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JULY - AUG - SEPT 2021

GEM 29 PROF. V. RAMAKRISHNAN - see page 3

GALVANIC SACRIFICIAL ANODE - see page 10

HIGHER STUDIES ABROAD - Er Dipti Vegada
see page - 18

NEWS AND EVENTS DURING
JULY – SEPT 2021 - see page - 23

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STRUCTURAL ENGINEERS

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

(JULY - AUG - SEPT 2021)

1979	Vivek Uttam Gosavi
1980	Vijay Shantaram Gurav
1981	Aakash Rajaram Deshmukh
1982	Rajesh Rajaram Edwankar
1983	Aroona Arumugam
1984	Rajesh Tanaji Mhatre
1985	Neelesh Dattaram Dabholkar
1986	Ajmal Hisham P C
1987	Nikesh Hareshwar Jadhav
1988	Soundararajan Arumugam
1989	Imran Yusuf Shaikh
1990	Baban Maruti Deshmukh
1991	Milind Ashok Patil
1992	Govardhan Bhatt
1993	Adil Muqueed Shaikh
1994	Prashant Shamrao Borge
1995	Mangesh Suresh Hindurao
1996	Rahul Devanand Bholebhavi
1997	Akash Mahadev Patil
1998	Susil Kanta Panda
1999	Animon Mathew
2000	Dilip Shrirang Ghadge
2001	Anil Haribhau Lad
2002	Akshay Pradip Palikundwar
2003	Ajinkya Pradip Girme
2004	Yogesh Hindurav Phadatare
2005	Utsah Jayvant Shingate
2006	Ameya Anil Rane
2007	Vinay Appaso Ghunake
2008	Vardhan Vinayak Nagarkar
2009	Nalin Harish Thakkar
IM 04	Sanjivani College of Engineering
JM 60	Soumya Ranjan Sethy

Patrons : 38
Members : 2009
Student Members : 224

Organisation Members : 33
Junior Members : 60

Sponsor : 8
IM : 04

TOTAL STRENGTH : 2,376

GEM 29 PROF. V. RAMAKRISHNAN - ARCHITECT, DESIGNER AND FRC SPECIALIST

By Dr. N. Subramanian

Prof. V. Ramakrishnan (b 1928-..)

Prof. V. RAMAKRISHNAN, B.E., D.S.S. (University of Madras), D.I.C. (Conc. Tech.), D.I.C. (Hydro-Power) [Imperial College of Science and Technology, London], Ph.D. (University of London), is currently Regents Distinguished Professor of Emeritus at Civil and Environmental Engineering Department, South Dakota School Of Mines & Technology, U.S.A. Dr. Ramakrishnan is an international expert in the field of concrete and concrete structures and application using concrete fibre composites for the past 40 years. He has received numerous awards, and honours, and has published more than 200 research papers and technical articles; presented at more than 200 international conferences; and submitted more than 300 technical reports on completed research projects. He has been a consultant for a number of construction projects in India and later for all major fibre producers (both steel and synthetic) in the U.S.A.

EARLY LIFE

Ramakrishnan was born of the leap year on February 29, 1928. His primary education started in Peelamedu, the school was one kilometre away (0.6 mile) from his house and he had to walk that distance daily. To go to high school, he had to walk a full 2 km (1.2 miles). The high school where he studied up to the SSLC (School leaving level), is aptly named "Sarva Jana High School". In his studies, he did well, got the highest marks in English test and second highest overall in the public examination, among the students from his school.

On completion of high school education in 1946, young Ramakrishnan was selected based on his performance at the High School examination to undergo a radio- assembling course conducted at that time by the famous Indian industrialist G.D. Naidu. It was a six-week Course where the students were taught all about the radio and they were asked to assemble a complete radio that would receive both medium and high frequency, same as the radios commercially available at that time in India. Ramakrishnan received the first rank in the course. He was using the radio he assembled till he left for U.K. in September 1955. Because of his performance, he was appointed as an Instructor for the next year course.

In those days in 1946 and 1948, students were admitted based on their merit only. Ramakrishnan got admission into the Government Arts College in Coimbatore and later to the Guindy Engineering College in Madras (now Chennai). It should be noted that in 1948, there were only two engineering colleges with a capacity to admit one hundred students in each, in the undivided Madras state, comprising of the present-day Tamil Nadu and Andhra Pradesh. He graduated with a B.E in Civil Engineering in April 1952. He passed with a First-Class distinction.

PROFESSIONAL CAREER

Even before writing the final B.E. examination he was appointed as overseer of the Kalingarayan Canal, a job very much wanted by many. However, he was not comfortable in the job because of the traditional practice of engineers accepting gifts from the farmers, which he considered them as bribes.

In 1951, the first private engineering college was started by the P.S.G. Charities in Peelamedu named as P.S.G College of Technology. Its founder and principal G.R. Damodaran invited Ramakrishnan and offered him the Assistant Lecture post in the new college. Ramakrishnan gladly joined the faculty of P.S.G. College of Technology in May 1952 after resigning from the coveted Government Job.

In 1955, he was awarded the Colombo Plan Fellowship by the British Council for his Post graduate Studies in the Imperial College of Science and Technology, London. He received two Diplomas of Imperial College (equivalent to a master's degree) from the University of London with emphases in hydropower engineering, and concrete technology, and earned his Ph.D. in civil engineering from the University of London in 1960.

After five years study he returned and joined the PSG College. He was then appointed as professor and Head of the Civil Engineering Department. He was very active in developing post graduate education in Madras University. He became Academic Council member and later was elected as the Senate Member of the University of Madras, his alma mater. He introduced the Ph.D. program in Civil Engineering. The first two Ph.D. candidates of the University of Madras in Civil Engineering were Ramakrishnan's students.

Dr. Ramakrishnan had attended, mostly by invitation, more than five international conferences between 1960 and 1968 in various countries in the world. The contacts and acquaintances he had during these trips round the world germinated in his mind the idea about conducting an international conference in his college in Coimbatore. He organized and conducted an international conference on Shear, Bond, and Torsion in reinforced concrete structures, which was the first one conducted in the former Madras State (the present Tamil Nadu and Andhra Pradesh combined) in January 1969. More than 20 professors and researchers from various countries including U.S., U. K., Germany, Japan, Czechoslovakia, Turkey, Sri Lanka, New Zeeland, and Malaysia presented papers in the conference. More than 100 professors and researchers from India participated. The Inaugural Address was given by central minister Dr. K. L. Rao who was a civil engineer and had written a book on reinforced concrete published in U.K.

PROFESSORIAL CAREER IN USA

One of the participants from U.S., Postgraduate Professor Shu Tien Li at the South Dakota School of Mines and Technology, a few weeks after his return to U.S., invited Prof. Ramakrishnan to chair a session at the ACI International Conference on Bridges. He was the convener of the conference held in Chicago in April 1969. Professor Li also invited him to give a special lecture about my recent research at his university in Rapid City South Dakota. He had also invited the President and Dean of the University for the Lecture. After the lecture, Dr. Li and the president invited Prof. Ramakrishnan to join the university as Visiting Professor of Civil Engineering and Director of Concrete Technology Research. The following year he was appointed as a tenured Professor of Civil Engineering, A few years later he was named as the Regents Distinguished Professor of Civil Engineering, the only one who had received that honour in the 135 history of School.

PROFESSIONAL EXPERIENCE

While he was a professor, his services were sought as a consultant. With great persuasion and sighting European University Professors examples, he was allowed to practice as a private consultant in addition to his being the professor and head of the department of Civil Engineering at the P.S.G. College of Technology in Coimbatore, India.

During the period from 1960 to 1969, he designed and built several unique structures both in reinforced concrete and steel. He was selective in accepting consulting work; he never accepted any assignment which the local professional engineer can do. He took the challenge only when the local professional engineers are not willing to do the work. He also included his colleagues, when they requested, in his team so that they would have some real experience in design and construction of structures.

Design of Multi-storey Buildings Using Improved Baker's Plastic Hinge Method

In 1964-65, he designed and constructed the tallest building in Coimbatore, a six story reinforced concrete framed building. It was the first building in the world designed using a new theory developed by Prof. A.L.L. Baker of the Imperial College of Science and Technology, London. When Ramakrishnan was a student in Imperial College, London, Prof. Baker was teaching a revolutionary new method of analysis of reinforced concrete multi-storey frames. This method used the real plastic behaviour of reinforced concrete frame assuming concrete as a semi-plastic material instead of treating it as an elastic material, like steel, while doing the analysis and later treating it as plastic material while designing the same frame. The beauty of this method is that the designer is in control and he dictates to the structure how it should behave during the collapse by providing the correct plastic hinge locations. Professor Ramakrishnan was teaching this method to the Graduate students from 1960. In his book on Ultimate Load Design of Reinforced Concrete published by Pitman, London, he had presented Prof. Baker's theory with minor additions, based on his research findings. The six-story building where the frame was analysed and designed using Baker's theory, resulted in 35% less material compared to the same frame analysed using the prevailing elastic method. The analysis was done using the newly available computer at the Guindy Engineering College in Madras (now Chennai) and it was presented as a paper co-authored by Dr. Rajasekaran titled "Limit Design of R.C. Frames by Baker's Plastic Hinge Method Using Digital Computer" at the Fourth International Congress on the application of Mathematics in Engineering, Weimar, Germany in June 1967. This building remained as the tallest building in Coimbatore district for more than 35 years. Even now (Dec. 2020) the building is fully used and remains as the safest building. The Indian Concrete Journal published a photo of the building on its front cover

First and second multi-storey RC buildings built in India using Prof. Baker's plastic method of design, improved by Dr. Ramakrishnan (he was the Architect and Designer), resulted in cost reduction of 35%. Both appeared on the cover of the Indian Concrete Journal

Another request received by Prof. Ramakrishnan was a real challenge, and the local professional engineers did not want to accept the job. The Coimbatore Mill owners Association had been functioning in an old two story brick building with minimal foundation required for the two story building. The building was in a prestigious location and they did not want to move it to another location. They needed 100% additional floor space for their increased activities. However, they did not want the old building demolished and they did not want any interruption in their continued use of the building.

Professor Ramakrishnan solved the problem by building a four-story reinforced concrete frame with independent footing foundation adjacent and enclosing the old building. The top two floors were completed and the whole structure was integrated seamlessly without applying any additional load on the old building. A new lift was provided in an independent new structure connecting the four floors. The frames were analysed using Baker's method. The elements were designed using the regular plastic design. Since the original side walls were curved, the end curved beam was designed for three-dimensional loading, bending, shear and torsion.

There was one problem, the column lengths violated the code regulations, which the Town Planning department followed. The building was not approved though it was explained to the approving engineer that code rules are only guide lines for the designer and they need not be followed if the designer is confident of his design and the safety of the building. The engineer did not know about Baker's method of analysis. After giving a personal guarantee and accepting the liability if a failure occurs, the construction of the building was permitted. For more than 55 years, the building has been continuously used; it is still safe and looks as good as new. A photo of the building had appeared on the front cover page of the Indian Concrete Journal in February, 1969.

Other Structures Designed by Prof. Ramakrishnan in India

Dr. Ramakrishnan never used the traditional designs in all the structures he had designed and built during the period 1960 to 1969. When his alma mater high school needed an overhead water tank, he designed one using the balanced cantilever method which had been largely used in bridge designs and which has never been used for overhead tank design. Most of the traditional designs used a circular beam supporting circular tanks. The circular beams are never designed using basic principles. Engineers are never taught the design of structural elements subjected to the real three-dimensional loading as in the case of the circular or curved beams. They simply use empirical rules and use much high reinforcement than needed. In Dr. Ramakrishnan's water tank design, the elements were considered as beams, columns and plates. Every element was designed fully based on basic principles. The new design produced a 25% saving in material and a 30% saving in form work and scaffolding. His design also created 4 small multipurpose rooms. Architecturally it produced a much pleasing appearance than the traditional monotonous circular tank.

Professor Ramakrishnan was also the architect for all the structures he designed in the 1960s. His major architectural achievement was the exhibition structure known as the PSG Pavilion built for the Indian International Trade and Industries Fair Madras, 1968. The Fair was scheduled for six-month duration.

The structure was a 36m tall steel building with a revolving globe at the top advertising the PSG logo.

The structure resembles a lotus flower on its slender stem, almost floating in water, with heavy petals fanning out in suspension and its proud pistil soaring up into the air. The suspended exhibit floor is 18.3 m by 18.3m overall and the central tower is 3m by 3m. The alternation of recessed and projecting compartments at the outer periphery of the suspended floor created numerous wall surfaces making it as 12 sided-building with 27 % of area covered with glazed steel windows giving a clear look of the products displayed for visitors, which was an added attraction for the people to visit. Full wall-size decorative panels of plaster relief work on plywood fitted to 4 of the side wall surfaces provided pleasing exterior décor. Decorative panels have been fitted to the interior walls to enhance the colour and gaiety.

The PSG Pavilion at the International Industrial Exhibition, Madras built in 1968. This structure rises from water in the fountain to a height of 120 feet, symbolizing the Lotus flower, sacred in the Hindu mythology.

Access to the elevated floor is through a graceful steel staircase of the shape of an inverted V with two flights forming the legs of the V and a third broader one leading up from the apex of the V. The staircase has been made open to avoid it masking the view of the pavilion.

A colourful and sleek geodesic dome of aluminium tubular frame work covered with reinforced plastic, coloured translucent panels has been positioned at the entrance as a sit-out. It provides a pleasing contrast in the foreground and makes its own architectural impact due to its unique structural form. The structure was designed for a total load of 300 tones and to resist a 176 kmph wind. The foundation consists of simple cast-in-situ piles down to 12.8m below ground level. The pile cap needed (785 tonnes) of concrete.

For the first time in the former Madras state, a large structure was designed and built as a modular structure. The entire tower was prefabricated into 7 mass transportable sections and each cantilever truss into 3 major transportable sections. All the steel was fabricated in Coimbatore and transported to the Fair site about 640 km (400 miles) away. On completion of the Fair, the Pavilion was completely dismantled and transported back to Coimbatore and re-erected at the P.S.G College of Technology. Several exhibitions had been held in the building including the exhibition during the International Conference in 1969.

Dr Ramakrishnan had designed and built another exhibition structure at the same Trade Fair for his client the South India Viscose. As per their wish it was a simple steel structure with cheap decorative architecture.

South India Viscose Pavilion at Madras Industrial Exhibition and Four-storey RC Apartment building for South India Viscose, where the new method of design was used

In 1963, Ramakrishnan was the architect, designer, and construction supervisor for his own four bedrooms, all concrete house with an open-air meeting and entertainment area to accommodate

about 100 persons at the roof top. The building had unique architectural features rare to see in Coimbatore at that time. Many other engineers, including his former students copied the layout and other features in their won constructions.

An overhead water tank designed by a new method developed by Dr Ramakrishnan, resulted in cost savings of 30% and Dr Ramakrishnan's first house in Coimbatore was a all-concrete building

In the early 1960s, the South Indian Viscose Company, one of the largest limited companies in India at that time, in collaborated with the Senior Viscose company of Italy and built a factory in Mettupalayam, 40km from Coimbatore. The Company was licensed to cut the Eucalyptus trees from the Nilgiris hills and digest them in large sulphuric acid tanks and produce rayon yarn. The structure was designed by Senior Viscose engineer in Italy and Italian engineers were supervising the in-site construction. Prominent construction Companies, the Engineering Construction Corporation (ECC), now part of the L&T, and South India Corporation, were major contractors of the Project.

Knowing that Dr Ramakrishnan was available as a consultant, the managing director of South India Viscose appointed him as a consulting engineer with full responsibility of managing the on-going construction and the design and construction of additional buildings needed for the project. Accepting an invitation from the Senior Viscose he visited their office near Venice Italy and presented his design and construction experience. After learning about his qualifications, they approved his appointment and recalled their engineers from India, giving full responsibility to Ramakrishnan.

Dr Ramakrishnan introduced precast reinforced concrete trusses, instead of the steel trusses to prevent corrosion due to the chemical products used in the building. The project needed a living quarters for the employees. Four blocks of four-story apartments were constructed. They were RC framed buildings. The frames were analysed by Baker's method which resulted in considerable savings. He introduced a new feature in the layout of the block,

so that complete privacy is assured for every apartment. Traditionally such blocks would be built one behind another and the windows in one apartment facing the windows in the opposite building. In Ramakrishnan's design the blocks were arranged in a staggered manner so that no window will face another window in all the apartments in the buildings.

When Ramakrishnan moved to U.S, he did not accept any consulting that involved design or construction of structures. However, he could not refuse the request of a close relative who was a practicing professional engineer in U.S. He designed a four-story steel structure for an office building. First only the first two stories were built in Connecticut for the Diversified Technologies, Corporation.

RESEARCH ON CONCRETE AND FIBRE REINFORCED CONCRETE

In South Dakota School of Mines, Dr. Ramakrishnan contributed much in the areas of fibre reinforced concrete, concrete fibre composites, and high performance concrete. He has been involved in research with the South Dakota Department of Transportation Highway Administration to develop high performance concrete of strength 114 MPa. A bridge prestressed concrete girder was built utilizing this concrete in Sioux Falls, marking the first time in the United States such a high strength concrete was used in bridge construction. Traditionally bridges were built using 41 MPa concrete. Since he has been at SDSM&T Dr. Ramakrishnan has also completed research on shear wall structures, plastic analysis of buildings, and latex modified concrete(Latex modified concrete is an impermeable concrete, typically used in the construction of bridges).

With India's former President Dr S. Radhakrishnan

Additionally, for more than 30 years Dr. Ramakrishnan has worked as an international consultant for such major industries in the United States as 3M Company, Mobil Research and Development Corporation, Forta Corporation, DuPont, U.S. Steel, and Allied Signal. He has done consulting for PPG – the second largest glass producer in the world – to develop glass fibre reinforced concrete, and he has also been working with 3M to develop new high-tech, synthetic fibre for addition in concrete.

His work on bacterial concrete is also noteworthy, as it involves self healing of concrete.

BOOKS AND OTHER PUBLICATIONS

He has authored 2 books, co-edited 4 books and published more than 200 research papers and technical articles; presented at more than 200 international conferences; and submitted more than 300 technical reports on completed research projects. More than 50 of his papers were on fibre reinforced concrete (FRC) and construction with FRC. He has done a lot of research and has field experience in using non-destructive testing techniques for evaluating concrete.

Dr. Ramakrishnan was charged by the Transportation Research Board to write a book on this subject that was published in 1980. He has held numerous offices in Professional Organizations.

AWARDS AND RECOGNITION

Dr. Ramakrishnan has received numerous awards including ACI/CANMET Award for his contributions in fibre reinforced Concrete. Recently, in 2021, he was elected as honorary member of the American Concrete Institute, the highest recognition by ACI.

Prof. M. Ananthakrishnan, former VC of Anna University and former Chairman of IITK with Prof. V. Ramakrishnan

Dr. Ramakrishnan is also the recipient of two prestigious awards, The Robert E. Philleo Award and an appointment as Emeritus Member of the Transportation Research Board (TRB) standing committee on Properties of Concrete. The Robert E. Philleo Award is the only award given for research excellence by the American Concrete Institute. It recognizes individuals for their contributions in the field of concrete and awards excellence in overall achievement. Dr. Ramakrishnan was the ninth individual to ever receive the award. Dr. Ramakrishnan was only the second individual to receive an appointment as an Emeritus Member of a TRB standing committee in the concrete section. The Emeritus Membership was established by TRB as a means of recognizing the significant and long-term contributions of individuals who have provided outstanding service.

Dr. Ramakrishnan is a fellow of the American Concrete Institute (FACI) and has served on ACI and TRB committees relating to FRC, including AASHTO TASK Force 36, Use of Fibre in Portland cement.

To recognize the tremendous impact that he has made in advancing higher education and materials research and for his contributions to the state, the governor of South Dakota State proclaimed September 29, 2002, as "Dr. Venkataswamy Ramakrishnan Day".

Dr. Karen Whitehead, Tech's Vice President for Academic Affairs presents Dr Ramakrishnan with a plaque Commemorating "Dr. Rama Day" in South Dakota

For his substantive contributions to South Dakota School of Mines & Technology research activities in concrete technology and other areas, a new materials laboratory at the university was dedicated as 'Rama Materials Laboratory' in April 2002.

GALVANIC SACRIFICIAL ANODE - NOVEL TECHNIQUE FOR CORROSION PROTECTION IN AGGRESSIVE EXPOSURE CONDITIONS

By Pranjali Takwale

Cathodic protection system is a rampant technology used for corrosion protection of ships, underground pipes, etc since a long time. Recent trend observed in past couple of years is that this cathodic protection system for corrosion protection is being used in reinforced concrete structure too. Cathodic protection technique works effectively by forming an electrchemical cell and arrests the rate of corrosion of a metal surface by making that metal surface cathode (state in which metal is in protection zone) in presence of another active metal(anode) .

Cathodic protection methods fall in the following categories:

1. Impressed current cathodic protection
2. Galvanic Sacrificial cathodic protection.

In Impressed current cathodic protection, external power is connected to permanently installed Anode in a structure which distributes the current throughout as shown in fig(1)

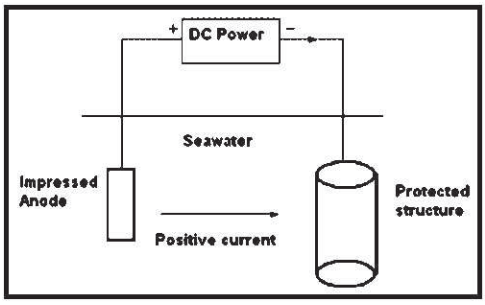

Fig No. 1

Wherein, in galvanic protection, dissimilar activated metal (metal which is susceptible to corrosion) is connected to base metal (reinforcement bar which need to be protected), as shown in fig(2)

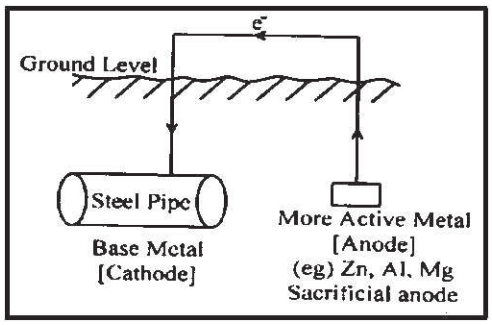

Fig No. 2

GALVANIC SACRIFICIAL ANODE:

India with it"s long coastline coupled with humid atmosphere is an environment highly favourable for corrosion. There are many structures like industries, bridges, jetties built on coastal areas. Apart from use of good construction practices, additional protection for such structure becomes not only essential but existential. Sacrificial Galvanic anode presents itself as one solution for the chronic corrosion problem.

For highly aggressive exposed condition, such as marine structure with high chloride contamination, splash zone, water retaining structures, foundation of RCC building (of which repair is difficult,) Galvanic Sacrificial Anode was introduced in reinforced concrete structure. Further due to technological advancement, usage of galvanic sacrificial anode increased significantly for protecting reinforcement bar embedded in concrete.

In sacrificial galvanic anode, anodes are active metals, which corrodes faster compared to the steel reinforcement. Typically magnesium, aluminium and zinc material are more active than steel and these metals are commonly used as

Dr. Ramakrishnan an international consultant has been invited four times by the Chinese government in 1987, 1989, 1997 and 2009. He had presented papers and lectures in Australia, Japan, U.K, Canada, all countries in Europe, India, Thailand, Taiwan, Vietnam, Singapore, Trinidad, Jamaica, Egypt, Mexico, Brazil, and Mongolia.

Prof. Ramakrishnan with other Concrete Technologists

FAMILY

Professor Ramakrishnan's wife Vijayalakshmi Ramakrishnan after postgraduate education at the Banaras Hindu University has worked as Research Scientist at the Sugarcane Breeding Institute in Coimbatore for 12 years and made a commendable contribution to the Sugarcane Industry. During this period, she co-authored three books and published 21 scientific papers in national and international journals on various aspects of sugarcane botany including Taxonomy, Agronomy and Pathology. She was a well-known Telugu Writer and published more than 100 short stories in Telugu Journals. She has also written a novel in Telugu.

Professor Ramakrishnan with wife Vijayalakshmi

In 1969, she followed Prof. Ramakrishnan to U.S.A, leaving her favourite scientific career. She worked as a high school chemistry teacher and initiated revolutionary changes in her teaching methods. She received numerous awards, including the Presidential Award for Best Mathematics and Science Teacher, Christa McAuliffe Fellowship Award, Catalyst Award, and Tandy Technology Award. Like Prof. Ramakrishnan she also received the highest State Award, the Governor proclaiming one day in her honour. April 18, 1986 was proclaimed as Vijayalakshmi Ramakrishnan Day in South Dakota. Prof. Ramakrishnan constituted a trust after the demise of his wife to assist needier and deserving students (http://vrct.org/).

Professor Ramakrishnan's son Anand Ramakrishnan, a computer specialist, worked for Diversified Technology Corporation, Connecticut as manager of the Computer Division. He later worked for CISCO Corporation in California in a senior position. Now he owns and runs a private Consulting Firm, Anand Consulting, L.L.C.

About The Author

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 Id: drnsmani@gmail.com

anodes. Amongst the three metals, Zinc is most preferred over the other two due to following reason:

1. High corrosion efficiency – High percent of electrons & ions that are discharged to protect the steel.
2. Low rate of expansion – Low rate of expansion than steel, makes zinc particularly suitable to be used in embedded concrete for protection.
3. Less potential difference – Relative difference between OCP of zinc and Fe is low compared to aluminium and magnesium with steel. Lower the potential difference, the longer is the life of the anode making zinc more preferable over aluminium and magnesium.
4. Zinc content in Anode alloy – Zinc confirming to ASTM B Type II has low % of Fe constituent, this prevents formation of passivation layer and protects the steel reinforcement.

Galvanic Sacrificial Anode consist of metal embedded in highly conductive mortar and GI wire passes through the metal (for tying rebar) as shown in fig (3)

Fig No. 3

In addition to keeping the anode active over time, alkali-activated systems are designed to be corrosive to the sacrificial zinc anode but not to the reinforcing steel in the concrete.

Areas of Application:

Sacrificial Galvanic protection is a protection by electrochemical process, where water/moisture act as electrolyte. Any structure where moisture/water is present use of Galvanic Sacrifical Anode for corrosion protection is most suitable method of corrosion protection.

Typical application areas include– marine structures, splash zones, foundation of RCC structures, underground RCC piles, etc.

Application methodology:

Firstly ensure the existing loose rust scales on reinforcement bar are removed by wire brush by mechanical means before the Cathodic treatment. The sacrificial anode needs to be fastened to the rebar to ensure the electrical conductivity between the Galvanic Sacrificial Anode and rebar. After fastening the anode and rebar securely ,surface levelling can be done. Sacrificial galvanic anode protection is a distribute system for corrosion control.

Fig No. 4

Spacing of Anode:

Spacing of anode fastening depends on various factors as below:

- Chloride content in existing concrete/soil – Depending upon Chloride content in surrounding soil/concrete the spacing is designed. More the chloride content, lower the spacing.
- The steel density – Percentage of steel with respect to concrete area need to be known for designing the spacing of the anode. Higher the density of the steel ,more anodes with less spacing should be places
- Surface area of steel to be protected- For designing the spacing, surface area of steel is major parameter to be consider. Larger the diameter of rebar lesser the surface area for protection.
- Steel details: Steel drawing is needed to see the placing of anode.
- Desired life expectancy – Duration for which corrosion protection is expected, accordingly the spacing is determined.

As a general thumbrule anodes can be fastened at spacing of 1 anode per 1 sqm.

Testing of Galvanic Sacrificial Anode in 3.5% NaCl electrolyte solution:

The ongoing cathodic prevention of carbon steel with Zinc anode can also be scientifically proved by locating the Ecorr value in Fe- water system Pourbiax diagram.

Pourbiax diagram is extremely useful for visualisation of material behaviour in corrosive environment, predicting the spontaneous or electrochemical reaction, identifying the corrosion products changed in the environment in terms of potential & pH.

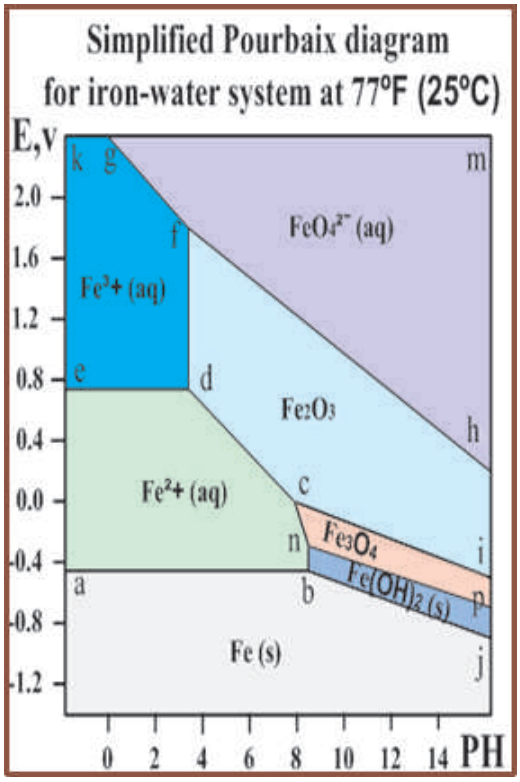

Fig No. 5

Following are the steps to carry out the test:

- In the primary stage, the Ecorr of zinc anode is noted in 3.5 % chloride solution with the help of SCE reference electrode & Voltmeter. Ecorr more than -950mV w.r.t SCE is preferable.
- In the next stage the zinc anode is fastened with one feet long reinforcement (12-16 mm dia) & is kept in same 3.5 % chloride solution. After a couple of hours again the Ecorr of steel is noted w.r.t SCE reference electrode & Voltmeter. This Ecorr value of -850 mV . Sacrificial anode with Ecorr value of -850mV or more is preferable to use as galvanic protection of steel under water & cementitious product.

Ecorr values are then plotted after converting it into hydrogen scale, with respect to pH and subsequent Ecorr value in the Pourbiax Diagram Fig (5) to check the respective electrochemical zone of protection.

Conclusion:

- Sacrificial galvanic Anode is cost effective, highly efficient to use in water/marine structure for protecting the reinforcement.
- Its easy application and efficiency to control corrosion have lead to increase in use of Galvanic Sacrificial anode.
- In all cases, it is important to understand and select an appropriate system that ensures the zinc anode provides the level of corrosion protection desired without creating additional corrosion concerns for structure.
- From last decade or so, this technology has been widely accepted by numerous industrial, infrastructure, commercial structure as a part of comprehensive corrosion protection measures for achieving unprecedented durability. However, there is a dire need to propagate this technology at a larger scale across the country to nullify corrosion induced distress.

About the author :

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PROFESSIONALISM IN CIVIL ENGINEERING

By Hemant Vadalkar

Civil Engineering is a very ancient branch of engineering which dates back to early civilization. Civil engineers around the world created wonders by building many outstanding structures and heritage monuments.

Life of modern age structures is reducing compared to ancient structures. Society at large is looking at civil engineers with suspicion due to poor performance of modern structures. Though, we have latest software tools to analyse complex structures, modern construction materials, latest construction machines and technology at our disposal, still the final product is not satisfactory and long lasting. There is a need for introspection. And it should begin right when we plan , design, choose material, construct and maintain our structures. At every stage, there is a compromise which results in poor quality of final product.

Association of Consulting Civil Engineers, Bangalore (ACCE) conducted a series of lectures on **"Professionalism in Civil Engineering"** during June to Aug 2021. Experts in the field expressed their views on various topics like Building bye-laws and building failures, Unprofessionalism in Government and private organizations, Legal disputes, Competence of civil engineers, Employability of civil engineers, Role of professional bodies and Engineers' bill.

Unethical practice starts from the planning stage itself. With some exceptions, client or developer, who is interested in only making money by selling the property to prospective buyers, wants an Architect who can provide maximum saleable area, make use of loop holes in the bye-laws to maximize the profit. On very odd shaped plots, odd shaped buildings are planned which do not follow good engineering practices. At times, concessions for open space, setback are obtained by paying premium. How safety Rules can be bypassed by paying premium? For appeasing masses, political class is allowing relaxation in bye laws and increasing FSI , which results in more congestion and degrades quality of life. Some of the redeveloped Tall buildings in Mumbai are standing at an open space of 1.5m from plot boundary under special relaxation. In the event of emergency, how fire brigade can reach for help is not known.

There was a national guideline for maximum ground coverage ratio of 0.2 to 0.5 based on type of structure which has not been followed in any bye-laws. We are virtually constructing every inch in the plot by using multiple basements, retaining structures and there is no soft patch of virgin soil available. Open space and garden is created at podium levels. Is this sustainable?

Rain water harvesting, wet waste composting, planting of trees around the building are shown on the plan for the sake of getting approvals and never been in the reality at least for buildings on small plots.

Clients are pressurising the Architects for extracting more area. Architects pass on the pressure to the structural engineers for designing and certifying badly planned framings and structural systems. There is no fear of being caught even if code guidelines or good engineering practices are not being followed. Because if you are not ready, some other person will take up the job and provide the certification. Formality of providing stability certificate is completed before OC with a mention

that National Building code 2016 has been followed. How many structural engineers can say with honesty that they are giving the true certificate? Are we not playing with the life of our people?

Some times disputes arise when the design is sent for third party vetting. There are many instances when it was learned that the buildings / structures are not designed as per relevant code of practice and not detailed properly. Many a times, it happens that proof checking is ordered when the project is half constructed. There are very few options to modify the design or strengthen the structure. This must be done before starting the construction.

During construction, many compromises are made in procuring cheap material in the name of lowest bidder. There is lack of strict supervision on material and workmanship. Project is always to be completed as fast as possible. Basic things like good quality concrete cover blocks and curing of RCC members is given least importance as there is no penalty if it is not done.

Many buildings show signs of distress even before handing over to end user. Instances of podium parking level flat slab , seen cracking up to 2mm wide which is much beyond the code stipulation. Some hotchpotch repair is carried out to hide the problem. Leakage is the prominent problem in many buildings. Are we not creating a diseased structure ? What is the life of such structure? Who is playing with the safety of the residents? Before occupation, are we going to call for a repair tender for a newly constructed building? If some one raises voice against such malpractices, he is shown the door.

Consultant is changed on the project as various certificates and NOC's can be bought in the market. This is really a tough and horrifying situation. How can society trust us civil engineers if every thing can be manipulated?

You can cheat others but not yourself.

Presently, it is observed that repairs are needed to low rise structures like G+4 and G+7 which are 30-40 years old. Some how, it is managed with additional propping and evacuation if required. Again repair is a continuous process. We can attend only part area where distress is visible and the process needs to be repeated at intervals of few years. I really wonder how are we going to do the repair of tall buildings? For tall buildings which are very complex in shape and designs, with basements, podium parking, floating columns, transfer girders, PT slabs etc, not enough open space around the building, no place for stacking material, difficulty in reaching great heights when building is occupied, safety of occupants and repair workers etc. will pose huge challenge when these buildings will come for repair in near future.

We need to upgrade knowledge and skill frequently, thrive for the best practices in design , construction and maintenance. Educate end user for the need of regular maintenance and do not tamper with the structural system for the interior work. Do not work under peer pressure from the owners or architects to do unethical things and compromises which are against good engineering practices.

If everyone in the profession works honestly, we can expect some improvement in future. Let us hope for the better.

About the author :

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HIGHER STUDIES ABROAD …….3

By Kirty Hemant Vadalkar

New Zealand, a very beautiful country. We wish to travel some day as we know the day first breaks near the islands. We visit it for some days, but wonder how students are selecting it for higher studies.

Here is Er Dipti Vegada. Born and brought up in Mumbai. Graduated from Mumbai University and joined Auckland university for her post graduation. Currently serving as an Intermediate Civil Engineer in the Transportation and Infrastructure team at Beca group, one of the leading professional services consultancy firms in the Asia-Pacific.

Its quite interesting to find a girl going to this off beat destination for higher studies. We normally see students prefer a place which is commonly selected by all. She worked as a site engineer for a year after her graduation in India. She then went on to join Auckland University.

Founded in 1883, Auckland is the country's largest university with over 40,000 students, nearly 10,000 of whom graduate annually. The University of Auckland is New Zealand's leading university, in the QS World University Rankings 2020. Placed 81st in the world, the University is the only New Zealand university in the top 100. The University of Auckland is also the highest ranked university in New Zealand for its global reputation amongst both academics and employers.

Department of Civil Engineering at Auckland University offers a variety of degrees ranging from a 1-year course, offering only degree to a 2-year research oriented Master's degree course. They also offer one of the most recognized civil engineering courses in the country. New Zealand has some of the most stringent building codes due to the frequency of earthquakes hitting the country.

Dipti has completed the Masters of Engineering Studies degree which included a research project. Her project was based on "Ageing population in New Zealand Construction industry".

Admission to universities in New Zealand usually requires only a language test for entrance. No GRE or GMAT are required for Engineering degree admissions. Dipti had appointed a counselor guiding her through the admissions process but she says, "it is usually not necessary. In general, TOEFL/IELTS are easy and just test your basic knowledge of English."

Admission process for universities is different from that of the admissions process for other countries. The first step is to appear for the language test, IELTS or TOEFL depending on the specific university requirements. Then start the application for your desired university. It is usually helpful if one attends the admissions events and seminars to get a better perspective of the university and chat with the admission officials. Dipti attended an event

organized by Edwise international in Mumbai. Usually, the admission decision is conveyed in 2-3 months after applying. They will also note any available scholarships and funding opportunities.

Once the admission was in hand, Dipti proceeded to prepare to leave. In a very crisp way she explains how to plan for the process. She says,"If you have a counselor to help you through the process they will usually take care of the visa application process. It is usually a very straightforward process and most information can be found out on Immigration New Zealand's website.When you have the visa stamp in your passport it is time to start preparing to leave your home in India. Book a flight with as fewer stops as possible. Avoid flights with lay over in Australia as you will have to apply for a transit visa to transit through any Australian airport. The journey is long and will definitely be tiresome so no point in prolonging your misery. Once you have found a flight combination that works for you, look closely at the baggage allowances for different ticket categories. There are different ticket categories that offer different number of check-in bags. If in doubt do not hesitate to call the airline directly to confirm the luggage allowances for each category. People end up paying extra for luggage at the airport if they are not aware of the allowances beforehand." Very interesting to note how these youngsters prepare for the journey. They are surely much smarter and practical.

When asked about how she decided upon what to carry, she replied, "it is essential to research about the city you will be traveling to. This is an important step as it will help you determine the things you will be carrying with you.Start by packing "the essentials", these generally include clothes, medications, and electronics. Have a decent mix of formal and informal clothes. You will end up using the informal clothes for most classes and the formal outfits for interviews. And the warm set of clothes is a must for winters. However, the warm clothes that we think of in India are really scanty in extreme weathers. One or two pairs of Indian clothes are helpful for some festivities. "

When asked, What about the other things required to carry, her experience is," Pack some kitchen supplies to get you started and would last for a couple of weeks. Pack a basic set of utensils that will help you cook most meals like a sauce pan with lid, a flat pan for rotis, a plate and a bowl, a set of spoons and fork, if required. Make sure all your utensils are flat bottomed so that they work with the stoves here. Pressure cooker is usually optional as you can buy an instant pot here for cheap." I really appreciate her simple but very useful observations.

She also mentions further, "Remember to buy good quality stroller bags for check-in luggage. Usually no seeds or live plants or food items are allowed in New Zealand. You will be asked specific questions at the border about the contents of your bags. You should answer all the questions truthfully and declare everything you have to avoid delays at the airport." this is very important, many times students are unaware about the importance of the border control or the immigration officers. It is also a very common habit of our students to bypass the rules, but they don't understand that any threats, like, don't you know who I am? Or my father / relative is so and so, do not help in the foreign land. Rules have to be followed strictly.

After a long and tiring journey one reaches the university town/city. Auckland University provided Dipti for a free shuttle pick up from the airport. Other universities might do this too if checked on their website. But if the University does not,there are other options like Ola, Uber to reach your place.
Dipti landed in Auckland around 1 am, of course, the city was very quiet at that time. That gave her a chance to ponder about the roads and infrastructure, all are well maintained and everyone follows all the driving rules. She thinks, its better to arrive at least 2-3 days prior to the first day at the University so that one gets some time to settle in, acclimatize and understand the local routes and transport services.

Auckland university held an orientation for all the students starting at the campus with special information for International students.it is very important to attend as this is where they introduce the students to the campus life, the different student associations, departments, and also take the new comers around the campus , just a little tour of different buildings. A warm welcome indeed!

Dipti says, “Overall my experience at the UOA has been great. The teaching patterns are very different to that in Indian universities. We do get assignments and group projects to work on ,similar to back home. However, they are different in terms of what is expected from you. Each student is expected to analyze the topic critically in their own way and put out their own opinions when it comes to non-technical courses”

Its a semester pattern and in each semester one gets to choose the courses one wants to undertake. Course can be customized each semester. Students should work towards completing the total required points to graduate for the degree.

The first week of each semester can be spent in taking the first lecture of any course that one might be interested in. This helps to decide if that course can be opted for or not.

Dipti mainly took up Project management, Construction management courses, BIM and a research project to get a little glimpse of the PhD world.

Dipti’s project work about, “Ageing population and its impact on the Construction Industry in New Zealand“ helped her a lot in learning the present condition of the construction industry in New Zealand. This paper was spread across both her semesters giving a full year to complete the research (for July intake) . she says, ”You can reach out to the appropriate faculty professor depending on the topics you’re interested in if you decide to take up a research paper.I conducted short interviews as part of the Research study to increase the understanding of health and safety of the ageing population in the construction industry of New Zealand.”

This investigation looked at how the skills, health, and safety parameters of the older population affect the construction industry considering the risk factors on work site. She interviewed construction professionals like Construction Managers, Site Inspectors, Health and Safety Managers and on-site construction workers who provided her with valuable information regarding the topic. She undertook critical review on the impact of ageing population in NZ construction industry from the health and safety perspective. Explored and analyzed the Risk factors for the ageing population on construction site. Studied the effect of these risk factors on Health and safety performance.

Her contribution to this research was to provide a pilot study for further investigations and subsequent quantitative analysis of the identified risks and develop an approach for the mitigation of these high priority risks.

Students are eligible to graduate once they have fulfilled the points/credits requirement for the course. The points system differs from one University to another. The graduation ceremony is held at the town halls or other similar big venues. It is a half day event and great to invite your family members for the ceremony as it is one to be experienced by everyone that was a part of your higher education journey. Most graduation ceremonies in NZ include a procession/parade before or after the ceremony through the busy streets of the city to be celebrated and acknowledged by the members of the public. Dipti's had a procession with the bagpipers ahead of the graduating students. What an experience, indeed!

For getting a job one can start applying while still completing the course as applications in New Zealand start well in advance. If one is looking for a Graduate level role after finishing the masters, a number of Engineering firms have a special Graduate intake program throughout the country.The application season for this Graduate intake usually starts from late January up to late April every year. Students should check each company's application deadline individually. Most universities here have faculty that help students out with their CVs and cover letters. Dipti totally recommends getting their help as NZ applications are different than our Indian formats. Some companies also have a career fair held at the university to announce their intake dates and provide more information about the jobs available.Students can opt for internship during the break between the semesters which has a similar process for applications as that of the Grad intake. Internship season in NZ is mainly during the summer months which is between mid November to late February. However, the application and selection process begins well in advance around June/July.

Upon graduating in September 2018, Dipti got a chance to work with an engineering consultancy firm called Beca . She started as a graduate Civil engineer with the Transport and Infrastructure team in Wellington and now she is an Intermediate Civil engineer. She had to relocate from Auckland to Wellington for the job. She searched for the residential options and selected one. Shifting from Auckland was a tiring job which she managed on her own. It was a lot of luggage to transport and carrying it along in the flight would have been expensive so she managed a road transport and matched the timing perfectly with her flight. Kudos to her managing skills.

Her work experience to date has involved designing pavements, roads, 3-water connections and layouts, transportation layouts for major cycle way and roadway projects and site construction monitoring as well. On the non-technical side she has also been involved in project finance management, resource management, job management, revenue recognition processes, Stakeholder liaison and contract administration.

Dipti finds, "the work culture in New Zealand promotes a good work/life balance. Your time and efforts are valued and so are your personal commitments." The NZ government law allows for 10 days of paid sick leave a year for all employees and annual leave might vary a bit from company to company, however, the usual is about 4 weeks a year.Overall, NZ has a great work culture, people are welcoming, open minded, supportive and understanding as per her experience.

Dipti is a trained kathak dancer. She carried forward her passion in the new place too. While she was relocating, the manager from the company gave a list of things she could enjoy in the new place. It included the name of the dance academy run by an Indian dance guru Parita Pathak Bose. On reaching Wellington, Dipti joined the academy and now takes part in many concerts organized by the academy , also various official functions to celebrate Indian festivals like Diwali, Holi, Navaratri.

On the Commonwealth Day, being celebrated at the Parliament, she got a chance to meet and greet the Governor General of New Zealand Dame Patsy Reddy . And for Diwali celebrations at the Parliament the Hon Deputy Prime Minister Winston Peters.

Apart from this, she is a vivid traveler and a great photographer too. She has been travelling across the length and breadth of NZ capturing the beautiful nature. She also enjoys adventures like bungy jumping, parachute jumping and many more such activities.

Its a great feeling to know our students are doing so well in a foreign land. They have not forgotten their culture and passion there. In fact, they are our true ambassadors. Best wishes to Dipti for all her future endeavors.

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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NEWS AND EVENTS DURING JULY TO SEPT 2021

by Hemant Vadalkar

8 July 2021: SEFI arranged a webinar on "CHAMPLAIN TOWER COLLAPSE : Early Observations & Implications" . Alpa Sheth briefed about the initial findings in the collapse. Dr. CVR Murty talked on " Provisions to prevent collapse of flat slab systems, code provisions and their limitations. He described three important aspects strength , stiffness and deformability. Redundancy and ductility are very important parameters for better structural systems. Dr. Rupen Goswami, IIT Chennai, talked on various structural systems and their effectiveness. Hemal Mistry from V H PT system, Surat talked on design and detailing provisions of flat slab as per International codes and touched on punching shear requirements including PT slab. Presentations were very concise and thought provoking.

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10 July 2021: Steel Day was celebrated by MX media with presentations on steel structures. Various industry experts presented their work with steel.

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13 July 2021: Webinar was arranged on " Stainless steel bridges"

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14 July 2021: Hemant Vadalkar was invited to talk on " Prospects in Structural Engineering " at MIT ADT university , Pune for the online session. He elaborated prospects for all civil engineering graduates and structural engineering post graduates in various fields. There are vast Career options such as Researcher, Academician, Construction engineer, Project management consultant, Structural consultant, Handling of huge infrastructure projects, Software development, Testing of materials, Non-destructive testing, Structural audit, Structural health monitoring, maintenance and repairs of all civil engineering structures.

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20 July 2021 : TATA Tubes arranged an online lecture on " Connections of hollow steel tubes using Hollow bolts". Edvin Vaz, Product engineer from Lindapter International made very interesting presentation on the subject. He had shown the use of hollow bolts in various projects like airports, industrial structures, stadiums, rail stations, elevators, hand rail fixing, glazing supporting steel frames etc, where-ever hollow steel tube sections are to be connected with bolting.

24 July 2021 : Epicons friends of concrete arranged an online lecture on " Performance based design part -1 " by Dr. Yogendra Singh, HOD IIT Roorkee.

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30 Jul 2021 : ISSE Student Chapter arranged lecture on "Importance of Geo-technical Investigation for structural engineers by Er. Shubhada Jagap, Mruda Geotech consultants. Er. Shubhada is Chief Consulting Engineer of M/s Mruda Geotech Consultants. She briefed on importance of geotechnical investigations for structural engineers. For the structures having 3-4 storeys, structural engineers used to visually inspect the strata and based on assumptions of SBC, they design the footings. However, it is not fair for multistorey buildings to do such assumptions. Similarly, lot of investigation and inputs are required from geotechnical consultant as far as multiple basements, deep foundations, retaining walls are considered. MCGM has taken initiative in this regard and made compulsory soil investigation for every new construction. She appreciated this move of MCGM and opined that there should be registration of geotechnical

engineers like structural engineers and architects. Around 60 students and faculty members attended the lecture. The program was coordinated by Er. Madhav Chikodi.

11 Aug 2021 : IGS Mumbai chapter arranged a lecture on slope stability and rock fall protection for steep slopes.
Interesting presentation was made by Chirstopher and Armin from TECCO System a Swiss company.

Wire mesh of different sizes 45mm or 60mm diamond shape are used with galvanized high tensile wires. Wires of 2mm, 3mm and 4mm diameter are used. Self drilling Nails are used at intervals of 1mx1m or 3mx3m or as per design requirement. For harsh environment, stainless meshes can be used. The mesh can be of open type where vegetation can grow and has better slope stability and eco-friendly green surface can be created. Life of system can be decided based on type of material used and climate condition which can be from 25 years to 100 years.
Swiss company had done many works in Pune Mumbai Ghat, Malshej ghat and many places in rock fall area in Himachal Pradesh near tunnels. The webinar was very informative.

20 Aug 2021: ISSE Student chapter arranged lecture by renowned structural consultant Chetan Raikar on "Introduction to Non-destructive Testing and its linkage to Construction and repair industry".
He provided detail information on 20+ non destructive tests on concrete. The information regarding "test locations, surface preparations, limitations, interpretation of test results" was given by Er. Chetan. He shared his case studies right from residential buildings to concrete road, silo, ESR, bridges etc.
Prof. Dr. V.S. Patil of Walchand college of Engg, Sangali expressed his feelings during question answer session. He said there is very brief information about ND Tests in curriculum. With this lecture, more students may get attracted to the field of Non-destructive testing.
Er. Chetan also expressed his willingness to conduct live session on ND testing in any of "Structwel Lab", either at Pune or Navi Mumbai.
The lead institute was "Walchand College of Engineering, Sangali".
Around 23 students and faculty members attended the lecture. The program was coordinated by Er. Madhav Chikodi

20 Aug 2021 : MX media arranged webinar on Steel construction in Healthcare infrastructure. Experts from JSPL, Architects, Consulting engineers involved in design of various steel structures related to health care facilities shared their experience. Advantages of steel construction like speed of construction, lighter weight, better flexibility in planning and expansion and advantage of composite construction was discussed by experts.

18 Sept 2021 : Epicon friends of concrete arranged a webinar on "Performance based design Part 2 – Non-linear modelling of RC buildings ". Dr. Yogendra Singh HOD IIT Roorkee talked about the theory and procedure for carrying out non-linear analysis. Dr. Singh explained use of Fibre mode (distributed inelasticity model) and lumped plasticity model (plastic hinges at the end of beams and columns) , use of back bone curves , modelling parameters for non-linear analysis, as per ASCE41. His student Ms Payal had shown illustrative example of building for non-linear analysis using ETAB based on provision of ASCE 41-2017.

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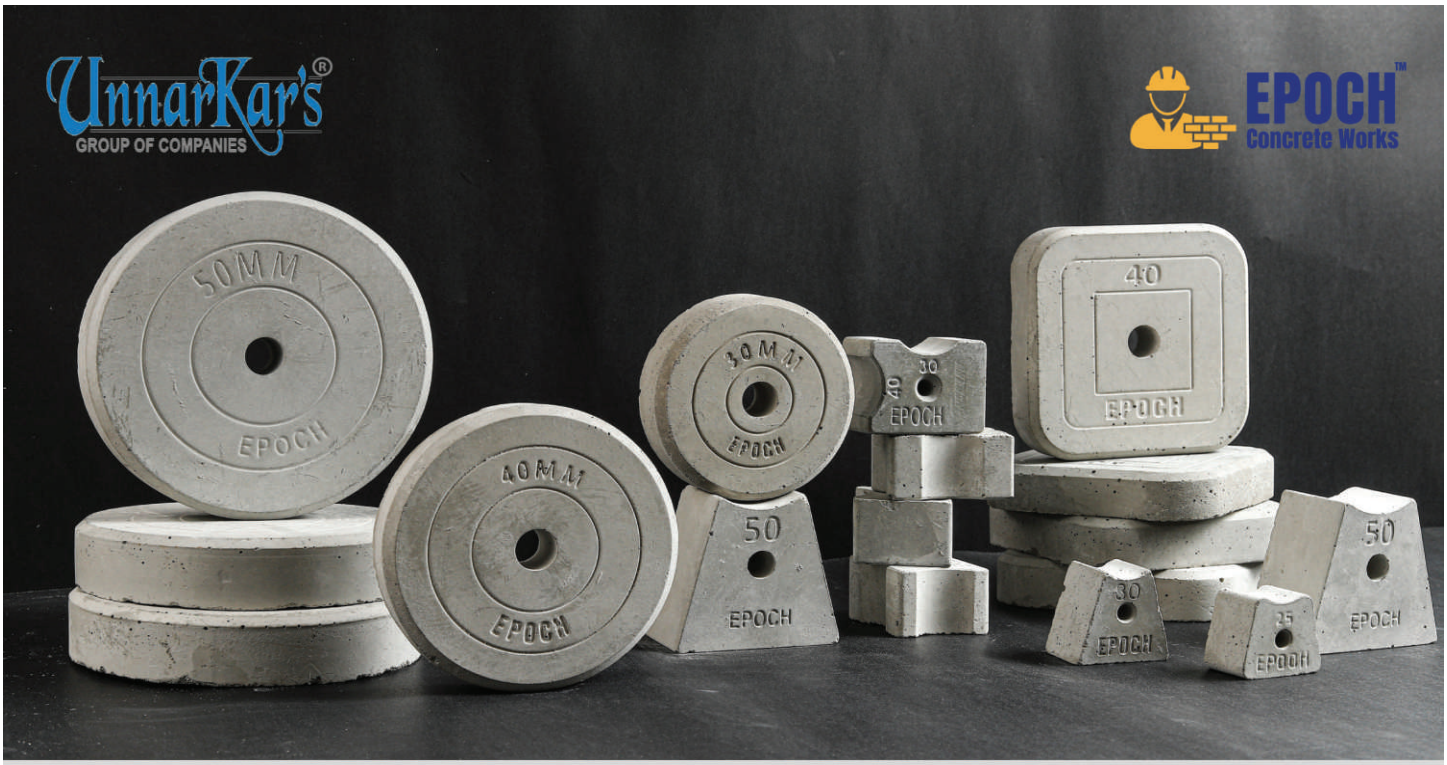

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Chloride Content	Less Than 0.5 kg/Cum	IS-456:2000 (RA:2016)
Water Permeability Test	Less than 6mm	DIN 1048 Part 5:1991
pH Value	More than 12.6	IS 2720 Part-26:1987 RA 2016

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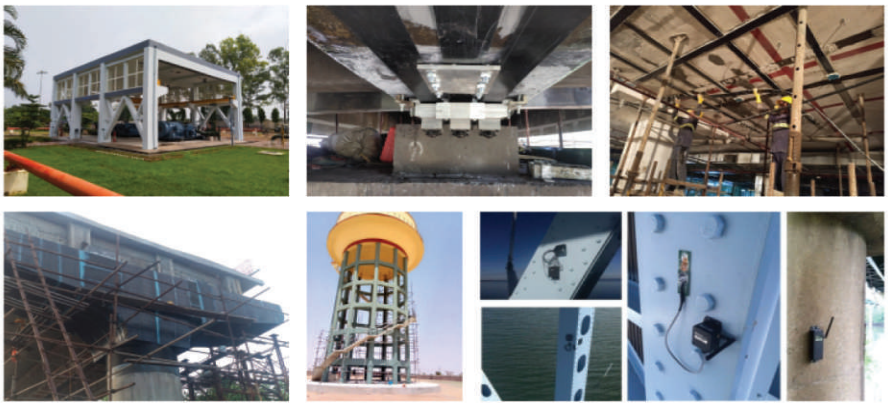

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