNDS is the utmost requirement of any redevelopment project to be successful. Howsoever and whichsoever expertise you may possess, without sufficient finances available for different stages of construction, it is impossible to successfully complete any project. This is where the Govt needs to pitch in with whole heartedness. Baby Steps taken, just as in case of Slum Rehab Projects, by bringing in a resolution by Govt's State Housing Department on Thursday the 21st of Sept.2023, wherein the Govt has roped in the State's Local bodies like MMRDA, BMC, MHADA, CIDCO and others, across Mumbai, Thane and MMR region, to revive and complete the SRA projects stalled over 10 years, by providing the required finances, are not sufficient for making the State safe for its citizens. There are thousands of old and dilapidated standalone buildings that need handholding from the Govt in each and every aspect during the process of redevelopment. Be it in terms of regulatory matters, permissions, ease of doing business and last but not the least, finances. The situation for the common man has become so precarious since neither the Govt seems interested nor the Builders for whom there are hardly any returns from small size projects.

This situation demands that the Govt should extend the scope of the newly published GR, which is only applicable to projects delayed beyond 10 years under Reg: 33(10) - SRA, to suit the development under 33(5), 33(7), 33(7)(A) and 33(7)(B). In all these cases the common factor is non-availability of "Finance", required for getting all the basic

documents such as Transfer of Lease Deeds, Conveyance Deeds, PR Card as in case of Co-operative Housing Societies falling under Regs: 33(7)(A) & 33(7)(B) and in case of Buildings owned by Single or multiple Owners falling primarily under Regs: 33(5) & 33(7), where land belongs to local Govts like BMC, MHADA, etc or Occupancy Class II lands belonging to the Collector. It is well known fact that, if the documents are clear and if the IOD is obtained from the respective statutory body, it opens the doors for obtaining the required funds for Construction from the Banks, NBFCs, etc.

Therefore, it all boils down to providing the required finance to buildings whose age has passed 30 years and wish to take up redevelopment or to those buildings which have become dangerous or are classified as Class I buildings. These buildings can be classified as those that can be developed under the Self Redevelopment Model the concept Govt is very keen on promoting. The return of funds provided by the Govt could be through equivalent Sale Area, the amount for which is arrived at, based on ASR Rate plus the accumulated interest, in the year of completion. Alternatively, by charging Additional Premium. The rate of premium could be worked out as percentage of ASR rate for that particular year based on the ratio of Land Rate to Cost of Construction. The Govt can also work a way out wherein it stands as a guarantor, like as in case of MSMEs, in the bank, for the amount required for obtaining the IOD. It may decide to charge a premium equivalent to say 5% of the certified loan amount by the bank. The bank, in turn, may transfer the disbursed loan amount along with the accumulated interest, on obtaining the IOD, as part of the loan to the Society/Building, which would be further sought against the construction and completion of the project. This procedure may also be adopted by the respective sanctioning local Govt body such as BMC, MHADA, MMRDA, etc. The Govt should create a special cell to help the common man by providing him with both mental and financial support.

The above procedure can also come in handy for the redevelopment of dilapidated buildings classified as falling under C1 category or which are over 60 to 70 years old, requiring extensive repairs that are beyond the capacity of the present owner/occupiers and classified under new Reg: 79A of MHADA, wherein six months' time for submitting the redevelopment proposal is allotted to each of the owner first followed by the occupiers failing which it would be taken up by MHADA for redevelopment. If MHADA decides to imply this Regulation in letter and spirit it sure will have to burden itself with huge capital expenditure as no builder or contractor would be interested in investing in such a model which looks highly unattractive from business point of view. Thus, it would be in the best interest of all those concerned, if the Govt participates actively by providing the initial seed capital, atleast till obtaining IOD (Till Plinth) and the local Govts help in releasing the NOC to enable the redevelopment, this will go long way in solving the acute problem of Redevelopment of old buildings.

The Self-Redevelopment model, that the Govt wishes to promote is not finding any takers only for the fact that there is no active participation from the Govt. The Govt is not ready to propagate the fact that what is needed is Finance and handing over the reins of the development to experts in the field and not to builders. Therefore, In the given circumstances and pursuant to the idea of promoting Self -Redevelopment, it is imperative that the Govt should show its wholehearted willingness to render financial support to help the buildings wishing to take up development on their own.

There is no denying of the fact that development, which may be from Infra, commercial, industrial or for that matter from any other sector, is directly executed under the expert supervision of Engineers and Architects, by the Clients. Finances are directly arranged by the Client and no such intermediary financing agency, known as Builder, is ever hired by him. The trend of hiring an agency to finance the project, unfortunately is observed only in case of development of Residential buildings. Therefore, it can safely be concluded that if the Govt is serious about the wellbeing of the common man and promoting Self-Redevelopment, it must act and not just provide Lip-service. The Govt needs to take bold steps in providing that initial handholding needed for successful completion of the projects. The Govt should also ease the process of the banks, and other financing agencies, who wish to provide the balance finances required for project completion. This will go long way in making the common man realise his dream of owning a new and safe house, come true.

About the author
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CIVIL ENGINEERING: NEXT DECADE & BEYOND -BUILDING BALANCE BETWEEN WORK AND WELLBEING

By Er. Jagdish Rele

The COVID-19 pandemic has altered the world in totality, affected our daily lives and forced us to think beyond what was considered "normal". One thing is certain that when the entire world was in lockdown the animal kingdom flourished, and the effects of clean air and climate were felt by one and all. There was an element of beauty all around.

As we now emerge from the pandemic, it is the time to think boldly and adopt radical ideas which will catapult us into the next era. Ironically, COVID in its variants continues to dominate the world with another wave in certain parts of the world.

Construction will continue to be a massive employer and thus a significant driver for economic growth. Civil engineering, which is a vast field, can play a significant role in shaping the future of society and can contribute to retaining this state of bliss by espousing wellness-focused objectives that promote sustainable and healthy environments. In this article, I have outlined some of the opportunities in reframing corporate real estate design.

The future of Work is Flexibility:

COVID-19 has raised numerous issues for real estate office planning with staff safety, health, and wellbeing the most paramount.

After years of home-based work, organizations are reviewing flexible work standards such as assigned and unassigned (flexible) seating arrangements for at least a few days in the week. Employees are encouraged to visit the offices primarily to collaborate with colleagues and engage with visitors. Hence, new designs could allow for an increased number of meeting and conference rooms with multiple configurations. On the other hand, there is considerable experimentation ongoing here, and the ways we used to work and workspaces themselves are being challenged. Some offices are adopting full time work in the offices and others a hybrid solution. These pilots, once implemented, will require some time before conclusions can be drawn.

The future of office design lies in flexible planning. The design must be able to adapt to different settings with a common theme of controlling the spread of pathogens, while keeping an eye on mitigating the risk and impact of future health crises.

Zoned spaces to protect staff:

An efficient way of controlling the spread of pathogens is to isolate spaces by creating zones, much like the steps countries are taking. We can start by minimizing the potential points of access, leading into three zones, hot, warm, and cold. In the hot zone entry is permitted to all staff and visitors. Warm Zone is where only authorized visitors can enter and the public conference rooms are located here. Cold Zone is a secure zone with access card entry open only to staff.

Indoor air quality with provision for efficient air-conditioning/ ventilation systems and 100% fresh air delivery intake is necessary. This poses its own challenges for which the industry has developed alternate solutions, such as introduction of bi-polar ionization and use of UV technology.

Leveraging technology

Contactless features including use of nanotechnology can be adopted for the main access, internal doors, restrooms, elevators, etc. Technology has and will continue to play a central role in the future, starting with the preference of portable and handheld devices over bulky hardware. This could form the backbone of office design and help to open smaller spaces.

Other aspects to be considered are use of hard, non-porous for the surface finishes that are easy to keep clean, taking care in providing adequate sound attenuation features. Signage, reinforcing good personal and public hygiene, is an important feature in the workspaces. Amazing advancement has been done in this field including use of digital, voice activated and audio-visual signage.

Facilities management is the most important requirement not merely for the upkeep of the office, but to always ensure clean spaces. Sufficient space allocation shall be done for this activity. Gone are the days of small janitorial closet spaces.

Sustainability: Secret weapon for wellbeing

"Wellness" is no longer limited to something felt by each of us individually. It is closely tied to a sense of harmony between mankind and nature. Thus, awareness about sustainable practices must start at the kindergarten level. Sustainable civil engineering that nurtures a healthy environment is the future. All projects, big and small must strive towards contributing positively to climate change and reducing carbon footprint. There are numerous platforms available globally that define sustainable practices, each with its own green certification. While certification is important, it should not turn into a competitive race to obtain the highest standards at the cost of adopting truly conscious methods.

Energy management & modelling

For energy modelling, steps can be taken to review passive and active strategies, such as use of daylight, natural ventilation, heat insulation, lighting, and cooling/ heating systems, moving on to energy management with sensors and building management systems and finally use of renewable energy. Having applied these methods even in remote locations, I know that not only is it possible, but it also makes a significant impact on the adoption of sustainable practices.

Many of these principles can be scaled to apply to the design and planning of urban cities and towns, as well as home, to create syncretic environments between work and leisure.

Self-sufficient smart localities-

The effects of lockdown have meant that it is essential to create smaller self-contained localities or neighborhoods that can fulfill most daily needs, with facilities within walking/cycling distance to minimize the need of personal vehicles and even mass transit for commuting. By minimizing movement of people across larger distances, we can reduce the chances of contamination and spread of pathogens. Many cities, especially in Europe are adapting/ experimenting with this model.

As we have seen, calamities can be better controlled in pockets rather than large areas without limiting freedom and movement within these pockets. I would even suggest that each locality should compete in outdoing each other in design creating a melody of spaces.

Smart localities within a finite radius can be equipped with electrical power outlets, broadband connectivity, and sufficient artificial lighting. Neighborhoods can further provide residents with quiet nooks and corners to work out of, while embracing the beauty of nature. This shall be coupled with smart street furniture.

Residences:

This article will not be complete without a brief mention of planning of residences to complement the office's design, especially given that home-based work is here to stay.

Designing homes is not easy in any environment, leave alone catering to a pandemic. This is successful only when one has enough space, which is not always the case. Dwellings with higher-than-normal floor height to enable mezzanine floors can be constructed, so that these areas can be used by family members for home-based work.

To provide natural light and ventilation, the floor plate could be designed around a courtyard concept. Where weather permits, large balconies can be incorporated in the floor plan. Windows must have space to grow potted plants and thus create a green oasis.

Way forward:

Indeed, there are many other aspects of civil engineering which need to be addressed, such as protection of the workforce, including organized and unorganized labour. One thought is to consider civil engineering as a manufacturing industry and gravitate towards increased reliance on prefabrication that provides a controlled setting, with all its benefits.

What is clear is that we are at the precipice of change, with many avenues that can be explored. I am confident that the civil engineering fraternity shall rise to the challenge boldly and leapfrog to the next era, much like it has done through the centuries!--

About the author

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DESIGNING OF NEW BRIDGES TO BE CORROSION FREE AND MAJOR-REPAIR FREE: EXPERIENCE FROM MAURITIUS METRO PROJECT

Dr. Sharvil Alex Faroz

ABSTRACT

As per the tender document of Mauritius metro project, the bridges of Mauritius metro should be design using Eurocode and must have a must have a design life of 100 years. As per the Eurocode definition of design life, the period should be "without major repair". Corrosion of the bridges is identified as a major source of deterioration. A corroded bridge performs differently than what they were designed for and needs major repair/rehabilitation. With this in sight the owners demanded that the bridge of the Mauritius metro should be deterioration resistant and free of major repair for the full design life. The article introduces this new way of designing bridges. The steps involves remaining life analysis (R.L.A.) of the existing structural design to evaluate its remaining useful life (RUL) and to provide enhanced longevity/durability design if the RUL is found less than 100 years. The longevity design involves analysing the expected effects of corrosion during the full-service life and enhancing the design accordingly. The complete analysis and design in this project is done using probabilistic approach and machine learning. The purpose of this particular paper is to create awareness of this new design paradigm amongst the Indian infrastructure engineering fraternity so that they do not lag behind while the rest of the world goes far ahead of them in the race of engineering supremacy.

KEYWORDS

Remaining life analysis, Deterioration analysis, Major-repair free, 100 years, Service life design.

INTRODUCTION

Mauritius Metro Express is a 26 km light rail transit system that will link Port Louis to Curepipe, in Plaines Wilhems District in Mauritius Island. A 3.4 km branch from Rose Hill through Ebene to Reduit constitutes Phase 3 of the project. The project investment is approximately Rs 3000 Cr. The structure is comprised of sections built below ground level, at ground level and elevated. The concrete elements of the structure, are I-girder, box girder, deck slab, piers, pier cap, pile, pile cap, open foundation, abutments, retaining wall and approach slab. Steel truss bridge is also a part of the phase 3, however the steel bridge is not included in this paper. The metro alignment passes through marine/coastal and industrial environment and thus is vulnerable to deterioration of the structure. The identified deteriorating factors for the reinforced concrete components over the service life of the metro rail are chloride and carbonation induced corrosion, global warming, sulphate attack, loss of prestress, reduction of concrete strength. All these effect are analysed for the actual project however, in this paper, only chloride induced corrosion aspect is presented further for conciseness.

As per the tender document of Mauritius metro project, the bridges of Mauritius metro should be design using Eurocode and must have a design life of 100 years. EN 1992-2 and EN 1993-2 are the design codes for concrete and steel bridges respectively. As per Eurocode, the design life is defined as, "the period for which a bridge is required to be used for its intended purpose, taking into account anticipated maintenance but not major repair [emphasis added]". Major repair is the activity required beyond normal maintenance, which is typically unplanned and a result of widespread systemic deterioration. The Eurocode definition of design life thus means that the bridge should be free

of any major repairs or requirement of rehabilitation for the full 100 years. Corrosion of the bridges is a major source of deterioration. A corroded bridge performs differently than what they were designed for and needs major repair and rehabilitation. With this in sight the owners demanded that the bridge of the Mauritius metro should be deterioration resistant ie. corrosion free and free of major repair for the full design life.

Conventionally bridges are designed considering only the structural loads, but deterioration loads are not used in the design. Because of this, many bridges have been repaired repeatedly, and put out of use prematurely (Faroz et al. 2021). The real reason for such severe deterioration is aptly described by Marsh and Frangopol (2008),"...RC structures are undergoing deterioration faster, because the mechanism of degradation was not understood well at the time of construction", and thus, not accounted by the engineers in the design. The fundamental reason for this is that the subject of deterioration was not a part of engineering education and one has to do a long and detailed study or go for higher education, such as PhD in the subject to understand it (Angst 2018). Thus, most conventional design engineers though expert in structural design, did not account for corrosion (and other deterioration factorsin general) in the design stage itself and are unaware how to do so in an engineered way. Engineers of new RC projects even until today only use the code based prescriptive durability provisions as a way to tackle deterioration. These prescriptions include providing a limit on maximum water-to-binder ratio, minimum grade of concrete, maximum cement content, minimum concrete cover for a given exposure condition. Design engineers 'assume' that by satisfying these provisions, they make the bridges absolutely deterioration free, however past experience clearly shows that such prescriptive provisions are not sufficient to guarantee the target service life, in chloride rich exposure conditions of coastal andmarine environments (Andrade et al. 2013). Moreover, these provisions are generalised in nature and are incapable to account the varying severity of deteriorating actions/loads for every project site (fib Bulletin 76). This is so because, a true design for deterioration resistance is project specific, involving a deterioration analysis over the design-life and the quantification of specific deterioration loads (Faroz et al. 2021). No wonder, doubts about the adequacy of this prescriptive approach have been expressed by experts a long time back (Browne 1986; Bamforth 1994). Therefore the Mauritius metro bridge owner demanded, to perform a detailed probabilistic deterioration analysis and the corresponding design specifications based on this deterioration analysis, inorder to achieve a repair free 100 years design life. The methodology is hence forth called service life design (SLD) or Major-maintenance Free Life (MFL) design which provides enhanced longevity to the bridge.

RESEARCH SIGNIFICANCE

The article introduces this new way of designing bridges. The steps involves remaining life analysis (R.L.A.) of the existing structural design to evaluate its remaining useful life (RUL) and to provide enhanced SLD if the RUL is found less than 100 years. The SLD involves analysing the expected effects of corrosion during the full-service life and enhancing the design accordingly. The steps involved are shown in the Fig 1. The purpose of this particular paper is to create awareness amongst the Indian infrastructure engineering fraternity about this new technology so that they do not lag behind while the rest of the world goes far ahead of them in the race of engineering supremacy.

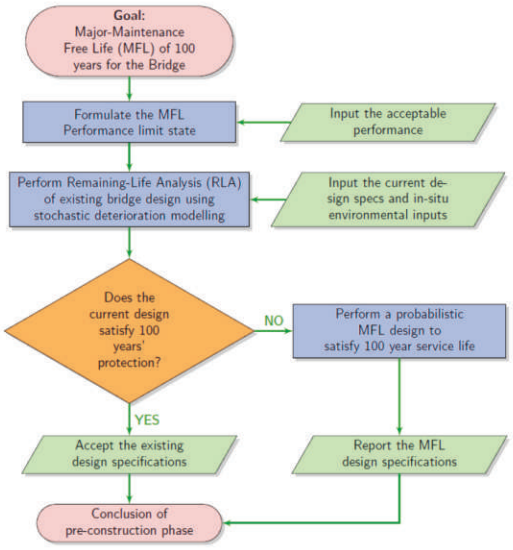

Figure 1 : Framework of service life design

METHODOLOGY

Chloride induced corrosion depends on the exposure condition ie. atmospheric, tidal, submerged. Each exposure

has its own separate analysis. In this paper only the effect of chloride induced corrosion for a circular pier submerged in saline water is considered, see Fig 2.

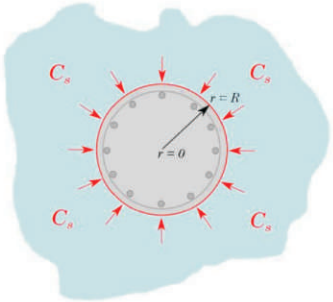

Figure 2 : Scematic of chloride diffusion in a submerged circular pier

The chlorides diffuse radially in an axi-symetrical long cylinder from external surface (Crank 1975) in the concrete as per the following:

$$\frac{1}{D(t)}\frac{\partial C(r,t)}{\partial t} = \frac{1}{r}\frac{\partial C(r,t)}{\partial r} + \frac{\partial^2 C(r,t)}{\partial r^2} \quad (1)$$

With the following conditions:

$$C(R,t) = C_s \quad (2)$$

$$\frac{\partial C(r,t)}{\partial r}|_{r=0} = 0 \quad (3)$$

$$C(r,t_e) = 0 \quad (4)$$

where, C (r,t) [%wt. binder] is the chloride concentration in concrete at radius r [mm] and time t [year], D (t) = D$_r$*f*1*f*2*f*3 [mm2/year] is the time dependent diffusion coefficient (Mortagi and Ghost 2020). The effect of climate change such as global warming is also included in this parameter. R [mm] is the radius of the pier, *Cs* [% wt. binder] is the external surface chloride concentration and *te* [year] is the time of beginning of exposure. *Cs* is a complex parameter determined by many factors, such as environmental factors (chloride concentration of sea water, zonation, action of carbonation, temperature, relative humidity, etc.), material factors (binder content, binder composition, water-to-binder ratio, etc.), and exposure time. To overcome the complexity, machine learning (ML), a branch of artificial intelligence is used for the project. The ML model is trained based on datarecords of the apparent surface chloride concentration in marine concrete, collected from past publications. The present site information are given as input to the ML model to obtain the *Cs*. for the present project. Similarly the *Dr* of the proposed concrete is also evaluated using ML.

The basic requirement of SLD is that the certain limit states should not be exceeded during the design life with an adequate degree of reliability. In order to achieve a deterioration cum repair free performance of the bridge pier, it is sufficient to ensure that corrosion is just on the verge of initiation at the end of design life. For a repair free life, the probability of corrosion initiation should be within limits during the design period. Repair is deemed necessary when the probability equals the target value. Corrosion is initiated when the chloride concentration *C(r.t.)* [wt. binder]. around the exterior most reinforcement exceeds the critical chloride concentration *Ccr* [% wt. binder] This is indicated by the following limit state

$$G(\cdot,t) = C_{cr} - C(r,t) \leq 0 \quad (5)$$

The *Ccr* of the proposed concrete type and rebar is evaluated using ML. The SLD methodology is based on reliability theory. The purpose of a reliability analysis is to determine the probability of a given event, e.g. the event which marks the end of the service life. The limit state function becomes negative if and only if the considered event occurs. For an acceptable performance, the probability of the event *Pe (t),* within the period of time [0;T] must be less than a target value (P *rarget*) throughout its life time :

$$P_e(t) = P[G(\cdot, t) \leq 0] \leq P_{Target} \quad (6)$$

The probability is expressed in terms of reliability index (ß) (EM 1990) : *Pe* = Ø (-ß), where Ø is the cumulative distribution function of the standardised Gaussian distribution. Corrosion initiation is treated as a serviceability limit state (SLS), since there is no immediate consequence on structural safely of the bridge. The target reliability index of a SLS for a reference period of 50 years, as per EN 1990 is : $ß_{50}$=1.5. Thus the target reliability index for a reference period of 100 years is obtained as (EN 1990) : $ß_{100}=Ø^{-1}\{[Ø(ß50)]^2\}$=1.13, whitch corresponds to a target exceedance probabilithy, P100=Ø(-$ß_{100}$) = 13%. The SLD criterion is as follows :

$$P[G(\cdot, 100) \leq 0] = P_{100} \quad (7)$$

The design variables in the SLD are :

1. Concrete type (depends on D*(t)*)
2. Cover thickeness (*X*)
3. Rebar type (depends on *Ccr*)
4. Inhibitor type (depends on *Ccr*)
5. Surface Coating type and thickness (depends on *D(t), X Ccr*)
6. Geometry of the member

The SLD involves multi variate design however in this paper we will demonstrate the design of the first and second variable only:

$$P[D_r < D_{req}, X > X_{req}] = P_{100} \quad (8)$$

RESULTS AND DISCUSSIONS

The pier is of radius 900 mm and the prescriptive provisions for the project is as follows: Concrete grade C40/50, concrete cover 65 mm. The cover is modelled as a beta distribution with a standard deviation of 6 mm. The first task is to evaluate the life of this design and check if it satisfies the design life of 100 years. Reliability analysis is performed using a Rackwitz-Fiessler method. The analysis is performed for every year in the range of 1 to 100 years, thus a total 100 analyses are performed. The life of the pier is considered exhausted when the time varying reliability index dips below the target value ($ß_{50}$). The target reliability index $ß_{100}$=1.13, which is equivalent to a target exceedance probability of 13% Fig. 3(a) and (b) show the probability and reliability profiles. From these plots the servie life is estimated as 6.27 years. Thus the present specification is inadequate to meet the 100 year requirement.

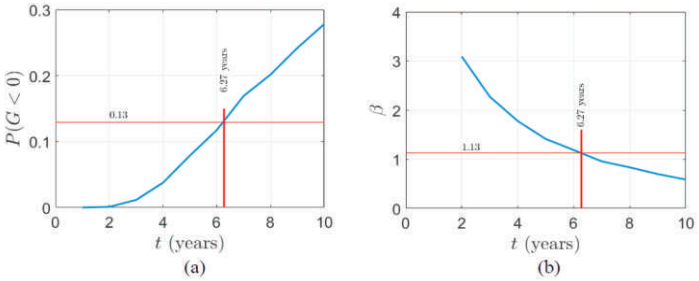

Figure 3 : Remaining Life of design based on prescriptive provision; (a) probability of exceedance and (b) reliability index

Since the prescriptive provision are inadequate design based on SLD methodology proposed in this paper is used. The design objective is to evaluate the design variables such that the substrate reinforcement steel remains corrosion free for the desired service life of 100 years. The outcome of the analysis proposed the mean cover of 70 mm and the mean diffusion as 1.4 x 10^{-12} m^2/s with its appropriate probability distribution. Concrete mix corresponding to this value of mean diffusion was extracted from our data base and suggested for the project. The reliability profile for this design specification is shown in Fig. 4. As is seen the design satisfies a 100 years life.

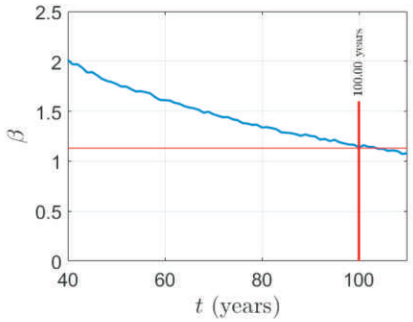

Figure 4 : Reliability profile of the redesigned pier

The methodology presented so far is a analytical design excerise, however it is important that the specification of SLD are implemented on site by the contractor. The second stage is essential to check if the contractor has done a good job or not. Monitoring data acquired during construction and in as-built conditions are used to Bayesian updating (Faroz 2017) the design parameters and to perform Remaining-life Analysis, to check if the as-built bridge satisfies a 100 year life or not. Decision are taken in this phase, whether improvement are required if the contractor fails to comply with the requirement of 100 years life. In case of non compliance, enhancements to satisfy the balance life are put in place. If the remaining useful life does not comply with the accepted service life, necessary corrective measures shall be done by the contractor to fulfil the deficient life. The payment to the contractor/constructor shall be based on attaining the on-site service life requirements. The steps involved are shown in the Fig 5.

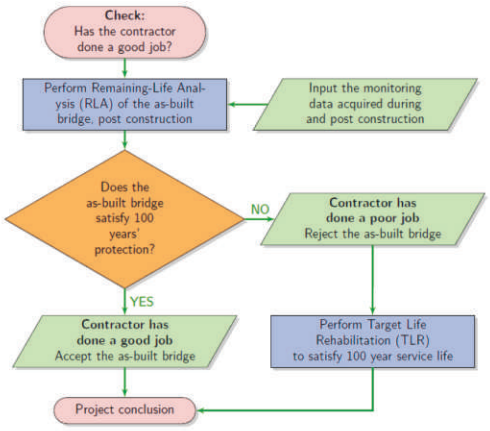

Figure 5 : Verification of the contractor's work and achievement of design life

CONCLUSIONS

For the requirement of very long design life (100 years), structural engineers have to be equipped with the understanding of deterioration of the bridges over 100 years. Conventional prescriptive durability provisions are inadequate and primitive, leading to premature deterioration and end of service-life for such high-ticket infrastructures. These prescriptive provision are the least or the first steps an engineer should take towards a long life for the bridge and not the conclusion of it. This paper provides an engineered strategy for the asset owners to proactively make their bridges deterioration resistant and thus major-repair free, thereby eliminating the conventional occurrence of sudden or unpredictable requirement of repair or rehabilitation. The methodology provides the following advantages:

1. Quantification of achieved service-life for any design
2. Design modification under non-compliance of actual service-life
3. Incorporates climate change which manifest over the long service-life
4. Decisions support based on life-cycle cost assessment

It is important to mention here that a mere service life design (SLD) alone is not sufficient. An engineering approach to verify implementation of the specification of SLD is equally important. This done using Remaining-life Analysis (RLA) of the as-buit structure. RLA is used to check if the as-built bridge satisfies a 100 year life or not. If the remaining useful life does not comply with the accepted service life, necessary corrective measures shall be done by the contractor to fulfil the deficient life. The purpose of this particular paper is to create awareness of this new design paradigm amongst the Indian infrastructure engineering fraternity about the new design methodology so that they do not lag behind while the rest of the world goes far ahead of them in the race of engineering supremacy.

ACKNOWLEDGMENTS

The author thanks the client for the opportunity to help them with this technology.\

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RECENTLY PUBLISHED BIS CODES : PROOF CHECKING CONSULTANCY AND EQ RESISTANT DESIGN AND DETAILING OF STEEL BUILDINGS.

by Er. Hemant Vadalkar

Bureau of Indian Standards recently published two important codes related to Structural Engineering which will have greater impact on practicing structural engineers. So , it is necessary to carefully study these codes. Important points in the code are highlighted in this brief write up along with comments by ISSE team.

A) IS18299-2023 Structural Design and Proof Checking Consultancy Services for Structures — Requirements

Most important topic of structural design, proof checking and responsibilities of various stake holders are defined in this code.

Structural Engineers Forum of India (SEFI) conducted e-conference on this document during Aug2022. ISSE had also participated in the discussions and provided comments on the document to BIS. ISSE suggested to have Category-3 as Peer Review which is just the over view by expert. But this has not been accepted by committee saying it is not part of this document. Second point raised by ISSE was about responsibility of Principal Design Consultant(PDC) and signing of DBR by all concerned for freezing design parameters. If the owner / architect / other consultants proposes some changes like bad geometry, improper framing, floating columns, loose mass which are against good engineering practices, then who will be responsible? Let this be mentioned in DBR and signed by all. This was also not accepted. ISSE had also raised a point that who will check and certify the qualification, experience and competence of PDC and PC as prescribed in the code for the respective project? There is no mention about it. Owner has to appoint a competent PC as per code.

Foreword in the code mentions the intent as follows -

" The intent of this standard is to:

a) overcome the shortcomings of the current practices and terminologies being followed (in the government and private sectors) and suggest those that ought to be adopted and followed as a matter of good and sustainable practices;

b) eliminate subjectivity/arbitrariness and bring transparency, uniformity, and inclusiveness in the qualification requirements and appointment of a Principal Design Consultant (PDC) and a Proof Checking Consultant (PC);

c) remove ambiguities that are evident or implied, by defining and thus clarifying the various associated terms; and

d) elaborate the scope of services, deliverables, and associated responsibilities for the owner, PDC, PC and constructor so that all stakeholders can take informed decisions while procuring and/or delivering such services. "

Various terminologies like Owner, Constructor, Comprehensive design consultant (CDC), Principal design consultant (PDC), Proof checking consultant (PC) have been defined.

Important points like sufficient time for design and proof checking work is to be provided.

Various models are discussed. In one model design is provided by owner and executed by constructor based on the PDC design and checked by PC. Both PDC and PC are appointed by owner.

In another model with design and build contracts also, owner has to appoint PC where as PDC can be appointed by constructor.

The constructor/CDC/PDC shall never act as a proof checking consultant for the same project.

In case of difference of opinion between PDC and PC, client can refer it to third party and owner's decision will be final.

Both PDC and PC are responsible for the design along with owner. PDC and PC have to sign the GFC drawings.

Owner should appoint Proof checking consultant and not the constructor.

Scope and responsibilities of Owners, Principal Design Consultant (PDC), Proof checking consultant (PC), Constructor are defined in the code.

Two categories of proof checking are mentioned :

Category 1 : Principal design consultant (PDC) and Proof checking consultant (PC) will be interacting at various of stages of project right from the start. This includes DBR, concept design, method of analysis, model studies etc. PDC will consult PC at every stage of design while carrying out assignment and then submits final design and drawings for approval.

Category 2 : PCD and PC shall discuss and finalize mutually agreed DBR and conceptual structural system. PDC can carry out analysis, design and detail drawings and only submits structural drawings to PC. PC will carry out independent analysis and design and submits the results to owner and shall review and approve structural drawings submitted by PDC.

So, it means PC has to spend huge time in independent analysis and design and shoulder joint responsibility of structural design with PDC.

Whether PC will get adequate fees for his voluminous work is a big question.

Minimum qualifications and experience for PDC and PC is also mentioned in the code.

It is important to read note 2 which says "The team leader of PDC and PC can be academic faculty member of recognized engineering institutions with relevant design experience as given above"

This implies that proof checking can not be done by academic faculty members of engineering institutions without requisite design experience mentioned in the code. The question is - who will check and decide on their experience ?

ISSE requests all design engineers to study the code for more details. This code is the first step in streamlining proof checking consultancy and bringing more clarity about various issued faced by the fraternity. Let us hope that this code will help in improving safety of our structures and fix the joint responsibility of design on PDC and PC.

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B) IS 18168 -2023 Earthquake Resistant Design and Detailing of Steel Buildings — Code of Practice

This is also very important code for design of steel buildings apart from IS 800.

In the forward it is mentioned -

"Provisions for ductile design and detailing of steel structures were first published in the country as Section 12 of IS 800 : 2007 'General construction in steel — Code of practice (third revision)'. But, a need was felt for having a separate and detailed standard dealing only with earthquake resistant design requirements of steel buildings in line with IS 13920 : 2016 'Ductile design and detailing of reinforced concrete structures subjected to seismic forces — Code of practice (first revision)'. "

Terminologies like beams, braces, columns, Concentrically braced frames (CBF), special concentrically braced frame (SCBF), Eccentrically braced frame (EBF), Moment resisting frame (MRF), special moment resisting frame (SMRF) are defined.

Under materials, minimum elongation of structural steel expected is 22% and specified yield stress of material is restricted up to E350. Material strength uncertainty factors Ry and Ru are defined in Table 1.

Structural sections should comply with width to thickness ratio as specified in Table 2

Load combinations : Apart from load combinations specified in IS800 following load combinations are to be considered

1.2 DL + γLLLL ± 1.0 ELm .....(1)

0.9DL ± 1.0 ELm .....(2)

Where partial load factor for LL can be 0.25 or 0.5 depending on class of loading

And ELm = overstress factor * EL

(overstress factor =2.5 or 3.0 depending on type of frames)

Therefore, most of the times, these load combinations will govern the design. This is a major change.

Another important point in clause 5.7.1

The strength of bracing connections shall be at least 1.5 times the corresponding strength of the bracing

Columns : Doubly-symmetric parallel flange sections rolled as per IS808 and flange width to thickness ratio and web depth to thickness ratio specified in Table2 should be used. Slenderness ratio of column is limited to 75 .

Splicing of columns to be done in the middle third height of column and at least 1.0m away from beam to column moment connection. Design strength of splice plates to be at least 1.2Ry times their respective strengths. This means the splice must be stronger than the section.

At beam column joint , column to beam strength ratio as per clause 8.2 is to be satisfied which is > 1.4 . So, columns should be stronger than beams.

Continuity plates at beam column joints are specified as per Fig 1.0

Structural Braces : Rolled sections or closed box sections with width to thickness ratio as specified in table 2 can be used. Slenderness ratio should be less than 160.

Requirements of special moment resisting frames are provided.

Different types of braces V type or inverted V type braces used in Concentrically braced frames (CBF) and its design requirements are described.

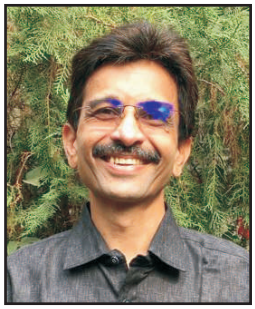
Eccentrically braces frames with Link length and its design has been provided.

All design engineers need to study this new code for implementing the design requirements for steel building design.

IS13920 provides some good sketches for RCC detailing. But there are no sketches or illustrations for detailing of steel joints and connections in this code. This is a shortcoming of this code.

Some explanatory handbook may be helpful to understand the design and detailing provisions of this code.

About the author :



Er. Hemant Vadalkar

Hon. Secretary of ISSE

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NEWS AND EVENTS DURING JULY – SEPT 2023

by Er. Hemant Vadalkar

5 Jul 2023 : ISSE student chapter at Maharaj Institute of Technology , Thandavapura, Mysore was inaugurated in hybrid mode. College principal Dr. Y T Krishnegowda and , Dr. H K Chethan addressed the students from civil engineering. Shantilal Jain President ISSE delivered welcome address. Madhav Chikodi informed about activities of ISSE. Hemant Vadalkar Secretary ISSE delivered lecture on Sustainable development and civil engineers. Certificates to students were distributed.

7 Jul 2023 : PEATA arranged a seminar on " Design Challenges in high rise buildings". Many aspects like design, approval, fire, electrical services, HVAC, plumbing were discussed. Dr. Shashank Mehendale , Structural consultant and HRC member talked on design challenges and expert review panel guidelines. Prof. Deepankar Choudhury, Head Civil Engg Department IIT Bombay also an HRC member talked on Geotechnical issues. Shri Hemant Sali spoke on electrical and fire hazards and mitigation measures. Dr. Prabhat S Rahangdale Ex- Director Maharashtra Fire services guided on fire and life safety measures and amended Maharashtra fire services act. Shri Dinesh Naik, Dy. C. E.(DP) and HRC member elaborated on approval guidelines and check list. Shri Jonhy Joseph , Chairman High Rise committee was the chief guest . The function was very informative and attended by more than 200 professionals.

Aug 2023 : ISSE Baramati Local centre has expressed their willingness to help and support for design of safe structure to avoid mishaps like slab collapse over the well.


पुढारी

विहीर बांधकामाला संरचनात्मक आराखडे गरजेचे

इंडियन सोसायटी ऑफ स्ट्रक्चरल इंजिनियर्सचे मत; म्हसोबाचीवाडीसारखी दुर्घटना टाळण्यासाठी करणार सहकार्य

25 Aug 2023 : Epicons webinar on "Sustainability through Innovative Ideas"

Thinking out of the box- when this becomes possible with expertise and excellence. Yong engineers were invited to speak about their experience.

Er. Tanvi Auti, MD, Dhruv Consultancy Services Ltd. set the ball rolling with her insights into her journey from a young engineer to the driver of a company that prides itself on a good work culture and constant emphasis on teamwork and client satisfaction. Combining the twin aspects of professional competence and being a good leader, Tanvi took the audience through the experiences that she has had, along with some very unique behind the scenes views of the working of her company, the projects that they are doing pan-India and their methods. Her session proved particularly inspiring for many collegians who had logged in.

Er. Sunny Surlaker, Director, Assess Build Chem Pvt. Ltd. was next in talking to the viewers on how good construction chemicals and systems can make all the difference to the aesthetics and the health of a building. His presentation was particularly very interesting in its content. With the help of animation and graphics, he succinctly described the role of processes, chemicals, treatment and perfection in the start-to- finish journey of a project. He also took the viewers to various elements of construction including some visionary products that have proved the adage that 'well begun is half done'.

Er. Varun Raje, Director, Raje Structural Consultants Pvt. Ltd. spoke on the huge relevance of project management across sectors. Giving examples of projects that his company has handled, he effectively conveyed the importance of ticking all the boxes right in the entire project management chart. From indentifying problems to overcoming hurdles on site, from dealing with tricky situations to enhancing the aesthetics of a building purely through excellent processes and neat manner of work, he highlighted the fact that India now needs, more than ever, good project managers who are multi-taskers in all aspects.

Er. Satish Jain, MD, UHPC India Pvt. Ltd began his session by asking people to imagine structures that are light on the eyes and also construction complexity and weight. He gave some important information regarding the end- to- end aspects and benefits of using UHPC.

From its applications in bridges, highways, large space structures, to even museums and homes and art galleries, his talk on UHPC was an excellent combination of imagination with engineering.

Adv. Mihir Govilkar, Govilker Associates closed the sessions with his very insightful and somewhat sombre talk on the need for every single professional to have a sound legal framework for themselves and staff and work. By illustrating his point using examples and some real life cases, he covered many areas; architectural projects, litigation, clients not paying up, avoiding going to court by providing a safety net for professionals and so on. He also decoded many points and also busted myths. Most important, his talk proved that being aware of your legal rights is not only for large companies and firms but also for the single proprietor or individual who may be heading a small or mid-sized consultancy.

Thinking out of the box- a title that beautifully sums up and encapsulates the expertise of these five individual and the fact that independently, they are experts but together, they comprise a vital core of society that raises the bar in terms of excellence, quality and ultimately enhancing the economic growth of the country.

Er. Jayant Kulkarni with Epicons' team conducted this program in an interesting manner, making sure that the five sessions were all interesting and included points of uniqueness. Ar. Priya Gokhale of WIDE Angle Forum moderated the session.

5 Sept 2023 : Prof . Keshav Sangle from VJTI felicitated by Hon. President of India with National Teaching Award at New Delhi. Team ISSE congratulates Prof. Sangle.

9 Sept 2023 : Inauguration of Amravati local centre of ISSE

Amravati local centre of ISSE was inaugurated by ISSE Trustee Madhav Chikodi, Paresh Unnarkar and Ranganath Satam. Event was supported by Ultratech Cement Ltd.

15 Sept 2023 : Inauguration of Kalyan Dombilvi Local centre of ISSE

Indian Society of structural Engineers, Kalyan Dombivli Local centre (ISSE-KDLC) was inaugurated on the auspicious day of 15th Sep, 2023 which is celebrated as Engineers Day. The day is celebrated all over India to commemorate the great civil engineer Bharat Ratna Sir Visevesvaraya.

The program was well attended by 180+ participants from various fields of construction industry from Kalyan Dombivli and nearby area. Structural Engineers, Civil Engineers, Architects, builders & developers, civil

contractors, geotechnical consultants, MEP consultants, demolition contractors, manufacturers of construction chemicals and distributors were there among the participants.
ISSE President Er. Shantilal Jain was the chief guest of function whereas guest of honor was chaired by Er. Nitin Wankhede, Chief Engineer, MIDC, Pune Region.
ISSE managing trustee Er. Madhav Chikodi took the responsibility as a chairman of ISSE, Kalyan Dombivli Local Centre (ISSE KDLC). Er. Srinivasan Mudaliar took the charge of Hon secretary of the centre. The managing committee of ISSE Kalyan Dombivli Local Centre will consist of 11 structural engineers from Kalyan Dombivli. They are Er. Nayan Dholakia, Er. Amogh Luman, Er. Rajendra Paranjape, Er. Gopal Bennur, Er. Rajesh Thakare, Er. Manohar Patil, Er. Ram Marathe, Er. Aditya Deshmukh & Er. Girish Marathe.
The program started with lighting the lamp and respecting Late Visvesvaraya by garlanding the photo. President Er. Shantilal Jain, in his opening remarks, gave best wishes to new ISSE KDLC and stressed on carrying more and more programs for betterment of fraternity and community. Newly installed chairman Er. Madhav Chikodi unfolded their committee plans. He said, its need of an hour to build strong and durable structures. ISSE-KDLC will take the initiative for training supervisory staff who will help project management consultants. The committee will also work on adding new ISSE students' chapters in nearby engineering colleges & polytechnics.

ISSE secretary Er. Hemant Vadalkar gave a presentation and briefed about various activities undertaken by ISSE.

Guest of honor Er. Nitin Wankhede through his words of wisdom guided on importance of structural engineering and wish committee members all the best.

Er. Vatsal Gokani gave an excellent presentation on "Advancement in High rise structures". Such advancements are going to take place soon due to latest UDCPR and higher provision of FSI from municipal authorities.

Senior civil engineer Er. Bhagwan D. Patil, senior architect Ar. Arvind Chikodi, IIA Kalyan Centre chairman Ar. Keshav Chikodi, Hon Secretary Ar. Uday Satavalekar were felicitated during the program.

Six new members were recognized by giving membership certificates at the hands of Advisory Trustee Er. Suresh Dharmadhikari.

Mr. Rohit Pandya gave a presentation from Ultra Tech cements. Today, Ultra Tech is providing services in construction industry like pin to piano. He briefed on various concretes which are supplied by the company, VAC products as well as company is guiding for rainwater harvesting.
The event was well supported by Ultra Tech Cements. Mr. Rohit Pandya, Mr. Ashwin Moghe, Mr. Harsh Pathak took lot of efforts in making the program a grand success.

15 Sept 2023 : Webinar by Epicons on All about the Tall, Dark, and Handsome structures:
In Part 1 of 'Masters of Structure', a new series, Epicons invited acclaimed structural consultant- the legendary **Dr. Joe Colaco- as chief speaker.**

The 140th webinar hosted by Epicons Friends of Concrete turned out to be rather memorable, with good reason; Engineers Day was commemorated, history was relived, great structures remembered, and the spirit of human endeavour reemphasized in the most fitting manner, thanks to the brilliant discussions between legendary structural consultant Dr. Joe Colaco and a glittering star cast of panellists that included Er. Abhay Ghate, Chairman Emeritus of Optimal Consultancy Services Pvt. Ltd and senior engineers from Epicons Consultants Pvt. Ltd including MD and webinar curator Er. Jayant Kulkarni. This webinar was organized in association with WIDE Angle Forum® with Ar. Priya Gokhale, Founder, WIDE Angle Forum®, essaying the role of anchor.

Considering the huge number of high rise structures that Dr. Joe Colaco has designed and his remarkable anecdotes about each, five very path- breaking structures were selected; after preliminary introductions, Dr. Joe began to talk about each of these five structures in a free-wheeling question and answer session. He began each structure's narrative by first

dwelling on the specific technology, its importance, and then went on to discuss other details. This made for a seamless and very engaging webinar.

Up first was the John Hancock Centre, Chicago, built in 1968 with its claim to fame being the innovative diagonal bracing that was utilized so effectively; Dr. Joe Colaco and Er. Abhay Ghate engaged in fascinating discussions on interesting facts like- for example- the lakeside location requiring the sinking of caissons into 10 ft wide holes drilled 190 ft into bedrock. Dr. Joe also narrated the story of how this building became the first to combine residential & commercial space together. The beauty and practicality of diagonal bracing vis-à-vis its perception as an elevational feature (both for and against) were also included in the frank and candid talk.

The second building to be discussed comprehensively was the One Shell Plaza, Houston, built in 1971. Recognized as the tallest concrete structure in the world at the time it was built, its appearance of having an undulating façade thanks to staggered columns and the entire exterior face clad in travertine marble, made for great stories of design, structure and technology combining men and machinery.

Next was JP Morgan Chase, Houston, the tallest composite structure of the time, circa 1981. By elaborating on in-construction challenges and explaining the intricacies of design and material, Dr. Joe Colaco effectively took the audience to the nitty- gritty of making a high rise that becomes the cynosure of all eyes thanks to its being the tallest five sided building in the world- a unique distinction, by all considerations! The speaker narrated how the team solved problems and challenges, whether it was about the foundation and retention system or temperature analysis or differential axial shortening or a host of other things that the structural team had to take care of.

The fourth building to be taken up was the Transco Tower (now called the Williams Tower) in Houston, built in 1983. Called the Empire State building of the south, this building boasts of a 7,000 watt beacon that sweeps across the sky at night, making for a compelling sight. Part of the talk around this building inevitably came down to the unique drawings showing tubular structure plus tree column including Idealized stress distribution, Cantilever action, Idealized tube structure, the Phenomena of shear lag and Lateral load resisting channels.

Finally, Dr. Joe discussed the Burj Khalifa, having done the peer review for the building. It was interesting to understand the plan and how the levels build up and how the architecture syncs with the structure, what such buildings mean to a city and also how to envisage the future of high rise buildings.

The entire discussion was conducted in a chatty style. The accompanying slides gave very important and interesting insights into the plan, the architectural style, the nuances of the structural design, the timeline of the building and its specific relevance to context, with regard to construction methods, socio-economic trends, and the world order as it existed then! Stunning photographs of these beautiful skyscrapers along with working drawings of projects (very kindly shared by Dr. Joe himself) made for a webinar that was interesting as well as very informative.

Dr. Joe also engaged in some tongue-in-cheek moments and wonderful memories from the time when he was a young student in college, to his journey leading up to his many interactions with the legendary Fazlur Rehman, being a resident of cities boasting of many skyscrapers and innovating constantly. He also spoke with great detail about his workings with iconic names in architecture; from the technically proficient I.M.Pei to Philip Johnson's love of the elevation, to Cesar Pelli and even recent names.

Above all, his talk was all about loving your work, respecting the workforce, and dreaming in a way that opens doors to better structures that are not only respectful to the fundamentals of design, structure and stability, but also stand the test of time by sticking to good practices.

Needless to say, the strong two hundred plus audience was transfixed and stayed glued to their screens all throughout this talk!

Epicons Friends of Concrete has been conducting webinars across a multitude of topics surrounding the realms of engineering, architecture, design, technology, expertise and much more. This- the 140th webinar- was a fitting tribute to the spirit of Engineers Day as well as Teachers Day.

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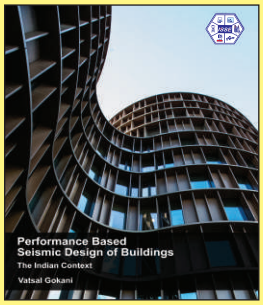

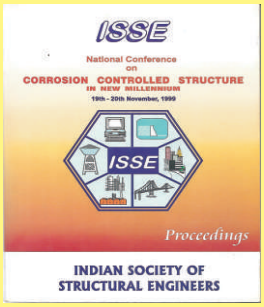

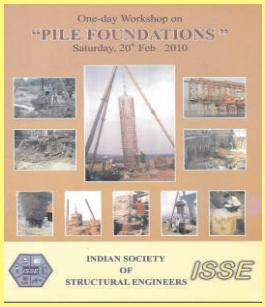

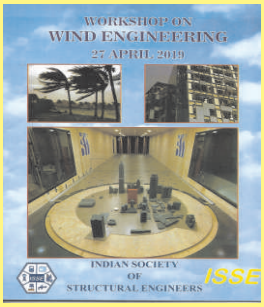

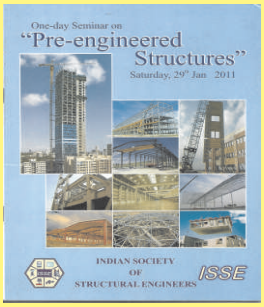

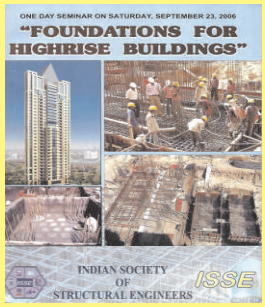

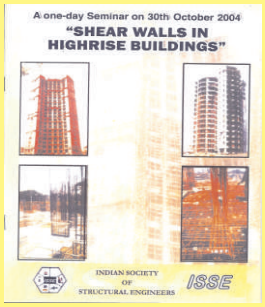

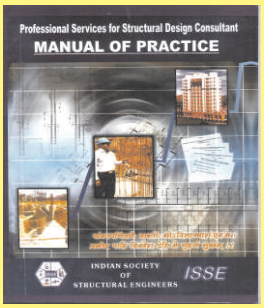

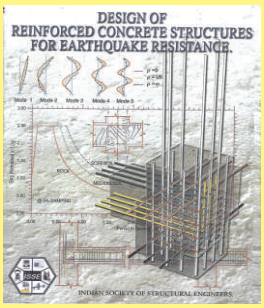

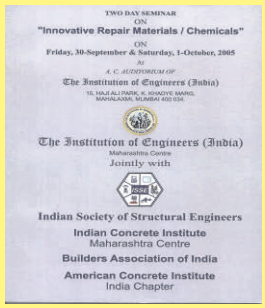

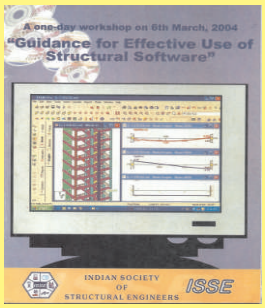

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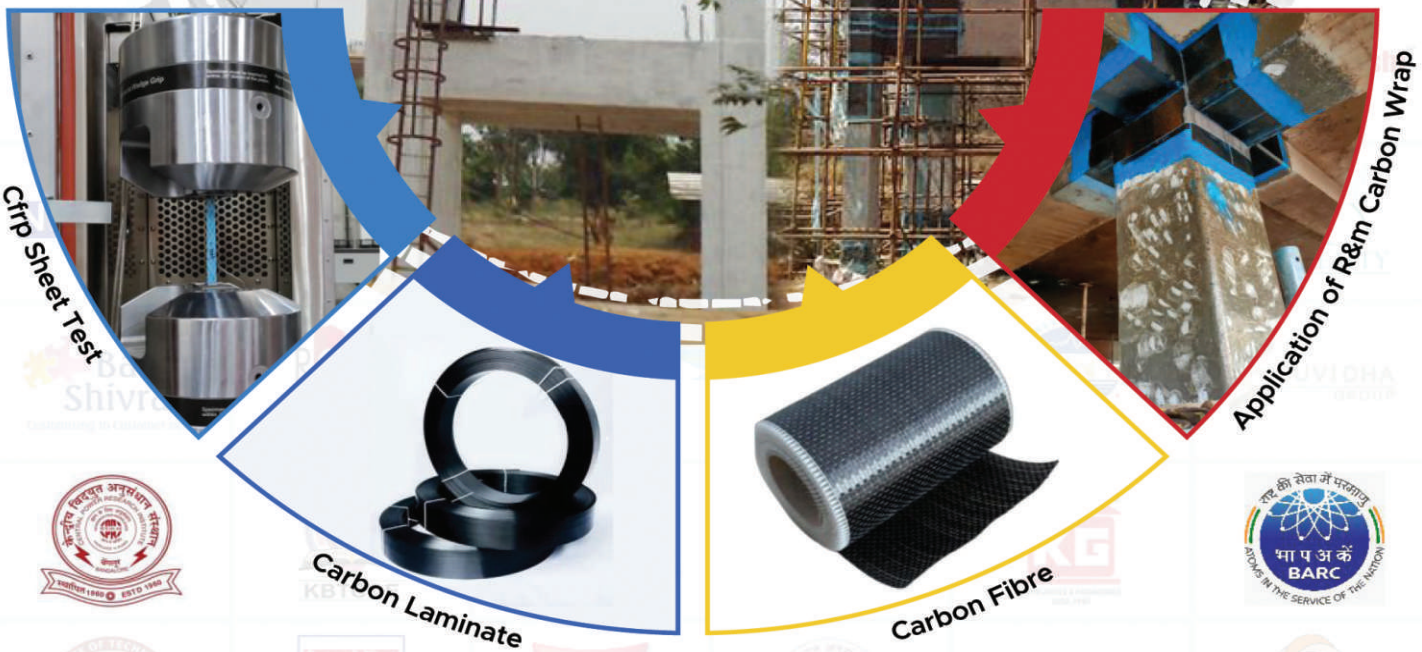

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