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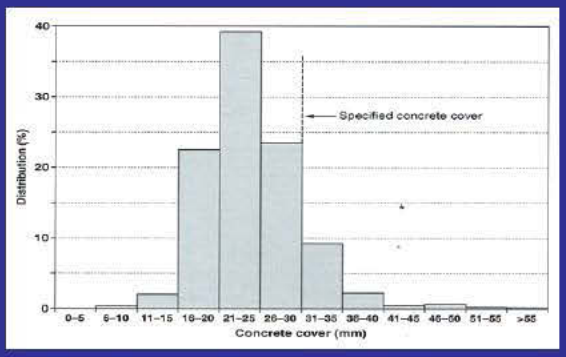
VOLUME 23 - 1

JAN - FEB - MAR. 2021

GEM 27 PROF. A. S. ARYA - see page 3

USE OF STEEL TUBES IN BUILDING CONSTRUCTION
see page - 10



CONCRETE COVER – IMPORTANT ASPECT OF DURABILITY
see page - 15

HIGHER STUDIES ABROAD
Nishad Madhav Chikodi
see page - 18

NEWS AND EVENTS DURING JAN – MAR 2021 - see page - 22

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INDIAN SOCIETY OF STRUCTURAL ENGINEERS

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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

(JAN - FEB - MAR 2021)

01M	1936	Mahendra Narayan Govind	16M	1951	Amit Devidas Umale
02M	1937	Abusalim Samiuddin Shaikh	17M	1952	Gaurav Dadaji Pawar
03M	1938	Winster Thomas Kochuthundiyit	18M	1953	Sunil Manohar Godbole
04M	1939	Deepak Babulal Suthar	19M	1954	Yashwanth Kumar Gorintla
05M	1940	Pravin Prabhakarrao Deshpande	20M	1955	Niraj Tiwari
06M	1941	Sadiya Abusalim Shaikh	21M	1956	Mayuresh Sudhakar Badgujar
07M	1942	Praveen Amarnath Patange	22M	1957	Suraj Valmik Bodke
08M	1943	Bhimaji Dasharath Kanawade	23M	1958	Sarang Vasant Khadake
09M	1944	Rohit Bhaskar Nimse	24M	1959	Prashant Kumar Bani
10M	1945	Atul Anant Patwardhan	25M	1960	Amit Madhukar Chaudhari
11M	1946	Vivek Garg	26M	1961	Vijay Dinkar Patil
12M	1947	Prajyot Prakash Deshpande	27M	OM32	Ashoka Strucural Consultant
13M	1948	Trushali Anand Gaikwad	28M	OM33	Arnita Consultants Pvt. Ltd.
14M	1949	Sachhidanand	29M	IM03	Sharad Institute of Technology Polytechnic
15M	1950	Akhil Maheshwari	30M	JM57	Ketan Ashok Akolkar

Patrons : 38
Members : 1961
Student Members : 224

Organisation Members : 33
Junior Members : 57

Sponsor : 8
IM : 03

TOTAL STRENGTH : 2,324

GEM 27 PROF. A. S. ARYA - EXPERT IN EARTHQUAKE ENGINEERING

by Mr. N. Ravi Kiran, Dr. Ravi S. Jakka, and Dr. N. Subramanian

Prof. A.S. Arya (16th June 1931 – 1st Sept 2019)

Padma Shri Dr. Anand Swarup Arya, popularly known as Professor Arya, is a well-known name in the field of Earthquake/ Structural engineering. He was an eminent structural engineer, known for his expertise in the soil and foundation engineering and earthquake disaster management. Prof. Arya had a long and distinguished record of research, design, and consultancy work. As a testament to his internationally acclaimed work, he was honored with the Distinguished Alumnus Award by the University of Illinois, Urbana-Champaign, USA as well as by IIT Roorkee. He was a Fellow of the Indian National Science Academy and the Indian National Academy of Engineering. He was the Pro-Vice Chancellor of the University of Roorkee when he retired in 1989. For his immense contributions to Earthquake Engineering in India, he was awarded the fourth highest National Award - Padma Shri, in 2002.

EARLY LIFE

Prof. Arya was born on 16th June, 1931 at a village Ambehta, in the Saharanpur district of Uttar Pradesh, in undivided India. After schooling, he joined the University of Roorkee in 1950 and obtained his Bachelor's degree in Civil Engineering and Master's degree in Structural Engineering, in 1953 and 1954 respectively. Later in 1959, he joined the University of Illinois at Urbana- Champaign, USA for his doctoral degree, and subsequently earned it in 1961. After completing his doctoral degree, Prof. Arya joined the University of Roorkee.

ACADEMIC CAREER

Prof. Arya spent his entire academic career spanning 36 years at the University of Roorkee (now IIT Roorkee). He played a significant role in the establishment of the Indian Society of Earthquake Technology in 1962 and the establishment of a Post-Graduate Course in Earthquake Engineering at the University of Roorkee in 1963. He made significant contributions to the methods of dynamic analysis and design of structures ranging from small to multi-storeyed buildings, arched and shell structures, bridges, dams, and atomic power plants. He was the most sought after Thesis Supervisor for students in the field of Structural and Earthquake Engineering in his early years. Prof. Arya guided more than 60 Masters and 11 Ph.D. theses in Structural and Earthquake Engineering. He was recognized as a great teacher whose lectures left lasting impressions of his subject knowledge on the students. He has lectured widely and taught Earthquake Engineering at several institutions with in and outside the country as well. He had taught and guided research at the Institute of Earthquake Engineering and Seismology at Skopje, Macedonia on a number of occasions in the late 60's, 70's and 80's. He rose to the position of the Head of the Department of Earthquake Engineering (DEQ) in 1971 after its elevation to a full-fledged department from the erstwhile School of Research and Training in Earthquake Engineering (SRTEE) and became the Pro-Vice Chancellor of the University of Roorkee in 1988. As the Head of the Earthquake Engineering Department, Dr. Arya started many courses in the subject including blast resistant structures. He disseminated Earthquake Engineering through specialist courses at Roorkee as well as other Institutions and Design organizations in India and other countries. After his formal retirement in 1989, he continued to hold the prestigious life-long position of Professor Emeritus in the Department of Earthquake Engineering at the University of Roorkee.

OVERVIEW OF SIGNIFICANT CONTRIBUTIONS

Prof. Arya was instrumental in the establishment and growth of ISET. He served as the society's Secretary for three terms during 1965-68, its Vice-President for six terms during 1972-79, and it's President for two terms during 1979-83. He was the Organizing Secretary when ISET organized the Sixth World Conference on Earthquake Engineering in New Delhi, in 1977. His long association with the Earthquake Engineering Sectional Committee of BIS resulted in the publication and revisions of various Indian Standards, viz., IS 1893, IS 4326, IS 4967, to name a few. He made tremendous contributions for improving the earthquake resistance of residential buildings through formulating codes, model building bye-laws, retrofitting measures and other natural disaster risk reduction activities taken at the national level such as the publication of the Vulnerability Atlas of India by BMTPC. His contribution to the internationally recognized IAEE manual of Non-Engineered Constructions is well known and acknowledged world over. The IAEE manual was translated in many languages and is used in several countries. His dedication and untiring efforts to improving the Earthquake Resistance of Non-Engineered and Low-cost Masonry Buildings and their retrofitting in Post-Earthquake Scenarios is unparalleled. He was among a very few engineers who were picked to be the founding Fellows of the Indian National Academy of Engineering in 1987 to prepare for the formal inauguration of the Academy by the then Prime Minister Shri Rajiv Gandhi, on 11th April 1988. He served the INAE Council during 1995-1996 and was awarded the Lifetime Contribution Award of the Academy in 2002. The award was given in recognition of Prof. Arya's work in the formulation of Codes of Practice for Earthquake Resistant Design and Construction of Buildings.

ROLE IN FORMULATION OF SEISMIC DESIGN CODES

In his keynote address during the National Symposium on Advances in Structural Dynamics and Design held at the Structural Engineering Research Centre, Chennai during January 9-11, 2001, Prof. Arya recounted the history of the development of Seismic Safety Codes for Earthquake Resistant Design of Buildings in India. Tracing the history from the original code IS: 1893 of 1962 right up to the 5th revision drafted during 1999-2000, he elaborated on the scientific basis of the design provisions. He was the Chairman of the Bureau of Indian Standards Committee, CED 39 on Earthquake Engineering Codes during 1991-2010. The year 1993 turned out to be a milestone year, when under Prof. Arya's chairmanship IS 4326 was not only revised but split into more detailed codes and guidelines viz. IS 4326:1993; IS 13827:1993 and IS 13828:1993. A new code of practice IS 13935 on Repair and Strengthening of Buildings and a new code of practice IS 13920:1993 on Ductile Detailing of R.C. Buildings were prepared and published. He was one of the very few champions of seismic microzonation as a tool for risk assessment and disaster mitigation and chaired a DST Expert Group on Microzonation of Delhi in 1998. As a consultant to UNCHS in Nepal, he helped in developing the National Building Code of Nepal and ensured that it included seismic safety provisions. Recognizing Prof. Arya's expertise, his services were utilized by international bodies like Asia Disaster Prevention Centre, UNESCO and UNDHA in erstwhile Yugoslavia, Thailand, Japan, Iran, Philippines, North Yemen and Armenia. He was also a member of the Bihar State Disaster Management Authority (BSDMA).

ROLE IN POST - EARTHQUAKE REHABILITATION

His focus was always on finding apt solutions to real life problems. When the Koyna dam developed cracks after the Koyna earthquake of 11 December 1967, he along with his colleagues at the Department of Earthquake Engineering, University of Roorkee took up the broader issue of strengthening the vulnerable masonry dams in the state of Maharashtra. Prior to his retirement, Prof. Arya and his colleagues published a report on the 1986 Dharmsala (Himachal Pradesh) earthquake. Post-retirement, he worked as a Consultant to the World Bank and other UN agencies and played a major advisory role in rebuilding and rehabilitation

after many destructive earthquakes, such as the 1991 Uttarkashi, the 1993 Killari, the 1997 Jabalpur, the 2001 Bhuj and the 2004 Indian-Ocean Tsunami. Impressed by Prof. Arya's simple retrofitting techniques, the World Bank came forward to fund a major project involving seismic retrofitting of nearly 200,000 houses after the 1993 Killari earthquake. He made a number of path-breaking recommendations in his role as the World Bank consultant for the Killari earthquake rehabilitation program. A very important recommendation was to encourage strengthening traditional building constructions (both damaged and undamaged) with government assistance instead of indiscriminately adopting modern construction practices. He also proposed the repair and strengthening methods for traditional buildings constructed with stone and mud mortar. The recommendations were based on his earlier work on IAEE Manual for Non-Engineered Constructions. For confidence-building among administrators and local people, the increase in strength of the traditionally-constructed buildings due to the retrofitting measures was demonstrated through earthquake-shaking experiments.

Prof. Arya was deeply concerned about the seismic safety of people residing in non- engineered constructions. He was also a champion of sustainability, decades before the concept became popular. He always advocated that buildings in rural and semi-urban areas that are constructed with locally available materials should continue to be used after incorporating suitable strengthening measures to improve their safety. This recommendation was accepted by the Government of Maharashtra after Killari earthquake, and later became the template adopted by other state governments for rehabilitation programs following natural disasters.

Prof. Arya believed that construction practices in India can be improved, only if, in addition to engineers, the masons and other workmen at construction sites are better trained with requisite skills. He passionately championed the need to impart training to construction workers to adopt safe construction practices. He was particularly concerned about training construction workers in rural and semi-rural areas where access to technical know-how is highly deficient. Under various programs of Government of India and international agencies, he developed a wide variety of training materials aimed at the skilled and unskilled construction workers.

On the 26 January 2001, when India was celebrating its 52nd Republic day, an intra-plate earthquake of Magnitude 7.7 hit the state of Gujarat. Prof. Arya being the most visible face and having great international reputation was invited to serve as the Seismic Advisor to the Gujarat State Disaster Management Authority, during the period 2001-2003. It was under his guidance that more than 200,000 houses were reconstructed and many hospitals and government buildings were retrofitted. In recognition of his outstanding contributions to the nation, he was awarded Padma Shri by the President of India in 2002.

ROLE IN DISASTER MITIGATION AND RISK REDUCTION

Prof. Arya's retirement coincided with the declaration of 1990's as the International Decade of Natural Disaster Reduction (IDNDR) by United Nations General Assembly Resolution 44/236. The prime goal of the IDNDR was to improve national capacities in order to mitigate the effects of natural disasters. India was expected to respond to the call as all national governments were asked to formulate National Disaster Mitigation Programmes. Prof. Arya being the most capable and experienced, was invited to be a Member of the UN Scientific and Technical Advisory Committee of IDNDR. In view of his substantial contribution in the area of Disaster Risk Reduction, he was honored with the United-Nations DHA-Sasakawa Disaster Prevention Award at the UN Head Office, New York. The Under-Secretary-General for Humanitarian Affairs, and Emergency Relief Coordinator, Yasushi Akashi, presented the Award at a ceremony held on 11 December 1997. It is one of the three prestigious prizes established in 1986 by the founding Chairman of the Nippon Foundation, Mr. Ryoichi Sasakawa. Prof. Arya received the award money of

approximately US $30,000, a citation and a trophy. He donated this money to his Alma Mater for Research and Development work in Disaster Risk Reduction.

Prof. Arya's engagements on projects of national priority became more intense with the passage of time. When the Building Materials and Technology Promotion Council (BMTPC) of the Ministry of Urban Affairs of the Government of India under the visionary leadership of its Executive Director Shri T.N. Gupta started looking for a consultant to produce India's first Disaster Vulnerability Atlas, Prof. Arya was invited to lead the project. The first edition of the Vulnerability Atlas was published by BMTPC in 1997, the latest edition of which was published by BMTPC and released by the Honourable Prime Minister, Shri Narendra Modi, on the occasion of the launch of Global Housing Technology Challenge - India (GHTC-India) during the Construction Technology India 2019 Expo-cum-Conference on 2nd March, 2019 at New Delhi. The outcome of Prof. Arya's long association with BMTPC was publication of some world class documents to further the national agenda.

The heightened concern about the devastation unleashed by the disasters in the 1990's led Government India to constitute a High Powered Committee (HPC) on 20th August 1999 under the Chairmanship of Shri J.C. Pant, a former Secretary in the Ministry of Agriculture, with the objective to prepare disaster management plans for the country. Professor Arya was invited to be a member of the HPC to which he made a seminal contribution as reflected in its report submitted to the Government of India in October 2001. When UNDP and the Ministry of Home Affairs of the Government of India were preparing to launch Earthquake Vulnerability Reduction Project, Prof. Arya was invited to guide the affairs of the project as National Seismic Advisor to the Ministry of Home Affairs during (2003-2009). National Disaster Management Act was enacted in December 2005. With the establishment of National Disaster Management Authority, Prof. Arya was invited to be a member of the Core Committee established to write National Guidelines on Management of Earthquakes. The Guidelines were published in April 2007, but even before that, the Prime Minister, Dr. Manmohan Singh honored him with the first ever 'National Disaster Mitigation Award' on the occasion of the first India Disaster Management Congress organized by the NDMA in November 2006. He also served as a consultant to the United Nations Centre for Regional Development, Japan, on School Earthquake Safety Project in the Asia Pacific Region.

ROLE IN PHILANTHROPY AND PROMOTION OF VEDIC CULTURE

Prof. Arya contributed generously to various organizations dedicated to the welfare of disabled and other weaker sections of the society, education for all, and to preservation and promotion of the Vedic culture and teachings. He established Anand Swarup Arya Saraswati Vidya Mandir, Roorkee, and remained president of the executive committee till his death. The school was started in 1996 and is affiliated with CBSE, New Delhi, from nursery up to senior secondary level, with over 2700 students. Its graduates have received national recognition in education and sports. Infrastructure is also in place for a girls-only school charging only nominal fees and expected to open in 2020. Prof. Arya established Arya Seva and Sanskar Kendra where weekly bhajans are performed on Sundays where students and teachers of the schools recite Vedic mantras and any interested person may join.

Anand Swarup Arya Saraswati Vidya Mandir at Roorkee

Prof. Arya also established Kaushalya Anand Arya Government Ayurvedic and Yunani, and Kaushalya Anand Arya Government Homeopathic dispensaries in Roorkee. These were donated to Uttarakhand government and inaugurated on 8 July 2019.

Prof. Arya donated money annually to support multiple polio operations through Narayan Seva Sansthan, education and also for construction of buildings for Gurukul students studying Vedic Sanskrit throughout the country especially in backward areas of Odisha and Chhattisgarh.

AWARDS AND RECOGNITION

Select awards and recognitions among the long list of awards and recognitions Prof. Arya received are listed below.

- Khosla National Award (1980), the annual research award of IIT, Roorkee
- Fellow of Indian National Science Academy (INSA) (1981)
- Fellow of Indian National Academy of Engineering (INAE) (1988)
- Honorary Fellow of IAStructE since May 2005
- ISET Jai Krishna Award (1982)
- FICCI (Federation of Indian Chambers of Commerce and Industry) Cash award (1986)
- National Design Award of The Institution of Engineers (India) (1987)
- United Nations' The Sasakawa/DHA Disaster Prevention Award (1997)
- Fourth highest National Civilian Award - Padma Shri (2002)
- ICI- Jaiprakash Associates Life Time Achievement Award (2002)
- INAE Life Time Contribution Award in Engineering (2002)
- University of Illinois at Urbana-Champaign Distinguished Alumnus Award (2004)
- IIT Roorkee Distinguished Alumnus Award (2005)
- Disaster Mitigation Award (2006)

He participated in many UNESCO and other international activities and was an active member of many international delegations as an expert in Earthquake Engineering.

IMPORTANT POSITIONS HELD

- Director of the International Association for Earthquake Engineering : 1977-84
- Chairman of the Bureau of Indian Standards' Sectional Committee on Earthquake Engineering Codes (CED 39) : 1991-2010
- Consultant to United Nations agencies such as UNESCO, United Nations Human Settlements Programme (UNCHS) and United Nations Centre for Regional Development (UNCRD) as well as the World Bank.
- Headed the "National Seismic Zoning Committee"
- National Seismic Advisor to
- The Ministry of Home Affairs, Government of India : 2003-2009
- The GoI-UNDP Disaster Risk Management Programme: 2003-2009

BOOKS AND PAPERS

Prof. Arya was popular among the researchers and academics through his many high quality original research papers related to Earthquake/ Structural engineering. He is very much popular and highly regarded among the practicing engineers and university students through his following well-known books.

1) Arya, A. S. and J. L. Ajmani, Design of Steel Structures, Nem Chand & Bros., Roorkee, (First Edition: 18th June 1964), 888 pp. (Sixth Edition: 2014 with Awadhesh Kumar)
2) A. S. Arya and S. K. Thakkar (1972), "Response of Arches under Earthquake Excitation", University of Roorkee.
3) Jain, O.P. and Arya, A. S., Theory and Analysis of Structures: Volume 2, Nem Chand & Bros., Roorkee, (Third Edition: 31st December 1992), 708 pp.
4) Arya, A. S., Masonry & Timber Structures Including Earthquake Resistant Design, Nem Chand & Bros., Roorkee, 2006.
5) Arya, A. S., Boen, T. and Ishiyama, Y., Guidelines for Earthquake Resistant Non engineered Construction, International Association for Earthquake Engineering, 1986, 158 pp.
6) Arya A. S., Earthquake Disaster Reduction: Masonry Building, Design, and Construction, National Institute of Disaster Management, KW Publishers, 2007, ISBN 9788187966500.

Apart from these, he contributed to several National/ International seminars, workshops, trainings and conferences on Earthquake Engineering.

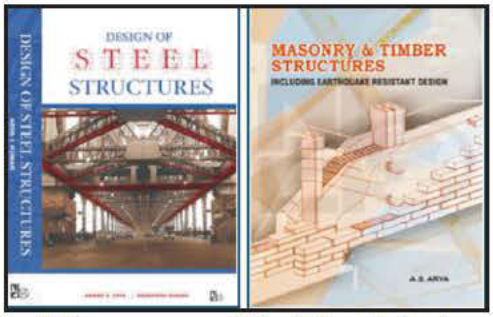

Fig. 1 Cover pages of Prof. Arya's books on steel structures and masonry & timber structures

PHOTOGRAPHS OF MILESTONE EVENTS

Fig. 2 Dr. Manmohan Singh presenting Disaster Mitigation Award to Prof. A.S. Arya (National Seismic Advisor, Disaster Management Division, Ministry of Home Affairs) at the inauguration of the First India Disaster Management Congress (2006)

Fig. 3 Prof. A.S. Arya receiving Padma Shri Award from President Dr. K.R. Narayanan (2002)

Fig 5 Prof. Anand S. Arya receiving University of Roorkee Khosla National Award (1986)

Fig. 4 Prof. A. S. Arya receiving FICCI Cash Award from Prime Minister Rajiv Gandhi (1986)

Dr Arya (Standing behind former PM Mrs. Indira Gandhi) participated in Sixth World Conference on Earthquake Engineering, 1977

Prof. Arya had a cardiac arrest and left for his heavenly abode on 1st September 2019. He is survived by his wife, a true life partner, Mrs. Kaushalya Arya, four children (Arun Kumar Arya, Poonam Agarwala, Anjali Agarwal, and Anshuli Arya), eight grand-children and three great grand-children. On his first death anniversary, Indian Institute of Technology Roorkee established an Institute Chair Professorship in honour and memory of its alumnus and doyen of Earthquake Engineering late Dr. Anand Swarup Arya. By creation of this Chair, Dr. Arya's professional contributions will continue to inspire generations to come.

ACKNOWLEDGEMENTS

The authors whole-heartedly thank Mrs. Kaushalya Arya (wife of Prof. Arya) for proofreading this article and adding information on Prof. Arya's family and philanthropy, Ms. Poonam Agarwala (daughter of Prof. Arya) and Mr. Subhash Agrawal (son-in-law of Prof. Arya) for kindly sharing the photographs included in this article. The authors also thank the authors of the references mentioned below which were the sources for much of the information presented in this article.

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About the Authors

Er. N. Ravi Kiran obtained his M.Tech in Structural Engineering from IIT Delhi in 2005 and is currently pursuing his PhD at IIT Roorkee. He actively volunteers for the Indian Society of Earthquake Technology (ISET) in its activities. Prior to starting his PhD, he was as an Assistant Professor at NIT Andhra Pradesh. Before moving to academia he was a Senior Structural Design Manager at SEMAC Consultants Private Limited. He also did a European Commission funded Masters in Earthquake Engineering and attended advanced level Masters on Steel Design and Emerging Technologies for Construction at the University of Naples, Italy.
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Dr. Ravi Sankar Jakka is working as Associate Professor in the Department of Earthquake Engineering, Indian Institute of Technology, and Roorkee. He is also currently serving as Secretary, Indian Society of Earthquake Technology. His areas of interest are Dynamic Site Characterization, Foundations, Soil Liquefaction and Slope Stability. He has published over 30 articles in reputed international journals and more than 50 articles in conferences. He has supervised 32 Masters Dissertations and 6 Ph.D. theses, while he is currently guiding 9 doctoral students.
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Dr. N. Subramanian, Ph.D., FNAE, F.ASCE, M. ACI, FIE is an award winning author, consultant, researcher, and mentor, currently based at Maryland, USA, with over 45 years of experience in Industry (including consultancy, research and teaching). He was awarded with '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, Principles of Space Structures, and Building Materials, Testing and Sustainability and 270 papers.
Email : drnsmani@gmail.com

USE OF STEEL TUBES IN BUILDING CONSTRUCTION BY PROF (RETD) M G GADGIL

By Prof. M G Gadgil

1. Introduction

Last couple of decades has seen tremendous increase in the use of structural steel sections in building construction. Gone are the days when structural sections were thought to be used only in industrial sheds or ornamental structures. Now a days increasing usages are found for structural sections for residential and commercial buildings. This trend is seen in all parts of the world. In terms of total steel usage India is number 2 in world ranking but we steel are far below in rank when we consider per capita consumption of steel. A brief look at the table 1 and 2 makes this point clear.

Total annual steel consumption (countrywise)

Rank (2019)	Country/Region	2019[8][9]
—	World	1869.9
1	China	996.3
2	India	111.2
3	Japan	99.3
4	United States	87.9
5	Russia	71.6
6	South Korea	71.4
7	Germany	39.7
8	Turkey	33.7
9	Brazil	32.2
10	Iran	31.9
11	Italy	23.2
12	Taiwan	22.1
13	Ukraine	20.8
14	Vietnam	20.1
15	Mexico	18.6

Per capita annual steel consumption

Name of country	Annual per capita steel consumption Kg/person/year
China	632.9
India	74.3
Japan	498.1
South Korea	1 039.0
Taiwan, China	759.8
Other Asia	88.9
Asia	299.2
Oceania	157.5
World	229.3

With increasing demands from industry and availability of more and more sophisticated tools, technology and expertise, we now see considerable interest shown by architects and engineering profession in choosing structural steel as construction material for buildings rather than concrete. It is true that concrete can never be totally replaced by structural steel as we see that even in steel

2. Steel and concrete as materials of construction

Main advantage of using steel as a construction material is it's high strength and strength to density ratio. Ultimate strength to density ratio for steel and concrete are 512000 and 125000 respectively (kg/cm2)/(kg/cm3) for fe400 grade steel and M30 grade concrete. As for steel tubes we have following grade steel available (Yield stress/ultimate stress)

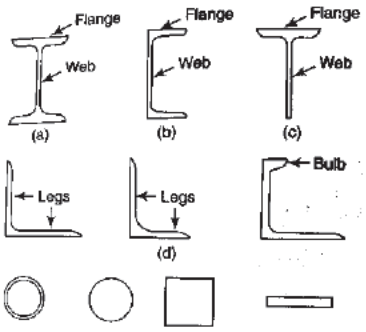
Grade of steel for tubes		normal concrete grades
Yst 210	210/310 Mpa	M20
Yst 240	240/410 Mpa	M25
Yst 310	310/450 Mpa	M30
Yst 355	350/470 Mpa	M35
Yst 460	460/580 Mpa	M40 —— M70

For concrete we get strength generally from 30 MPa to 70- MPa. Thus from yield point of view steel appears to be 7 to 10 times stronger but due to better quality control in its manufacture and also due to better (homogeneous) molecular structure as against heterogenous for concrete, normal load factor for material is 0.33 for concrete while it is 0.67 for steel. The result is that permissible design stress for M30 grade concrete is 8 MPa (in compression) while for steel it is at least 150 Mpa (in tension and compression) for lowest grade steel. Further concrete has very poor strength in tension and shear while for steel the values are comparable to value given above. All these numbers indicate that for steel there is great advantage as far as strength of the material is concerned. This makes steel structure appreciably lighter compared to same structure built in concrete.

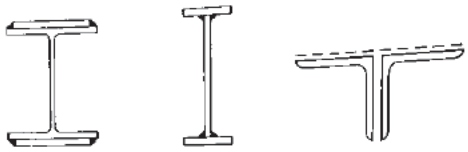
Further, over the years there is tremendous improvement in quality of steel resulting into very high grade steel being made available which makes the structure lighter and lighter.

3. Choice of section –- critical step in structural steel design

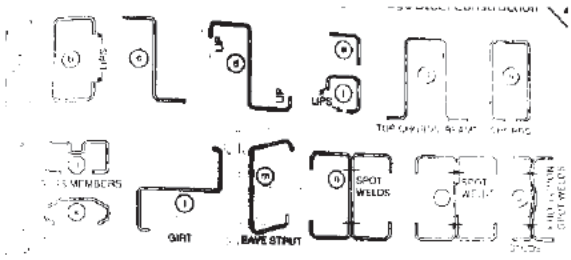
Major difference between using structural steel and using concrete in buildings is the type of section to be used for a specific application. In case of concrete, as most of the construction in buildings is cast in situ, majority of sections are rectangular or rarely circular (for aesthetic purpose). In case of structural steel sections, a large no of options are available and it is therefore necessary to make a judicious selection for sections. Different sections have different plus and minus points and as such the choice of sections becomes all the more important. Following sketches list various available generally available in industry.



Rolled sections



Built up sections



Cold formed section (Thin walled)

In general a structural member in a structure carries predominantly one or more of the following forces

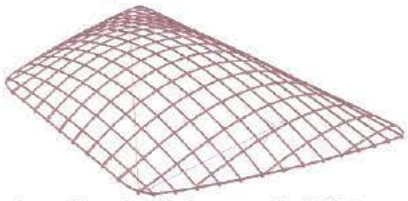
Plane and space truss members	Axial force (A.F.)
Plane frame	AF, SF, BM in one plane only
Plane grid	SF, TM, BM in one plane
Space Frame	AF, SFy, SFz, TM, BMy, BMz

It is to be noted that of the available sections, listed above, not all are equally efficient in resisting all types of forces. Due to the geometry of X section these sections have some inherent strong and weak points in resisting various types of forces listed above. Table below gives some strong points of these sections

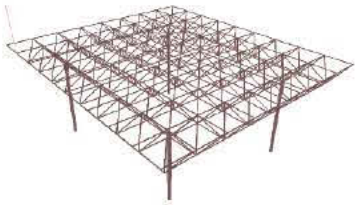
Sr No	Good to resist	sections
1	AF	Single/double angle-chanel, I/H sections, round / square/rectangular tube section
2	AF+ uniaxial M	Single/double chanel, I/H sections, round / square/rectangular tube section
3	AF+ Biaxial M	I/H sections, round /square/rectangular tube section
4	AF+ Biaxial M +TM	round /square/rectangular tube section

There are certain types of structures where tubes of any shape are preferred due to types of forces developed or their aesthetics. In the following category of structures, generally tube sections are preferred

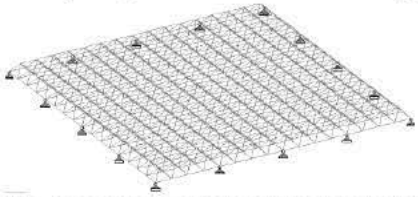
- Space frame with ball connectors or plate connectors or special Connectors



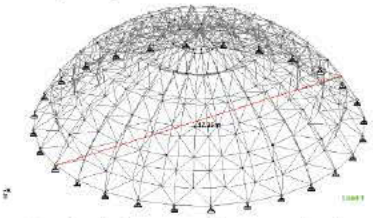
curved roof in single layer with RHS



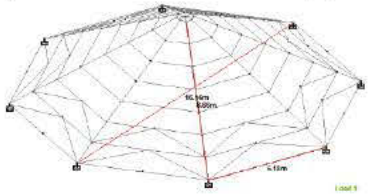
Double layer space frame with Round pipes



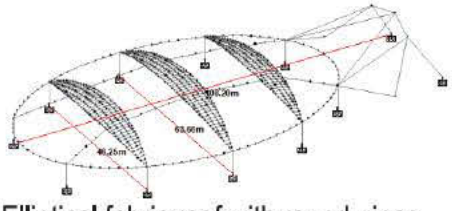
Double layer space frame with round pipes



spherical dome with round pipes



Pyramidal roof with RHS



Elliptical fabric roof with round pipes

4. Design of steel tube section

Steel tube sections being bi-axially symmetric structural design of these type of sections is a very simple process. Following simple formula from structural mechanics can be used to check whether actual stress is less than permissible stress of respective type.

Design for axial force actual stress = AF/Area of section

Design for shear force-- actual shear Stress = SF/Area of web

Design for bending moment– bending stress = M/Z

Design for torsion torsional stress (shear) q = T r/J

Where AF —- axial force, SF -— shear force, M — bending moment

T -— Torsional moment

Z —- section modulus about axis of bending

J —- polar moment of inertia = Ix + Iy

r -— Max distance of a point from axis of rotation

5. Connections for steel tubes

After having designed the members of a structure (which are tube sections) the next task is to design the connections where members meet at a joint. Four types of connections are generally available to connect tubes to each other so that the forces in the tube members get effectively transferred to each other and equilibrium of forces and integrity of structure is maintained.

I. Ready to use connectors (bolted connection)

1. Use of spherical connectors – only axial forces are transferred
2. Use of plate connectors – Only axial forces are transferred
3. Use of cylindrical connectors – AF, SF and BM (about one axis only) are transferred

II. Direct tube to tube welding. AF, SF and BM (about one axis only) are transferred

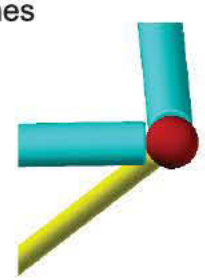
III. Tube to tube connection with cover plates and hidden plates

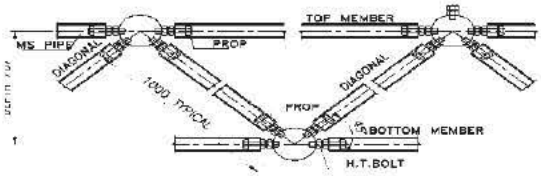
IV. Tube to tube connection with stiffener plates.

Above listed connections are explained in details in the remaining part of this article

I. Ready to use connectors

1. Spherical connectors -- Hollow or solid --- These connectors are available from different manufacturers and in different sizes. Depending on size of the connector, the max load carrying capacity is generally specified by manufacturer or can be ascertained in laboratory tests. Bolts (of required grade and diameter) are used to connect members to the connector. In this type of connection the bolts are in tension / compression. Typical connection is shown in following sketches

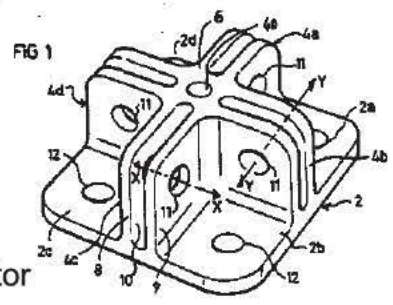




TYPICAL NODE ARRANGEMENT

2. Plate connectors

These connectors are made by welding of plates to each other so that max of 8 members can be connected to it. At least two bolts are used to connect members to the connector. Generally round pipes are provided with this type of connector. To facilitate connection, round pipes are crimped at ends and then bolts are used to connect the members to the connector. Bolts in this type of connector are in single shear. This connector is generally used when members (round pipe or tube) carry primarily axial force. Schematic arrangement of the connector is shown in sketch below



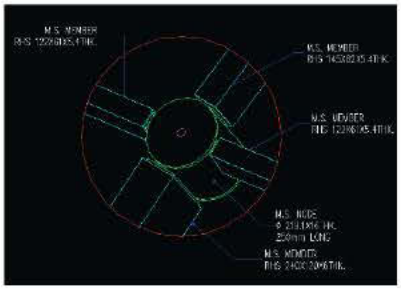
Typical plate connector

Snap shot of plate connector used in space frame

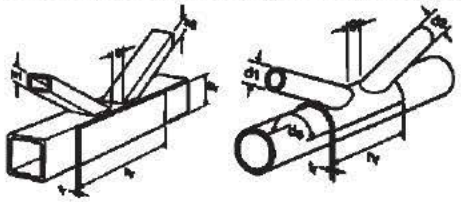
3. Cylindrical connectors

These type of connectors are provided when members of the structure carry axial force and moment. The cylindrical connector is designed in such a way that skin stresses in it are within permissible stresses of parent metal.

Two bolts are provided to connect each member to the connector. Force in the bolt is axial tension or compression (due to direct axial force in member) and moment induced axial tension and compression in bolt plus shear in bolt due to shear in connected member. Schematic arrangement of this type of connector is shown in sketch below.



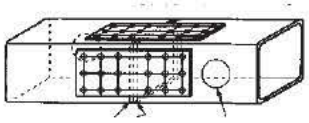
I. Direct tube to tube welding. AF, SF and BM (about one or two axis only) are transmitted in these type of connections. Weld stress is calculated due to all forces developed in the connected member and is limited to the permissible stress in weld. Additional plates are welded to the connected member if its thickness is not adequate. Schematic arrangement of this type of connector is shown in sketch below.



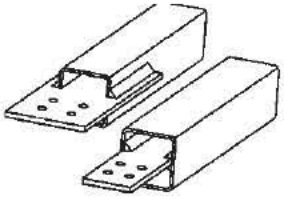
Tube to tube direct welding

II. Tube to tube connection with cover plates or hidden plates or face plates

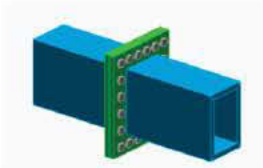
This type of co of connection is generally made for splicing of member and also beam to column connection when the sizes of both members are same. The connection can be welded or bolted. The cover plate should carry same force as the parent plate and bolts or weld of cover plate on each side of joint should carry the full design force of the connected plate. Face plates shown in sketch are welded to the parent plate and the weld should transmit full force from parent plate. The connection(bolts or weld) between two adjacent face plate should carry full design force in tension. Typical connections of these type are shown in sketches below.



Splice of tubes with cover plate

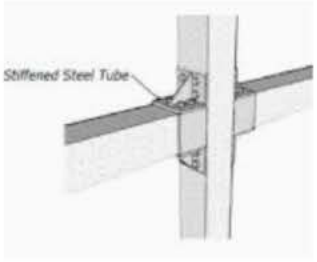


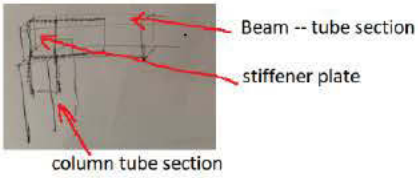
Splice connection with Hidden plates

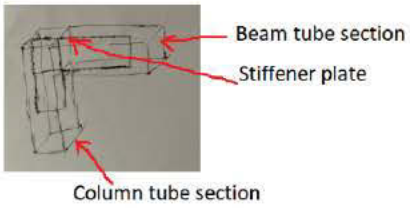


Splice connection with face plate

III. Tube to tube connection with stiffener plates- In this type of connection the stiffener plate acts as a main connecting plate that transmits force from one member to the other and vice versa. The weld of stiffener plate transfers force from connected plate to stiffener plate and vice versa. The stiffener plate transfers force from beam to column and vice versa. Thus the stiffener plate shall be as strong as the connected members.







6. Concluding remarks

An attempt has been made in this paper to show various options available for connecting steel tube being used in construction industry. The option presented here are not exhaustive and a designer can use basics of structural mechanics and visualize flow of stresses at a joint to provide safe and efficient joint in alternative fashion. These days, with tremendous progress in computer based stress analysis, it is possible to model a joint with all its intricacies using finite elements (either shell element or brick element) and understand the stress pattern at a joint and ascertain that the stresses are within safe limit. In case of major innovative joints, it is always advisable to carry out laboratory test on a prototype of the joint and measure stresses at joint to ensure that stresses are within limits

About the author :

Prof. M. G. Gadgil is a retired professor and head Structural Engineering Department, VJTI, Mumbai and independent Consulting Engineer having four decades of experience. He has designed and proof checked variety of steel and concrete structures.
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CONCRETE COVER – IMPORTANT ASPECT OF DURABILITY

By Paresh Unnarkar

Higher Grade of Concrete do not guarantee Durability.

One of the factor affecting Durability is Concrete Cover to Reinforcement.

1) Importance of Concrete Cover -

- To Prevent Corrosion of Steel by Carbonation and Penetration of Moisture and Air from the surface.

Durability Requirement –

- To Give the Reinforcement bar the necessary Embedment to be Stressed without Slipping.
- Acts as a Thermal Insulation of Reinforcement bars to protect it from Fire.

2) Requirement of Concrete Cover –

- Based on Durability
- Based on Fire Resistance

3) IRC112-2011- Indian Road Congress –

- Bridges are designed for anticipated life span of 100 Years.
- If want life span of 50 Years then reduce the cover by 5mm and keep everything same. This shows the importance of Concrete Cover on Life Span of Structure but this is the most neglected in construction industry.

IS 456 : 2000

Table 16 Nominal Cover to Meet Durability Requirements
(Clause 26.4.2)

Exposure	Nominal Conerate Cover in mm not Less Than
Mild	20
Moderate	30
Severs	45
Very Severe	50
Extreme	75

NOTES
1 For main reinforcement up to 12 mm diameter bar for mild exposure the nominal cover may be reduced by 5 mm.
2 Unless specified otherwise, actual concrete cover should not deviate from the required nominal cover by + 10mm

3 For exposure condition "servre" and "very severe",reduction of 5 mm may be made, where concrete grade in M35 and above

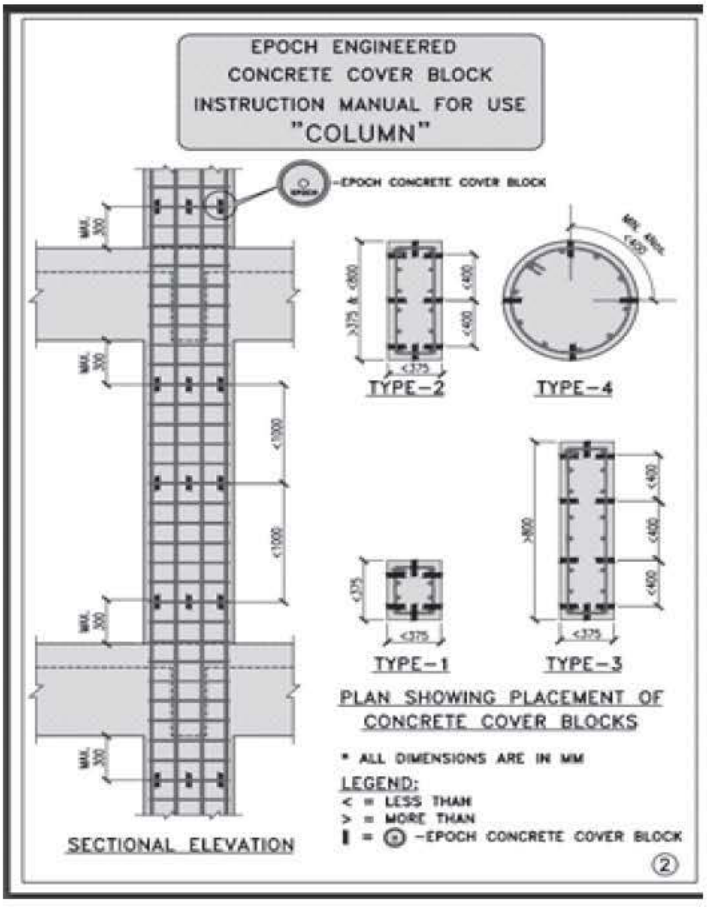
Table 16A
Nominal Cover to Meet Specified Period of Fire Resistance
(Clause 21.4. and 26.4.3 and Fig. 1)

Fire Resis. Tance	Nominal Cover						
	Dearms		Slabs		Ribs		Columns
	Simply supported	Continuous	Simply supported	Continuous	Simply supported	Continuous	
h	mm	mm	mm	mm	mm	mm	mm
0.5	20	20	20	20	20	20	40
1	20	20	20	20	20	20	40
1.5	20	20	25	20	35	20	40
2	40	30	35	25	45	35	40
3	60	40	45	35	55	45	40
4	70	50	55	45	65	55	40

4) IS 16700:2017- Structural Safety of Tall Concrete Buildings-
   - Concrete to satisfy the Durability Test –
   - o For Foundation –
     - RCPT < 1000 Coulomb
     - Water Penetration < 15 mm
   - o For Super Structure –
     - RCPT < 1500 Coulomb
     - Water Penetration < 20 mm

   Cover block should also satisfy the durability criterias.

5) Handbook on Concrete Durability – Technical Committee (ICI-TC/08)
   - The actual reinforcement cover achieved in the structure plays important role in Performance Based Durability Design to calculate the life span of structure.
   - The Quality – Strength & Durability and Accuracy of Cover is very much important.



6) BS-7973-1:2001- Spacers and chairs for Steel Reinforcement and their Specification – Product performance & Requirement
   - Minimum grade of concrete of Cover/Spacer block = M50
   - Cover Block should not be made at site.

7) BS-7973-2:2001- Spacers and chairs for Steel Reinforcement and their Specification – Fixing & Applications -
   - General Arrangement of Spacers/Cover block for 8mm & 10mm stirrups.

8) Draw back of site made cover blocks-
   - Porous
   - Allow ingress of Water, Vapour & Gases
   - Strength below 10 Mpa

9) Draw back of PVC Cover Blocks-
   - Does not bond with concrete.
   - Permit development of hair cracks.
   - Melts in heat.
   - Release toxic carbon monoxide upon burning.
   - Water vapour seeps to the reinforcement.
   - PVC cover made of recycled material deform during concreteing.

10) On Field Variation of Concrete Cover - Example-

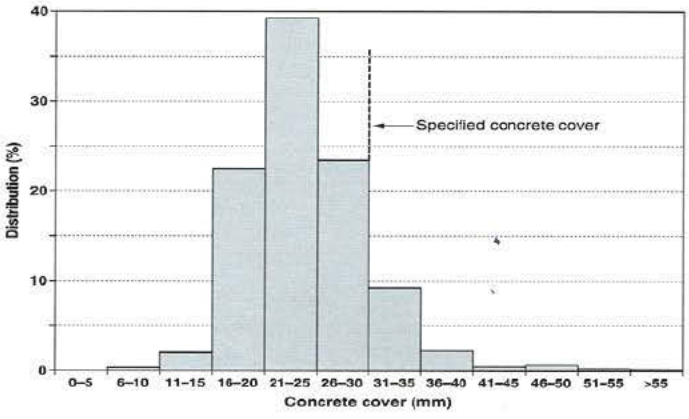


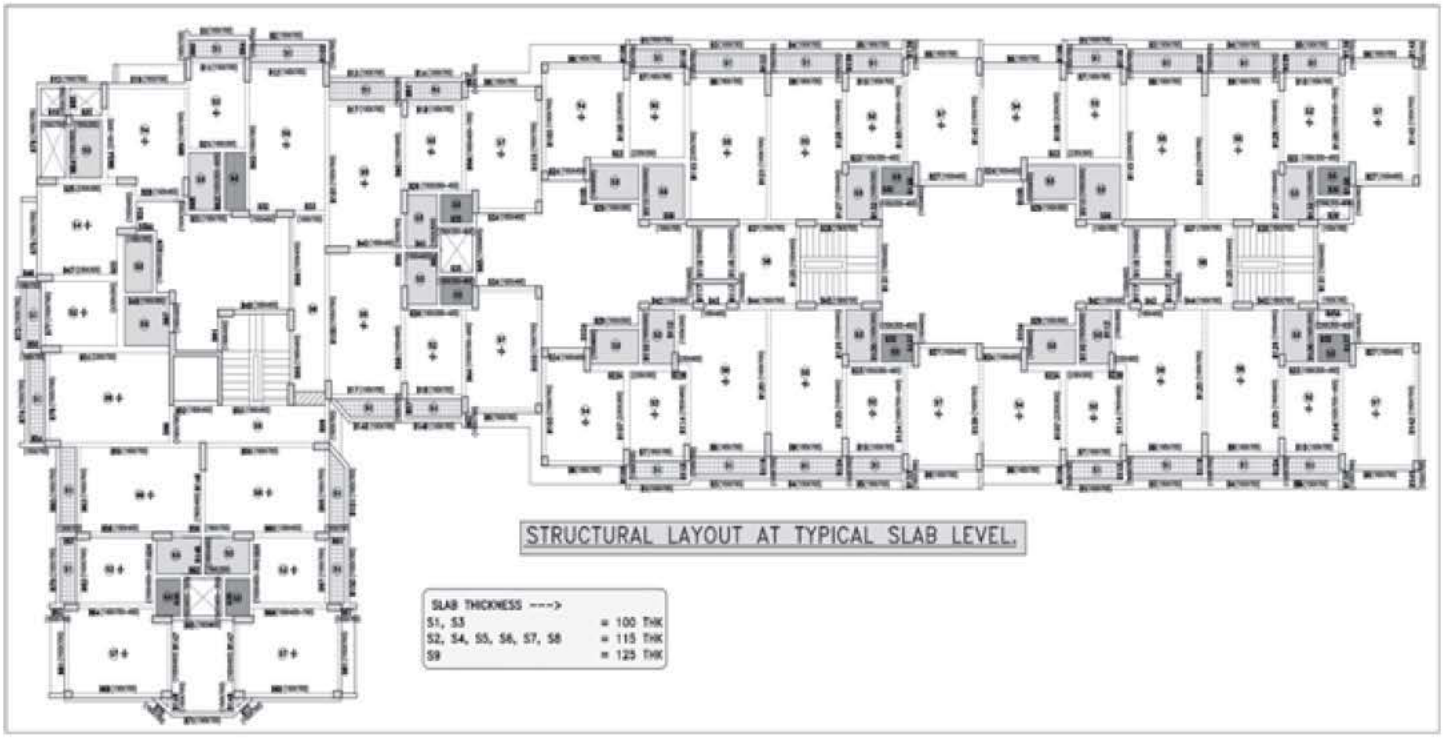
Figure 2.40 Gimsoystraumen Bridge (1981) with observe variation of achieved concrete cover (source : Kompen (1998)).

11) Cost of Concrete Cover Blocks in Rs./SqFt-

- Project – Residential and Commercial Building at Umroli, Palghar.
- Floors – Ground+4 Upper Storey
- Total Construction Area = 36,216 SqFt

12) Conclusion-

- Concrete Cover is one of the important aspect of Durability.
- Minimum Grade of Concrete for Cover block = M50.
- Concrete Cover Block should also satisfy durability criterias.
- Cover block made at site should not be used.
- PVC Cover Block should not be used.
- For Performance Based Concrete, Concrete Cover plays very important and crucial roal in Life Span of structure.
- Tentative cost of Cover Block is around 0.35% to 0.5% of construction cost which is negligible but plays very important role on Life Span of Structure.



SUMMARY OF COST CALCULATION

Sr. No.	Description	Cover in MM	Type of Block	Unit	Quantity	Rate	Amount
1	Footing	50	Rectangular	Nos.	588	6.60	3,881.00
2	Column	40	Circular	Nos.	12708	10.70	1,35,976.00
3	Beams - Bottom	40	Circular	Nos.	4508	10.70	48,236.00
4	Beams - Sides	30	Circular	Nos.	9016	6.60	59,506.00
5	Slabs	25	Rectangular	Nos.	8638	1.80	15,548.00
6	Lift Wall, U.G. Tank & O.H.Tank	40	Rectangular	Nos.	2000	3.10	6,200.00
							2,69,347.00

Total Construction Area	=	36,216	SqFt
Cost of Cover Block	=	2,69,347	Rs
Cost of Cover Block of Construction Area	=	7.40	Rs/SqFt

About the author :

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HIGHER STUDIES ABROAD 1

By Kirty Hemant Vadalkar

In the past we saw many engineers from different faculty leaving the country either for higher studies or for work or both. In the recent past, its observed that many fresh civil engineers have started preferring to leave the country and pursue their career abroad. Its a matter of concern, why do they leave? What attracts them there, salary? Work culture? Something else that we cant provide them here? Its become so common for a fresh mind to go to a foreign university, is it a cakewalk to be in a different country?

Many freshers want to go abroad and they are confused as to where to go? What to study for the entrance? Should we join some highly charging consultants to help us through the admission process? Is it as simple and glamorous as we dream of? What difference does it make with the university?

In this series of articles I am trying to find the answers to many questions that come to our mind from the young stars from India. I have tried to contact the students who went to different countries and various universities. They have pursued different career there but they have one thing in common, they are all civil engineers from India, went abroad and either settled there or returned after a brief working experience.

I mailed them same set of questions. I am so much grateful to them they took time out from their busy schedules to provide me with the answers.

Nishad Madhav Chikodi
(nishadchikodi@gmail.com)

They say, if you don't have a civil engineering family business to support, it is difficult to find a satisfying job in India. Or if there is no one to support from the family, without any such background, it is not possible to be happy with the job.

Contrary to this popular belief, a bright boy, from a civil engineering "family", with a degree in hand from a reasonably good college of Mumbai university , Nishad Chikodi, thought of going abroad. His father is a reputed structural consultant, his family has many civil engineers working on their own. Yet, he preferred going abroad.

Nishad had a good score for his GRE and TOEFEL. He doesn't find it necessary to join any highly charging consultants or coaching classes to get through this. But he took help from the internet for practise, since its a timed test, he emphasized on time and score. He worked for a year after his graduates degree, in India. He then completed his masters from the University of Houston and is pursuing his career in a reputed structural engineering firm, Coastello,Inc.

He chose Houston university because its reputed, the tuition fees are reasonable, there are good job opportunities, the research facilities are state of the art, the curriculum is interesting and most important Houston Is a large city with proper living conditions.

For admission, the writing skills are also important along with the clarity of thoughts as to why the student wants to join the university ,as also his intention to pursue higher studies. Its called the

Statement of Purpose (SOP). letter of recommendation (LOR) from reputed persons from the industry and academic fields are essential. Nishad arranged all this and then proceeded for application.

The applications are available online with the university website. Nishad first studied the university ranking from trusted websites like QS world rankings, US news ranking, as he was aiming at the universities in the US. He also visited websites of

various universities. There are videos available on official You tube channels, he saw all those. He did a lot of ground work and finalised 10 universities based on various factors like curriculum, future job market, location and tuition fees.

He finds, Completing an application for any university is a very easy task once you have everything ready, I.e. your official degree marksheets and transcripts, GRE & TOEFL exam scores, Statement of purpose (SOP), and letters of recommendation (LOR). Admissions committee of all universities have a proper understanding of all Indian universities, their GPA format and ranking of the University.

According to Nishad, main factors governing acceptance into any University are mainly GPA and test scores, research, and work experience (if any) and some universities also consider extracurricular activities other than academics. It's always good to send all information, which will increase chances of acceptance.

He also thinks its essential to be honest and not to include anything other than your own qualities.

He is also very humble in saying that his profile was mediocre. But he was honest in providing all the correct information, along with a good SOP and LORs.

Having got into the reputed university of Houston, Nishad started his preparations.

Getting his visa was the first task followed by booking a ticket. And then the real test started.

He was very systematic in his approach. He prepared a list of things to carry along as there are so many. First he listed the absolute essentials. He studied the weight restrictions of the airline first.

He first visited the graduate admission office and college of engineering building to complete the required formalities and then went around the campus admiring the facilities.

He says, “My campus is right in the centre of downtown, so there are a lot of important roads and railway lines which pass right through the campus. Overall, my first day at the campus was a fruitful day and a day which I will always remember.”

Having done all the basics, the actual studies started. Nishad finds it quite different from our indian pattern. It is more industry/research oriented. His university had given him an option to pursue a master’s degree based on research (thesis) or industry-oriented courses (non-thesis). It’s a very important and flexible option which the university had offered before the start of first semester. Nishad was more interested in industry-oriented courses and hence selected his courses accordingly.

He was a structural engineering student, so he had to choose courses in this main discipline. But he could additionally opt for 1-2 courses out of total 12 courses, other than main discipline. So he selected Structural Dynamics, Advanced Steel Design, Seismic analysis of structures, Advanced foundation design, Prestressed Concrete. These all were core courses and some of them were prerequisite for gaining master’s degree. He did not take any course which was outside his domain of structural engineering.

Nishad’s master’s degree was more industry based, still he did a lot of projects which helped him in his courses. He had, earlier read on University website about some professors and their research. This helped in finalizing the courses.

His main guides were Dr Mo and Dr Mercan who taught Structural Dynamics, Advanced Steel Design and Seismic Analysis. They are simply great professors and have made huge contributions through their research projects and as professors for last 30 years. Nishad has developed a great relationship with both of them, during his college days and even after 2 years of graduation, he is still in touch and seeks their guidance in work whenever required.

Most important point of concern is the expenses. The universities in Texas charge relatively Lesser fees than universities in other states like California or New York. There are a lot of

scholarships available at University of Houston as it is a public research university. Especially, there is one Specific rule in Texas which states that if one gets any amount of scholarship from the department (let it be $100 or $1000), The person will be paying in state tuition fees, that is paying fees as per any other local American. This cuts down tuition fees by almost 50% as one is not required to pay all other expenses and taxes associated with being an International student. On an average, without in-state scholarship, tuition fees of an International student will range from around $20-$30k at University of Houston.

During the course, Nishad had many nice memories to cherish. He finds the course days the best days. He especially remembers his participation in American Society of Civil Engineers (ASCE's) concrete canoe competition. A concrete canoe was to be made out of the given materials , that canoe should withstand some specific load while floating on water. Though It was not a part of his curriculum, he participated in that event along with 3 other classmates , 2 of them Americans & 1 Chinese and won that event. The inter-nationality of the competition was a great experience. It is easier to work with your own country men but to work with people of different origins takes to the global level. This definitely was a moment to cherish forever. It was the most memorable experience for Nishad.

Overall studying experience at University of Houston was very enriching, he thinks.

They studied during the day as the lectures were in the evening. There are multiple libraries fully equipped with everything needed for studying. Nishad spent most of his time in library during the day. He shared a common bond of coming to U.S with the sole purpose of studying with his course mates who came from different countries. He made good friends and enjoyed his tenure at Houston university with them.

I have heard so much about the colourful graduation ceremonies in the US. So I wanted to know Nishad's experience. He graduated in December 2018, but since he wanted his parents to join the ceremony, he postponed the ceremony to May 2019. this is something interesting, one can finish studies as per ones convenience. He had already started working from Jan 2019.

His graduation ceremony was held in the newly built basketball stadium (Fertitta Center) in the campus. Nishad says, "Walking up that stage and getting degree from the Dean of Engineering, with my parents and younger brother sitting on the stand was indeed a site to behold. Nothing will ever match that."

Having received the prestigious degree, Getting a job is the next task. The immigration policies and the system matters a lot in this. Yet, once you get a job its quite rewarding in terms of experience and money, too, thinks Nishad.

After your graduation, you only have around 60-70 days to find a job in order to maintain a lawful visa status. So, most students usually keep minimum courses in their last semester, so that they can concentrate on securing a full-time job. Ideally, according to Nishad, if you have a choice, keep only 1 or maximum 2 courses in the last semester, so that one can focus more on finding a job.

But he didn't have that liberty as in order to maintain his scholarship, he had to take certain number of courses every semester. So he had to take 3 courses in the last semester, with added load of finding a job.

He was constantly applying on company websites and job search platforms like Indeed, zip recruiter and LinkedIn. Finally, he got an internship opportunity through Indeed and within few days got a full-time job offer from his present company as well. All of this happened even before he graduated, because of his continuous job applications. Besides that, he also actively participated in University Career fairs every semester. He later discovered

from his senior at work that HR had received his resume through Career fair and that's how it was forwarded to the department. So, Career Fairs are very important for job search.

He is working at present with a reputed company 'Costello, Inc.' as a Structural Engineer. He has a reasonable 2 and half years experience to his credit . he finds his experience both rewarding and enriching at the same time. Costello, Inc. has been ranked as one of the best places to work in Houston for last 10 years. There are 16 other civil engineering divisions, around 600 employees and offices in metro cities of Houston & Austin.

Nishad is mainly involved in analysis and design of bridge structures, metal buildings and oil refineries. He is getting an opportunity to work with several talented structural engineers over multiple projects. His role and responsibilities have increased over time

He is actively involved in the extra curricular activities of the company as well. He represented the company in winning the beach volleyball competition.

His experience is enhanced by the opportunity he was given to work on a $250 million USD bridge connector project.

The variety of projects and the open atmosphere has definitely improved his personality in many angles, as a Structural Engineer as well as a responsible individual.

Most important thing to adjust in a foreign land is the rules and regulations, restrictions, local laws and customs. We find many students returning having found it difficult to adjust. As there are too many differences in both cultures, but Nishad thinks one thing surely can help you through everything is flexibility. Flexibility to mould and change according to the situation or surrounding will help a lot to cope up with the differences. Most important is food. U.S is a predominantly non-veg eating country, so people eating non-veg, find many joints serving their choice of food, though it may not be as spicy and tasty as the Indian dishes. But if you're a vegetarian, no problem, there are still good options available, though limited.

Living standards compared to India are quite high, so its better to spend wisely on essential activities only until you start earning.

Laws are very strict compared to India so being proactive and attentive is always important. One should not break laws unknowingly in a foreign country. Its better we understand the requirements of the law and abide by it.

Going through Nishad's experience, I feel its really a different world that he has gone to. But he has taken a lot of efforts to reach there. Its difficult to start afresh in a new land. He is definitely enterprising. I wish him a very bright future.

About the author :

Kirty Hemant Vadalkar, working with engineering students for a long time, helping them in their career planning and further studies. Certified STAADPro trainer , conducting training programs for past 25 years.
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You are right sir, this column is out of plumb. Instead of breaking it, shall we make it with additional plaster to look plumb, as usual?

(Courtesy Indian Concrete Journal)

NEWS AND EVENTS DURING JAN – MAR 2021

by Hemant Vadalkar

22 Jan 2021 : ISSE student chapter arranged guest lecture on virtual platform. **The topic was " Recent trends in repairs and retrofit of RCC structures ".** The lecture was delivered by **Dr. Mangesh Joshi CEO of M/s Sanrachana,** eminent engineer and specialist in repairs of variety of structures.

Guest speaker Dr Mangesh Joshi who is associated with ISSE for a long time had given very interesting information on recent trends in repairs and retrofit of RCC structures. He emphasised need for structural repairs and retrofit with different strategies depending on site condition. He talked on advance and updated strengthening techniques and case studies like column retrofitting, Chimney & Silo retrofitting. He feels that repair and retrofit is reverse engineering process and selection of technique and material depends upon the site condition, available time & budget.

The programme was coordinated by Madhav Chikodi and Ranganath Satam and conducted by students of Walchand College of Engineering. It was attended by about 75 students from different ISSE student chapters.

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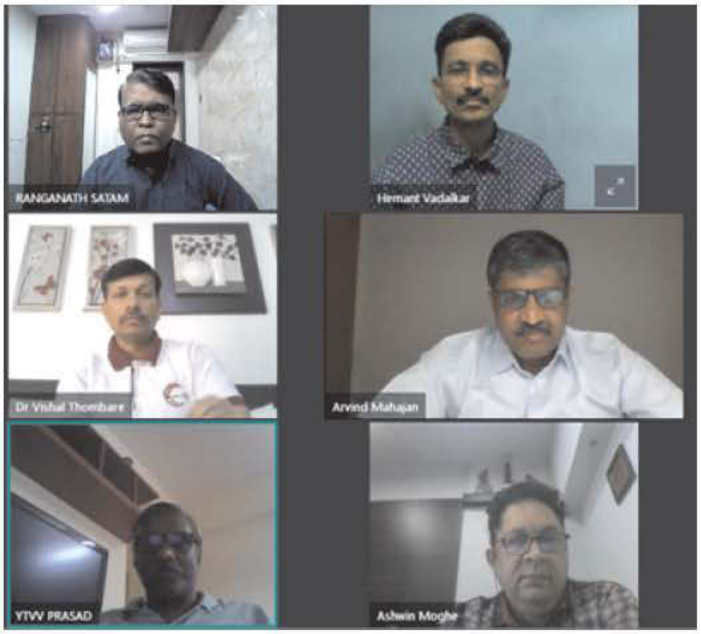
23 Jan 2021 : ISSE in association with ICI and Ultratech Cements arranged a technical webinar on the topic **" Shifting of Utilities in concrete roads". Dr. Vishal Thombre, Executive Engineer (Coastal Road Projects MCGM)** addressed the gathering and elaborated advantages of concrete roads and Ultrathin White Topping over the asphalt roads. He also described the difficulties in shifting various utilities running under the road. He cited guidelines by MCGM , IRC and MORTH for running utility corridor along the road in the soft patches. The presentation was interesting and was attended by more than 125 engineers.



27 Jan 2021 : A special lecture on **"Computer Software application in Civil Engineering"** was arranged for ISSE student chapter from Vivekanad Polytechnic, Mumbai. Diploma Students from second and third year attended the lecture. Presentation was made by **Mrs. Kirty Hemant Vadalkar** who is a software trainer. She elaborated various software packages available for civil engineers for different tasks right from concept to finish. This includes Survey, 3D mapping, contouring, Architectural design, Structural Design, Geotechnical design, MEP, drawings preparation, BIM, quantity estimates, Project planning and Asset management. Lecture was attended by about 60 students. Ms Fatema from Vivekanand college coordinated the event.

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30 Jan 2021 : Epicons Friends of Concrete arranged a **WEBINAR -117** on **"Analysis, Design & Detailing of Shear Walls".** The lecture on virtual platform was delivered by **Prof (Dr.) Yogendra Singh - IIT, Roorkee.** Following topics were covered

1. Difference between a Wide Column and a Shear Wall
2. Shear wall shapes and configurations
3. Failure modes of shear walls during earthquake
4. Modelling and analysis of shear walls, shear wall buildings, and dual system buildings
5. Design and detailing of shear walls
6. Design and detailing of shear walls with openings
7. Miscellaneous topics : Geometric discontinuities, slab-wall connection, design of back-stay, openings in slabs connecting to shear walls, design of collector elements, shear walls terminating or starting from columns.

The session was very informative which covered the topics which are of critical importance for practicing structural engineers. The session was moderated by Er. Arvind Parulekar and attended by more than 320 engineers.

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13 Feb 2021 : Indian Society of Structural Engineers (ISSE) in association with Ultratech Cement conducted technical webinar on **"High Performance Concrete - Some critical Issues"** . The speaker was **Er. Vijaykumar R. Kulkarni,** Past President of ICI and Partner - Midas Techfin Consultants LLP. Mr. Ashwin Moghe introduced the speaker. Er. Vijaykumar has vast experience in concrete and is recipient of many awards. He had written many technical papers and made presentations at various conferences. He pointed out requirements of high performance concrete and its test procedures. He touched upon sensitivity of high strength and high performance concrete design mixes, water cement ratio, compatibility of admixture, modulus of elasticity, microstructure, shrinkage, carbon footprint, fire resistance, brittleness, reduction in column sizes, cost of concrete and durability parameters. He described tests recommended for durability like water permeability, RCPT and need to design the structure for more than 100+ years of service life. The presentation was very informative and interesting. During panel discussion, Devendra Panday and Vijay Kulkarni answered questions raised by attendee. Mr. Shantilal Jain raised issue of quality at high rise building sites. Curing is most neglected at site and use of best quality cover blocks is important for durability which is still lacking. Overall programme was coordinated by Arvind Mahajan from Ultratech. Hemant Vadalkar proposed vote of thanks and requested Vijay Kulkarni to provide write up on the subject for ISSE Journal. The webinar was attended by more than 400 engineers across the country.

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25 and 26 Feb 2021 : Institute for Research, Development and Training of Construction Trades and Management (INSTRUCT) arranged two day webinar on marine structures . There are many aspects of marine construction that fall within the ambit of general civil engineering construction practice. The aim was to elaborate specialist nature of the construction of marine structures and guidelines on construction methodologies for Geotechnical investigations, berthing structure, ship lifts, durability, pitfalls, and particular aspects of underwater concreting, repair technics based on E 1504. Overview was presented by Dr. P V Chandramohan. Er. Vilas Joshi , Chief research officer CWPRS , talked on hydraulic modelling. Er. Sandip Deshpande showed methods of Geotechnical investigations for marine structures. Prof. R Sundaravadivelu, Emeritus Professor, Department of Ocean Engineering, IIT Madras discussed the analysis and design of "Berthing structures" . Dr. Sunil S Basarkar, General Manager (Geotechnical),AFCONS Infrastructure Limited shared his experience on Marine piling operations – execution Techniques & case histories in india. Mr. S Seshadri described New technologies for repairs of marine structures and Er. Sunny Surlekar touched up on provisions of Repair materials and techniques based on E1504.

Overall it was very interesting session on marine structures.

26 Feb 2021 : ISSE student chapter arranged lecture on **Sustainable and Durable concrete.** Concrete expert **Er. Paresh Unnarkar** talked on the subject and shared his experience. He emphasised the importance of proper selection of materials, water cement ratio, mixing , placing , transportation and compaction of concrete. Proper cover blocks of correct size and quality along with curing is very important for durability and long life for concrete structures.

26 Feb 2021 : Epicon Friends of concrete arranged **Webinar 118: Testing for Long Life & Advanced NDT.** Experts from industry shared their experience. Service life of RCC buildings 100 years or more? High Performance Concrete and tests for Durability was discussed by **Er. Jayant Kulkarni** along with **Er. P. P. Pandey** and **Er. S. S. Dhur** of E-Cube Consultant. Advance NDT for civil structures was discussed by Saiprasad Gaonkar Manager. IRCLASS Systems & Solutions Pvt Ltd. He talked on reinforcement scanning by GPR , Reinforcement Corrosion Mapping By profometer, Concrete Resistivity & Corrosion rate of reinforcement by Galvapulse and Impulse response test for detecting voids in deck slab. These advanced tests are very useful for detail investigations.

Non-destructive testing for concrete durability assessment was discussed by Er A. S. Parulekar , Director Epicons consultants pvt.ltd.

17 March 2021 : IGS Delhi and DFI India arranged webinar on Continuous flight auger piling. Various experts from the field shared their experience. Dr. J T Shahu from IIT Delhi talked on Pile foundation: Difficulties in Alluvial Soils and possible way forward. Mr. Andres M. Baquerizo, Vice-President, Keller - North America discussed World Case studies on CFA piles, from a typical project to an extreme application. Dr. Sunil S. Basarkar, Afcons, shared his experience on CFA Piles: Design approaches, Suitability and Applications in India and some tests conducted. There is a great future for CFA piles in India where large number of piles are to be done in a short time and economically.

27 Mar 2021 : Epicons Friends of concrete arranged **Webinar 119** on **"Outstanding structures".** Different types of structures were presented by experts sharing their experience. **Prof. M G Gadgil** talked on tensile structures and elaborated his experience with a fabric structure supported on two existing buildings. Mr. Abhijeet Kulkarni from BuroHappold talked on tall building in Dubai. This includes 'U-Bora Tower' that is 262 m high tower having a unique three-dimensional twisting shape, 'Damac Heights' which is 335 m super tall luxury residential tower with complex and unique elevation and 'Vida Hotel' is luxury hotel with many unique structural features.Mr. R. Eswaran & Mr. Raghupathy–L&T Constructions elaborated on design aspect of 'Narendra Modi' World's Largest Cricket Stadium, Ahmedabad. Innovative design of Mega precast elements and structural steel Fabric roof and Major Challenges Faced during design and construction. Mr. Hiten Mahimtura from ahimtura Consultants, Mumbai, talked about a 'Super Tall Structure' –"The Crown" rising up to 249 m and effective use of outriggers to control the deflection.Mr. Abhay Ghate–Optimal Consultancy –having wide international experience spoke about a unique project in India REC Head office at Gurgaon which is a composite structure with large cantilevers have floor deep trusses , steel sections embedded in concrete. 'Beauty Of Form Finished White Concrete Structure' was explained by the project Architect.

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Compressive Strength	Minimum M60	IS-456 & IS-4031 Part 06 1988
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Rapid Chloride Penetration Test	Very Low-Less than 1000 Coulomb	ASTM C 1202-19
Sulphate Content	Less than 1% by MoC in Mix	IS-456:2000 (RA:2016)
Chloride Content	Less Than 0.5 kg/Cum	IS-456:2000 (RA:2016)
Water Permeability Test	Less than 6mm	DIN 1048 Part 5:1991
pH Value	More than 12.6	IS 2720 Part-26:1987 RA 2016

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