



STRUCTURAL ENGINEERING

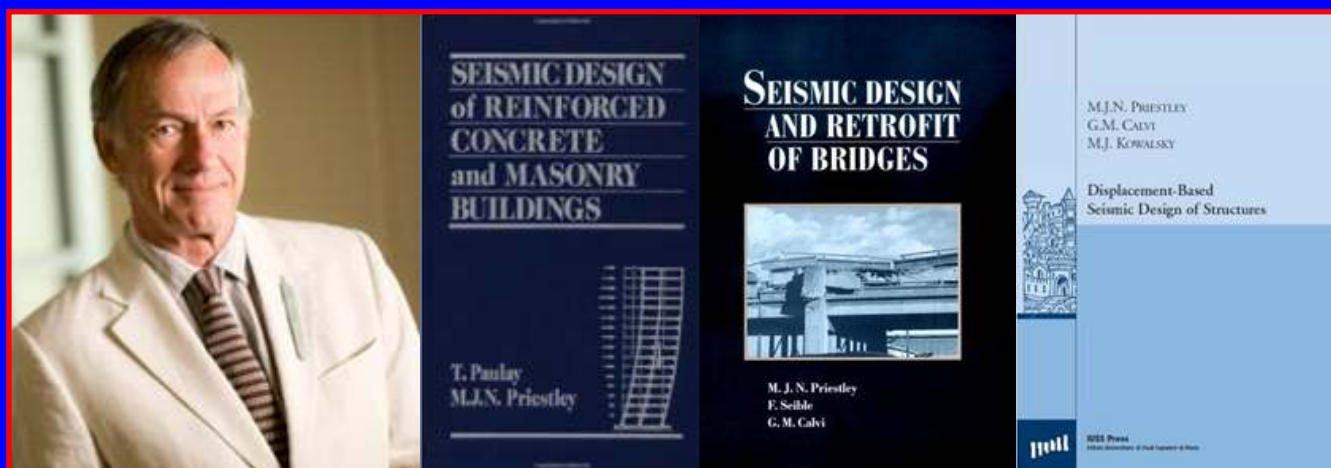
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OF

STRUCTURAL ENGINEERS

ISSE

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Jan-Feb-Mar 2016



GEM.7- -PROF. M.J.N. PRIESTLEY-LAST 'P'ILLAR & LEGEND OF EARTHQUAKE ENGINEERING FROM NEW ZEALAND (See Page 3)



REPORT ON E-CONFERENCE CONDUCTED BY SEFI ON “STATE OF STRUCTURAL ENGINEERING PRACTICE IN INDIA” (See Page 7)

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STRUCTURAL ENGINEERS

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INDIAN SOCIETY OF STRUCTURAL ENGINEERS

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Contents

- ❖ FRATERNITY NEWS 2
- ❖ GEMS OF STRUCTURAL ENGINEERING
GEM.7- -PROF. M.J.N. PRIESTLEY-LAST 'P'ILLAR
& LEGEND OF EARTHQUAKE ENGINEERING
FROM NEW ZEALAND
by Dr. N. Subramanian and
Er. Vivek G. Abhyankar 3
- ❖ REPORT ON E-CONFERENCE CONDUCTED BY
SEFI ON "STATE OF STRUCTURAL
ENGINEERING PRACTICE IN INDIA"
by Alpa Sheth, Hemant S. Vadalkar,
Dr. N. Subramanian, Alok Bhowmick, Nilesh Shah
& Dr. Rupen Goswami, 7

Editor : Hemant Vadalkar

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Fraternity News
WELCOME TO NEW MEMBERS
(OCT-NOV-DEC - 2015)

M- 1456	Shnmuganathan Rajangan	M – 1463	Shiladitya Chanda.
M -1457	Khan Ziaurrehman Hifzur Rehman	M -1464	Rafiulla Neyamatulla Khan.
M – 1458	M. Muruganantham	M -1465	Aniket Arun Rajoba.
M-1459	M. Shankar	M-1466	S. Chandra Bose
m- 1460	Archana Pandurang Kasture.	M – 1467	Deepak Shashikant Lokhande
M -1461	Afia s. Hameed	M- 1468	Joy Kolappan Jose.
M- 1462	Jigneshkumar Nareshchandra Lad	Jm – 41	Sunil Bhirud

Patrons : 35

Organisation Members : 23

Sponsor :8

Members : 1468

Junior Members : 41

TOTAL STRENGTH 1575

- | | |
|---|--|
| <ul style="list-style-type: none">* Structural; Designing & Detailing* Computer Software* Materials Technology, Ferrocement* Teaching, Research % Development* Rehabilitation of Structures | <ul style="list-style-type: none">* Construction Technology & Management* Geo-Tech & Foundation Engineering* Environmental Engineering* Non Destructive Testing* Bridge Engineering* & Other related branches |
|---|--|

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.

GEMS OF STRUCTURAL ENGINEERING

GEM.7- -PROF. M.J.N. PRIESTLEY-LAST 'P'ILLAR & LEGEND OF EARTHQUAKE ENGINEERING FROM NEW ZEALAND

Dr. N. Subramanian and Er. Vivek G. Abhyankar



**Prof. Nigel Priestley Credit:
Tobolski Watkins Engineering.**

Those working in the area of earthquake engineering definitely would have referred the excellent papers of the three 'P'illars & Legends from New Zealand whose contributions are fundamental to our understanding: Prof. Robert Park

(<http://www.civil.canterbury.ac.nz/news/parkdeath/BiographyRPark.pdf>), Prof. Thomas Paulay (<http://www.civil.canterbury.ac.nz/news/docs/Tom%20Paulay.pdf>), and Prof. M.J. Nigel Priestley. The earlier two professors passed away a few years ago.

Prof. Nigel Priestley passed away recently on Tuesday 23 December 2014, in Christchurch at the age of 71. According to Quincy Ma, president of the New Zealand Society for Earthquake Engineering, Prof. Priestley "revolutionized the design of structures to resist earthquakes" over the course of his career. Among many achievements, he led the way to the seismic design and retrofit of bridges in the State of California. Today, Caltrans follows many of the

recommendations that stemmed from his research. He was also instrumental in the development of performance-based seismic design methods, which were first used to design container wharves for the Ports of Los Angeles and Long Beach and form the basis of the current ASCE/COPRI code for the design of container wharves. Furthermore, he was also instrumental in the development innovative precast prestressed seismic systems for PCI-NSF Precast Seismic Structural Systems project.

Engineering Career in New Zealand:

Priestley's career started in New Zealand. At the age of 20, he obtained a bachelor's in Civil Engineering from the University of Canterbury (UC) and completed his Ph.D. when he was only 23 years old, in 1967, at the same institution. Until 1976 he was head of the Structures Laboratory of the Ministry of Works Central Laboratories, where he carried pioneering research in structural concrete involving complex laboratory and field full-scale testing. From 1976 till 1986, Prof. Priestley taught at the University of Canterbury where he performed acclaimed research work on pre-stressed concrete focusing on thermal and seismic design of prestressed concrete tanks, ductility based design of masonry structures (in collaboration with Prof. Tom Paulay), thermal and seismic design of bridges and seismic design methods incorporating rocking foundations (in collaboration with Prof. Bob Park).

During 1985 and 1986, Prof. Priestley was president of the New Zealand Society for Earthquake Engineering (NZSEE).

Work in America:

In 1986, Prof. Priestley joined the Department of Applied Mechanics and Engineering Sciences at

UC San Diego, USA and was a founding faculty of the Department of Structural Engineering at the Jacobs School of Engineering at UC San Diego. With damaging earthquakes in Whittier in 1987, Loma Prieta in 1989 and Northridge in 1994, Priestley contributed to the unprecedented growth of the Charles Lee Powell Structural Engineering Laboratories. He conducted extensive research into the seismic design, assessment and retrofit of bridges. From 1991-1999, Prof. Priestley was also US coordinator of the joint US/Japan research program on seismic design of precast structures (the PRESSS program).

Work in Italy:

Prof. Priestley retired from UC San Diego in 2002 and went on to co-found the Post-graduate European ROSE School, based at the University of Pavia, Italy, to train of students worldwide on ways to reduce seismic vulnerability.

PRESSS (Precast Seismic Structural System):

Another significant advance in earthquake-resistant design is PRESSS, developed by a team led by Prof. Priestley. Whereas in the past, buildings were designed to absorb force and crunch and grind at certain structural points, this new system designs buildings as a series of rocking blocks that can move independently of each other. To stop the blocks tumbling down in an earthquake, they are held together by steel tendons that allow the blocks to move but always pull them back to their original position. The beauty of this system, and the reason it's being widely applied in the Christchurch rebuild, is that not only can you ensure lives are safe "but you also minimize the damage to the building or restrict damage to elements that can be easily replaced after the earthquake", says Richard Sharpe, Beca's technical director of earthquake engineering.



**Alan MacDiarmid building at
Victoria University of Wellington,
built following the PRESSS system.
Credit: Victoria University of Wellington.
Full Metal Jackets:**

Prof. Priestley's "full metal jackets" – a cost-effective retrofitting system in which concrete bridge columns are wrapped in steel to reduce the risk of them collapsing in an earthquake – are now widely used in Californian bridges and highways and were adopted for the retrofit of the Thorndon Overbridge in Wellington.

Master Consultant:

In addition to his research, Prof. Priestley was active with consulting on projects in NZ, USA, Guam, Turkey, and Greece. A number of the design projects with which he was involved received awards for excellence. These included the 1978 Air New Zealand hangar in Christchurch with a 124.5 m segmental pre-stressed concrete span, and the 78 m high South Rangitikei rail viaduct with rocking piers constructed in 1981. He was chairman or member of Caltrans committees regarding the assessment/retrofit/design and research on bridges from 1989-1999. Prof. Priestley also acted as an expert witness on high profile collapses. As a result of the devastating 2010-11 Canterbury earthquake sequence that affected the city of Christchurch, New Zealand, Prof. Priestley was appointed Deputy Chair of the Department of Building and Housing there to study the failures and catastrophic collapses

experienced by the Canterbury Television (CTV) building, as well as three other notable structures, which formed a very important part of Royal Commission of Enquiry held there to formulate recommendations for future developments.

Displacement-Based Design Approach:

Prof. Priestley's most revolutionary move, though, was to reject the traditional force-based design that had dominated seismic engineering for its 60-year history and embrace and promote displacement-based design. This approach gives a better understanding of the forces and displacements within a structure and led to fundamental changes in the way new buildings are designed. Significantly, it allows engineers to actually dictate how a structure will respond in an earthquake.

Contribution as Educator:

Prof. Priestley had a profound impact on educational institutions in three continents; University of Canterbury, University of California San Diego, and the ROSE School. He was primary advisor for more than 25 PhD students and many masters students. His research resulted in more than 450 papers, 250 research reports, and he wrote three books "*Seismic Design of Concrete and Masonry Buildings*" with T. Paulay (1992), "*Seismic Design and Retrofit of Bridges*" (1996) with F. Seible and M. Calvi, and "*Displacement-Based Seismic Design of Structures*" with M. Calvi and M. Kowalsky (2007). All of these are regarded as definitive texts in their areas. retrofitting system in which concrete bridge columns are wrapped in steel to reduce the risk of them collapsing in an earthquake – are now widely used in Californian bridges and highways and were adopted for the retrofit of the Thorndon Overbridge in Wellington.

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Displacement-Based Design Approach:

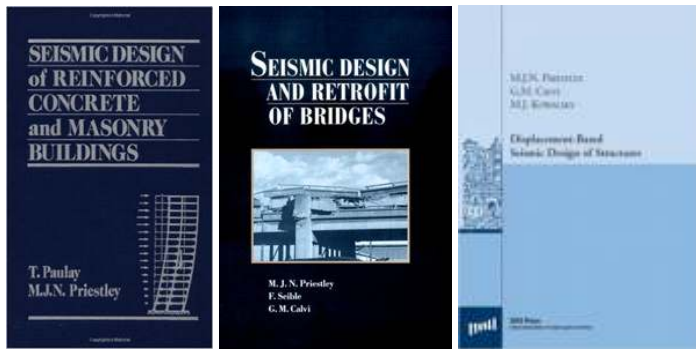
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Awards:

Prof. Priestley received more than 30 awards for research publications. He was made a fellow of the Royal Society of NZ, the Institute of Professional Engineers of NZ, NZSEE, and the American



Concrete Institute. He held honorary doctorates from ETH, Zurich, and Cujo, Argentina.

In 2014, in recognition of his contributions, Prof. Priestley was made an officer of the New Zealand Order of Merit. At that time, he said that his biggest contribution was in determining the best way to design structures for earthquake response.

Prof. Priestley passionately believed in the need for engineers to understand structural behaviour. He advocated capacity design principles and the importance of careful detailing. He abhorred the indiscriminate use of elastic analysis, and had an innate distrust of computer output. His work was conducted for engineers and recommendations were expressed clearly to allow easy implementation. As a result, recommendations based on his research are included in standards around the world where earthquakes are a threat to structural safety.

Many Skills:

Prof. Priestley will be remembered for his passion, his clarity of thought, his perceptive and pointed questions, his ability to communicate complex concepts simply, his ability to inspire others, and his kindness to his students and many others who knew him. He was more than an engineer. He also read and wrote poetry, played classical guitar and was an accomplished carpenter.

Family:

Nigel is survived by his wife Jan, four children, four step children, and nine grandchildren who recall his marmalade jam and his enjoyment in chasing butterflies.



Nigel with his daughters (from left) Rebecca, Rachel and Ana at the IPENZ awards dinner in 2013: Nigel was being made a Distinguished Fellow of the Institute of Professional Engineers of New Zealand. Credit: IPENZ.

Priestley's funeral was held in Christchurch, New Zealand on Jan. 3, 2015

Sources:

1. <http://www.iaee.or.jp/pdf/PriestleyObituary.pdf>
2. <http://www.roseschool.it/news/2015/02/94/tribute-to-prof-nigel-priestley-by-rebecca-priestley.html>
3. http://jacobsschool.ucsd.edu/news/news_releases/release.sfe?id=1689

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REPORT ON E-CONFERENCE CONDUCTED BY SEFI ON “STATE OF STRUCTURAL ENGINEERING PRACTICE IN INDIA”

Alpa Sheth, Hemant S. Vadalkar, Dr. N. Subramanian,
Alok Bhowmick, Nilesh Shah & Dr. Rupen Goswami

Structural Engineering Forum of India (SEFI) is a group of structural engineers on the net, interacting for the cause of Structural Engineers and Design aspects. Many seniors contribute to the group regularly. Anyone can raise the issues faced by them and they will get replies from the experts.

SEFI conducted e-conference on “State of Structural Engineering practice in India” during February 2016. Summary of views expressed by many structural engineers is presented here in five sections with opening remarks, response from the participants and closing remarks by the moderators.

People can participate at their own leisure. They can think over the issues and reply. All the contributions were very interesting. ISSE Readers will be enlightened by the views expressed by the experts. It was a novel idea to conduct an e-conference.

- Editor

A) Topics for discussion

The Chief moderator was Er Alpa Sheth. She suggested to have five different subsections with a moderator assigned to each subsection. The conference was held from Feb 8 to Feb 21, 2016.

Section (I)

Quality of Services of Structural Engineers and the conflicted Architect -Structural Engineer relationship
- Moderator: **Hemant Vadalkar**

- How do we define and maintain min standards of structural engineering services?
- Role of Structural Engineering Associations in improving engineering design standards
- Why is there a deterioration in services of structural engineers?
- Increasingly conflicted relationship with architects due to poor and delayed payments and compromised structural options as a result of which most engineers do not wish to work for architects.

- Roles and responsibilities of Structural Engineers

Section (II)

Structural Engineering Consultancy Fees
Moderator- **N Subramanian**

- Why are Structural Design Services not able to command better fees? Who is to blame?
- Why is there so much undercutting of fees between Structural engineers?
- Is the practice of Structural Engineering viable in the current fee structure?
- What can be done to improve the situation?

Section (III)

What is role of the Structural engineer in the next decade? - Moderator- Alok Bhowmick

- Increasingly, routine projects are reduced to computer modelling and design and afford little space for engineering innovation from the thinking engineer. Where does the innovative engineer fit in?
- What sectors will see a greater opportunity for engineering creativity- Infrastructure, Tall Buildings, Large Span structures, Construction technology...?

Section (IV)

How do we regulate the Structural Engineering Profession? Moderator - Nilesh Shah

- Creating a Professional Identity
- Techno Legal regime for professionalisation of the Industry
- Professional Idemnity
- Framework for Continuing Education

Section (V)

State of Education of Civil (structural) Engineering in India-Moderator-**Rupen Goswami**.

- Paucity of good teaching resources in most civil engineering colleges.

- Poor preparation for industry- Good colleges especially IITs have reduced student exposure to structural engineering core subjects
- Poor continuing education opportunities

B) Reports from various moderators on different sections

Section (I)

1.1 Opening remarks

Quality of Services of Structural Engineers and the conflicted Architect -Structural Engineer relationship
- Moderator: **Hemant Vadalkar**

In his opening remarks , Hemant Vadalkar , while commenting about the deteriorating quality of services by the Structural Engineers , said that structural engineers are the bright students of Civil faculty. Society is looking at us for good and economical solutions. But why the services offered by structural engineers are very poor and deteriorating ? If one looks beyond the urban areas, there are no guidelines for practicing as structural consultant. Any civil engineer or even diploma holders are acting as structural engineers in semi-urban areas. With their very limited knowledge and experience, they are providing the designs which are of very poor quality. With some exceptions, this happens in urban areas as well. In urban area, local municipal bodies are insisting on registration of structural engineers with some annual fees. Sometimes, grading is provided to designers permitting maximum number of storeys based on qualification and experience. Many aspiring structural engineers are not able to draw correct bending moment diagrams and are poor in understanding structural behaviour. They can be good at producing huge computer output and acting as computer operator. This is very serious.

He also emphasised that Most of the times, schedules are only provided for all structural components like footings, columns, beams and slabs without any detail drawing. In gaothan area, houses are touching each other with common walls on two sides. There is no concept of open space or setback. This necessitates construction on the entire plot with columns on the boundary. Even today, many engineers are providing half and quarter

footing (eccentric footing) for periphery and corner columns or provide floating columns from plinth beams. It is necessary to educate these engineers on probable solutions.

Other major reason for poor quality service is the meagre amount of fees paid to structural engineers. Clients or architects pressurise and negotiating hard with structural engineer for reducing the steel and his fees. It is the fact that an estate broker (agent) is earning much higher fees by selling one flat in the building compared to fees received by a structural engineer for the design of entire building. Structural engineers are also undercutting the fees to grab the job.

He suggested, “We expect to have minimum design standards, preparation of design basis report, basic design calculations and detail drawings from a good structural engineer.”

While commenting about the Structural Engineer – Architect relations, he said, “Most of the times client is not willing to appoint separate agencies. To have one point responsibility, client appoints architect as the project leader for all the design services including liaison, architectural, structural, PMC, HVAC. Architect is intern appointing other agencies. Naturally architect start dictating terms to structural engineers which may include restriction on structural framing arrangement, forcing to reduce sizes of beams and columns, orientation of columns, omitting some columns as per their wish. This may lead to poor structural arrangement. On one hand, client is pressing for minimum steel consumption. Structural engineer's efficiency is measured by steel consumption ir-respective of whether he follows any code guidelines.

Definition of good structural engineer from perspective of property developer is “ Lighter the design (steel) better is the engineer”. From architect's perspective, a good structural engineer is a person who listens to architects without arguing on structural framing, deletes the columns as directed, ready to carry out any number of revisions without grumbling, does not send reminders for his meagre fees, signs the stability certificate with life time responsibility of structure without any control over material and workmanship “

There are always exceptions to these rules and there are some good knowledgeable clients and wonderful architects but their number is very small. One should be really lucky to get an opportunity to work with such people.

Architects are charging fees on the total cost which ranges from 3 to 6%. When it comes to paying the structural engineer, it is either about 1% of RCC cost of on sq. ft basis or lump-sum. This fee is very less compared to what they are charging the client. E.g. if an Architect is getting 4% on total cost, he is getting 4% on RCC cost as well but only paying 1% of RCC cost to Structural engineer.

Therefore many a times structural engineers are not happy to work with architects but for the fear of losing the project, they fall in line, ready to compromise the structural system to please the architects, accept less payment, even delayed payments. This generally happens in building segment. Eminent structural engineer Late N.N. Bhagwati of Bhagwati & Associates had decided not to work under architects. He founded a firm of structural consultancy and employed architects to work for him.

Structural engineers working for infrastructure projects like bridges, roads, dams, tunnels, ports, industrial structures etc. generally have better freedom for implementing innovative solutions without much interference from architects.”
We require a mechanism by which Structural engineers are to be directly appointed by client and paid reasonable fees.

While talking about Roles and responsibility of structural engineer he said, "Time has come to define role and responsibility of structural engineers. We are endlessly waiting for Engineers bill. Alpa has done good amount of work for preparing exhaustive document on this subject. We need to push it at least at respective state level. There can be a state level registration of structural engineers with grades. They should be able to work in the entire state without any hassle and no need to have separate registration with various municipal corporations.

Presently structural engineers are signing all formats of stability certificates and taking the life time

responsibility of structure without any control over the construction process. Structural engineers are only responsible for the correctness of their design and compliance to code provisions. There is no standard certification format. All the Govt. agencies want someone to be responsible. Who is the best scape goat for this job than the structural engineer? Certification drafts by various agencies like local Municipal corporations, CIDCO, Town planning, Collector office, Industrial Development corporation etc are one sided and putting whole responsibility on the shoulders of structural engineers for design, foundation safety, quality of material, material testing, workmanship, supervision etc. Responsibility should be fixed based on the scope of work of each agency. Design responsibility to Structural engineer, Supervision responsibility to PMC, construction safety responsibility to contractor, stability of founding strata, settlement, stability of deep excavations for basement to geotechnical consultant and overall responsibility should be with the owner who is controlling the finance.”

1.2 Response by participants

Quality of Services of Structural Engineers and the conflicted Architect -Structural Engineer relationship
- Moderator: **Hemant Vadalkar**

Our friend **Sunil Sodhai** expressed that in the age of marketing, structural engineers have no direct contact with the clients and they have to work through architects without any regulatory mechanism or government support. So we have to work hard.

Senior Structural Engineer **N. Prabhakar** feels that quality of structural engineering services can be improved if there is third party quality audit or proof checking. This is lacking in the building industry which is controlled by property developers and building contractors. For other type of structures like bridges, industrial structures, port structures etc proof checking is mandatory.

He suggests that it is high time that the system of proof-checking is adopted by appropriate legislation by the Central Government for all types of construction projects to improve on the quality of service offered by structural consultants.

Practice of providing schedules of RCC components must stop. Structural engineers must produce detailed structural drawings which is the language of engineers to communicate the data to site. Ductility provisions, closely spaced links, splice locations, beam-column junction details must be provided by structural engineers and should not be left to site staff. Detailed drawings for improving the quality.

Senior Structural Engineer **Vasudeo Pandya** who worked for S.O.M. feels that ASCE manual covers most of the points of discussion. ASCE Manual: Manuals of Practice (MOP) MOP 73 : Quality in the Constructed Project, Third Edition A Guide for Owners, Designers, and Constructors. Web-Link:

<http://www.asce.org/templates/publications-book-detail.aspx?id=7089>

On the relation with architects he shares that One very Sr. Architect at S.O.M. (Skidmore Owings & Merrill) says that “ NO SERIOUS ARCHITECT CAN AFFORD TO UNDERMINE CONTRIBUTION OF HIS SR. STRUCTURAL ENGINEER TEAM . He (Architect) wants his good looking building to stand in Chicago's Wind Loads.” This truth must be understood by Indian Architectural firms also.

SATYA PAUL feels that there must be single body to regulate the structural engineering profession and we must work together to pass the bill for engineers in parliament. We should join hands with architects and other international engineers to provide services.

I feel the time has come that we all structural engineers must come together. There has to be a single central body which should get recognition from the Government. This body can then register the structural engineers based on their level of experience and knowledge under various categories. The body can define role and responsibilities of structural engineers, minimum standards to be maintained in providing the services, prepare a manual of practice to guide structural engineers, publish draft certification formats to be provided by structural engineers. ISSE (Indian Society of Structural Engineers) has done some work in this direction by publishing a manual of practice for Structural design consultants in 2003. This is under revision now. ISSE has defined some

minimum fees related to minimum standards. For more information one may visit www.isse.org.in

1.3 Closing Remarks

Quality of Services of Structural Engineers and the conflicted Architect -Structural Engineer relationship - Moderator: **Hemant Vadalkar**

We are coming to the end of the e-conference. It was a good attempt by SEFI to discuss various issues faced by Structural engineers. I thank the organisers for providing me an opportunity to moderate a sub topic “**Quality of Services of Structural Engineers and the conflicted Architect -Structural Engineer relationship**”

Various points were raised regarding improving the quality of services provided by structural engineers, maintaining minimum standards , defining the role and responsibility of structural engineer, liability of structural engineer against providing stability certificate, training to structural engineers, relations with Architects and expecting minimum fees. Some good suggestions emerged through the discussions but many issues are yet to be resolved. It is clear that we all structural engineers need to come together and speak in one voice.

If all the like-minded organisations like SEFI, IEI(I), ACCE, ECI, CEAI, ISSE etc join hands to prepare guidelines on professional practices addressing all issued discussed during the conference, it will be a great achievement. I hope SEFI may take lead role in this endeavour since it has the largest membership 20000+ across India.

I thank all the participants who expressed their views and provided valuable suggestions during the discussions.

Section (II)

2.1) Opening remarks

Structural Engineering Consultancy Fees - Moderator- **Dr. N Subramanian**

Er N Subramanian said that the structural engineers are doing the most important jobs in the development. All the infrastructure is built thanks to the brains of the structural engineers. But the problem of meagre fees is always the focus of discussion for any civil engineers group. His another important observation was for any project, the names of all its contributors are prominently displayed except that of the structural engineer.

He further said, “ Also, since the clients think that everything is done by the computer these days, they want the drawings immediately! They also want more and more services including stability certificate, providing detailed calculations, bar-bending charts, etc. without paying any extra money.”

While addressing the problem faced while receiving the fees, he said,” The present day consultant has to equip himself with a good knowledge and incur expenditure in setting out his/her office, pay for his/her staff, buying expensive computer hardware and software, and also continue to improve the standards of his/her employees as well as himself/herself with training. In addition, he/she needs to have good living standards commensurate with his/her education (present day engineers are also having the burden of repaying their educational loans). Though the Government recognizes our profession and introduces several taxes which we need to pay such as profession tax, service tax, etc in addition to the Income tax, it is not passing the Engineers Bill which will give credibility to our profession.”

Civil engineering consultancy is a strange profession, in the sense one has to compete with several people vying for the same project. This include diploma holders, Degree holders, Doctorates and post graduates of civil engineering as well as degree/P.G. /Ph.D. holders of Mechanical and other engineering disciplines (I myself know several persons doing Civil engineering consultancy, without having a degree in civil engineering). In addition, we have part-time engineers, who in most cases, are engineers retired from service, who are willing to do the job for a pittance as they have no overheads. Though organizations like SERC, IITs, NIITs also do consultancy, the clients are willing to pay the fees they demand!

Professional Institutions like IASE, ISSE and the likes should join hands and prepare comprehensive guidelines for:

- (a) Selection of Consultants & Proof Checkers
- (b) Model Fee Structure
- (c) Model procedures to be adopted for ensuring value added service to the Client
- (d) Sample Formats for Design Certification as well

as Proof Checking certification, which will put more responsibility on Consultants to ensure that the works delivered are of certain minimum standard.

(d) Every structural consultant should be a member of any of these institutions and must adhere to these guidelines.

Some questions which are commonly raised were brought forward by him.

- Why are Structural Design Services not able to command better fees?
- Who is to blame?
- Why is there so much undercutting of fees between Structural engineers?
- Is the practice of Structural Engineering viable in the current fee structure?
- What can be done to improve the situation?
- Should there be minimum qualification prescribed for structural consultants, in the wake of several failures? [Already ASCE is contemplating to raise the minimum qualification to Masters degree in USA]

2.2 Response by participants

Structural Engineering Consultancy Fees - Moderator- **Dr. N. Subramanian**

Er Irshad Khan was of the opinion quality of services provided is related with the fees charged by the structural engineer and hence any one who is charging Re. 1 to Rs. 2 per sq. ft. can not provide good quality of service. He felt that this kind of poor quality has devalued the structural Engineers. He felt that we need to have a legally binding association for registering structural Engineering practice. In such a situation, the Association can fix a minimum fee structure based on certain guidelines, thus regulating the field of structural engineers.

Er J.D. Buch cited his 'Point of View' paper on 'What ails structural engineers', published in the Dec. 2010 issue of ICJ, wherein he had given suggestion to improve the profession. He also mentioned about the paper by the undersigned on 'Are our Structural Engineers Geared up for the Challenges of the Profession' published in the Jan 2011 issue of ICJ (Both the papers were appended).

Senior Engineer **Satya Paul** felt that Professional jealousy, cut throat competition, no regulatory authority fixed by Law are some of the reasons that have let down our profession. Though countries like USA and UK have some regulations. India does not have any because Engineers are not considered as

vote banks for politicians. Mushroom growth of many universities, has deteriorated standard of engineering education. Owner does not want to pay to the engineer, but willing to spend lacs of rupees for construction. Even now Mason/Mistries supervise the buildings, though they may not have knowledge. He even narrated his personal experience in which the contractor, who made some wrong entries in order to make money wrongfully, arranged a vehicle to knock him on the road and his leg was broken. He suggested that Our PM should be approached to start immediately projects and to employ engineers, as Engineers are job creators. our Govt. should be approached for appointing a regulator similar to that available in countries like USA, UK, Germany and France.

Er. Bijoy again stressed the urgent need to comply with NBC because he had come across many designs (Architectural Designs) that have not considered the stipulations of NBC. He questioned whether there is a mechanism to educate clients regarding this? or any authority to check whether any building is designed in accordance with NBC? [in USA, the contractor has to get working permit from the authorities and the work will be supervised at critical stages, especially at the foundation level and if the foundation or columns are not according to the standards, the work will be stopped].

Er. Gururaja felt that structural engineering associations or the Govt. should fix standards and register engineers so that a structural engineers are not under paid by an architect.

Our **Er. Alpa** informed that Architects and other professionals are also in a similar or worse state than us, with regard to fees. Even consultants who are paid three times the fee than an ord. consultant feels that he is not compensated properly. She feels that No bill we introduce can legislate virtue. The GCPE Act was quietly buried by the Gujarat R & B dept. So we should not chase the Holy Grail of Professional Bill for resolving poor fees issue. What we can try to do is to "command" better fees, by our quality of work, by working as a unified community and all adhering to standards laid down by ISSE, ACCE or any agreeable body.

I thank organizers once again for giving me this opportunity. I personally feel that we are talking about the **Engineers Bill** which may solve some of

the problems of fees, not because it will eradicate under cutting by other engineers, but because it will give Engineers some status in the society which will give some power to us to negotiate.

2.3 Closing remarks

Structural Engineering Consultancy Fees - Moderator- **Dr. N. Subramanian**

Senior Engineer and author **Er. J.D. Buch** is of the opinion that clients do not pay standard fees due to cut-throat competition, particularly in India. He also felt that the Architects/Engineers who speak so forcefully in various forums on the need of having standard fees, themselves compete among themselves and are prepared to work at the lowest unworkable fee. He says that we should accept this fact and find a solution!

Another friend and Senior Engineer **Er. N. Prabhakar** feels that there can not be a standard fee, as it depends on the quantum and quality of service that is provided, besides the reputation of the Consultant. He says that there is no such standard fee among other professionals like doctors, lawyers and chartered accountant (I do not think so-CA's have a standard fee structure; My CA quoted one, Specialist Doctor's consulting fee is uniform, I think Rs. 500, and ordinary doctors charge Rs.100 as consulting fee). He rightly says that the consultancy fee paid by the property developers/builders to small consultancy offices (with a staff of say about 30 people), doing mainly building type structures, is very less. He also points out that it is a question of survival for these small offices and hence an united action is needed to fix minimum fees, without any under-cutting, for building type structures.

My friend and another senior engineer **Dr.V.Balakumar** says that he gave up his professional practice 8 years ago, since the fee was never paid at the right time and on many occasions the efficiency of the designer was measured by the quantum of steel provided per sq.ft. He could not get more than Rs. 2/SQ.FT. He also mentioned about the steep rise in the salary level of draughtsman and engineers due to the entrance of MNCs.

My friend and another well known Bridge Designer **Er. Alok Bhowmick** blamed ourselves for not getting reasonable fees. He felt that it is due to the following:

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- a) We are not organised enough to set for ourselves, a minimum standards of performance and minimum fee structure.
 - b) We are accepting very low fee due to cut-throat competition and also because we know that we can get away performing poorly in the job by hook or by crook.
 - c) Due to absence of any licensing regime in the country, there is no accountability for structural engineers and therefore there is no fear for non-performance. We have allowed ourselves to lower our standards and compromised.
 - d) We also accept unrealistic schedules for design submissions, and in order to finish on time we compromise on the quality of delivery output, which may surface later.
 - e) There is no fear of doing poor quality work. Whenever there is a structural failure, all people involved in the profession somehow bury the issue till public memory fades. Due to this we do not learn positive things from structural failures.
 - f) For our fee to be reasonable, he suggests the following:

- All structural Engineering must be a member of any consulting / structural engineering associations (e.g. IAStructE, CEAI ...etc.)

- All such associations / institutions must improve their performance and should be much more active and aggressive in disseminating knowledge, in imparting special training to engineers for continuous professional development and in orienting young engineers in the right direction.

- The Governing Council of all these associations must do brain storming in these lines. They should induct bright and young structural engineers in the decision making team so that they become a part of the think tank from early age.

- All big sized consultancy organisation MUST aim to set a standard of performance in addition to setting a standard of fee. Both are equally important.

Er Alok mentioned about the two guidelines brought out by The Indian Association of Structural Engineers (IAStructE) in the year 2014 for proof checking of buildings and bridges respectively. Er Anees endorsed the views of **Er. Alok**.

Er Deepak Bansal feels that there must be clear and unambiguous definition of roles and responsibilities of each professional in every project and that there should be liability provisions on structural engineers for their actions.

Er Ankur Shah feels that many who call themselves as consultants (just because they were in the field for a number of years) do not do their job properly. He suggests that we should have a competent body for validating/rejecting Structural Designs and that Structural engineering license has to be issued only after passing proper exams. His views were endorsed by **Er Ajay**. Similar views by expressed by **Er Ajay Chaudhari**.

Er Dipak Bhattacharya expressed that Govt. agencies have their own problems and controls and hence Committee Members of IAStructE, should make separat documentations/Guidelines keeping Government Clients in mind. He feels that due to the clauses prescribed in documents of Govt. agencies, there is no responsibility for the proof checking authorities- Hence they do not do their job properly but collect huge fees, and the responsibility of the design is with the Principal Design Consultants only! This point is endorsed by **Er A.V. Bijoy**, who also cautions about the importance of designing buildings in accordance with NBC.

Another well known consultant **Er Vasant Kelkar** explains how structural engineers are not paid well for the design of basements and lower parking and podium floors and we accept them, because we do not have a strong organization/lobby like Chartered Accountants. He also mentions about the escalation of costs of all items such as staff salaries, prices and maintenance costs of software, & computers, but consultants are paid the same rate per sq. ft. as fees by the clients; due to this consultants are unable to pay decent salaries to their staff. Hence he suggests that the fees should be linked to the Cost of Living index. He also paints a dark future as far as structural fees are concerned comparing future designers to the advocates standing outside courts in Mumbai looking for prospective clients!

Er Sunil Sodhai says the Municipal Corporations should not accept simply the Structural Design Certificate but insist on Structural drawings and

check them in their own office employing proper Structural Engineers.

Er. H. N. Prasannakumar, who is a chief engineer, feels we are not paid properly compared to Architects, contractors, or project co-coordinators. His suggestion is to pay 10 % of total RCC cost as fee for built-up area more than 1 lakh, similar to that paid to the contractor.

My friend and well known consultant **Er Umesh B. Rao** mentions about the Manual for Guidelines of Consulting Engineers, published by Consultancy Development Center [Now called as Consulting Engineers Association of India] in 1993 in association with Association of Consulting Civil Engineers and Association of Consulting Engineers. The paper posted along with my introductory remarks discusses about these Guidelines.

Section (III)

3.1 Opening remark

What is role of the Structural engineer in the next decade? - Moderator- **Alok Bhowmick**

While emphasizing on the role of Structural engineer in the next decade, Er Alok Bhowmick first listed out the present state of the structural engineers. With the advent of technology, younger generation is losing the feel of the subject and depending more & more on the computers. They do not understand the basic structural behavior. He stated that the computers be used judiciously and not blindly.

He also stated that the profession has not been glorified by the State. No civil or structural engineer gets recognition for the great contributions to the infrastructure. Due to this the best of the talent doesn't get attracted to the profession.

He also found that The massive population of India will need affordable, sustainable housing and infrastructure on an enormous scale. There is a lot of building and infrastructure to be built. This will require developing a new breed of structural engineers, more broadly capable than ever before – more creative, collaborative, and communicative – who should aim to become global leaders in society's grand challenges.

He wrote about the need to be skilled to handle the change. He said A globally flattened market means that engineers of the future will need breadth, both in

technical skills and soft skills, to operate in many diverse locations and cultures. Perhaps most importantly, the structural engineers need to be adept at collaborating on teams with members scattered around the globe.

The natural resources are fast depleting. He emphasized the need to gain proper knowledge to provide designs which are sustainable and eco-friendly.

He also said that engineers should take leadership roles in major policy questions in hazards management, or even in some cases advising societies on where to build and where not to build.

He emphasized the need to have a harmonized schooling with industry. Young engineers must be trained by the industry on the job so that they are more practical than be just book worms.

He also said , "More than ever, tomorrow's Engineer must be aware that a career in engineering requires a commitment to life-long learning. Comprehensive gain of knowledge and skills will be an intensive, ongoing effort from engineering institution to the practice, until the engineer retires."

Not only this but he should have the vision to save the planet by inventing alternate sources of building materials.

3.2 Response from participants

What is role of the Structural engineer in the next decade? - Moderator- **Alok Bhowmick**

Mr R J M Prasad is disheartened by the fact that structural engineer, despite taking all the responsibilities, is lowly paid and do not get any recognition. The SE is only in 'pain without gain' according to him.

A Senior and Active Member of SEFI, **Prof A R C** opined that one must accept the fact that the in future, structural analysis and design will be software based. Knowledge of Engineering will be required only for those who certify the designs and drawings and those who translates these designs to reality (i.e. The Constructor). He emphasized that in future, structural engineers training should be more oriented towards writing software to know theory of structural and foundation engineering.

Mr S I Zubair opined that we structural engineers need to show leadership. Self help, according to him, is the best way to find our own recognition. We structural engineers need to uplift ourselves with

self-initiating and self-serving programs to get recognition and fees that commensurate with our effort and responsibility

I would like to appeal all the participants of the e-conference to stay focused and share your thought, 'more' about how to improve this situation in future. Ultimate aim of this e-conference is to form strategy for future. While demonstration of emotion is useful, but cool thinking has no substitution. So let us think cool and spend more time in deciding what is to be done to improve the situation in future. Let us share our thoughts on :

- a) What should be change in Civil Engineering curriculum, in the universities so as to orient the Engineers who come out of the college in the right direction?
- b) How to improve the connectivity between industry and academia? How the industry should treat fresh engineers who come out of college, so that they are on track in the field of structural engineering.
- c) How to inculcate this sense of commitment from the engineering profession, and, by proxy, the individual engineers who belong to the profession, to place the public safety and interest ahead of all other considerations and obligations. There has to be some code of ethics, which we structural engineers should follow in our day to day working.
- d) How to improve our overall image and visibility in the society by connecting ourselves as a group and working together, particularly when society needs us (Say in case of any disaster).

3.3 Closing remarks

What is role of the Structural engineer in the next decade? - Moderator- **Alok Bhowmick**

As the E-Conference on the '**State of Structural Engineering Practice and Education**' draws to a close, it is time for me, as one of the Moderator, to give my closing remarks on the sub-topic of "**Future of Structural Engineer in the next decade ?**".

At the outset, I wish to profusely thank the admin of SEFI for conducting this full fledged 2-weeks e-conference on this most important and relevant topic that concerns all of us. I must admit that this has been an extremely successful E-conference. We have received suggestions and comments from a very wide spectrum of Engineers, ranging from a budding young and fresh structural engineer to

TITANS representing the consulting industry and also TITANS from academic institutions. What emerged during this 2 week of intense debate and discussion, on the sub topic "Future of Structural Engineer in the next decade" is the following :

1.0 Structural Engineering Profession is not getting the status in the society that is fitting with the social responsibility that this profession has to take. The central issues that beleaguer our profession today are the following :

- a) Low status in civil society
- b) Poor salaries, and low professional earnings
- c) Poor education, with no continuing education after graduation
- d) No commonly observed code of ethics in securing and performing work
- e) No regulating authority for the profession. Structural Engineering is not considered as a profession in construction industry !!
- f) No accountability.

2.0 Several suggestions were given by Sefians to improve the present situation. Some of these are :

- a) To improve co-ordination between Industry and Academic Institutions. To give more industrial training and exposure to students. Industry to take this on-the-job training seriously and be a little more proactive in generating interests about this fascinating world of structural engineering in the minds of these young students.
- b) There are several structural engineering associations in India. These associations must take more proactive steps and initiative in bringing about this change and work together to impart initial professional training to budding engineers and also impart continuing education and professional development program for the experienced engineers. All the associations must have a commitment to improve the professional standards within structural engineering community and strive for their continued technical excellence; advancing safety and innovation across the built environment..
- c) There is a need to have some guidelines on minimum range of fee structure for the structural engineers. Industry must be sensitized in this regards and selection of consultant shall not be based purely on fee structure, but it shall be based on Quality and Cost Based Selection system (QCBS). This will bring certain minimum quality

3.0 In order to build upon the momentum generated by this conference and in order to change the growing perception of many structural engineers that this profession is becoming a 'sun-set industry', I would like to put forward the following closing remarks :

a) Structural Engineering is a High Responsibility Profession. Giant steps are required to be taken by all the stakeholders to revive this profession and bring it to its logical position of glory.

b) The industry is expected to respond to this distress call in following manner :

- Develop Skills of Structural Engineers with continuous professional development programs. This may involve participation and funding by the construction industry in a large scale. Governments support will be necessary too.

- Train young professionals how to lead. If you are a leader in the profession, please involve young professionals in decision making process and also in various professional committees.

- All institutions and associations (like IEI, ECI, IASE, ACCE, CEAI) in the country must unite and jointly work to regulate this engineering profession. Engineers Bill must be brought in as an act of parliament. This is in the interest of public safety and in the process, Engineers will get recognized by the society as well.

- Industry must work towards improving the visibility and image of Engineers in the society. Let us start to celebrate "National Engineers Week" (as celebrated by many other countries like USA, Canada, UK), wherein the engineers of the entire nation will celebrate and would deliberate on issues about how engineers would make a difference in our world. During this period, we can increase public dialogue. We can bring engineering to life for kids, educators, and parents and we can devote time to do our chintan baithaks for improving our performance in the society.

c) There is a need for better collaboration between structural engineering professionals in practice and those in academia. These collaborations helps both the sides to orient the young structural engineers in the right direction, when they come out of the college to join the industry. Academic Institutions must invite practicing structural engineers of repute to give lectures to the students and share their experience and Senior structural engineers in the industry must be prepared to devote a fraction of their time in imparting technical knowledge to this young budding engineers.

I sincerely hope that there would be movement in these directions in the very near future and all of you will come together to make this happen. We must change the perception about this profession from a 'sun-set industry' to 'sun-shine industry'.

I wish to close by acknowledging the herculean efforts of Er. Alpa Sheth, Dr N Subrmanian, Dr Rupen Goswami, Mr Nilesh Shah, Mr Hemant Vadalkar and SEFI administrator, Er. Sanjeev Kumar in putting together a successful e-conference for sefians.

Section (IV)

4.1 Opening remarks

How do we regulate the Structural Engineering Profession? Moderator – **Nilesh Shah**

While giving his views about the structural engineering profession, Er Nilesh Shah listed out some important issues that regulate the structural engineering profession.

1. The first and the foremost issue is our professional identity. Though we call ourselves professionals, we are not professionals in legal terms. There is an urgent need to give legal status to our profession like that of other professions such as Architecture, Medical, Chartered Accountancy and Lawyers. This is important to ensure ethical practice, security, dignity and welfare of engineers in general and the society. Engineers Council of India was established in 2002, which took up the task of facilitating draft of Engineers Bill. It still awaits formalization amongst various government departments and nod from the parliament. The Engineers Bill is general for all branches of engineering. The question is - Even if the said Engineers Bill is enacted, would it give us a professional identity befitting to the stature of Structural Engineers?

Let us peep into the present scenario. Currently the licensure as Engineer/Structural Engineer is undertaken by local authority (Generally at city or town level) as per their norms and procedures, which may vary by region or state. Following that, person with recognized degree in civil engineering can get a license from concerned local authority to practise as Engineer/Structural Engineer within its franchised area. This appears to be an open but laissez faire system for such an important task. For efficient practice and regulation of structural engineering profession:

- a. Do we need a single apex body specific to the Structural Engineering Profession which grants us Professional status, based on recognized academic qualification and minimum relevant structural engineering experience? This body may have region or state branches for deliberation of work and smooth functioning. There may be a two tier system of Registered Structural Engineers (having required minimum qualification but not having required minimum experience) and Professional Structural Engineers (having both, required minimum qualification and required minimum experience)
- b. Do we need further categories within the designation of Professional Structural Engineer, based on their academic qualification (Bachelors, Master and Doctorate) and number of years of relevant experience?
- c. Do we need a mechanism to track performance of Professional Structural Engineers and their participation in continuous education? Such records may be referred, when someone wish to migrate to a higher category. This will ensure that challenging jobs are in safe hands of more qualified/experienced structural engineers. It will also ensure that new or less experienced structural engineers get opportunities to work on challenging jobs under a senior and expert guidance.
- d. Do we need a framework under the aegis of apex body for continuous education and updating of Professional Structural Engineers?
- e. Do we need standards of duties, responsibilities and norms for practicing the profession of structural engineering?

2. Any regulation would be effective only when it is backed by legislation and a system for its strict compliance. We do have regulations, applicable to those possessing license to practise as an engineer/structural engineer within the domain of respective concerned authority. Neither have we had legislation to back professional practice nor a system to track compliance to regulations. We need clear norms to practise structural engineering that has legal meaning; Clear identification of duties and responsibilities of Professional Structural Engineer, Authority, Client and Users of the building. We need a simple regulatory system to check technical compliance of structural engineering norms in practice.

Moreover, it would be appropriate to have a legal cell constituted under the aegis of apex body to facilitate issues between Professional Structural

Engineers and judiciary/Legislative body relating to professional practice.

3. There is an issue with first hand understanding of Structural Engineer's liability. Whenever a structure collapses, it is most likely that fingers would be pointed to concerned structural engineer. We should create awareness in the society that Structural Engineers are responsible only for "design of the structure". Apart from that, several reasons contribute to failure of a structure. It is time that we have a standard set of contract agreement which all practicing structural engineers can refer to and follow if they wish. And that it incorporates "defect liability period" for our design.

4. There is one more issue which I wish to put forward. Whenever a doctor deals with his client - mostly a patient- he deals with risk of one life. When a structural engineer deals with his client for design of a structure, he deals with risk of several lives. More over lots of money is at stake for his single design. That way, we shoulder greater responsibility. How many of us think about safeguarding themselves against such risk. Many leading insurers abroad classify Structural Engineering as medium hazard activity. Even when we buy a two wheeler, it is mandatory to buy insurance including third party coverage. It is high time that we have a system in place for insuring our professional practice through professional indemnity. Rarely insurance company in India would offer professional indemnity to practicing structural engineer. Leading engineering organizations may proactively take up this issue and make it available to practicing structural engineer.

4.2 Response from participants

How do we regulate the Structural Engineering Profession? Moderator – **Nilesh Shah**

It was nice to be with you over last fifteen days while reading discussions/debate on various subsections of this E-Conference. I thank the organizers for giving me an opportunity to moderate a sub section on "How do we regulate the Structural Engineering Profession?"

There are standards/codes available to "test" various building materials prior to its use for constructing a structure, but it is pity that no standards are available to "test" structural engineers who specify such tests for building materials and that no legislation is available to regulate/monitor the

structural engineering profession. In my opening remarks for this subsection I have raised four issues pertaining to "regulating the structural engineering profession". They are:

1. Creating a professional identity that is legally recognized
2. Need for a single apex body exclusive to the profession of structural engineering which sets standards for professional practice, provide guidelines for registration and licensing of structural engineers along with further categories based on academic qualification and experience, sets norms for CPD (Continuous professional development) and conducts qualifying exam to practice structural engineering.
3. Understanding structural engineers "(Limited) Liability" and "Defect Liability Period" for structural design.
4. Need for Professional Indemnity Insurance for security of structural engineers.

The first two of the issues listed above have been discussed at length. Almost everyone who posted for this subsection felt the need for professional identity and a regulating body backed by legislation. Even, discussion in other subsection also revealed the need for a regulating body. Er **Alok Bhowmick** informed that currently, three institutions are appealing for registration of PE and there is confusion, whether to register PE with IE(I), ECI or CEAI. At the end of the E-Conference, still the confusion prevails. Even though it is discussed at length, questions raised below remain unanswered:

- a) If PE currently being offered by IE(I), ECI and CEAI carry any value?
- b) Which of these organisations (or any other organisation) should look after regulating the structural engineering profession? Or should it continue to be laissez faire as being practised currently.
- c) As we know, IE(I) has a Royal Charter since 1935. Does this mean that we don't need Engineers Bill enacted by the Parliament? Through its royal charter, is there a clear understanding of IE(I)'s role in regulating engineering profession in India?

As mentioned by **Er. B V Harsoda**, The Gujarat Professional Civil Engineers Bill was passed by the

state legislative assembly in March 2006 – post 2001 Bhuj earthquake. Under this bill, Gujarat Council of Professional Engineers was formed which comprised of 12 members. The council was to perform several functions including preparation of register of professional civil engineers, hold examinations, prescribe standards of professional conduct and etiquette, prescribe code of ethics for professional engineers, grant or refuse certificate of practice, etc. But as of now, there is no significant progress to implement this bill. Again, it is legislation specific to Gujarat and not mandatory across the country.

4.3 Closing remarks

How do we regulate the Structural Engineering Profession? Moderator – **Nilesh Shah**

While the first two issues (professional identity and regulating body backed by legislation) mentioned in my opening remarks were discussed in detail, rarely someone posted about the last two issues concerning "(Limited) Liability" of a structural engineer, "Defect liability period" for structural design and "Professional Indemnity Insurance". I feel these issues are important and need appropriate mention while standardising our profession. These would ensure safety to a structural engineer and would help him defend his case in court of law, if need arises.

The situation is grim. After decades of continuing efforts, we do not have a legal body to regulate our profession. After discussions/debate over 15 days, we have clarity on issues related to regulation of our profession but, not resolution for the issues. This collaborates well with anguish of fellow structural engineers who expressed their frustration saying that such discussions and debate would go on for decades without any positive outcome.

It is important that any one from the IE(I), ECI and CEAI is recognized for registration of PE with consensus of others. It is high time that all individuals unite on this platform. May be one of the organisation (or SEFI?) can lead from the front and play role of a facilitating and coordinating agency amongst IE(I), ECI and CEAI for registration of PE and regulation of profession. There is a model agreement available with other organizations, which can be reviewed and

amended as necessary. The standards of practice, fees, roles and responsibilities, performance criteria, frame work for continuous education and exams may be drafted. It would be apt to convince the licensure that only PE from recognized institute shall be considered for issuing license to practise as structural engineer. Any unethical behaviour, duly investigated by such an institute and reported to local licensure would result in forfeiting the license to practise structural engineering. If sought by the structural engineer, such an institute will conduct unbiased technical investigation and give technical opinion on his role, responsibility and faithful performance of duties.

I do appreciate **James Cohen's** mention about industry-internal means by which allegations of unethical behaviour can be investigated, judged and published, even without legal backing to enforce penalties. It is indeed a good idea to have such a mechanism till we identify the organization that regulates the profession and have clarity on legislation. While, such a mechanism can investigate, judge and publish unethical behaviour; enforcement of penalty would be realistic only with legal backing. Well, something is always better than nothing.

I hope that united efforts from all of us would soon mobilize a system to create our legal identity and regulation of profession.

Section (V)

5.1 Opening remarks

State of Education of Civil (structural) Engineering in India- Moderator- **Dr. Rupen Goswami**.

Er Rupen Goswami took a very good review of the education system. He opened his remarks from a well presented study of the system. He then went on to evaluate the present scenario.

He wrote, "No doubt, Civil engineering was, and was considered, to be a noble profession both pre- and post-Independence. Civil engineering was a necessity to 'Build the Nation'. To develop quality human resource to help achieve that goal, the IITs were set up too in the 1960s. Nothing but "education" was at the forefront both in the minds of the teachers as well as students. Civil engineers did great.

But, once the dust settled, it was observed that other

disciplines had progressed, probably, a bit too far. Civil engineers continued to work, but silently. Also, due to various social and economic reasons, the scope and pace of work stagnated too. Students were beginning to look outside their classrooms... the decline had initiated.

With economic liberalization, came a new phase in Civil engineering in India, but unfortunately, Civil engineering was not liberated. With opportunities elsewhere, students no longer wanted to become Civil Engineers, but just engineering degree holders. This remains true, to a large extent, even today!

This new situation had a dangerous effect on education. Students were no longer interested in education, or profession at least, – they were interested in "job" (but, who would blame them for that? Everybody deserves, and wants, a "better" life). With decline in sincerity came decline in quality. To cope with the situation, academia shifted focus from "teaching" to "research".

And just then, came the big revolution – opening of hundreds and thousands of engineering colleges across the country (disclaimer: some are really doing great today, but let us focus on the norm). Everyone wanted a degree, with little regard for education. "Quantity" became more important than "quality"!

Academia too fell for this trap! Along with numerous global rankings coming up every other day and taxpayers' question of "what have you done?", academia hinged on quantity against quality to justify their existence too! Quality of professionals produced for the society cannot be quantified, but number of research projects, publications, and number of students graduated do help in getting better ranking. This constant pressure led to one simple thing - "teaching" and "learning" took backseats!

The result was diversion of focus from educating and training to graduating, often, even undeserving candidates. The easy way out to achieve this was dilution of curriculum. For records, considering all forms of mechanics, analysis and design courses to be part of Structural Engineering curriculum, earlier a student would take at least 6-7 such courses in an undergraduate degree programme in Civil Engineering. Today, we are contemplating having

only ONE analysis and design subject each, as part of CORE curriculum in Civil Engineering, in top institutes in the country including in IITs. Is this fact not enough to describe the “State of Structural Engineering”? We seem to have lost our senses by the catch-phrase “rounded” development of our students; “sharpness” of mind is no longer important – academia is mandated to offer more “free” electives than “core” subjects.

The game of quantity has led to an appalling situation – today, we have many institutions but little infrastructure and good teaching resources, too many colleges but few qualified (rather capable) teachers, innumerable graduates but few competent professionals. Only now, have we realized what we have done to our beloved profession – today, we talk about, probably trying to salvage our profession through, “continuing” education opportunities. But, what about basic education? A recent article reported that about 80% of engineering graduates in the country are unemployable, even in non-core sectors!

In this situation, does “industry” have a role to play? Today, there is tremendous need for Structural Engineering for the next re-building of the Nation. Can the Structural engineering fraternity seize this opportunity to showcase the demand for their profession? If they do, can they not then demand better professionals out of academia and “treat them well” (remember, everyone deserves a “better” life), both financially as well as intellectually? Today's market is “demand” driven. If the Industry demands better professionals, and students see potential in the profession, will this jinx not break? With little help from industry (probably an important issue that needs focused deliberations), can academia not spring back in action? Can Education in Civil (Structural) Engineering and Structural Engineering profession not prosper again in India?

5.2 Response from participants

State of Education of Civil (structural) Engineering in India - Moderator- **Dr. Rupen Goswami.**

Since the beginning of the e-conference, many of you have written on the subject of “education”. Rather, you have expressed disappointment, frustration, and even anger, on the issue of current state of education in Structural Engineering in the country. It was necessary to do so before we could

collectively think of deliverables to improve the situation. Let us do that this week.

To begin with, let us now focus on what we can do rather than spending our time and energy discussing what Government, AICTE, Universities should do, why lack of infrastructure, etc. Few suggestions have already been made, and here is an attempt to highlight key issues to take the discussion forward.

On the issue of industry complaining about poor quality of fresh graduates: Yes, they are right, the quality is bad. There are no two opinions about it. But, two additional issues are also worth taking note of. First, in the good old days, there used to be a compulsory “Industrial Training” as part of BE/BTech curriculum, which most of us would agree, was very useful. It gave the aspiring engineer an opportunity to see the exciting world of structural engineering practice, meet senior engineers, develop contacts, and above all, feel inspired about the prospect of being part of the system. Is this happening today as well? And second, today those who say that the fresh graduates know nothing, can they pledge their honor and say that when they joined the industry as fresh graduates, they knew everything? Were they not groomed to be what they are today by their seniors? Again, is this happening today as well?

In the recent past, the reality is that industrial training has become a farce in most companies. Students are made to sit and develop spreadsheets or simply thrown to construction sites, both without proper guidance and supervision. Because of “cut-throat competition in the market”, senior engineers do not have time to spend with these trainee students. Further, after joining, a fresh graduate is expected to immediately start “producing drawings” – the best guidance on offer is “look up what we did for the previous project and use it as a mother”, meaning copy and reproduce what was done before. It comes as a shock for most fresh graduates and shatters their dreams. And, after this, we expect them to be ethical in their conduct in future!

So, can this situation be changed a bit? Can companies step forward and take charge, and offer meaningful grooming of trainee students and fresh graduates? Yes, there are some companies who do practice this, but surely that number is too small. Can we have more voluntary participation?

Next, on the issue of appropriate curriculum: Some top institutes undertake curriculum revision, probably once in a decade or so. Some also do request input from industry. While the general perception is that this exercise is futile in that they have only helped dilute the curriculum till now, still, can this opportunity be used to the advantage? Every top executive of a company today is an alumnus/alumna of an engineering college / institute / university. Is it possible for them to re-establish contact with their alma-mater and impress upon them the need to have a proper curriculum in place as the first step? Is it possible for the industry to “dictate” what ought to be there in the curriculum, not just for their immediate gain alone, but for betterment of the profession in the long run too? Of course, there will be resistance from the academia. So in return, industry may have to promise, possibly recruitment or something, but still, is this a possibility in the future? Also, with this partnership in place, will it not be easy for the industry to engage with academia more in terms of providing ideas of meaningful practical projects, special courses, etc.? Even the idea of joint guidance of projects can be pushed forward. Only, it will require “time” from the industry, which is critical no doubt. But, can industry afford to offer that to help academia? For a change, can industry take the lead?

5.3 Closing remarks

State of Education of Civil (structural) Engineering in India - Moderator- **Dr. Rupen Goswami.**

After two weeks of intense brainstorming, we have finally reached the end of this e-conference. I acknowledge each and every one of your critical inputs, suggestions and criticisms that you have voiced; indeed there were quite a number of both thought provoking and pointed posts. But, this is not really the end. This should be seen as only the beginning of a long process of cooperation among all the stakeholders to improve the current state of our Profession. Also, it is amazing to see that the topic of 'education' had maximum number of posts, either direct or indirect with change of subject. Nonetheless, it shows that collectively, WE still value it and consider it to be as important as ever. Therefore, here is my attempt to summarise the 'critical points' discussed, and not necessarily highlight individual posts or ideas.

The domain of discussion ranged wide and far, from the highly philosophical realm of education versus literacy, to the more practical immediate question of how to make Structural engineers employable. In this regard, the following specific points were raised:

(1) Nurturing

It is important to nurture a young mind, in the right way, early in the career. There has to be role-models, and history of great achievements of the profession needs to be highlighted. In this regard, academia should consider inviting experienced professionals more often to give, at least, invited talks. And senior engineers from industry will have to pledge a little bit more of their precious time to enthusiastically deliver such talks.

(2) “Strong” Fundamentals

Having lack of grasp on the fundamentals of the subject is NOT an option, is perhaps opined umpteen numbers of times in various forms. Even qualitative reasoning of deflected shape, SFD, BMD, etc, is probably a more important item to be ingrained than sophisticated analytical tools at the undergraduate level. Academia will have to take note of this and act accordingly (in terms of modifying conduct or structure of courses, or even curriculum).

(3) Skills

While knowing is important, it is not enough. To be able to communicate is perhaps more important. More number of small term paper or project based presentations as part of regular courses could help students develop better communication skills. Also, design studio based activities could help students learn to work in groups and debate contradicting ideas. In all these, engineering drawing (manual sketches and drawings to CAD) is an essential tool and must be harnessed as an integral part of regular design courses. Academia will have to work towards helping students develop these skills.

(4) Training

The notion of “gap” between academia and industry is probably a misconceived one. Training is an integral part of any professional service (reminds me of the mention of military training!). In case of Structural engineers, this has to be imparted to young aspirants in two stages, first, as industrial training as part of the curriculum, and then, as an

initial phase of training as part of the practice. The so called gap can be narrowed down significantly through proper training, and industry has to contribute strongly for the cause.

(5) Character

A profession is as strong as the character of the professionals. Seeing compromise around not only weakens the character of a young engineer, it leads him to wrong path. Academia should stop compromising on quality of education imparted and industry should stop compromising on quality of service provided. But who is academia and industry? First, it is each and every one of us, the senior, the teacher, the boss. We need to "introspect". Needless to say, this is the most challenging task at our hand.

I thank one and all for actively participating in this e-conference. If I have missed any specific or significant point, it is not intentional but I apologise for that. I hope that each one of us had something positive to take home from this e-conference to make our Profession better.

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The secret about **Graebert** is out. **Graebert** is a CAD pioneer from Germany with 32 year history behind them, you may not have heard of...until now but Overall, more than **7 million professionals** utilize this CAD technologies in more than 100 countries. The installed base is second only to that of AutoCAD from Autodesk.

ARES Commander 2015 from Graebert is available for **Microsoft Windows, Macintosh and Linux operating systems**. It includes enhanced features for model editing, ribbon customization and a licensing feature called License to Go.

Graebert first CAD vendor to cover all viable Platforms.

Graebert GmbH is now the first CAD vendor that will be providing a drafting program on all viable platforms. I'm the one using the word "viable" to emphasize that the program doesn't run on platforms like Blackberry or Windows Mobile. The list now consists of the following OSes, in alphabetical order:

- **Android**
- **iOS (iPhone and iPad)**
- **Linux desktop**
- **OS X (Macintosh)**
- **Web browser (OS-independent)**
- **Windows desktop**

ARES Commander includes all the common CAD tools required for creating, editing, and viewing structural drawings while maintaining compatibility with the DWG files.

Graebert has announced more software solutions recently - ARES Mechanical for Mechanical Engineers, ARES Map for GIS Users, and ARES Kudos is Graebert's cloud solution for CAD users. Overall, Graebert (www.graebert.com and www.graebert.in) and its software innovations inject a breath of fresh air in the world of structural and technical drawings.

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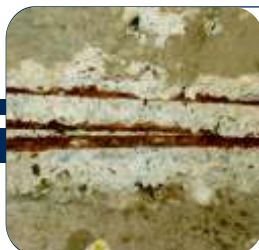
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