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CONSTRUCTION PHILOSOPHY

Vol. No. 01 Issue No. 07 | Kochi | December 2019

Pathways to progress

In the last ten years, construction industry had experienced tremendous growth in technology. construction methodology has improved dramatically during these years. The old way of designing and execution has changed with the invention of modern tools and artificial intelligence had given a big push to the growth of the industry. Every details are now at the tips of the finger. Earlier ways of execution and designing had many challenges including possibilities of fatal mistakes that can always be cumulative and sometimes applying changes could impair the structure in many ways. With the discovery of Augmented reality and virtual reality gears, an instantaneous information of the structure can be now made available at the site with precision that an engineer can apply it with real-time application. Superimposing of the structural design at an original scale on the actual structure is a revolution which lets the engineer figure out any errors likely while execution. All these discoveries when integrated to a project could largely improve the quality of the structure and reduce the duration of the project. Efficiency of projects has highest importance as it lessens destructions. We have seen many structural failure due to indecorous building practices. Construction if digitalized can bring in big changes that could enormously reduce such errors. This issue of "Construction Philosophy" discusses various technological developments in the industry with respect to digitalisation and the need of it to be incorporated.

Together let us raise our voice for quality.

Nebu Abraham
Editor

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Join our author family : Send your articles to Editor@constructionphilosophy.com to get it published in our upcoming volumes

Don't take soil for granted

Trying to save money in geotechnical investigations is a classic case of being 'penny wise and pound foolish'. Inadequate and improper investigations result in a very conservative value of allowable bearing capacity being recommended and adopted, says Madhav R. Madhira.

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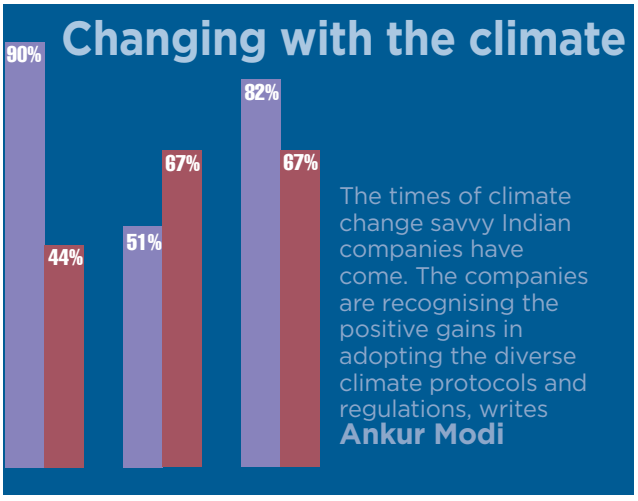
December 2019

COVER STORY

Techno Storm Sweeps Construction Industry

Slowly yet surely, the construction industry of India is evolving under the influence of digital technology. The industry players have begun to embrace new technologies in a big way with a focus on cost and time saving, sustainability and newer aesthetics, writes **Cinu P Thomas.**



The times of climate change savvy Indian companies have come. The companies are recognising the positive gains in adopting the diverse climate protocols and regulations, writes **Ankur Modi**

Penn State's 3D reality mesh

Bentley's reality capture technology, ContextCapture- photogrammetry software, helped Penn State University, US, in simplifying the process of generating high quality, geospatially accurate 3D reality mesh from digital aerial images. says Chintana Herrin.

Digital transformation

The myriad ways in which technology has influenced the geotechnical sector, says **Ashish D. Gharpure**

Needed: Lessons in life skills

These days, students focus only on their curriculum which is quite evident during interviews, writes **Mirzam Malik**

Digital transformation, the Gleeds example

Adoption of new technology is not an option now. It has now become inevitable to sustain the construction industry, writes **Jagjit Avdeel**, Head, Gleeds Digital Service, UK.

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Best Paper Award for ASCE Journal Bagged by Indian Professors

Dr. Anusha S.P, Assistant Professor in Civil Engineering, College of Engineering Trivandrum, Dr. V. Lelitha Devi, Dr. C.S Shankar Ram, Professors of IIT Madras and Prof. Laurence Rilett , Director of Nebraska Transportation Centre, University of Nebraska-Lincoln bags the Arthur M Wellington Prize, the Best Paper Award across all ASCE journals for their paper "Cycle-by-Cycle Analysis of Signalized Intersections for Varying Traffic Conditions with Erroneous Detector Data" for Journal of Transportation Engineering, Part A: Systems. The award was received from the American Society for Civil Engineers during the ASCE convention held in Miami, Florida on October 12, 2019. An article on this award winning paper will be published in the upcoming issue of Construction Philosophy.

100 airports in India by 2024

In an attempt to boost the economic growth, India is considering to set up 100 airports by 2024 with an aim to connect smaller towns and rural areas by adding 1000 new routes. An amount of Rs.1 trillion has been dedicated towards the development of this sector. The proposal was mentioned during a meeting that mapped out all industrial needs of the country by 2025. It also aims to increase the number of locally trained pilots to around 600 a year and domestic aircraft fleet to 1200.

Cochin Shipyard to build indigenous aircraft carriers

Cochin Shipyard signs a contract of Rs.3000 Crore and above for constructing indigenous aircraft carrier. The contract covers the operational and harbour acceptance trails of equipments and systems onboard. The contract was signed between Nidhi Chhibber, Joint Secretary & Acquisition Manager, MoD and Suresh Babu N V, Director (Operations) CSL at the Ministry of Defence.

NHAI floats tender for four laning of Gandhidham – Mundra Port section

The section is a part of NH-8A in Gujarat. The estimated cost for the project is Rs.134.95 crore. The expected duration for completion of work is 18 months.

Projects worth Rs. 800 crores launched in Madhya Pradesh

The 'Magnificent Madhya Pradesh' Investors Summit held in Indore saw Kamal Nath, Chief Minister of Madhya Pradesh, launching five new projects worth Rs.800 crore. Out of the 800 crore, Rs. 375 cr was dedicated to the smart industrial park in Pithampur, Rs.116 cr for an IT park at Indore, Rs.225 cr for a water supply scheme for industrial units of Pithampur, Rs.50 cr for Indore Municipal Corporation and Rs.60 Cr for an inter –state bus terminus (ISBT) .

Green signal from the Centre for new dam at Uttarakhand

The centre gives green signal for the Jamrani dam project in Uttarakhand.

The project was proposed in 1970s. The aim of the project is to provide drinking water and not to generate electricity. The dam will be built on Gola River in Nainital. The project will help in irrigating 5000 hectares of land in Terai-Bhabar region of Uttarakhand. It will also generate 14 MW of power.

Toll revenue to swell in the next five years

Indian toll revenue is expected to swell to Rs.1 lakh crore annually in the next five years, says Union Minister Nitin Gadkari. He added that the length of highways under the toll ambit will swell to 27,000 km by the year-end from the current length of 24,996 km.

From December 1,2019, toll payments will be only via FASTag under the National Electronic Toll Collection (NETC) programme, an initiative of the ministry to remove bottlenecks and to ensure smooth movement of traffic. This cashless system will save time and also result in huge savings to the GDP by reducing delays at toll plazas and cutting down on vehicle fuel.

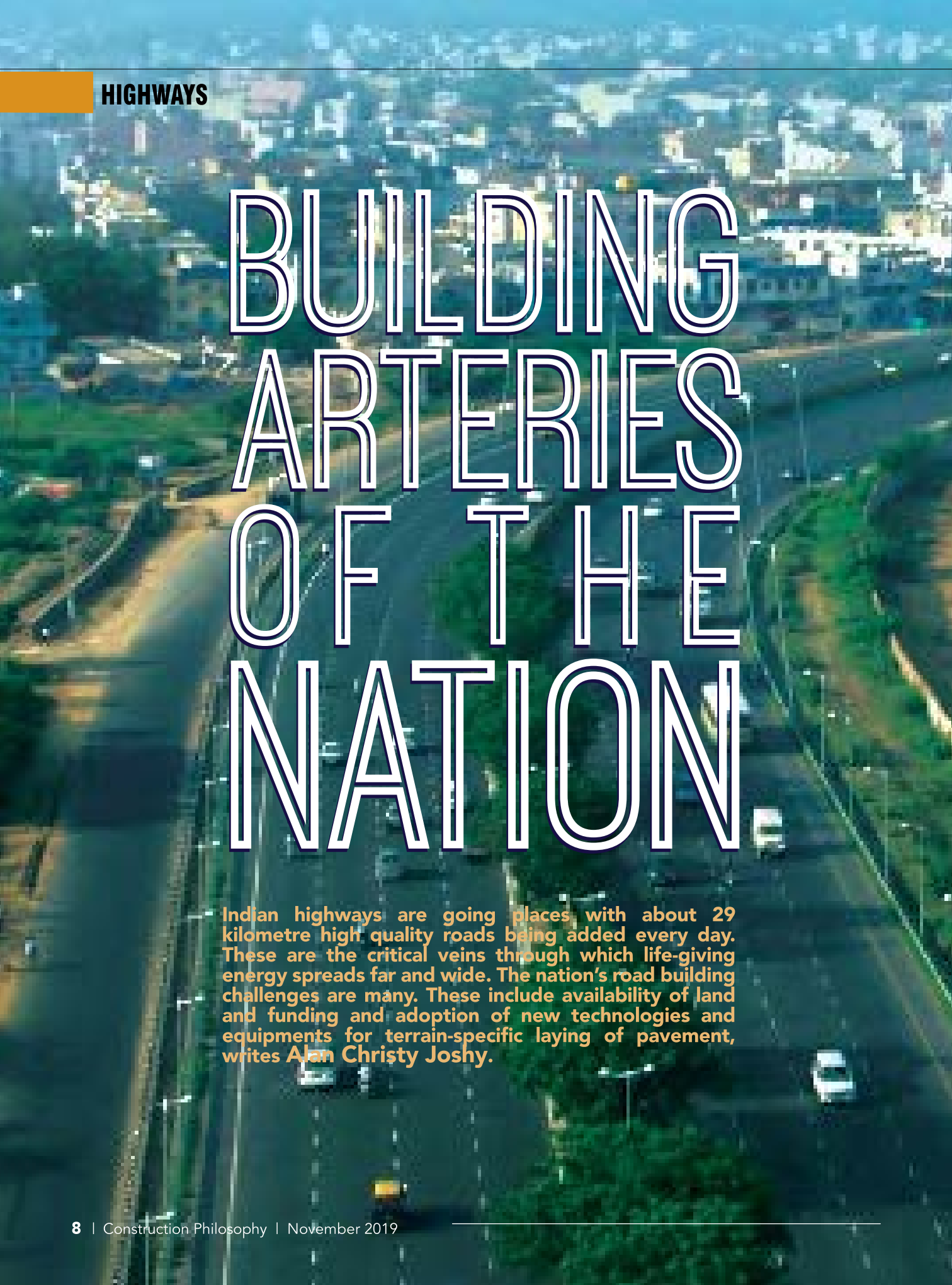
Andhra Government launches water grid project

The AP government launched a water grid project with an aim to provide drinking water connection to every household in the state by 2022. The project will help in supplying clean drinking water to every household for at least the next 30 years. The project is a result of severe shortage of drinking water in some districts, like Kadapa and Nellore, during summer. The estimated cost of project is Rs.46,675 crore.

No more rural homes without electricity!

Tata Power and The Rockefeller Foundation set to solve one of the major challenges in India – the lack of access to affordable, reliable electricity for rural homes and enterprises. The team announced the launch of a major initiative to set up micro grids in collaboration with Smart Power India and the Institute for Transformative Technologies.

These micro grids will provide clean power to about 5 million households thereby, amplifying the Government's campaign to provide electricity to rural areas. The model will be a competition to the current non-grid sources of power, like diesel. It will also be a clean source of power thereby lowering the carbon emissions by 1 million ton per year as well as reducing the amount of diesel burned by 57 million litres yearly.



BUILDING ARTERIES OF THE NATION

Indian highways are going places with about 29 kilometre high quality roads being added every day. These are the critical veins through which life-giving energy spreads far and wide. The nation's road building challenges are many. These include availability of land and funding and adoption of new technologies and equipments for terrain-specific laying of pavement, writes Alan Christy Joshy.

India is currently witnessing a major transformation in its road infrastructure, particularly highways. The length of roads being built each year now is almost equivalent to that built during each Five Year Plan period. Bulk of the public sector infrastructure investment now go to the highway sector and the nation has been gaining immensely from the sharp spurt in economic activity resulting from smoother movement of cargo and people over long distances within the country.

The road network in India increased from 3.99 lakh km in 1951 to 56.03 Lakh km in 2016. Highways having a total length of 9,829 km were added during fiscal 2018, which meant construction of 26.93 km each day. The National Highway Development Program (NHDP) was launched in 1998 to upgrade the National Highways. The NHDP was founding block for construction of the 5,846-km Golden Quadrilateral and the North-South and East-West Corridors.

While the Golden Quadrilateral seeks to connect major industrial, agricultural and cultural centres such as Delhi, Mumbai, Chennai and Kolkata. The North-South and East-West Corridors, which constitutes the second phase of NHDP, is the largest ongoing highway project in India, involving construction 7,142 km of four/six lane expressways linking Srinagar and Kanyakumari and Silchar and Porbandar at a cost of US$12.317 billion (at 1999 prices).

In transportation, a corridor generally refers to a linear area that is defined by one or more modes of transportation such as highways, railroads or public transit which share a common course.

Bharatmala Pariyojna

Launched in 2017, the Bharatmala Pariyojana targets completion of 24,800 km of road by March 2022 at an estimated outlay of 5,35,000 crore. The project has the following components:

Economic Corridor: The origin-destination study conducted in preparation for the project had identified 44 economic corridors having a total length of 9,000 km for improving logistics efficiency. Some of these are Mumbai-Agra, Mumbai-Kolkata, Chennai-Madurai, Bilaspur-Delhi, Pune-Vijaywada, Indore-Jaipur and Amritsar-Jamnagar.

Feeder Routes: This 6,000-km long road is expected to carry 20% of all the freight originating

in different parts of the country. The effectiveness of the NS and EW corridors is sought to be improved by developing the feeder routes.

National Corridor Efficiency Improvement: As much as 5,000 km of roads constructed under the scheme will fall into the category of national corridor. Golden quadrilateral and North-South and East-West are to be considered national corridors. The average traffic in the six national corridors is more than 30,000 passenger Car unit (PCU). Under Bharatmala programme all these stretches will be widened to 6-8 lanes.

Border Roads and International Connectivity: Connecting the cities and remote areas, which are situated in the border regions, the project has provision for constructing 2,000 km roads that fall in the Border Road or International Connectivity category to facilitate trade with Nepal, Bhutan, Bangladesh and Myanmar.

Port Connectivity and Coastal Road: To connect the areas that are dotted along the shorelines and important ports, the Central government has ordered the construction of 2,100 km of roads to boost the tourist and industrial development of the coastal region. This will also improve connectivity to ports to facilitate better export-import trade.

Green Field Expressways: Out of the total length of the national and economic corridors, which account for more than 50,000 PCUs and multiple choke points, stretches having a total length of 1,900 km have been identified for development as Greenfield Expressways.

Balance NHDP Works: The government had plans to end the NHDP programme in early 2018 and construct and maintain new roads of 10,000 km under Bharatmala Pariyojana.

Setu Bharatam project

Setu Bharatam, launched by Prime Minister Narendra Modi in March 2016, aims to construct 208 Railway Over Bridges (ROBs) and Railway Under Bridges (RUBs) at an estimated outlay of ₹102 billion (US$1.5 billion) to prevent the frequent accidents and loss of lives at level crossings. The project also envisages upgrade of 1,500 dilapidated bridges through replacement, widening or strengthening in a phased manner at a cost of about ₹30,000 crore.

Char Dham Expressway

The objective of the 900-km Char Dham Express way is to link holy places such as Rishkesh, Kedarnath, Badrinath, Gangotri and Yamunotri with two-lane roads. The road will have several long bridges and tunnels to eliminate accidents in landslide prone areas.

Rashtriya Rajmarg Zila Sanjoyokta Pariyojna

Under this project, roads will connect 100 district headquarters across the country, besides upgrading National Highways with no uniform configuration.

Innovations

Highway construction has gone hi-tech in the country with several innovations being made by engineers to ensure greater sturdiness and longevity for the roads.

Plastic Roads

Jambulingam Street, Chennai was one of

India's first plastic roads. As observed by India's Central Pollution Control Board "The plastic tar roads have not developed any potholes, rutting, raveling or edge flaw, even though these roads are more than four years of age". Today, there are more than 21,000 miles of plastic roads in India, and roughly half are in the southern state of Tamil Nadu. Most are rural roads, but a small number have also been built in cities such as Chennai and Mumbai.

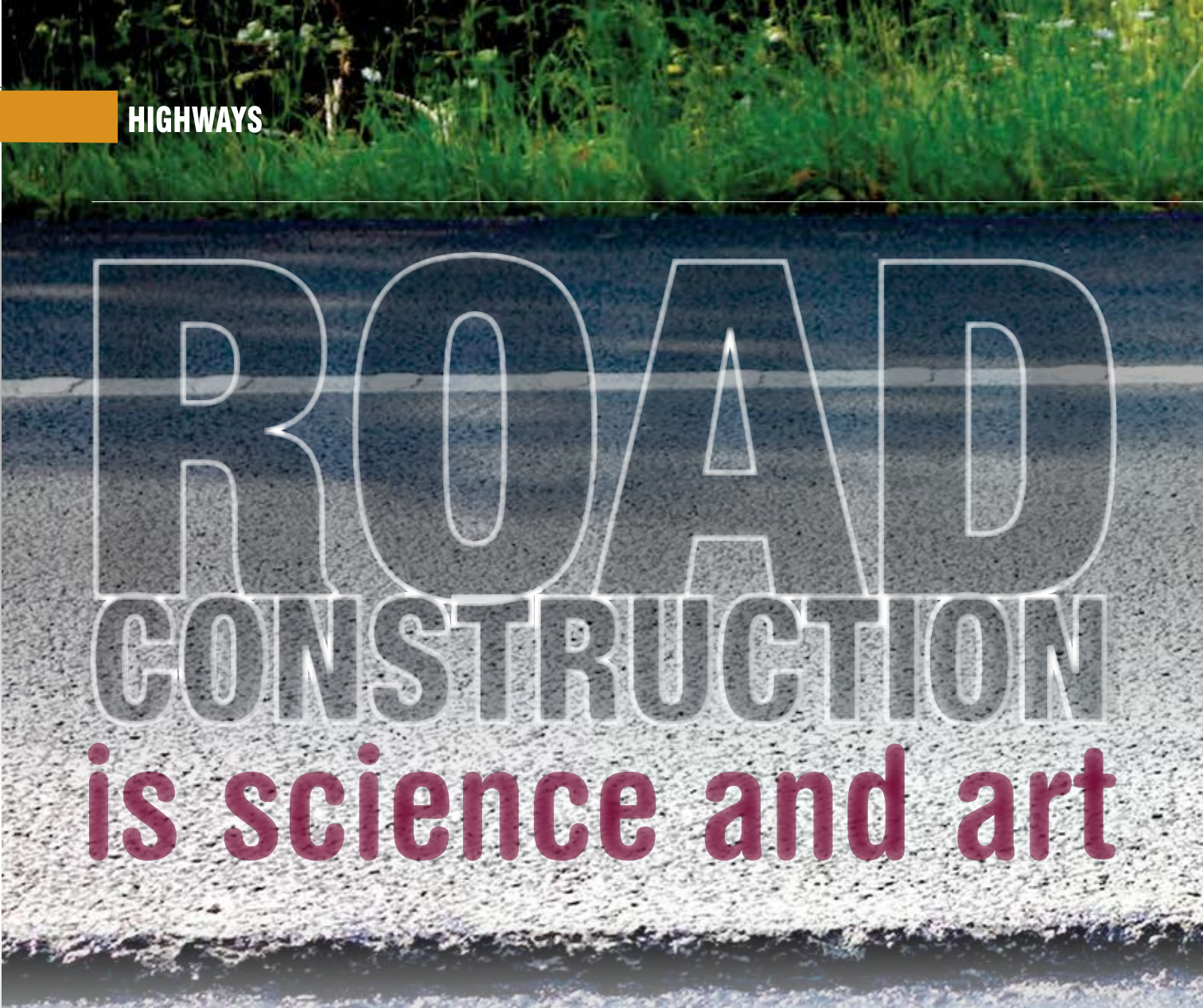
Stone Matrix Asphalt Technology

Since April 2009, Indian roads have been constructed using Stone Matrix Asphalt (SMA) technology, promoted by its implementing consultant Genesis Infra Project Consultants (GIPC). The first project was Palanpur-Deesa on NH-14 in Gujarat. The technology originated in Europe nearly five decades ago. It is used in Europe, China, Brazil and Sri Lanka now. In 2017, for the first time, a road in Maharashtra was built using pinewood pulp to prevent the pothole menace.

The road on the World Bank-funded Palghar-Mahim highway, built by the Public Works Department (PWD) of Maharashtra in Palghar Mahin district, is composed entirely of pinewood pulp cellulose mixed with bitumen and stones.

Micro-surfacing

Micro-surfacing is the application of thin layer (6-9 mm) of cold mixes which, when applied with the help of a specially designed machine, prevents problems such as ageing and oxidation of the surface, surface water infiltration, pavement degradation etc. The cold mix consists of ingredients such as Polymer modified bitumen emulsion, graded aggregate, mineral filler, water and additives.



ROAD CONSTRUCTION is science and art

India has taken giant strides in all aspects of scientific development, but when it comes to construction of quality roads and pavement, the country has left much to be desired. As colonial era roads remain in the pink of health, roads and pavement constructed purportedly using the latest technology crumble within one or two years of their construction. The problems are many, but new technological advances and top-of-the-line equipment could well be changing all that.

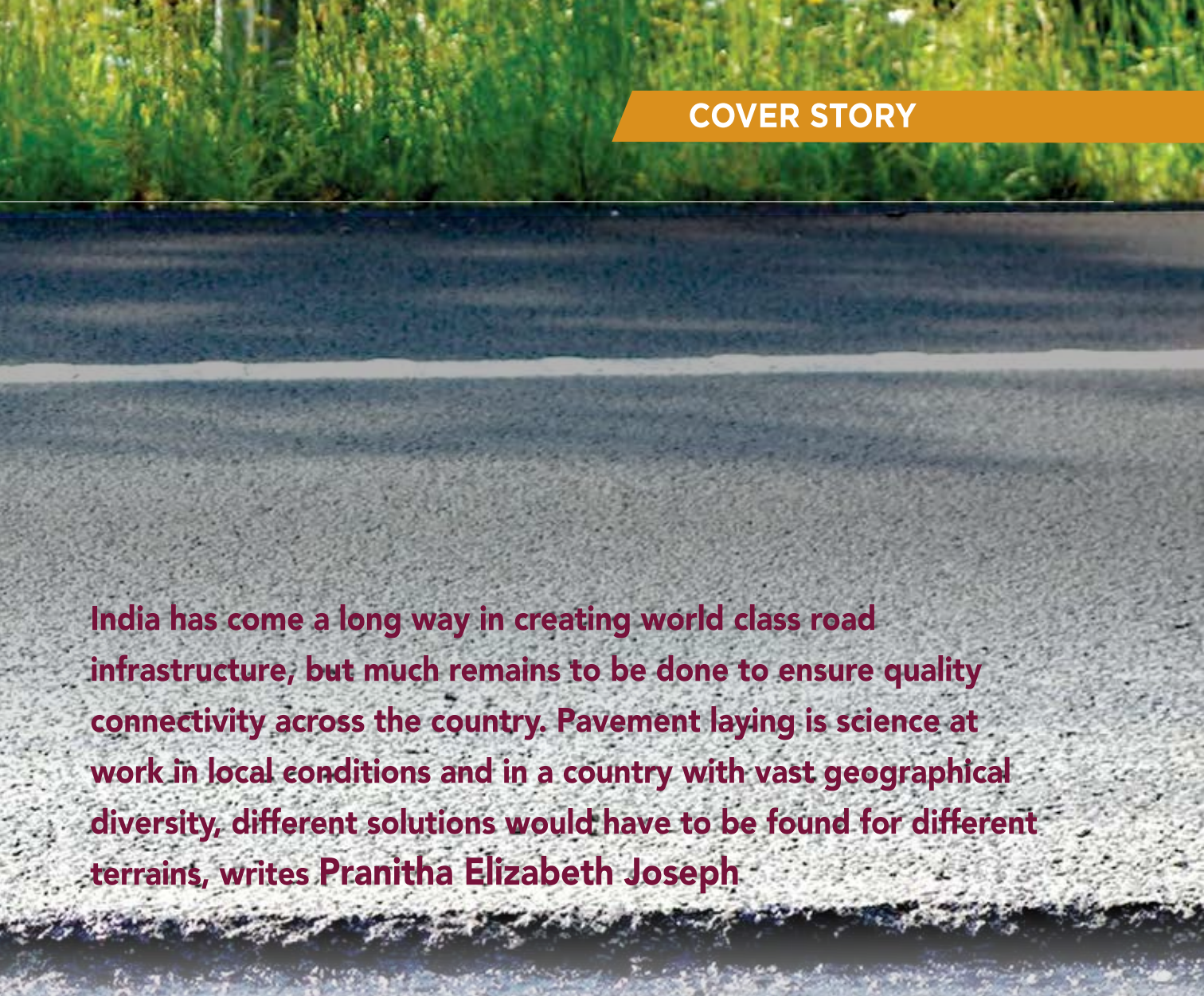
Design challenges

Designing pavement and its construction are very complex processes covering construction of a sub-base, sub-grade, base course, binder course and varying courses. The design of pavement in any particular area depends on the local conditions, type of soil, density of traffic and the type of axle loads.

Low CBR (California Bearing Ratio) values, heavy traffic and high loads would make it necessary to use very thick bituminous layer which can be laid only by using huge quantity of aggregates. In order to avoid this, the latest IRC 37, 2018 'Design of Flexural Pavement' suggests a cement-treated base and a sub-base layer which would help increase the base strength. This will help in reducing the thickness of the pavement as the strength of base and the sub-base would get enhanced considerably. This also helps in conservation of materials.

National Highways

Construction of National Highways is a challenge in itself. There are a few basic factors to be considered when constructing National Highways.



India has come a long way in creating world class road infrastructure, but much remains to be done to ensure quality connectivity across the country. Pavement laying is science at work in local conditions and in a country with vast geographical diversity, different solutions would have to be found for different terrains, writes Pranitha Elizabeth Joseph

The first of these is avoidance of cemented bituminous concrete. Instead, bituminous concrete should be used. In such contexts, use of Bituminous Macadam as a binder layer is ruled out.

The option in such instances should be a Dense Bituminous Macadam, which would be a composite of DBM (Dense Bituminous Macadam) + BC (Bituminous Concrete). In water-bound Macadam, the Plasticity Index (PI) of the binding material should be less than 6. If the PI value is not less than 6, the thin bituminous layer will get ripped off.

Flexible pavements last more than rigid pavements. And once deterioration occurs, it is easier to rectify flexible pavements than is the case with rigid pavements. In such cases, the only solution is to remove the entire slab and recast another slab, and it has to be cured for 20 days.

Highway Capacity Manual

Development of a Highway Capacity Manual and the inventory of the entire National Highway Network is one of the major contributions to the nation in the highway engineering sector from the Central Road Research Institute (CRRI), New Delhi, with such support of various institutions.

Among the institutions that came up with technical support were Indian Institute of Technology (IIT), Roorkee, Indian Institute of Technology (IIT), Mumbai, Indian Institute of Technology (IIT), Guwahati, School of Planning and Architecture, New Delhi, Indian Institute of Engineering and Sciences University, Shibpur, Sardar Vallabhai Patel National Institute of Technology, Surat, and Anna University, Chennai.

The Highway Capacity Manual addresses unique characteristics of the Indian traffic sys-

tem, gives a clear idea about the composition of traffic in different regions, focuses on travel time reliability as a performance measure of urban and inter-urban corridors, lays down criteria for taking decisions on widening pavements. Once the decision to lay a construct a new highway or to widen or re-lay an existing pavement is taken, the engineers can turn to the many new technologies and composites available to do the job.

Polymer Modified Bitumen (PMB)

One of the proven and robust technologies for laying pavement is 'Polymer Modified Bitumen', which has enhanced the life expectancy of flexible pavement. PMB is normal bitumen with added polymer such as Styrene Butadine Styrene (SBS) making it more elastomeric. The primary objective of SBS polymer modified bitumen is to provide extra life to pavement, roads and construction designs. Some of the qualities exhibited by PMB are

- Higher rigidity
- Increased resistance to deformations
- Increased resistance to cracks and stripping
- Better water resistance properties
- High durability
- High cohesiveness
- Resistance to fatigue, stripping and deformation

PMB is used for:

- The development of very stressed pavement
- Heavy-duty traffic
- High loading
- High temperature amplitude
- Home roofing solutions
- More durable pavement
- Draining pavements

Microsurfacing

Another technology that has come into play these days is 'Micro-surfacing', which is a cosmetic treatment, because the top layer or renewal layer does not provide the pavement any additional strength. However, it will improve the roughness, prevent ageing and oxidation of surfaces and infiltration of surface water. Micro-surfacing is suited for both flexible and rigid surfaces.

This technology is suitable only for a pavement which is structurally adequate with minor hairline cracks. Micro-surfacing can be opted in cases where the pavement looks old, less rough, etc.

Microsurfacing of the roads can be carried out by applying thin layer of cold mixes of 6-9 mm .The cold mixes consist of polymer modified emulsion, graded aggregate, mineral filler, additive and water.

Stone Matrix Asphalt

Stone Matrix Asphalt, with its first project in Palanpur-Deesa on NH-14 in Gujarat, has set a new trend in the field of highway engineering. Stone matrix asphalt is nothing but gap graded hot mix asphalt with a structural configuration of stone on stone contact .This technology is highly resistant to rutting as it gives more importance to aggregate properties rather than asphalt binding properties.

The supporting material used is bitumen-coated cellulose fibre. The only difference from bituminous concrete mix is the higher percentage of bitumen and dosing of fibres. Roads with intersections and roundabouts in Delhi have been re-laid using this technology, which

Central Road Research Institute Head Quarters at New Delhi

produces a very strong material.

Cold Mix Technology

The Supreme Court of India has now banned the use of Hot Mix Plants in the National Capital Region (NCR) because of the environmental problems they create. Hence, we are required to prepare the mix outside the NCR and transfer it to the work site. But the mix becomes cold by the time it is reaches the work site. To prevent this, Cold Mix Technology put to use. It is a composite of emulsion, warm mix asphalt and half warm mix. It is done by mixing some additives along with the bitumen, giving it partial viscosity. It will then be laid and compacted.

Potholes

Potholes are formed due to various reasons. One of the primary reasons is that by the time hot bituminous mix reaches the site from a distance, it turns cold, making it impossible to achieve rolling temperature. When the mix does not have the required rolling and laying temperature, the engineers would have to allow it to compact at whatever temperature it arrives. It, therefore, fails to obtain the optimum density required for the pavement to set. When pressure of traffic acts on the pavement, the aggregate starts to come off after 2 to 3 days due to the improper density and compaction.

Another possible reason is that in certain cases, the aggregates do not get mixed suitably well with the available bitumen. Here, when the bitumen and aggregate are mixed and laid, there will be a stripping action whenever water comes into contact with the aggregates during the rainy season. IRC Code and Ministry Codes suggest conducting stripping tests.

Whenever the stripping action is more than 5%, anti-stripping agents will have to be applied before mixing. A through laboratory study would be needed to see what quantity of anti-stripping agent is required. The mix should be prepared based on the inferences of the study. If this is not done, there is the chance of potholes developing.

In short, potholes develop because of the lack of proper compaction, as the temperature while laying is not adequate or quality control during various stages of work is inadequate. In addition, there is the problem of zstripping of the aggregates and the bitumen, which occurs

when adequate quantity of anti-stripping agent is not added.

The country needs to undertake a very big study about the requirement of pavement so as to develop models for different types of pavement needed for different parts of the country. Laying a pavement requires time and, once constructed, pavement behaviour depends on specificities of the locations, tropical conditions and different axle load conditions.

Impact of rains

Rains cause havoc with the road surfaces when they do not have proper drainage layer or granular sub-base with proper permeability. Materials will have proper permeability only when there are proper voids. Proper voids can be ensured only using materials with proper gradation and specification. Kerala is perhaps a case study of a State which does not give adequate weightage to gradation. Instead, what gets priority in the State is the CBR value.

In Kerala, a CBR value of 20 or 30 is considered a marker of quality. But gradation need not justify that conclusion. The situation is aggravated by the use of finer materials which would will fill the voids, reducing permeability. In the absence of proper permeability, water will not seep off, but form a water top, affecting the pavement. Improper Camber also can contribute to deterioration of roads. Water is a prime factor that every civil engineer must take into account as water is needed for mixing, curing, casting, etc.

When it comes to a flexible pavement, there are three enemies-- water, water and water. Whenever water comes into contact with the pavement, it triggers deterioration due to improper drainage system. As experience has shown, in this country, de-silting of drainages takes place only on paper. Cleaning and desilting of drainages before the onset of monsoons can bring in a dramatic change. This should be followed up with tests to see the level of stripping of aggregates and compatibility of aggregates.

Road construction and pavement laying call for dedication of a dynamic kind, bringing to play both the science and art of construction engineering. Roads give the citizens of any nation, their first-hand experience about the state of their nation. Engineers owe it to society and the nation to make the citizens feel proud about the roads they take, whether on foot, on a two-wheeler, super luxury car or a public transport bus.

Dr. B.G. Sreedevi

Road connectivity challenges in Kerala

THE BIG PICTURE

Kerala has achieved impressive road connectivity for any Indian State, but the State has a long way to go to accommodate the rising number of vehicles, improve riding quality and avoid accidents.

Nations and people the world over are on the move and, therefore, a sustainable transport system is a sine qua non for the development of any nation. India being a nation with vast diversity in its geography and physical attributes, the country has to plan for each State, factoring in the lay of the land and the transportation challenges. Kerala, with its undulating terrain and presence of water bodies of diverse sizes and shapes, is case study in transportation planning.

Going by the data available with the State Planning Board, the total length of roads in Kerala aggregates to 2.19-lakh kilometres, of which the share of National Highways (NH) is 1,588-km (0.82%) and State Highways (SH) 4,342-km. There are also around 26,237 kilometres of major district roads (MDR) in addition to panchayat roads, and more than 90% of the roads in the State are maintained by the local bodies. The state has a 1,588-km-long rail network, but it is highly inadequate to meet Kerala's passenger demand and the State's demographic distribution has meant overwhelming dependence on road transport.

Growth potential

A number of factors influence the roads and road transport sector in the state. These include the growth of population, changes in land usage pattern, and growth in Net State Domestic Product. They, in turn, contribute to the increase in per capita trip rate, and vehicle population which cause traffic congestion, transit delays and environmental degradation. These, in turn, contribute to high and low intensity road accidents and the resultant impact on

the families and the surviving victims. The future transport scenario should envisage growth in the above parameters so as to assess the impact and plan accordingly.

Based on the existing growth rates of different parameters that impact the transport sector, and their consequences, the following growth scenario has been visualized for the State. The traffic growth rate in Kerala is expected to decrease over the years in view of the low population growth, wider use of IT applications, dispersion of traffic from high-level corridors to low-level corridors due to increased traffic congestion in the existing corridors and diversion of additional traffic generated in the State to asses /new /upgraded roads.

Growth scenario visualized for the State

With the population in the State remaining stagnant, people's social status going up, and the expanding road network, the trip length of residents, which is 8-km at present, is bound to increase to 10-km with the per capita rate of trips remaining almost the same at 1.07 for the entire State. The projected traffic by 2021 will optimistically be around 10-crore strong, distributed around 3.72-lakh kilometres of roads.

Road sector in Kerala

The total length of roads in Kerala in 2014-15 was around 2.19-lakh kilometres with the share of National Highways being 0.82% and the share of PWD roads being 14.54%.

All major highways and urban public transport corridors should have segregated bus bays. Dedicated lanes for bus transport should be given top most priority at least in the five corporation areas in the State. Road safety features such as well-designed junctions, grade-separated flyovers at important junctions, pedestrian facilities like flyovers/underpasses, adequate road signs and markings, etc., should form part of the road network.

Flyovers should be constructed on a priority basis at high-conflict intersections in urban areas and National Highways. Bypasses for major cities/towns should be completed at the earliest. The proposed Coastal Highway and the Hill Way covering the entire State are to be completed in quick time in order to augment the mass transport systems.

Core network of major roads

There is an urgent need to identify a core network of arterial routes with a corridor concept that would include State Highways, MDRs (Major District Roads) and LSG (Local Self Government) roads. This corridor has to be planned in such a way as to enable traffic to move at an average speed of 60-km per hour in order to facilitate commercial vehicles to cover a distance of 500-km to 600-km a day.

The core network of State roads should essentially comprise SHs and MDRs, which have

high volumes of traffic or have such potential. All SHs/MDRs having traffic beyond a certain threshold (say 5,000 PCU per day) should be included in the core network. Surfacing and two-laning of roads under the core network should be undertaken on a priority basis.

Improvement of riding quality

Maximum priority has to be given to improving the riding quality (IRQ) of the existing PWD road network and widening of PWD roads to two lanes. The target is to bring all PWD roads to two-lane IRC standards wherever there are single or intermediary-lane widths, and construction of missing links as two-lane roads. On account of the limitation of funds, other types of improvement may be taken up in a phased manner.

Road maintenance management

Norms for maintenance of National Highways (applicable to other roads also) were finalized by a Committee set up by the Central Government in 2000. The Committee has recommended the need for developing the best scientific road infrastructure management system, the major components of which in the initial stages may be a Pavement Management System (PMS) and a Bridge Management System (BMS). The State PWD has already initiated steps for establishing PMS on its routes.

Urban transport

According to the National Urban Transport Policy 2014, priority should be accorded to non-motorized modes of transportation like cycles and pedestrians, and public transport. Accordingly, it has been proposed that at least 10% of the roads in urban areas should have cycle tracks and 75% of the urban roads should have footpath of reasonable width on both sides.

Auxiliary road infrastructure

Facilities for pedestrians should be developed in all urban areas to minimize the severity of accidents involving pedestrians who are found to be the major casualties at all conflicting points. The features provided must include pelican crossing, road signs and markings and amenities like subways and foot over bridges.

Serviceability

The serviceability indicators for the city should

be fixed and action should be taken to achieve this. The various parameters of serviceability indicators can be speed, walkability, accidents, congestion, air quality NMT, etc.

This can be achieved by:

i. Taking advance action to widen the existing arterial and sub-arterial roads to 4/6 lanes with provision for pedestrian walking and crossing facilities, cycle tracks and off-street parking.
ii. Redesigning the existing road intersections to enable them to cater to the projected demand.
iii. Constructing grade-separated flyovers/ underpasses at all major road intersections that carry more than 8,000 vehicles per hour..
iv. Constructing a network of ring and radial roads, bypasses, link roads, flyovers, multi-level off-street parking facilities, pedestrian crossing facilities, etc. in cities and towns to relieve traffic congestions around CBD areas.
v. Encouraging greater use of public trans port and non-motorized modes by offering financial assistance for this purpose.
vi. Creating dedicated bus lanes on the existing main roads.
vii. Enabling the establishment of multi-modal public transport systems that focus on quality and are well integrated, provide seamless travel across all modes, establishing effective regulatory and enforcement mechanisms that allow a level playing field for all operators of transport services, and enhanced safety to those who use the transport system.
viii. Establishing institutional mechanisms for enhanced coordination in the planning and management of transport systems.
ix. Enhancing the Intelligent Transport System (ITS) for traffic management.
x. Promoting the use of cleaner technologies which should help in reducing pollution levels.
xi. Encouraging the PPP(Public Private Partner ship)method for developing the urban trans port infrastructure through innovative mechanisms that tap land as a resource for investment.
xii. Enabling the availability of adequately-trained manpower and institutions to manage and operate different transport operations, and to control traffic congestion and also to plan for sustainable urban transport. This in effect is an exhaustive plan for developing a sustainable and efficient transportation infrastructure in Kerala. What is needed is the will and the capacity to implement it as desired.

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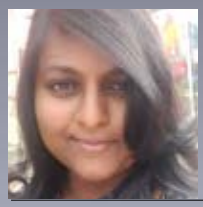


Anusha C.S.

Safe System Approach:

Is India game for it?

With economic liberalization opening up the Indian automobile sector, the country saw its roads being clogged with automobiles of different makes. However, the people in charge of our roads never woke up to the challenge in time, which in effect saw Indian roads registering record numbers of accidents and people from all walks of life dying or getting maimed. Our roads have become the major killer in the country with one death occurring every four minutes. In 2018 alone, 1,49,000 people died in road accidents, that is more people than those that died in all our wars put together. And the number of people who were maimed and became invalid in these accidents is anybody's guess!

In the last one decade, deaths on Indian roads have been wiping out a population equivalent to that of the number of inhabitants in small cities such as Gangtok (1,00,286), Port Blair (1,00,608) and Darjeeling (1,20,414) per year. India loses 3% of its GDP, which is over $58,000 million in terms of value, every year due to road accidents, says a study conducted by the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP).

How do accidents impact families? The death or disability caused by a road accident and the subsequent trauma and loss of income can be devastating for a household, especially when considering the fact that many countries like India do not have enough safety nets for victims. Here the major challenges are issues like the impact of road crashes not being properly analysed, as well as dearth of proper data or evidence.

Here it would be worth highlighting the results of a survey on the situation in South Korea conducted by Korea Transport Institute

(KOTI) in 2013. The results clearly show the impact of road crashes on household income, unemployment, home ownership, divorce rate and income gaps for the surviving victims. The chart below shows how the average income of surviving victims considerably diminishes. According to the study, 70.7% of the disabled victims and 27.6% of the non-disabled victims lost their jobs after the incident.

From the given figures it can be concluded that we have a major problem that needs immediate solution. Road safety has traditionally been promoting adherence to traffic rules through education, training, regulation and enforcement. Although such initiatives are appreciable, they leave out a whole set of design, infrastructure and systemic issues that affect people's ability to care for themselves while on roads. Realising that the effects of education and enforcement diminish over time, many high-income countries have adopted a broader and systemic approach (ITF 2008). This approach, the **Safe System**, has been embraced by many western countries as their road safety strategy. This approach has been more effective in reducing traffic deaths and injuries compared to the traditional approaches (Johansson 2009, Mooren et al. 2011, Weijermars and Wegman 2011, Munnich et al. 2012).

What is 'Safe System' approach?

It is a holistic view that advocates interaction among roads and roadsides, travel speeds, vehicles and road users. It caters to all those who are using the road system, including commercial and heavy vehicle drivers, motorcyclists, passengers, pedestrians and cyclists. It is also known as Vision Zero, which targets achieving zero deaths. It's guided by core elements and principles that include planning, implementation, evaluation and monitoring.

It was pioneered in the 1990s through programs such as Vision Zero in Sweden and Sustainable Safety in the Netherlands. Australia and New Zealand, as well as the states of Minnesota and Washington and cities such as New York and San Francisco in the United States adopted similar policies in the following decades (SWOV 2013, ITF 2016). More recently, cities in middle-income countries, including Bogota and Mexico City, have begun to redirect their road safety strategies toward a system-based approach (CDMX 2017).

Although the Safe System strategies have been applied mostly in high-income countries, they can be applied here as well. However, there is a notion that they are not cost-effective and are not suitable for countries like India. But that's far from the truth. We do not need exuberant sums to build safe roads, definitely not 3% of our GDP. All a country needs are political will and designs that prioritize safety.

Does this mean India is doing nothing to make its roads safer? There have definitely

Diminishing Average Income of Surviving Victims

been noteworthy policy interventions like the new Motor Vehicles Act 2019 which has made it compulsory for vehicles to have safety features like airbag, ABS, etc., compulsory 3rd party insurance to provide safety net to the victims, as well as a revised fines structure for the better enforcement of traffic rules, all which are trying to push India towards the 'Safe System' approach.

In addition to this, the country has been conducting 'road safety weeks' to create awareness amongst its people, and traffic regulations have been made part of the academic syllabus in schools. We however, have a long way to go. There still isn't a mechanism in place to build a safer road infrastructure!

Forgiving highways

One of the first principles of the Safe System approach is that people make mistakes. Our transport system should be such that it accommodates these mistakes. This gives rise to the concept of 'forgiving highways'. Forgiving highways are designed to accommodate drivers' mistakes. They are self-explanatory, encourage safe travel speeds and help drivers avoid errors.

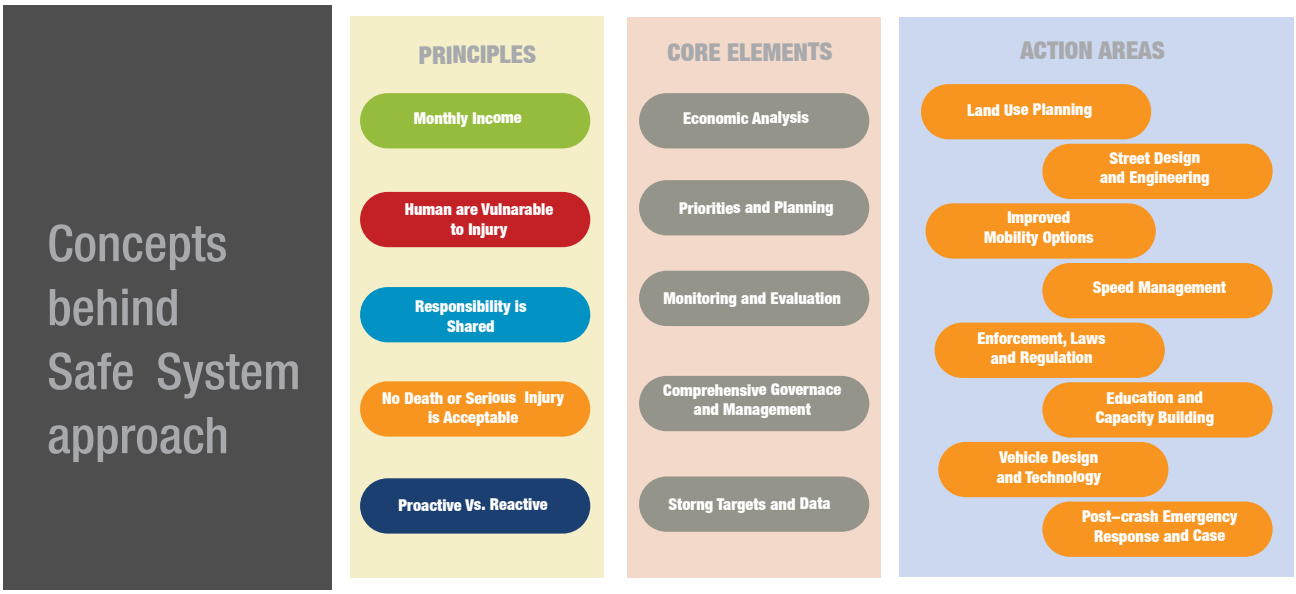
IRC (Indian Road Congress) Codes emphasis a road design and corridor planning exercise that take into account the needs of pedestrians, cyclists, animal drawn carts, motorcycles, cars, trucks and buses, and ensure that the appropriate function, speed, road space allocation and design features are incorporated to deliver the best safety outcomes. IRC Codes also have incorporated roadside safety features like depressed medians, paved shoulders, earthen shoulders, clear zones and crash barriers which make our highways forgiving.

Though our Codes incorporate all that are necessary, on-the-field implementation is abysmally poor. This is mainly because our system is still a function of mobility and accessibility. Our society, most of our engineers, and elected representatives perceive development in terms of how wide the carriageway is and how fast one can travel from A to B. That is why safety factors are always compromised.

Reasons like difficulties in land acquisition and budget constraints are quoted as excuses for not providing the minimal provisions on designs as per the Code that enhances safety. Hence, a policy level intervention is needed to bring safety parameters into the equation of our transport system; it should not be a variable in the equation, but should have threshold limits that cannot be exceeded.

Points to consider before designing a highway

Instead of first fixing the carriageway width in the existing budget and land, designers should start fixing safe median widths and clear zones requirements, and check the feasibility of capacity augmentation of a particular road. This



ITEM	2011	2041	
		CAR ORIENTED DEVELOPMENT	SUSTAINABLE TRANSPORT
Populations (Millions)	5.4	13.2	13.2
Trips (Millions per Day)	5.6	39.75	39.75
Area (Sq. KM)	1330	6484	3242
Emissions (Millions Tonnes CO_2/ YEAR)	0.33	12.32	197
AnnualTraffic Fatalities	175	5232	1225

could enable more sustainable development too. Our designs currently don't address the effect of kinetic energy of fast-moving vehicles. It is required to conduct research and develop ways to incorporate this kinetic energy into the design of our road geometrics, road side safety features, etc.

When it's impossible to increase the capacity of road within the safety parameter threshold, increase in demand can be addressed by providing efficient alternative public transport systems which is both safe and sustainable. A study conducted in Ahmadabad by Pai (2012) showed how sustainable traffic can reduce traffic fatalities.

Drivers to be educated

Educating/sensitizing road users to follow safer driving practices is another challenge. As there is no minimum education requirement to obtain a driver's license, most of our drivers, especially those driving commercial heavy vehicles, are uneducated and unaware of traffic rules, signs and markings. Even most of the educated drivers are unaware that there is a Motor Vehicle Driving Regulation 2017, section 118 of Motor Vehicle Act which lists dos and don'ts of driving a motor vehicle (At least I didn't know till recently. However, I do not have a driving license). Hence our licensing procedure should include these regulations as compulsory syllabus in its driving license test.

The accidents statistics in the country show that most of the accidents happen on non-urban highways. If we put all the other factors aside, it will be found that over-speeding is the common cause of accidents.

Along with many other reasons, lack of enforcement on these highways is one of the reasons for over-speeding. However, with the advent of the ITS technology, it will now be both feasible and economical to have a monitoring system to enforce safe driving behavior.

Rome was not built in a day. With right research backed by strong data, right policy interventions, responsible education and enforcement, and smart utilization of technologies, we can definitely achieve the targeted 'Vision Zero', which is also economically feasible.

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R.V.G. Menon

Go green for power

Kerala is blessed with nature's abundance. Water and sunlight are aplenty in the State. The State has hit a cul-de-sac in hydel power generation and must look at other options has pumping back water to generate electricity and try out floating solar panels in hydel reservoirs to augment the State's power generation capacity.

Everybody agrees that a crisis is imminent in the energy sector the world over, mainly because we depend very heavily on fossil fuels for energy which are running out. The pollution created by fossil fuels cause global warming and climate change, endangering the very survival of humanity and balance of the environment. It is high time we switched over to fuels or energy sources which do not increase the proportion of carbon dioxide in the atmosphere. An analysis of the increase in CO_2 has revealed that it had increased from 350 ppm(Parts per million) to 392 ppm by the middle of last century.

Kerala, a society that is bursting at its seams with modern lifestyle patterns, is as much a contributor to this process as any other part of the globe, particularly in the use of fossil fuels. It has been blessed with plenty of running water which has helped it to meet a part of its power requirement by harnessing hydel energy. But this has been at the expense of the environment and the effects are already showing in the form of loss of green cover, heavy soil erosion in the mountain ranges, landslips and landslides.

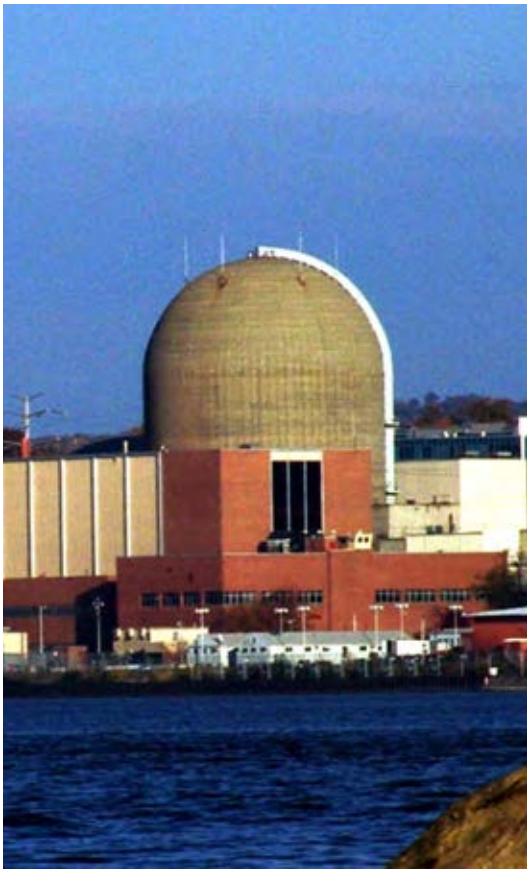
It is high time Kerala looked for renewable sources of energy to face the looming crisis in the power sector. Development of a place

keeping energy resources intact is next to impossible, but development at the cost of nature is disastrous too. This is where sustainability becomes important, and it all about meeting the requirements of the present generation without sacrificing the rights of the future generations.

Nuclear energy a viable option?

There is a public perception that nuclear reactors are the answer as they provide clean energy. The nuclear bomb accidents in Three Mile Island (USA), Chernobyl (Ukraine) and Fukushima (Japan) should be eye-openers for all those who subscribe to this view because no nation can withstand the disasters caused by nuclear reactors.

The use of Uranium 235 for power generation throw up Plutonium 239 as a byproduct, which can be separated easily through chemical means, to make bombs. Also, there is the question of disposal of the waste. Even 50 years after commissioning the first nuclear reactor, there is no satisfactory answer to this. So, it is prudent to rule out nuclear energy as the solution.



Renewable sources

The focus should now turn to renewable sources of energy like the sun, wind and water in various forms. Energy from the ocean is still expensive and it needs varied means of modern technology and economics to tap it. But energy from wind and sun are already in use and both are competing with

conventional sources of energy in cost of production. They will cost about Rs 3 to 3.5 a unit depending on the location.

Harnessing solar energy was expensive till about five years ago, but thanks to China, which found a very revolutionary and radical process, the price of high purity silicon has come down drastically leading to a sharp fall in the cost of solar cells. But, many aspects of their practical management still remain to be addressed. No we are burdened with a system of centralized power stations of 500-1000 MW or even higher. That is certainly not the best solution for the present and future challenges in the power sector.

Advantages of solar energy

Solar energy is available in a distributed manner and we can harness it in the same way. As far as Kerala is concerned, rooftop collection is a viable option. A middle-class house with a 1200 or 1500 square feet terrace can generate about 5 kW of electrical energy a day. That produces about 50 units of electricity a day, i.e.,1500 units a month, which is more than enough for any ordinary house. The rooftops of public buildings, schools, colleges, offices, factories, etc can also be used effectively.

Unlike states like Rajasthan and Gujarat, Kerala lacks large open spaces to implement solar farms of huge capacity. An available option for Kerala is to make use of waterways and reservoirs for laying floating solar panels. For example, the Idukki reservoir has about 60 square kilometres surface area. Even in summer, when the water level is down, the surface area would be about 1/2 or 1/3rd of this and floating solar panels mounted on pontoons can be used in the reservoir.

These panels can be anchored to the base level or they can be tied together as there is no water flow in the reservoir compared to the backwaters or rivers. Floating solar panels have been tried in Kerala on an experimental basis in Wayanad. The National Thermal Power Corporation (NTPC) has offered to generate 100 MW of electricity from floating solar power plants in Kayamkulam.

Since renewable energy is variable, there will not be any generation of electricity when there is no sun or wind. So, the electricity generated has to be stored. The conventional method is to store in batteries, which is expensive. Present day batteries are not very different from what Alessandro Volta made a hundred years ago. Large-scale storage in batteries may be feasible only if sufficient energy and investment goes into it.

Hydraulic energy

A feasible option for Kerala is to use

pumped-storage where energy is stored in the form of water in an upper reservoir after pumping it from a lower reservoir. As the state has many reservoirs and power stations, it is possible to generate electricity in a sustainable way through a combination of solar energy and wind energy and a series of pumped storage systems.

As far as the rest of India is concerned, pump storage may not be feasible everywhere, but it can be adopted for specific areas. Otherwise, battery storage is an option. Using extra electricity during day time is another method to produce hydrogen by electrolysis of water. Hydrogen can be an energy storage system and also the source of energy.

Our country relies heavily on private companies and State Electricity Boards (SEBs) to meet our energy demands. We are relying heavily on materials such as naphtha and gases, which are affected by international rate fluctuations. In the years to come, countries like India with no oil reserves of its own will be affected severely as the price of raw materials is expected to skyrocket.

This would mean drastic hike in electricity charges. It is only a matter of time. Before this happens, it is important to find alternatives to the looming crisis without hurting the fragile ecological balance any further. The younger generation of engineers and scientists should be encouraged to take up this challenge and come up with new solutions for our power sector challenges. ●

R.V.G. Menon, former Principal, Goverment Engineering College, Kannur, is a noted scholar and environmental campaigner.

Jaya R. Shinganmakki

RASTA Shows the way

RASTA –Centre for Road Technology (Resource Centre for Asphalt and Soil Training Academy) was started by the then Ingersoll-Rand (India) Ltd. in January 2002, as a non-profit organization and now supported by VOLVO. It is an extension centre of the Visvesvaraya Technological University (VTU), Belgaum, for PG studies and Research.

Vision: To be the acknowledged expert in the Road Development Industry.

Mission: To be a knowledge centre that will enable Civil Engineering professionals keep abreast of trending Road and Infrastructure Technology

The main aim of the Road Institute is to create an amalgam of professional expertise, academic infrastructure and appropriate equipment technology towards bridging industry and institution and establishing a 'Centre of Excellence' for post graduate education, training and applied research in the field of highway engineering and technology.

The Road Institute is a self-sustaining entity, which can support and fuel its growth as

- Training Institute
- An Academic Institute conducting PG courses in Highway Technology and Infrastructure Construction and Management
- Research and Development centre
- Consultancy and Testing centre

Objectives

To organise special workshops and programmes for the senior level engineers of government organisations highlighting the latest developments in materials, design, construction and maintenance of roads

To conduct specially designed courses for various target groups of engineers associated with highway development projects and rural road construction works who are working with (a) State government organisations (b) consultants and (c) construction companies

To conduct post graduate diploma and certificate courses on identified areas of highway engineering / technology in collaboration with Visvesvaraya Technological University (VTU) of Karnataka state.

To arrange for training programmes for the technicians and operators of various road construction equipment.

To carry out all relevant laboratory tests on highway materials and field studies for pavement evaluation and design.

To provide a platform for expert advice and consultancy in various aspects associated with road construction projects.

RASTA as a Training Centre

RASTA has successfully organized more than about 145 training programmes, which were

INFRA ROAD TECH,2019

Fourth National Conference on Highways and Infrastructure Technology "NFRA-ROAD TECH 2019", was held at RASTA, Centre for Road Technology, Bangalore on the 4th and 5th of April,2019.The Scholars from different parts of India presented their technical papers in the presence of eminent personalities of the profession like Dr.B.R. Srinivasmurthy,Former Prof. IISC.Chairman, Dr.A Veeraragavan ,Prof IITM ,Prof. Aravind Bashyam, Christ university and other various dignitaries. Technical quiz was also conducted as part of the event.

highly appreciated by various clients such as Government Departments, viz. Karnataka PWD, NRRDA, PRED and private companies like GMR group, L&T, etc.

RASTA has also conducted Workshops on "Recent Developments in Materials, Design and Construction of Roads at client locations such as Kolkata, Delhi, Mumbai, Kochi, Lucknow for senior engineers of government departments, contractors and consultants,

Training Programs for Technicians / Operators of Machines

RASTA has conducted 6 training courses for operators / technicians from various construction companies on proper operating methods and servicing techniques for rollers and pavers. All the operators who attended were given certificates in recognition of their participation in the training programmes.RASTA organised several training programmes on "Materials Design and Construction of Rural Roads" for more than 400 engineers of various departments.

RASTA as R&D Centre

MoU between VOLVO and VTU

VOLVO signed a Memorandum of Understanding with Visvesvaraya Technological University (VTU), Belgaum, Karnataka on December 16, 2002, with the main objective of faculty Development, curriculum development, facilitation of student projects, and conduct of research and training programmes.

Post Graduate M.Tech /Certificate Course in Road Technology of VTU

The Institute offers 2 years Full time M.Tech course in Highway Technology and Infrastructure Construction and Management. The Post Graduate Certificate Course in Road Technology is conducted for a period of six months for graduates in civil engineering.

This is an intensive course covering subjects/ topics such as materials, pavement design and management, project preparation, construction, maintenance, traffic engineering and design.

The first PG batch in Road Technology of VTU was successfully conducted by Rasta during November 2004 – May 2005, and all candidates received excellent employment offers from reputed companies during campus selection. The second batch of this course was conducted during August 2005 – February 2006.

RASTA's Consultancy and Testing

The Institute offers expert consultancy

services in the areas of investigations, design, construction problems and quality control in the field of highway engineering and technology.

RASTA executes PMC/QMC services for Government organizations like KIADB/BBMP/PRED and private companies like L&T, Feedback Ltd., ACC, etc. RASTA has been actively involved in KIADB QMC works our role in achieving quality in road works has been highly appreciated.

RASTA's extensive expertise in Road Technology offers consulting services in Material Characterization, Pavement Evaluation, Technical Audit, Premature Failure Investigation, QMCs, and other areas in Road Technology.

RASTA is recognized as the State Technical Agency (STA) for Pradhan Mantri Gram Sadak Yojana (PMGSY) for Evaluation of Technical and Commercial scope of Rural road projects in Karnataka.

Facilities are available to carry out the relevant laboratory tests on highway materials, such as soils, aggregates, cement concrete, bituminous materials including emulsions and modified bitumen (PMB/CRMB) and for the design of bituminous/concrete mixes.

Facilities are also available to conduct field studies for checking the compaction and other properties of all the pavement layers and for Structural and Functional Evaluation of Pavements, Axle load and Traffic studies.

RASTA's Future

- Collaboration with international organisations in the areas of training and research
- ISO certification for Institute in the areas of training, research and testing
- Undertake research projects of national Importance from Department of Science and Technology and Ministry of Road Transport and Highways, Government of India.

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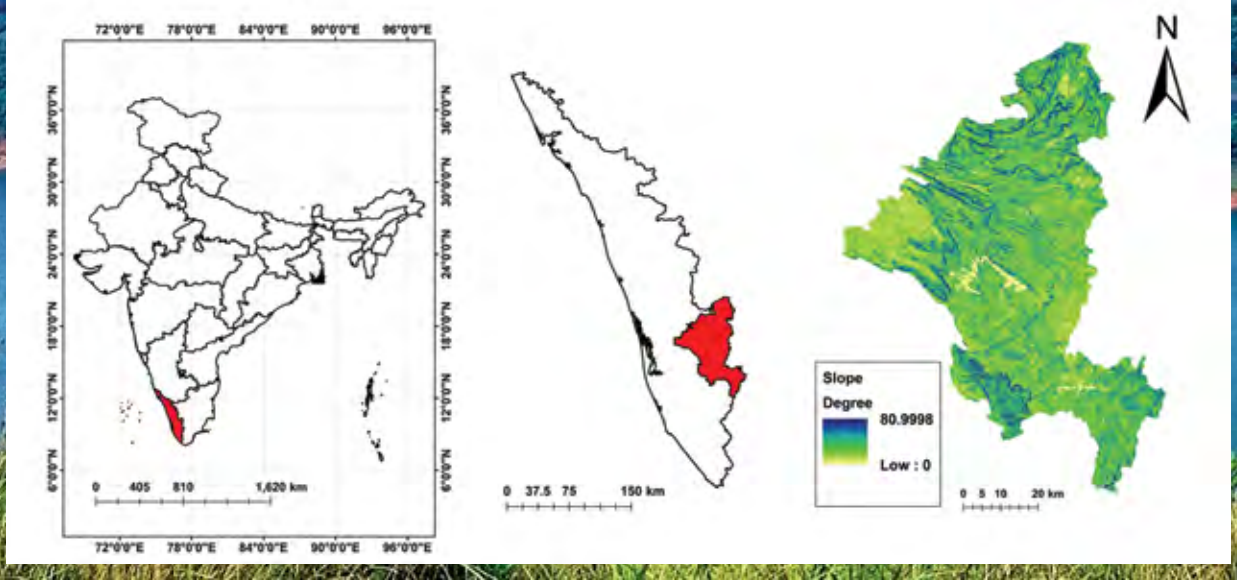
Dr. Neelima Satyam

Landslides! Idukki needs scientific support



Earth Slide at Cheruthoni

Idukki district with its wide variety of flora and fauna, and topographical characteristics is one among the major tourist centers in Kerala. This beautiful hill country is however prone to devastating landslides during the monsoons, and was the worst-hit region in the 2018 floods, having recorded as many as 143 major landslides.

Sprawled across a 4,358 km^2 area, Idukki is mostly hills and valleys, with slopes sometimes as steep as 800 , and with elevation ranging from 1,100 to 2,695 meters--Vagamon (1,100m), Meenuliyanpara (1,220m), Eravimala (2,401m), Meesapulimala (2,640m), Mannamala (2,659m) and Anamudi (2,695m) which is on the Idukki-Ernakulam border. Idukki with more than half of its landmass under forest cover is the second largest district in the state in terms of area.

Most local residents here have houses of their own, however, many of these houses, irrespective of the building typology, were destroyed in the 2018 landslides. Around 97% of the major roads in Idukki cut through rugged hills, and often become unmotorable during the monsoons due to landslides. It is hydropower from this district that meets a major portion of Kerala's electric power requirements.

The study undertaken was an endeavour to define, on a regional scale, the empirical rainfall thresholds of the area which is a severe landslide-prone zone in Western Ghats.

Why Idukki is vulnerable?

Idukki is located at the southern part of the Western Ghats where regolith thickness ranges from 0.25m to 5m, and is a region prone to shallow landslides. Large amounts of high-intensity rainfall in the region increase the pore water pressure within the soil mass which eventually decreases the shear strength of the soil. And this primarily triggers landslides in the Western Ghats as fissures in the bedrock siphon excess rainwater during the monsoons to the unstable zones on the slopes.

The population in this region increased rapidly after the 19th century with people from the midlands beginning to migrate to this hilly region realising its agricultural potential. And with the population increasing exponentially, the need for infrastructure in this industrially-backward district was deeply felt. This quest for better infrastructure resulted in land use patterns changing rapidly in a short span of time, ultimately resulting in the occurrence of landslides.

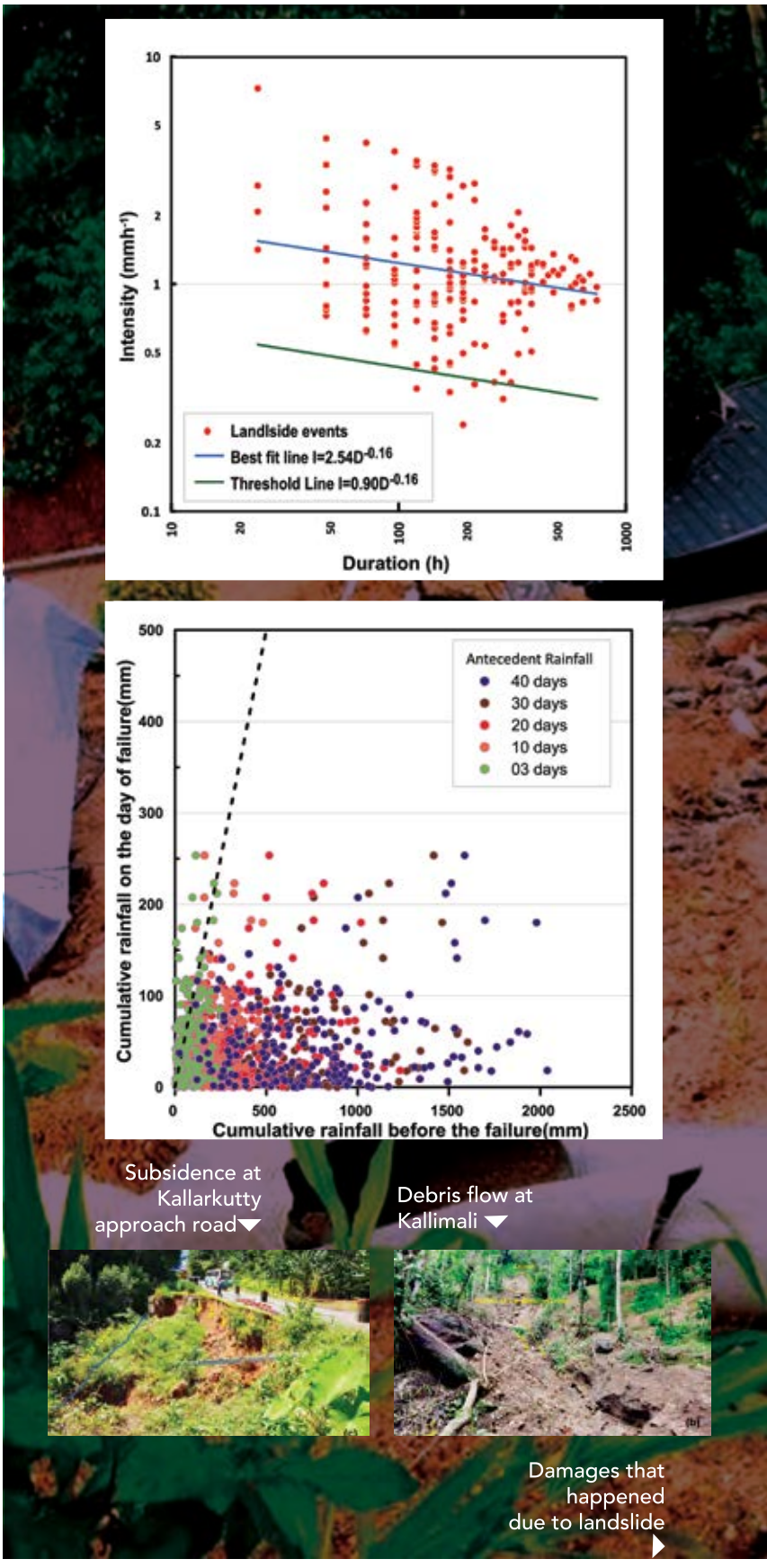
Unsavoury impact of developmental activities

With largescale heel-to-toe modifications being undertaken in the district in the past few decades in the name of infrastructure development, hill slopes have become steeper, and are devoid of any lateral support. The terraced slopes, modified for monoculture plantations with no sufficient drainage provisions, aggravated the situation. And with the meagre drainage system getting clogged, water from intense rainfall begins accumulating in the top soil layers, setting off landslides.

Landslide typologies in Idukki vary from creep and subsidence to debris flows and avalanches. Earth/debris sliding along the major road corridors of the district have become a common sight during the monsoon season. Sharp turnings and vertical cuts along the roads are highly susceptible to cut-slope failures. Incessant rainfall and the subsequent increase in pore pressure adversely affect the steep slopes, resulting in landslides.

A major share of untoward disasters in Idukki are on account of the debris flow triggered by heavy rainfall and influenced by factors such as slopes, land use, and the overburdening thickness and disposition of streams.

For analysis, the rainfall data of daily resolution from 2010 were collected from the four rain gauge stations maintained by the India Meteorological Department (IMD) in the district. A threshold defines the possibility of occurrence of a minimum of one landslide in the Thiessen polygon surrounding each rain gauge station. All the 225 landslides that occurred in the densely populated areas in the district during 2010-18 were looked into in the present analysis. Reports from the GSI and the District Soil Conservation



Office (in Idukki) along with those from print media sources were made use of in the data collection process.

Rainfall and other triggering factors

Rainfall thresholds using intensity-duration relationships and antecedent rainfall conditions were developed in the research taking into account the increased number of casualties which occurred in the study area in the recent past.

Intensity-duration thresholds consider only the rainfall event in the immediate past as a triggering factor for landslides. Landslides may also occur as a result of moisture content variations due to continuous precipitation, which is difficult to monitor with precision. Hence, a simple way is to study the effect of antecedent rainfall before a landslide event and define a threshold based on it.

A threshold is defined for all individual time durations of antecedent rainfall considered in the study. The study can be refined if the temporal resolution of the available rainfall data is improved.

The threshold values obtained for Idukki district is lower than that of many thresholds established worldwide. However, the lower threshold values could lead to a number of false alarms being generated in forecasting landslides. Hence the study has to be refined using a better data-set and state-of-the-art methodologies.

The rainfall thresholds defined in this study establish a minimum cut off below which chances of occurrence of rainfall is very low. In the case of short duration rainfall events (24 hours), a continuous rainfall intensity of 0.54 mmh−1 can trigger landslides. For the maximum-observed-duration of 31 days, a rainfall intensity of less than 0.3 mmh−1 could trigger landslides. The values of thresholds are too low for a regional scale threshold, the reason can be the biasness of landslide occurrences to the antecedent rainfall conditions other than the event in the immediate past. Above these thresholds, the probability of occurrence increases exponentially, but still the chance of false alarms cannot be ignored.

From the analysis of antecedent rainfall conditions, it can be stated that in Idukki district, an antecedent rainfall of 70.6mm

over a period of 10 days and 229.8mm over a period of 40 days can trigger landslides. Around 99.56% of landslides are biased towards the antecedent rainfall conditions when a duration of 40 days is taken into consideration.

It is evident from the results that the occurrence of landslide events is more influenced by antecedent rainfall conditions rather than the amount of rainfall on the day of occurrence. Hence, apart from this classical approach of defining intensity--duration thresholds, state-of-the-art models should be made use of for the area.

Need for effective early warning system

For a powerful Landslide Early Warning System to work effectively, parameters like moisture of the soil and soil movement/tilt, etc. should be incorporated along with the rainfall thresholds. An integrated system with multiple sensors and rain gauges can be installed in the region for this purpose. Similar researches have been carried out for Darjeeling Himalayas using Micro Electrical Mechanical System (MEMS) tilt sensors.

A network of such sensors can effectively transfer the data to the authorities in real time and this can be used as an effective warning system.

The frequency of available rainfall data is the key factor which determines the accuracy of thresholds. By establishing a network of sensors across the district, the spatial and temporal resolution of rainfall measurements can also be improved.

Simple empirical models can also be modified conceptually by incorporating physical or hydrological parameters to improve the veracity of forecasts. Further studies must be conducted in the area using the existing models which are being practised in different parts of the world, and the best suited rainfall threshold should be integrated with a sensor network and rainfall forecasting system.

This research is a small step towards achieving the goal of establishing an effective Landslide Early Warning System in Idukki that can minimise the number of casualties in landslide hazards. This first attempt is expected to encourage more research in the study area, which has been severely affected by the increasing number of landslides. This is a first step in the process of establishing a regional scale warning system for the district. Considering the increase in the number of high intensity rainfalls in recent years, if anthropogenic activities are not controlled, even a small amount of precipitation could trigger landslides in the region.

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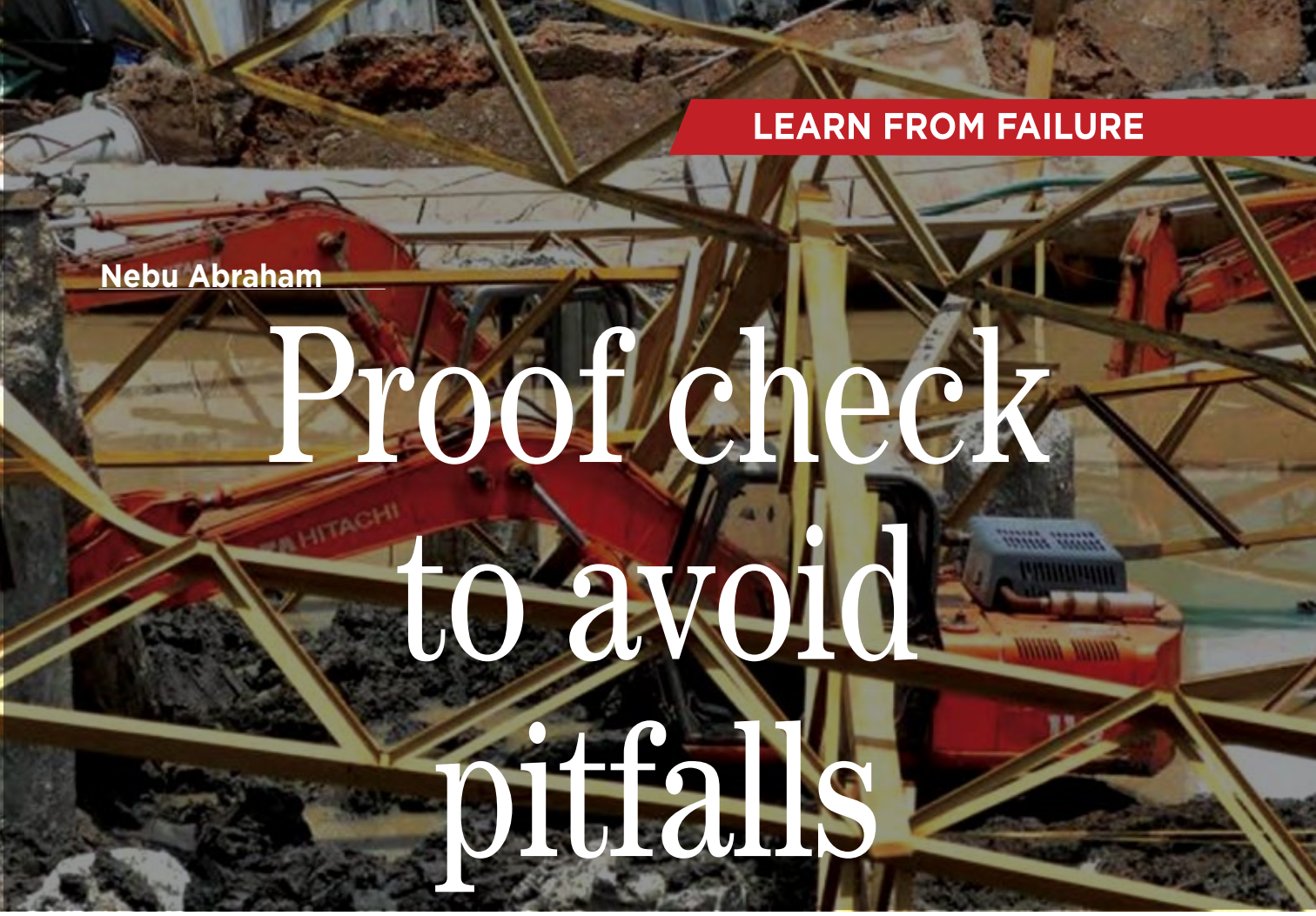

Nebu Abraham

Proof check to avoid pitfalls

At 9 pm on 19 April last year, the shoring pile system at a project site adjacent to the arterial road in a major city failed creating furor in the news world. Experts from various verticals of civil engineering sector analyzed the causes for the failure and submitted a report to the authorities concerned. Although the media had made it appear that the incident was a construction failure, the investigations revealed that the failure was due to design errors. And therein, lies a lesson for aspiring every civil engineer.

The experts who looked at the cause for failure of the shoring pile system flagged the following points:

1. The shoring pile with single strut propping system used in this project was insufficient to transfer the lateral forces.
2. The reinforcement of the shoring pile was not match against bending with single struct propping system in the project.
3. The strutting system used was a series of trussed beam in grid pattern, but not orthogonal to each other. This resulted in the tendency to make the grid system skewed and facilitate further yielding of the props.
4. The soil at level to which excavation had been done had turned very soft on account of water seepage. This considerably weakened the interface soil. High thrust from the shoring pile at the interface caused yielding of this soil. Subsequent increase in unsupported length of pile contributed to the failure of the pile in bending.
5. The strut drawing indicated two tier propping system. However, this had not been provided at the site, thereby reducing effective propping capacity of the system. (It later turned out that a second layer of propping was provided diagonally at the corners as designed and delivered by the consultants).

The above conclusions show a serious design error. But as a constructive conception, a failure is an eye opener and part of the industry's evolution on the way to perfection. It is said that 'intelligent men learn from their own failure, but wise men learn from others' failure'. When an accident occurs at a construction site, chances of loosing life is more compared to other sectors since the number of manual

labour is comparatively more in construction. Proof checking of designs of construction projects is very important in all cases. Its relevance is highlighted by the event narrated here.

What happened?

The project team came in with a target of casting 551 piles of 900 mm diameter and depth of 45 meter (building foundation pile) and 30 meter (shoring pile) in 120 days from the date of commencement of work. Considering the special conditions of the locality where many restrictions prevent movement of material and men, it sounded quite ambitious. But to me, a well-planned schedule can always beat time even in any challenging situation.

One of the biggest challenges was to find the right trained professionals. The contractor for piling work was chosen from the best performers of the locality and we deployed a professional company with many years of experience in working under such peculiar conditions for the job. The soil at the project site was black cotton soil. When such soil comes into contact with water, it becomes fluid with no strength/ bearing capacity.

Things went well in the beginning but, gradually, local population and political organisations began interfering with the work. It was tough to tackle them, but gradually I could build a good relationship with the neighbourhood societies and the local politicians. Another major challenge was flooding when it rained. Many a time, I had to rush to the site late at night to handle difficult situations. Often, local public would block our vehicles from plying. And most of the time we found it difficult to dispose off the bore muck since there was a space constraint.

Concrete millers were not allowed to ply at day time and drilling was normally not allowed at the night. Despite all these difficulties, we were able to complete the piling of 571 piles in 127 days including the extra ones proposed for various reasons.

We had started searching for a civil contractor even before we completed the piling. A good number of contracting companies were considered, including the ones suggested by the consultant. Contractors were short listed based on their performance and the quality of their previous projects.

The designed shoring system had a capping beam at the top which was 600mm depth and 900mm wide. The bracings were designed to be connected to this beam with intermediate soldier piles supporting them. The bracings running over the supporting piles were designed to be anchored to the pile.

▲ Bracing system before failure

Excavations started with a good number of machineries and men required to move the expected amount of earth to achieve the desired pace of project execution. As it progressed, we could see some amount of water flowing from the external face, but it was very little as the soil was impermeable.

Water percolation from such soil will be nil, but when there is a sandy layer, water would flow through it. For that purpose, water pumps were placed at intervals to drain water out from the trench. At 6 metre depth, we noticed a slight deflection at the southern and west side shoring system.

We communicated this information to the consultants. The situation was analysed.We decided to monitor the deflections on a daily basis and the work was allowed to proceed as advised by the consultant.

A senior geotechnical engineer from Bengaluru was assigned to inspect the sight and verify the scenario. He suggested a system to hold the shoring system with a much heavier system at the corners.

This design was further revised by the project consultant and a new drawing was issued. The

shoring system at the south side failed when the excavation was at about 9.5m. The service road adjacent to the site caved in causing blocking of the road.

Possible reasons:

1. As the expert committee had mentioned in their report, the shoring system failed to hold the lateral load. Many factors seem to have been ignored at the time of design, which became crucial later when the excavation reached greater depth.
2. The reinforcement designed were insufficient to hold the lateral load as indicated in the experts' report. This also showed that certain elements that could mount additional pressure on the structure were not considered for the design.
3. As the expert committee cited, the soil at current depth of excavation had turned very soft on account of water seepage. During excavation, we could find only very little amount of water flowing in. Where did all this water came from? This shows that a survey of local area's utility system was not conducted before designing.

   It is a usual practice to ignore such elements but at times that would make the project vulnerable and can cause potential damages. A project manager should always look for such possible threats before commencement of work. If any such element is found, it should be brought to the attention of the designer and a proof check sought.

   It is always necessary to assign a third party for proof checking with the design data considered by the project consultant. This should be mandatory for all projects even though there is an approval agency from the government side.
4. The channels provided as bracings were insufficient to hold the extra load imposed on the structure.
5. If you look at the caping beam design and its bonding with the pile, it is a very weak connection since the only holding factor is the pile reinforcement which is extended into the beam. The bracing sections when connected and once the piles are loaded, dislocation is easily possible with such a weak connection.
6. The bracing system is designed to be fixed at zero level where the lateral earth pressure is lesser. The bracing should be at a lower level (maybe at 4 m below the ground) where the pressure would be more.

Possible triggers

There were two huge water lines running through the service road, one of 300mm dia and the other of 700mm dia. During the excavations, water started escaping from the voids through

sandy layers causing vertical settlements at the adjoining areas including the road. Due to differential settlements, the road got damaged with ups and downs causing heavy vibrations when heavy trucks plied at high speed.

The 300mm pipe exploded causing heavy water pressure on to the shoring system. When there is ambiguity in the soil condition, we must always expect a settlement that could damage a utility posing a major threat.

Extra care should be taken while designing such structures in peculiar soil type. It is always required to avail the service of a structural consultant from the locality who would have good experience in working in such conditions. This could save a lot in terms of cost and time.

I ordered an immediate evacuation on noticing a horizontal earth movement. Order was issued at 6:30 for complete evacuation and few people were deployed to block the road in case of a catastrophe.

Conclusions:

Before commencing a project, the project team should create a guideline a part of the planning process. Many incidents show the importance of assigning a project manager and his team at an initial stage before the designing starts. Every stage of design planning and designing needs to be closely monitored and every tiny element should be taken into serious consideration.

Always conduct a survey and study of the local utility services close to the plot, foundation details of adjacent buildings, nearby drainages, water sources, etc. An external dewatering system can be a possible solution when there is a possibility of water pressure. Once the design is issued, the points listed below can be considered.

Future measures

Detailed design check and approval from a competent authority such as IIT/NIT.

Definite Terms of Reference between working teams, consultants

Checking of design document with design assumptions

Mandatory advance obtaining of detailed drawings from architects

On time response of structural engineer and architecture

Soliciting second opinion on any critical executions

Having team meetings wherein technical debates and solutions are entertained.

Possible means of immediate rescue at the location mentioned above was filling the trench with water or earth that could create an equilibrium. In our case, bringing such huge quantity of water was next to impossible.

Corrective measures

The whole bracing system was redesigned and new soldier piles of larger sizes were cast. The position of bracings were lowered to 3.5m from the zero level.

Lakshmi Priya P.S.

Muhammed Nihal

Rena Susan Roy

Potholes?
Let plastic do the job!

A pothole repair mix that uses cutback bitumen and plastic has proven to be a success because the low viscosity of cutback bitumen (bitumen mixed with solvents like naphtha, gasoline and kerosene) allowed it to penetrate easily and efficiently into the pores of potholes.

Starting with the 1950s the use of plastic has steadily increased to such an extent that today, it is hard to imagine living without it. From eyeglass lenses to bullet proof vests, water bottles to carry bags, they are all over the place.

India's annual per capita consumption of plastic is 11 kg as compared to 109 kg in the U.S., according to figures released in 2017 by the Federation of Indian Chambers of Commerce and Industry (FICCI). However, India generates nearly 26,000 tons of plastic waste every day polluting our air, poisoning the earth and choking our animals to death.

What makes plastic so deadly is that they are impossible to break down, allowing them to accumulate in our environment as they are. Which is why there is a global campaign now to find ways to reduce, reuse or recycle plastics.

Scientists in the U.K. first developed a technique to use recycled plastic waste to pave roads in UK and Australia, followed by the U.S., in 2018. Encouraged by these successes, a team of engineering graduates from TocH Institute of Science and Technology (TIST) in Kerala decided to try concocting a pothole repair mix using discarded plastic.

Poor design along with even poorer quality of execution has made the average road in India perilous, which is more so the case in Kerala, where the long monsoon rains exacerbate potholes on roads. When there are disproportionate aggregates along with poor drainage systems, water percolates into the ground soil reducing its strength and rendering it incapable of transferring the load without shrinkage. This results in cracks forming which enlarge into potholes within no time due to the continuous

ongoing traffic.

When potholes are repaired the conventional way, traffic needs to be blocked for a long time to allow the surface of the filling material to set and attain sufficient strength. Since this time-consuming process is not practical, it becomes impossible to rectify potholes as soon as they are discovered. An alternative repair mix that can set faster would not require traffic to be stopped.

A pothole repair mix that uses cutback bitumen and plastic has proven to be a success because the low viscosity of cutback bitumen (bitumen mixed with solvents like naphtha, gasoline and kerosene) allowed it to penetrate easily and efficiently into the pores of potholes. Since this is made at lower temperatures, it was thought that plastic granules of a similar size could effectively replace the aggregate in the mixture.

But plastic coated aggregates, when used along with hot bitumen, emitted unfavourable gases from the melting plastic. Using cold cutback bitumen, along with partial replacement of aggregates with plastic granules, was found to be equally effective in the repair of potholes, though anti-stripping agents had to be added to the mix to prevent the repaired area from stripping out.

The researchers from Kerala's Toc H Institute were hopeful about finding the optimum amount of plastic granules necessary to replace the aggregate in the pothole mix. The optimum content of bitumen using OPC as the filler material was calculated. To this mix, plastic granules were added to partially replace the aggregate. The optimum content of plastic granules to be added were also evaluated in the process.

The assessment of favourable bitumen content and the amount of plastic granules of the mix was done using Marshall's stability analysis. The strength measured, according to Marshell's stability of mix, is defined as the maximum load carried by a compacted specimen at a standard test temperature of 600C.

In this test, the compression loading was applied on the specimen at the rate of 50.8mm/min till it broke. Temperature of 600C represents the weakest condition for a bituminous pavement. According to the Marshall mix design, for a mix to have the optimum properties to be used in road construction, it should satisfy the following conditions:

Lathi Karthi, HoD, Dept of Civil Engineering, TIST

(i) It should have sufficient binder to ensure a durable pavement.

(ii) It should have sufficient stability to provide resistance to deformation under repeated loads.

(iii) It should have sufficient flexibility to withstand deflection and bending without cracking.

Compacted samples of various combinations were prepared and all these were subjected to theoretical tests such as specific gravity, bulk

Marshall Stability Test Apparatus

Samples for Marshall Stability test

density, stability, flow tests, density and voids analysis. From these tests, the optimum content of bitumen and plastic granules were calculated. Thus, a combination which brought out the maximum strength for bitumen as well as plastic content was evaluated.

After the mix was prepared as per IRC 116:2014, it was tested for (i) water resistance and (ii) workability. The water resistance test was conducted based on the procedure described in IRC 116:2014, which indicates that if there is a failure, it means sufficient amount of anti-stripping agent was not added. In the work conducted by this group, the mix was prepared using SUPER BOND A99 ASA and it provided 98% of bituminous coating over the aggregate indicating that ASA showed better water resistance.

The workability test was also carried out based on the procedure presented in IRC 116:2014. When 2.5kg of the mix is cooled to 70C in a freezer, it should be able to break with a spatula with a blade of 200 mm. If it failed the test, the possible reasons would be improper bitumen type, low bitumen content, excessive fines or improper gradation. The mix prepared in the project showed good workability.

The optimum bitumen content for the mix, using OPC as the mineral filler, was evaluated to be 5.67 percent. The optimum content of 2.36 mm plastic granules to replace 2.36 mm aggregates was evaluated using Marshall's Stability test and was found to be 9 percent.

During the trial, the mix was applied according to the procedure outlined in IRC 116:2014. The efficiency of the mix was checked after two wheelers went over the newly patched potholes several times. No cracks appeared on the applied area nor did it settle or shrink, indicating that the combination of the newly developed mix was ideal and could be adopted for practical use.

To have a longer life, it is recommended that the mix be prepared and applied based on the specification given in standard codes.

The advantages of using plastic granules over conventional method for pothole repair were manifold. One, was the improved properties of the mix. Second was the overall reduction in cost of the mix. Most important was how it could address the plastic waste piling up around us.

Lakshmi Priya P.S., Muhammed Nihal and Rena Susan Roy are alumni of TIST, Kochi.

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A.N. Prakash

Uday Simha Prakash

Nemmadi

Guarantors of quality

Planning to buy a house? Worried about the quality of work? Turn to Nemmadi, guarantors of safe structures, and relax

In Kannada, the word 'Nemmadi' instantly connects with "peace of mind." And it is exactly the philosophy that Nemmadi follows. What this Bangalore-based home inspection company does indeed has a cooling effect on the minds of clients, taking care of their concerns and anxieties about one of their major life decisions – buying a home!

A sister concern of the oldest construction project management consultancy in India, Nemmadi focuses only on the quality aspects of construction, whichever the process under review. "Get what they paid for, and pay for what they get" is the client policy of Nemmadi as its home inspection service potentially help home buyers save lakhs of rupees.

What differentiates Nemmadi from similar ventures is the role played by its parent company that has been in existence for over three decades. This association helps Nemmadi understand the nuances of the field of civil engineering and deliver unparalleled service. In fact, the venture was started after many people wanted the company's opinion on the quality of work done by its builder clients. Initially, the idea was discouraged but when the demand increased showing that such a service is highly valuable, the company floated Nemmadi in 2017, providing home inspection services to home buyers along with third-party quality certification for builders and developers.

Initial challenges

Customer education was the biggest task for the company. Since this service was unheard of




when it started and many potential clients didn't even know such a service existed. It took a long time to convince the customers that not only would the developers listen to them but also it was well within their rights to do so.

The field of civil engineering is known to be technology averse. As a company, Nemmadi wanted to change this by leveraging technology to improve not only the efficiency of the engineers but also collect copious amounts of data at the same time. This meant going against the tide and developing an app that would perform a factor of magnitude better than the existing tools, an app that people could use with ease and minimal learning.

Target groups and benefits

Being a neutral party unbiased by personal interests or advantages, Nemmadi has the permission to conduct a thoroughly professional inspection purely in the interest of quality of the end product. The company is not weighed down by obligations to the management of any of the involved parties, bound only to the code of conduct set out as its guide.

For individual home buyers [B2C]

The company has its Engineer visit the apartment and conduct a thorough check of the workmanship, completeness of work, hidden dampness, etc. Electrical works are also checked for safety and functionality. This forms the basis for an exhaustive automated checklist that helps in carrying out the inspection thoroughly. Instead of depending only on the human eye, the latest technology is utilized for identifying and locating defects. The inspection is carried out through a customised software with automatic report generation and detailed analysis. State-of-the-art gadgets like Thermographic Imagers, Laser Measure, Moisture meter, Electrical fault detector, etc., are used for inspection.

For builders & developers [B2B]

Nemmadi offers a service that is more in-depth and multi-dimensional. The company has the talent and capability to provide support in terms of quality at any stage of the lifecycle of a building construction. For projects, the handing-over is eased due to a proactive snag clearance. With the RERA coming into force, a third-party quality inspection is in the interest of the customer as it ensures that the quality promised is delivered.

For running projects, Nemmadi provides an online inspection monitoring console for instant reports and analytics helping in real time de-snagging. It helps builders as third-party

Nemmathi Team during their inspection▲

inspectors and certify units in the project for quality conformance. The company's support is extended to apartment owners' associations before they take over common areas and amenities of the project from builders to ensure snag-free operation in the future. Comprehensive inspection is done using structured checklists compiled on the basis of years of experience in managing all varieties of projects.

Do it yourself with 'dSnag!'

A technology marvel that takes away guess work and brings out facts, detecting and documenting the most common snags or issues which could happen in an apartment/house/villa. With the dSnag! App, anyone can be an expert home Inspector to identify common snags with all the information required by the builder to fix them. This app is the outcome of 500 person-years of construction engineering expertise. It is packed with all the engineering knowledge amassed by the company over the years to help people become smart with the purchases, rental, or maintenance of their planned or existing home.

Simply install the dSnag! app, open it, select the house type, download the company checklist,

and click pictures of the defects found in the house as guided, step by step. This intelligent app will record the location, direction, and let the person annotate or jot down all the details of the defect, in an easy-to- manage window. Upload the snag, and move on to the next stage. Finally, when done, share it with the builder, homeowner or contractor to fix the issues.

	Technologies used for inspection
a	Nemmadi uses an internally-developed Android app – AIMS (Automated Inspection Management System). AIMS is used by all engineers, and the app helps the company generate inspection reports instantaneously, share reports across geographies, and ensure that all engineers follow the specifically curated checklist for that particular apartment without skipping any points. The app not only captures snags, but also annotates its location and captures the snag description immediately. As all snags are located via an app, Nemmadi can generate statistics on the fly.
b	The engineers use IR Thermal Cameras to locate dampness that are not visible to the human eye. These hidden and latent damp spots are identified using IR Cameras and then doubly made sure using Moisture meters
c	Laser measures are used to accurately measure Carpet Area of flats as described by RERA
d	Other specialised tools are used to locate electrical conduits below the surface of the walls
e	Electrical Fault Detectors to ensure that the earth and line are correct
f	With the help of the app, the trained engineers, deployed on site, ensure that all the Standard Operating Procedures [SOPs] and checklists are followed to the T. Nemmadi's backing is its decades of professional experience. The quality plan is basic and the subsequent goal for them. Later quality assurance and Quality control processes are performed as per the already drawn quality plan to ensure that required quality levels are achieved at every stage of construction. This results in Total Quality Control in the construction process as well as their objective.

A.N. Prakash is Chairman and Co-Founder and Uday Simha Prakash is CEO and Co-Founder of Nemmadi.

AD

Qatar tries blue coating on pavements to reduce Heat!

Lack of trees and other vegetation has led us to an atmosphere of uncomfortable living .Considering the increasing heat emission from dark asphalt,the City administration of the-capital of Qatar, Doha, tried painting city roads in blue.It was found that the the temperatureof dark asphalt is 20 degrees Celsius higher than the actual temperature as black attracts and radiates heat.Currently, roads are painted only on one of the central streets of the city, where the temperature can rise to 50 degrees Celsius (122 degrees Fahrenheit) .

Doha engineers believe that painting asphalt will help reduce its temperature by 15-20 degrees, as well as increase the service life of the coating.

Stefano Boeri Architects designs "forest city" for Mexico

Stefano Boeri ,an Italian Architect comes up with an idea to create a sustainable environment through his design for 'FOREST CITY'. The city's plant life will absorb 116,000 tonnes of carbon dioxide each year. This development will contain 400ha of green space with 7,500,000 plants across 400 species, 260,000 of which will be trees, the rest will be made up of shrubs and bushes.This city will be completely food and energy self-sufficient with a ring of solar panels around the development. It will also have measures to control water use, including a canal system and a series of water gardens to fight floods.

During summer time ,the vegetation on the balcony reduces heat on the facade by 30 degree . Also this Forest city will be able to host all worldwide university departments, international organizations, and companies that deal with very important sustainability issues and the future of the planet.

New Zealand construction apprenticeships hits 13,000w

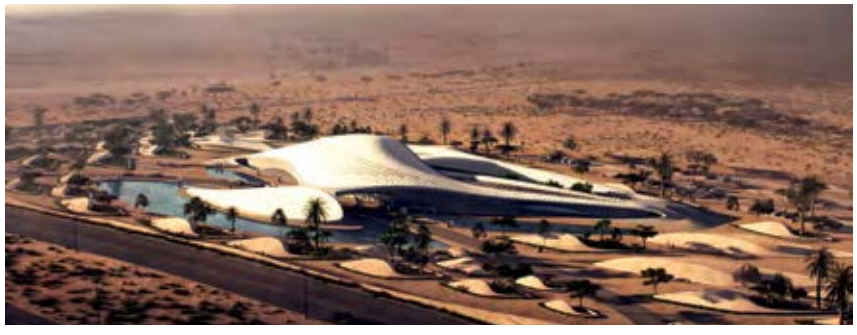
Number of Apprentices in building and construction has reached record of 13.000 The Building & Construction Industry training Organisation (BCITO) being the main provider has launched new initiatives Increase in Trades Academy places, commitment to a new centre of excellence for vocational education for the construction sector to drive innovation,-support for the future of the industry through the Construction Sector Accord and the Construction Skills Action Plan,creation of the NZ$2,000 (£1,000) Prime Minister's Vocational Excellence Awards for the top vocational student in every secondary school in the country.Construction activity is expected to hit $43.5 billion before 2024, with 80,000 new and replacement construction jobs needing filling over the next five years. The sector currently employs 240,000 New Zealanders.

Prevent bridges from collapsing using AI technology

Dynamic infrastructure, a start up based in New York and Tel Aviv, has begun implementing world's first deep-learning solution to prevent bridges and tunnels from collapsing. The technology enables the bridge or tunnel operators to obtain a visual diagnosis by the system which provides live, 3D views of the bridge or tunnel. This provides automatic alerts when changes in maintenance and operation conditions are detected. The company maintains a record for every bridges and tunnels by collecting images of the structure taken during periodic inspections along the years. The technology compares old and latest images to detect maintenance and operation issues.

Tesla backs Masdar to build a solar plant at Sharjah

Waste management company, Bee'ah with its headquarters at Sharjah, has signed a contract with Masdar to develop a ground mounted solar power plant at the facility. The project is backed up by Tesla Powerpacks. Tesla Powerpacks will use the extra energy stored, to power the headquarters by night. The project will have a total built up area of 7450 square meters and is expected to be completed in 2020.



U-M unveils autonomous roofing drone software

Autonomous drone software designed to allow drones to nail roof shingles was unveiled by University of Michigan. The technology enables the drone to nail shingles to a surface without a human activity controlling it. The drone is battery operated and can work for 10 minutes at a stretch.

World's biggest petrochemical plant to be built by China-Russia

China National Chemical Engineering Group (CNCEC) and Baltic Chemical Complex (a subsidiary of RusGasDobycha) have come together to build, what is to be, the biggest ethylene integration project in the world. The agreement has been signed for an amount of $13.3 bn. The plant, which is to process Russian Natural gas, will be built at the port of Ust-Luga near the Gulf of Finland.

New Sydney airport aims to set up construction training centre

Technical & Further Education (Tafe) NSW had joined hands with the Government of New South Wales (NSW) to provide on-the-job training for workers at the Western Sydney International Airport. The program aims to equip about 250 workers a year with skills in areas like civil construction, safety and traffic control etc. It is important that it provides the chance for people to skill up while on the job and learn from the delivery of this important project, said Alan Tudge, Minister for population, cities and urban infrastructure.

Dr. Fixit Roofseal Top Coat

UNIQUE HEAT REFLECTING ROOF WATER PROOFING COATING

Every construction is subject to the vagaries of nature. With global warming, the mercury is on the rise across the globe. Statistics show that the average temperature has increased by 0.6 degree Celsius. The rain pattern is also now subject to sharp fluctuations. Torrential rain and high atmospheric temperature affects the durability of a concrete structure and that calls for additional protective measures. The House of Pidilite, numero uno when it comes to waterproofing solutions, has answers for two major structural problems arising from atmospheric phenomena – protection from leakage and heat.

Description

Pidilite's solution to the impact of atmospheric changes on concrete structures comes under the brand name DR. FIXIT ROOF SEAL TOP COAT, a single component, insulating elastomeric waterproof coating for roofs. The coating acts as a seal against water and heat, thereby waterproofing and insulating in easy steps. This monolithic waterproof membrane provides superior crack bridging and long lasting tough weather protective seal for exposed (new and old) roof surfaces. The product combines the benefits of waterproofing as well as heat reduction. No additional protective coating is required for roofs subjected to foot traffic. It is easy to apply, using either a brush or a roller.

ROOFSEAL TOPCOAT has been developed based on PU Acrylic Hybrid technology with unique properties of waterproofing and heat reflectivity. The product has a water proofing warranty of 7 years and surface temperature reduction up to 10 degree centigrade. These dual features help to prevent water seepage as well as thermal stress on the structure in a cost effective manner. It can be applied as topcoat over the plastered surface of concrete terrace (sloped and flat) without using a primer and over the existing cementitious waterproofing treatments like sound brick-bat coba, concrete screeds, etc.

Typical Applications

Building Roofs/Terraces –Flat & Slope.
Over Existing cementitious waterproofing treatments like sound brick-bat coba, concrete screeds, etc.

Application of the product on site

Features

Waterproofing	–	Nano particles in the product enables the formation of tough durable elastic membrane with > 200% elongation.
Coverage	–	24 -25 sq.ft per lt/coat.
Good Adhesion	–	Bonds strongly to the substrate.
Crack bridging	–	High flexibility of materials enables it to bridge hairline cracks up to 1mm.
Tough and abrasion resistant	–	Suitable for light foot traffic.
Economical	–	Cost effective and durable coating.
Bright white	–	Heat Reflective and UV resistant top coat
Temperature reduction	–	Reduces surface temperature up to 10°C** during peak summer
Eco friendly	–	Low VOC
Low cost	–	Rs.18-20/- per sq.ft material cost.

Application area – Villa or individual house project with roof area of approximately 3000sq.ft
Packaging – 1, 4, 10 & 20 litre

Technical Specifications

Solid Content	*ASTM D1644*	*58*	
Density (gm/cc)	*ASTM D 1475*	*1.31*	
% Elongation at Break	*ASTM D 412*	*Min. 100 %*	*200*
Tensile Strength Mpa	*ASTM D 412*	*1.5*	*2.10*
Tear strength (N/mm)	*ASTM D 624*	*Min 21*	*23*
Water absorption- 24 hr. dip	*ASTM D 471*	*Max. 20%*	*Passes*
Pull off Adhesion, Mpa	*Average*	*Min.1.5 Mpa*	*2.20*
Crack Bridging Test (mm)	*ASNZ4548- 5*	*Min 1 mm*	*2*

The product has been launched in South Indian markets and has received appreciation from dealers and customers. The product is available in all major paint and hardware outlets. For ensuring quality in execution and to improve the confidence level among users, the company will be initiating free training and site sampling for valuable customers.

Other Product Categories available

Dr. Fixit brings you the widest range of Construction Chemicals for:

▲ Dr.Fixit Roofseal Topcoat

P.G Venkatram/Interview

Let's enhance employability of our young engineers

The nation has been churning out engineers year after year, but their employability is under question. In this third and final part of the interview with him, P.G Venkatram CEO L&T Infra Engineering, looks at the causes for the dip in quality and ways to train young engineers to make them employable.

How do you spend quality time with youngsters?

Last year, the Civil Engineering Association of IIT Madras invited me to spend an evening with graduates on Fresher's Night. All BTech and MTech students were to join us. They wanted me to interact with the students and convince them not to leave the civil Engineering career after post-graduation. I was basically asked to show them with examples as to what they could actually do. If IIT Madras feels that way, then I can imagine the plight of other colleges. Recently L &T and IIT(M) had a discussion on Post Graduate Diploma courses in Bridge Engineering after MTech. This idea had come up after we realised that there was dearth of students who had been trained enough to take up work. By students we don't mean students who had just completed their MTech, but those who had worked for up to two years after passing out. We have now promised to let 15 students work with us for 5 years on contract basis. L& T has already signed MoUs with IIT(M) in this regard.

Can you brief us on Post Graduate Diploma course in Bridge Engineering?

This course is being designed by us in collaboration with IIT Madras. It is, in fact, a finishing program for those who have worked for a couple of years after their postgraduation. In the selection process, both L & T and IIT will have equal weightage. The aspirants will go through a test and an interview. This course is actually meant to avoid the GATE route because these students have already gone through that. It is meant to meet our expectations about what we feel are the requirements for a Bridge Engineering program. So, the course and the content are being discussed by us. Of course, it needs to be structured in a fashion that is acceptable to the IIT Senate.

What does this course aim at?

It is about filling the gap between what they finished at the college and what we need as a practicing organisation. It is this gap that is meant to be bridged through this program. The faculty will be

mostly from IIT Madras, and the course content is expected to comprise a lot of practical examples from our organisation and elsewhere. The study material is expected to be compiled in the form of guidelines that people can refer to. It is a long-term vision in that sense, and we hope to kickstart the program by the end of this year. Once that happens, the selection process will start.

What would be the teaching methodology?

It would be as if a professor is sitting with the students and teaching them, but they will physically be at their place of work. The program will thus be interactive. We will also invest a little bit on classrooms, but in this campus we have enough facilities for all that. We have just selected the course content and we are supposed to have a meeting with them to agree on the formality.

How do you envisage the future of this concept?

We will be providing seats to students for the first few years of operation, and then they (IIT) hope to sell this concept to other organisations. The selection process will, however, rest with the IIT, and the recruits will not be people that an organisation nominates. Obviously, they expect they will concur with the nomination because we are also going to select people whom we think are suited for further training and we would like to retain them, hence along with this course there will be some kind of retention program attached.

Do you see the need for a complete overhaul of Engineering education in our country?

Till the late 1970s Engineering education was purely governmental. With the opening up of Engineering education to the private sector in the late 80s, there was proliferation of Engineering colleges and many of them even acquired notoriety of being only certificate printing establishments. However, over a period of time some of them changed their character and are now trying to become truly good educational institutions.

But the problem is that opening up of Engineer-

ing education exposed a major flaw; in the civil Engineering department particularly investment in infrastructure was extremely poor through the 70s and 80s. I remember working on designing various components of a project for over 10 years. I am pretty sure that if I had designed that project now I would have been fired from the job in no time. These days, people expect us to complete a job within 6 months or maximum by 12 months. Nobody wanted to stay as a civil Engineer because of the lack of investments, and some of the best civil Engineers were employed by the government sector. Private sector did not have much intake of quality civil Engineers. The situation was the same in educational institutions, and people not wanting to remain civil Engineers led to a shortage of teaching faculty.

Quality of teachers who produce Engineers are downhill. What do you think?

With the mushrooming of private Engineering colleges, there was an acute shortage of teaching staff and most of these institutions began employing postgraduates as teachers as they were not governed by the UGC norms; the concept of Deemed University was also not there then. These colleges produced a lot of Engineers who were taught by postgraduates, and sad to say many of them were the kind of people who were not found to be fit for working either in the premium government job sector or in the private sector. Many of them ended up teaching in Engineering colleges that had come up in their hometowns. I remember interviewing a faculty member from one of the colleges near Chennai in 2003-04. He wanted to leave the academic field and join the civil Engineering workforce.

We thought that having taught structural Engineering for three to four years, he would be familiar with the subject. But on talking to him, we found that he had been teaching hydraulic system, structural Engineering and geotechnical Engineering. You can imagine the plight of a man teaching 3 to 4 subjects; in that process he had not absorbed any one of these subjects. Remember, he was someone with an M. Tech degree and three to four years of teaching experience. So, obviously the teaching methodologies adopted were not proper and we could not employ him. We felt very sad because he was from a college that produced 50 to 60 civil Engineers every year, and if that was the case in one college, we dreaded the thought of what was happening in other colleges. So much show without any substance!

What should be the government's role in moulding Engineers?

We have always felt that recruiting graduates from government Engineering colleges was far better than recruiting from private colleges. However, government cannot be expected to invest heavily in establishing education institutions as higher education is not necessarily its sole priority. It was hence felt that participation of private sector would help, but for various reasons, in the first 20 years of liberalization, that is from the late eighties to early 2000, the trend was not very healthy. We started to notice a change in the quality of output coming from the private Engineering colleges.

Has Deemed University status really helped in improving quality?

After the UGC began granting Deemed University status to some of these Engineering colleges, they realized that they were educational institutions and started to invest in improving the quality of the faculty thereby bringing about a qualitative change in the education system. Once they realized that they were universities and were handing out degrees, they became more quality conscious as they know otherwise they would lose the benefit of having started the institution. And of course, recently the UGC norms were amended. None of these institutions will be known as universities anymore. They can offer degrees like a university. This move essentially tells you that it is an assessment of their performance over the last 30 years and the UGC feels that their performance has not been good enough.

How does this affect the industry?

Now, if at that level we realise that the quality of education and therefore the quality of the product is not good enough, the industry will suffer because the need for Engineers is huge in our country. The amount of money we are investing in infrastructure and its associated fields demands that we get quality Engineers, but we're not getting it. So, what is happening is that many of us end up becoming grooming centres. We take people and then spent four or five years training them, making them fit for industry. That is why you hear the lament because now we are actually paying them to learn; it doesn't actually gel with us. But if we say, "Oh, you are still an Engineer in the making", and pay them less, then they may lose interest and leave this field and go elsewhere. So, in that sense, some of the industries are caught in a bind. They have to pay in order to keep people flowing into the industry, but at the same time, are not getting the expected output and productivity from those whom they pay. Essentially big companies like us end up spending on training recruits, and many smaller companies survive by picking up people from us. Well, we do have objection, and at a personal level we all regret losing our trained staff. However, we feel okay if they continue to work in India, because somehow, they are contributing to the growth rate of the country's economy. But that is not the case always as many of these Engineers, once they have gained enough experience, opt to leave the country, making our loss even harder to bear.

Can this be prevented?

I believe it is a transitional phase. However, I am not sure how long it will last. My feeling is that unless something drastic is done to improve the quality of teaching in our Engineering institutions, Engineers passing out from these institutions will remain unemployable. And once those who pass out of these institutions fail to find jobs, then students will not join these colleges, and once that happens, they will have to close down their Engineering branches. So, in a way, only the market force can make sure that these educational institutions improve their standards. The second most important thing is the quality of input. I don't know the exact number of Engineering colleges in the country. In the 2000s, there were around six to seven thousand. I am sure in the last 15 years many more would have been added. And from among these only students passing out from IITs, NITs and a few other reputed institutions are picked by recruiters. The rest remain mostly jobless unless they opt to do sundry jobs.

What are your selection criteria for employees?

The quality of educational institutions is often exaggerated. Hence the selection process boils down to the quality of people you pick for a particular slot. If you pick a good input obviously your output will also be good unless you manage to spoil a good input. That would actually be the reverse case of students adding to the glory of an institution. The same is true at the school level. Every reputed school has standards as per which they acquire input and whom they give admission to. When you do that, you are filtering out and making sure that you get quality students. Similarly, we have policies pertaining to where we recruit from. That does not mean that there are no good students in other institutions. But talking statistical-

ly, if I have to take a risk between picking a student from NIT and choosing someone from other colleges, I would pick the one from NIT.

Are there lessons in this for educational institutions?

Of course, the message is absolutely clear. If they absorb it and do something about bridging the gap, they will stay afloat, or else they will sink. However, it is impossible to fully bridge the gap because all that an institution does is introduce a subject. For every subject in any semester we have 40 to 50 hours of contact program. It is a three-credit course. It means 3 lecture hours per week. If you have a practical hour or some kind of an assignment, it becomes a four-credit course. And semester is for 14 weeks. So, what you get is about 40 to 45 hours for a subject. You can't teach a subject in that duration. You can only introduce students to a particular subject, and then it becomes the responsibility of the students to learn. If they are enthusiastic enough to pick up from there build on it, they will succeed. Somewhere along the line, we have missed teaching people how to learn.

How can students be taught how to learn?

If you take a look at those institutions which make students work on their own, you will realise that they produce better quality Engineers. And that is what I found out when I did my Masters abroad. Classroom lectures are minimal; they dump assignments and projects on you. You will spend sleepless nights teaching yourself. Once you go through that mode, then you will realize that you can learn any subject. It wouldn't matter to you. If you have a new problem to solve, you will be able to do it and improve your problem-solving skills. If on the other hand, you come through a system where you are given limited facts and are expected to reproduce them in order to be evaluated, then you have not learnt anything. So, the concept has to change. The system of making students work on their own should be introduced in all branches of study. When that is the case, students will be able to sustain themselves right through their life after college as their learning skills will always remain receptive. But this is where we are failing. We are failing to produce people who are able to sustain their learning ability. Our colleges are not teaching them how to do that. And our professional institutions are not trained to train people in that mode. We are only trained to get work done and, in that process, a few of those

who are able to maintain their learning skills end up being recognized, and he or she grows to become a more recognized professional. Hence the complaint that they are not ready is always going to be there. Our college system is one which feeds facts and reproduces facts because, especially from an Engineering point of view, we are only an applied science field, which means application is the most important factor.

Should there be a training program for Engineering students during their course of study?

In fact, I understand that they have changed the system. Now it is compulsory for students to to go through an internship. But then this three-months internship can only introduce a student to the subject. Instead, a different approach could be adopted. They could be told: "This is the subject. You study it. We will come back after you prepare". This will enable them to learn the learning process. The present pedagogy must change. Rote learning should be done away with and self-teaching methods must be introduced. If you ask me, I feel that this should be introduced at the plus two level itself so that students are ready for the actual college education. At the plus two level, you are still in the rote learning mode. My personal opinion is that rote learning methodology is good till the 10th standard because that will make sure that everybody reaches a bare minimal level of literacy. After the 10th standard, plus 2 must only be a choice. Students are going to make career for themselves, so they must be taught how to learn themselves, because they do not yet know what they really want to learn. Many of us choose fields on the basis of peer pressure, parental pressure or societal pressure. Let's say you made a wrong choice. Now, do you have a mechanism to start afresh? So, if you institutionalise that in your students, I am sure this gap between learning and application will be bridged, or else it will remain forever.

How are students made industry-ready in the West?

Even in the western world, nobody comes out ready for the industry. They have a mechanism, especially in the civil Engineering field where there is a certification process that declares an individual a practicing professional. In the US they call such a person a professional Engineer, for which, I'm not exactly sure what postgraduation is needed. You have to work for a certain number of years and pass an exam and prove that you're fit enough to be a practicing professional. We don't have such a mechanism in our country, and bank on our college degrees to claim we are eligible to practice as a civil Engineer.

We do not have that extra step of qualifying process. Maybe things will change in the near future. However, even if policies are introduced you may have to wait and see whether they are actually implemented. So, the college-industry gap will remain as none in our academia is a practicing Engineer. None of our academicians, except maybe for a few years, practices Engineering. So, they are not able to introduce the practical aspects of Engineering among students. and it is left to us in the professional fields to train those recruited.

What kind of challenges do you encounter here?

The biggest challenge is to keep the flame of motivation to learn burning. if they say, 'No I have finished all my exams and finished reading all my books', then that will be a bewildering situation as our colleges are still churning out quite a large number of such students. We do not have a mechanism to pick and choose and say, "He has the learning spark." It's a difficult situation!

Praveen E.

Interviews, the 21st century nightmare

Interviews are a nightmare for any aspiring engineer. How do you face an interview board? How do you put in your best performance when everybody seems to have the same skill set? Do some hard homework and you can crack any interview.

In an era when there are enough people with similar skills competing for the same position, what makes you stand out would be your interpersonal skills.

Interpersonal skills are those skills that enable a person to understand what motivates others, and achieving the best results by using them. They are a combination of verbal and non-verbal aptitudes.

Verbal and non-verbal skills: People often consider verbal skills to be your skill at talking. Anyone can string a few words together and throw them at a person. But does that mean the person listening to you would understand what you imply?

Verbal skills include the way you deliver a message and also the way you receive it. It enables you to be understood and to understand others. Basic communication skills include effective speaking and listening. It also includes confidence, friendliness, empathy and respect. It is a soft skill that is in huge demand.

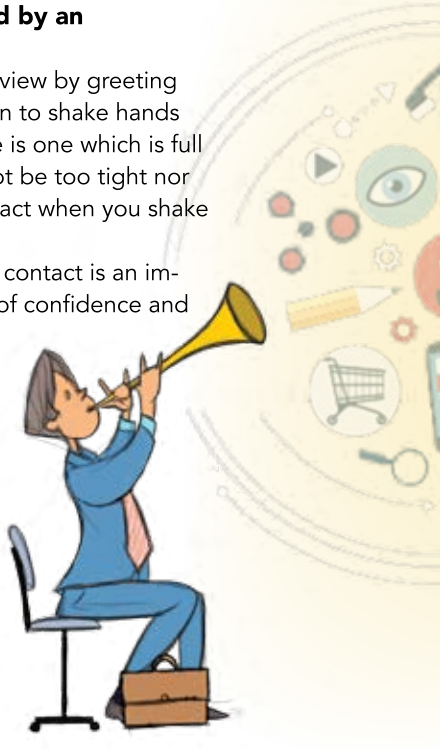
Non-verbal skills, also known as manual skills, involve communication without using words either in spoken or written form. Some examples of non-verbal communication are body movements (includes facial expression), vocalic (includes tone, pitch of voice), personal appearance, etc.

In order to bag that dream job, it is necessary that the candidate work not just on his or her verbal skills but also on non-verbal skills.

Non-verbal skills analysed by an interviewer:

Hand shake**:** Start an interview by greeting the interviewer warmly. Learn to shake hands properly. A good handshake is one which is full and firm. The grip should not be too tight nor too slack. Maintain eye contact when you shake hands.

Eye Contact: Good eye contact is an important factor as it is a sign of confidence and self-esteem. It indicates that you are interested in the conversation. When you communicate with an interviewer, maintain eye contact instead of looking at your hands or the wall. Ensure that your gaze is not piercing either. The trick is to keep a balance.



Punctuality: Reach the interview spot on

time. Punctuality is a trait that is appreciated and admired by everyone. Showing up late for an interview can tell a lot about your personality and work ethics. It is an indicator of your lack of respect for the value of other's time. It also shows that you do not pay attention to important details.

Tone by which you speak: The tone that a candidate uses and the flow of communication are other important traits that an interviewer analyses. The tone of your voice is an indicator of your mood. One should not speak too much or mumble while communicating, as it makes you appear nervous. The tone used should be appropriate, neither arrogant nor too modest. Use a steady and clear tone. Emphasis should be on keywords while talking; increase the speed as and when required to show enthusiasm.

Facial Expressions: Never underestimate the importance of facial expressions; be conscious about them. Maintain a positive demeanour. Always remember that your expression when you are listening to the interviewer matters as well. Nodding your head while listening is a sign to convey that you are acknowledging what is being said. Through subtle expressions, show them that you are impressed as well as intrigued.

The right approach--honesty or diplomacy? Diplomacy is the art of dealing with people in a sensitive and tactful way. Most often recruiters ask you difficult questions knowing fully well that it is hard to answer those questions honestly. In such cases, give an honest answer laced with diplomacy. For example, when asked about your weaknesses, do not go into a full-fledged explanation of all your short comings. Tell them you are learning from your mistakes.

The proper dress code: The first impression is the best impression. The way you are dressed when you attend an interview is a major factor that would contribute to creating an impression on those who are interviewing you. Difference industries/positions have different expectations on how a candidate or employee should be dressed. No matter what the dress code is, the point is to wear clean, pressed clothes.

The right way of answering: When asked your opinion about something, answer with confidence and surety. Do a research on the company and your job responsibilities. Answer frequently asked questions like "Why should we hire you?" or "Tell me something about yourself", smoothly and without hesitation. For other questions, a candidate must not give a simple 'yes' or 'no' as the answer. Take your time and answer them thoroughly. Usually, the response to a question at an interview should last between 60 seconds and 2 minutes.

Communication skills and non-verbal skills are equally important. In an interview, it is these skills that the interviewer analyses. The assessment of a candidate does not end with the interview. They will be assessed during the probationary period too. There are other skills that a candidate should develop in order to ensure his survival in the company. They are:

a). Competence
b). Passion
c). Integrity
d). Professionalism
e). Self-motivation
f). Leadership (based on position)
g). Decision making and
h). Upgrading skills.

Fear no more! Interview is never an uphill task!

Praveen E. is Head, Human Resources,
Gina Engineering Company Pvt.Ltd

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Biju K. Nair

Preet K. Lawrel

The Grand Lobby:

Chattisgarh has it all planned!

Naya Raipur, the new State capital, is one of the best planned cities in the country. And the Grand Lobby in the Capital Complex is a

How well can you plan a city? Chattisgarh has the answer – visit Naya Raipur and you will know.

Chattisgarh, the State formed in 2000 by partitioning ten Chhattisgarhi and six Gondi speaking southeastern districts of Madhya Pradesh, had Raipur as the official capital. But a new planned city was in talks among the State's leaders and that vision has now been made a reality as Naya Raipur.

Located 20 kilometers south of the former capital Raipur, Naya Raipur is the new administrative capital of Chhattisgarh. The city is the fourth planned city in the country after Chandigarh, Ahmedabad and Bhubaneshwar, and has been constructed in phases incorporating world class architecture and design. Apart from housing the seat of the Chhattisgarh government, the city is also planned to be the cultural and educational capital of the state.

It has been developed as a modern green city with 23% of the land in the city having green cover. The city has a 500 metre-wide green belt around it along with parks and landscaped recreational facilities.

There are arrangements for water conservation and water recycling, along with the maximum use of non-conventional energy. Wide roads have been built integrating underground electricity and telecommunication network, so overhead wires are absent. The city is equipped to provide round-the-clock uninterrupted water and power supply.

A residential complex of 2600 units has already been developed by Chhattisgarh Housing Board on 62 hectares of land. As part of the second phase of construction, a circular Capital Complex was constructed. Close to the Capital Complex lie the Raj Bhawan and residences of ministers.

The visual impact of an architectural marvel is something that evokes various emotional responses in the viewer. "GRAND LOBBY", as the name suggests, is a building that functions as a Lobby to the Ministers Block and the Secretary block, of the Capital Complex.

Conceptualized by UCJ Architecture and Environment, Principal Architect Chirag Jain and his team envisioned a structure that embodied their firm's ethos, drawing inspiration from India's multi-cultural fabric. The peculiar design of the structure, with its sprawling spider-like canopy and the confidently tall truncated pyramidal evokes a sense of dependability, power and reach, to anyone who visits the complex.

Built by the Naya Raipur Development Authority at a budget of Rs 560 crore, The Grand Lobby stands as a common entrance to different blocks in the Secretariat Complex, namely,

External View of Canopy and Grand Lobby

Sections
Analysis Model

The Ministers Block (G+5, plinth area approx. 6200sqft), The Secretaries Block (G+4, plinth area approx. 9600sqft), the Sections Block (G+3, plinth area approx. 18,000sqft) and two ancillary facilities block of G+2 levels.

The Architect has conceived an Innovative design approach of a Truncated Pyramid like Shell structure with varying sizes along the Height. The aesthetics of the structure is further enhanced by a sprawling canopy structure, with a flowing pattern and shape. It Comprises of Lift and Staircase block with a ramp for the handi-capped.

Entrance Canopy

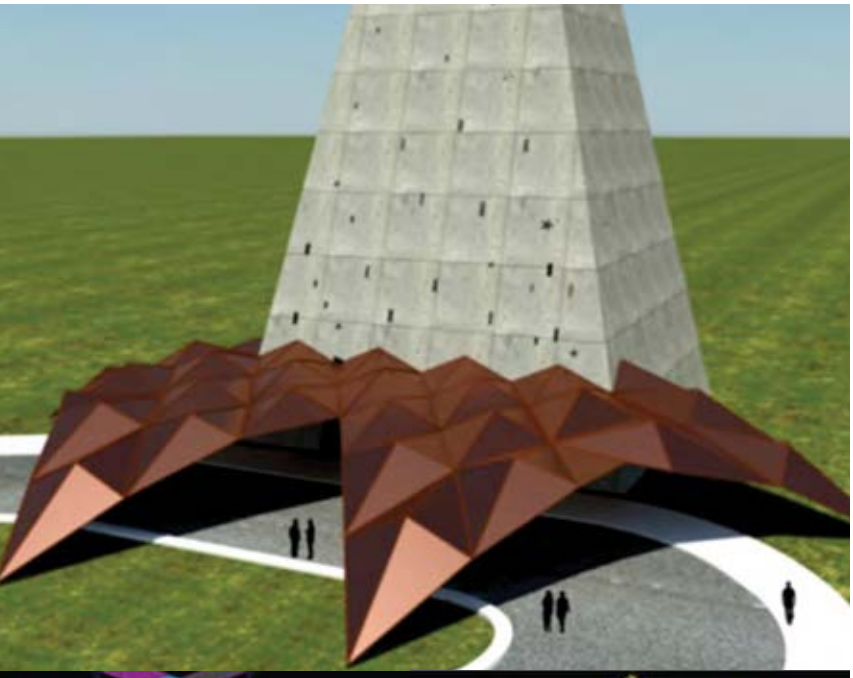
The size of the canopy structure is about 50m in length and 25m in width. The butterfly shaped canopy is supported at four points. The folds of the shell elements are planned in such a way that rain water would drain off the Canopy without getting accumulated on the roof.

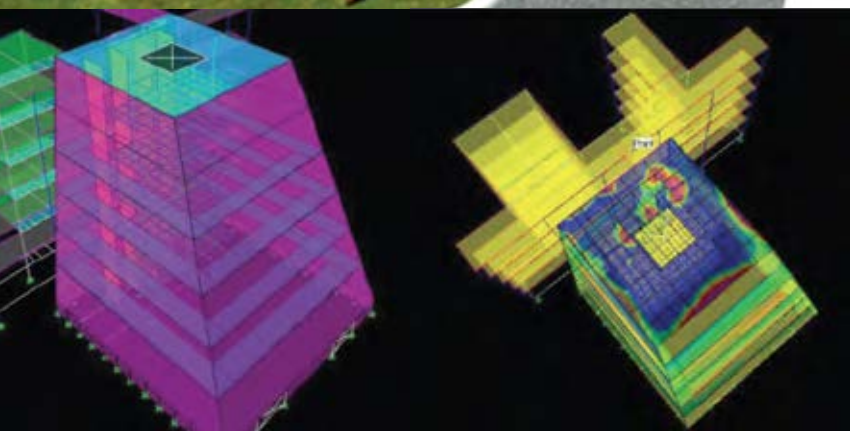
The Canopy is attached to the "Grand Lobby" with just pinned connections to arrest long term deflection, but with an expansion gap of 100mm. Water tightness for this expansion joint was achieved using Flashing.

Structural analysis and design

The Shell Block which covers the main lift area has a square dimension of 22m at the base, but keeping the lift side as constant it gradually reduces in dimensions from three sides, in inclined fashion till it reaches 13m size at the roof. There is a ramp slab cantilevered at the inner face of this wall which goes up continuously from floor to floor.

Architectural View of the GRAND LOBBY ▼





▲ Pinned Connection of Canopy to Foundation

◀ Stress Contour on Shell Elements

▲ Internal View of Entrance Canopy

◀ Pinned Connection of Canopy to Foundation

The space between lift lobby and the shell wall is kept as void at all levels gives the space a feel of grandeur with natural day light from the star-shaped skylight from the roof falling on the floor and walls.

At the construction stage, the walls of the shell element behaved like cantilever walls till the time the roof slab was cast. Hence for structural design, construction sequence analysis was also considered The self-weight of the inclined walls in the horizontal direction was the governing load case for staging design.

Laser guided Total stations were used to ensure that the wall's thickness and alignment was maintained internally as well as externally. 3D models of the supporting system (cup lock system with external braces) had to be specifically designed for different levels and each pour stage and the safety and stability of the staging system was checked through conducting mock trials.

Shell structure

Analysis of the shell structure was a task in itself due to its non-symmetrical shape and non-association to any standard geometric shape. Heavy cantilever load due to the internal ramp from one side of the wall only compounded the problem. Cantilever ramp slab played a dual role of a horizontal beam across the transverse walls for imparting stiffness to the walls. Adequate load flow path was ascertained using various FEM softwares like ANSYS and SAP 2000.

The 350mm thick RCC wall was the final pick, along with a ramp slab depth of maximum 450mm, truncating to 200mm. Various trial mix of concrete was done to ensure that it was pumpable and quick setting and at the same time the consistency had to be maintained as it was to be poured on the inclined surface.

Biju K. Nair is Technical Director and Preet K. Lawrel is Engneer (Design), at SACPL, Kochi.

ACMS: The byword for quality

Their mantra is quality assurance, and their service aims at a total management package that delivers the best for clients. In fact, ACMS Infra, created by 10 experts who had retired from L&T, offers services beyond its portfolio, ensuring quality and good practices at every phase of work for construction companies. Project management, construction management, cost management and audit, quantity survey and more are on offer from this group of veterans.

M. Ramkumar, Managing Director, ACMS Infra, shares with Construction Philosophy his views on this new venture. Excerpts from an interview:

What was the inspiration behind ACMS Infra?

All of us were with L&T for more than 35 years. We worked hard on the site, we have the domain knowledge and we know how to do a job facing all odds. As our fundamental aim was to satisfy customers, at times we did jobs that were more than what we were given.

After retirement, we needed to keep ourselves engaged and that is how we ventured into this. Now, we get the satisfaction of doing something good for construction companies. The primary purpose of the company is to tell them how to do a job better, but by taking their interests into consideration too.

Tell us about your target group

Our employees posted at the sites will not directly participate in performing the day-to-day task at the site but will track and inform the construction manager and planning manager about the happenings there and pointing out which areas are working well and which need more focus.

There is great scope for such services in the future. To start with, we will do only project controls like safety audit, cost audit, quality audit. Whether they are doing everything properly after utilisations or whether they are over mobi-

lized and also the delay from customer side will be properly documented so that later on it can be used for contract management purposes.

Our employees posted at the sites will not be worried about the day-to-day progress but will be informing the construction manager and planning manager about the happenings there and pointing out which areas are working well and which need more focus.

What according to you is the basic quality that we lack in the construction industry?

There are so many companies which have gone into bankruptcy. Basically, the reason is under-quoting and quoting unworkable prices. When they do this, they will get caught and that will result in the customer getting squeezed. Customers will always give them adequate opportunity to make up. Some people have got stuck in such mess and abruptly stopped and run away. In the long run, such practices do not work. Construction industry was not well organized back then. Today, it is well established and even Provident Fund is provided for all construction workers.

We are allowed to make mistakes. Mistakes happen when you do something. The only thing is that you should not repeat them.

How do you scrutinize customers?

Initially we will be working like an extended arm of L & T without direct interaction with customers and will be executing the internal auditing works. We will be contacting more MNCs in future.

What is the latest technology that your company has adopted?

Digitalization is the new trend, and we are into that. An extensive external format called Enterprise Information Portal, which is exclusively designed for construction industry and patented by L&T. We have the domain experience in the software that L&T uses and for their specific projects we can use their software with access provided by L&T. We also can install licensed software like Spoolgen, Primavera to monitor a specific project.

Construction industry is facing a number of issues because of the poor quality of work. For example, in Kerala the flaws in the construction of the flyover in Palarivattom and the proposed demolition of apartments have given a bad name for the industry. What changes would you suggest to improve the quality standards of the industry?

Companies that compromise on quality will not survive in the long run. Like the old saying, you can fool some people for some time but not all the people for all the time. Kerala is a State of brilliant and intelligent people, and I am surprised and pained that this has happened, because in construction industry, demolishing what we construct is the biggest doom a construction engineer faces.

CREDAI Mumbai

Navi Mumbai witnessed the sixth edition of BIZNET- A business and networking platform by CREDAI MCHI on 18th of October at Fortune Select Exotica. The event aims to create a highly interactive interface between developers, procurement heads and top allied industry players. The key note was by Mr. Amit Haware, CEO and Joint MD, Haware Properties. The event saw participation from several famous companies like Hindware, Hitachi, Jaquar etc.

FutureFit – To make the Engineers Fit for the Industry

FutureFit, an event by Construction Philosophy was held at St. Joseph College of Engineering and Technology (SJCET),Pala, Kerala and Federal Institute of Science and Technology (FISAT), Ankamaly, Kerala on the expectations of the recruiting world and on how to meet the demands?. 'Future fit' solely aims at making the engineering graduates fit for the industry. These initial sessions were received with wide appreciation for Construction Philosophy's effort to make scholars fit for profession.

Site Visit

As an extension of the FutureFit programme, team CP organised a site visit to the Palarivattom Flyover to study the case. Students from SJCET and FISAT were the first batch to be taken under this programme. The students were enlightened on the Palarivattom bridge issue and the possible remedies by the Executive Editor of CP, Divya Divakar.

Don Antony

Ask questions, learn on the job

'By three methods we may learn wisdom: First, by reflection, which is noblest; Second, by imitation, which is easiest; and third by experience, which is the bitterest.'

–Confucius

Learners inherit the future and there is no better place to learn than at the workplace.

Two years ago, after I had graduated in civil engineering, I had to face a plethora of questions from people about what I intended to do next. I was clueless.

Should I start working, or continue my studies into post-graduation? What branch of engineering should I chose to specialize in?

Coming from a family in the construction business, I naturally thought I should start as a site engineer in a construction firm, as a trainee. I did so, but that stint was very short lived and did not last more than a week. Since the job pressure was so immense, I felt that doing such herculean tasks for free was not worth the effort.

The other options I had were to either find work in a large firm that offered growth in a specific area or work in a small firm where one gained broader experience in several different aspects of civil engineering. Fortunately, I got the opportunity to work in a firm that gave me the latter kind of experience. I joined an infrastructure consultancy owned and managed by veteran PWD engineers with 30+ years of experience.

It was a very rewarding experience working with them. The first job I was given was that of a structural draftsman where I had to prepare structural drawings for school and college buildings. This involved drawing layouts of the foundation, columns, grade beam and floor beam, schedule of columns, beam detailing and reinforcement details of all structural elements such as footings, retaining walls and stairs.

A prerequisite standard format was provided by the client for the drawing. While at college, during the CADD labs, there was so much importance given to architectural plans, sections and elevations that we overlooked the importance of structural drawings. Initially, therefore, I found it difficult to recall beam detailing and

column schedules. With a few days' practice, nevertheless it became easier.

Unlike the architectural work I was familiar with in college, on this job AutoCad was used for structural drafting and the layers, and viewport options were used more extensively in the structural drawings. While this substantially improved my AutoCAD skills, the use of dynamic blocks and layers made the work easier.

The next responsibility I was given was estimation work and structural valuation. Estimation was done based on the drawings and specifications from the client which in this case was a government proposal. Hence it required an in-depth understanding of Kerala government's CPWD rates and usage of Project Information and Cost Estimation (PRICE) software.

Quantity Surveying was one of my favourite subjects during my studies so it was interesting to understand the various aspects of quantity surveying in practice. What seems like huge buildings at first would be dissected into smaller units using different methods. In my opinion, following a single method from the beginning to the end (for instance, the centreline method)

The best way to learn is to learn on the job

As a fresher, one must ask questions, resolve doubts and tap into the knowledge and experience of the others at the workplace. The questions you ask now will lay the foundation for your intellectual contribution in future projects and enhance your troubleshooting capabilities. The process of learning is never ending and learning on the job is the best way to enhance your knowledge.

worked better for most estimators.

The next project was structural valuation for the acquisition of buildings and structures for Kochi Metro. This required taking measurements from the site using a measuring tape, identifying the materials used in the construction and creating an estimate, while also considering the depreciation that had happened over the years.

It also required preparation of drawings with sections showing the materials used in each section. The effort required in this work was huge but the experience gained was unparalleled. To get acquainted with the work, we were at first given simple structures like compound walls and entrance gates and only later allowed to work with complex buildings.

One of the most complicated valuations I was given was that of a house built in the Laurie Baker style of architecture. This required an understanding of different building methods like Rat trap bond masonry and filler slabs which I had not encountered before. It required not only researching on the net but involved talking to experts and people, familiar with the subject.

What struck me was that it is interesting to work on old buildings and traditional architecture because it required you to evaluate the skill and labour involved.

Another area that I learnt a lot from was the design of roads. The firm undertook a detailed project report (DPR) for road development projects under KIIFB and PWD. The DPR consisted of a study that included the necessity of the road, traffic data, soil test, engineering survey details, a cost benefit analysis, rough estimates and alignment drawings.

The drawings attached to the DPR contained a detailed plan and profile, cross sections at specific intervals, road furniture and details of curves, culverts and bridges. The approach and methodology followed varied as per the requirements of the road and to calculate factors like curve radius and super elevation, and I had to go back to academic textbooks.

The softwares we used for the road design were Civil 3D and ESurvey which was novel to me, but I found that the industry lacked personnel trained in these software. Budding engineers would be advised to invest time in learning these software.

What proved critical during my tenure at this firm was the experience and core competence of my senior managers, who transferred their technical know-how to me. The expertise I gathered there made a quantum shift in my mind and pointed me towards a career in planning and estimation, for buildings and roads.

I would like to share some of my key learnings as a novice engineer. Maximum knowledge can be attained at the workplace if you are open to new ideas. While one must always be keen on learning, it is best to learn by doing. Quality of work improves only with practice. Consider the first few months at any workplace to be a grace period for you to learn.

As a fresher, one must ask questions, resolve doubts and tap into the knowledge and experience of the others at the workplace. The questions you ask now will lay the foundation for your intellectual contribution in future projects and enhance your troubleshooting capabilities.

The process of learning is never ending and learning on the job is the best way to enhance your knowledge.

Don Antony is Project Engineer,
Essense Consultants, Kochi

INTERESTING FACTS

Illusion and reality merge in Tower Infinity

How far-fetched and crazy would the idea of an invisible building sound? Well, not so far-fetched is the answer given by GDS Architects in South Korea. The masterminds of this firm have managed to get approval to construct an "invisible tower" near the Incheon Airport, outside Seoul in South Korea.

The tower christened as Tower Infinity, is also known as Ecoprism Tower and Cheonga City Tower. It is dubbed as the World's first invisible tower. With an area of 145,500 square metres and 453 m height, the tower is being built primarily for leisure activities with 4D theatre, restaurants, water park, landscaped gardens and is the third highest observation deck in the world. The tower aims to introduce state-of-the-art optical camouflage that will make the tower invisible.

The technology behind the invisibility.

The tower is equipped with a sophisticated computer system, LED cameras and projectors that will create a reflective cover on the building's exterior, making it translucent during the day and bright at night which is achieved by using 18 strategically placed optical cameras. These cameras capture real time views of the surroundings and project them on to the tower. A complex digital process is used to adjust and rotate the images to render the tower invisible.

The design was selected from the 146 entries from 46 countries for the Korea Land Corporations' Design Competition in 2008. The aim of the competition was to find a new building to symbolise the position of South Korea.

CCTV HEADQUARTERS BUILDING, BEIJING,CHINA

This iconic skyscraper, a contorted infinite loop,with its shape inspired from 'mobius strip' , is located in Beijing, China. Comprising of 51 floors. This 234 metre high building stands in a stable position with its huge cantilever overhangs attributed to the very unique 'Diagrid structural framing system' and transfers the horizontal and vertical forces diagonally instead of the conventional directions. Against the race for creating the tallest and largest buildings, the CCTV Building has created a unique space for itself as a structural engineering wonder in a class of its own!.

Rupin Sidharth
Structural Engineer
Trivandrum

DHANUSHKODI

Harry Josey
Adi Shankara College of Engineering

Sent us your clicks to mail@constructionphilosophy.com with a brief of the structure location and a self introduction

TENDER DETAILS

1)Central Public Work Department

Tender no: 01 SE PD EE SM IITKPD 2019 20

Tender Brief: 2 Girls Hostel Of 500 Capacity Each
G +8 Storeyed Building Dining And
Kitchen G+2
Substation Building G Including All Internal Water Supply Sanitary Installations Internal Electrical Installations Lifts Fire Fighting with Sprinkler System

State: West Bengal
Publish Date: 24/10/2019

Due Date: 03/12/2019

Tender Opening Date: 01/11/

Tender Value: INR 124.50 Crore /-

2)Ministry of Road Transport and Highways

Tender no: CE-RO/LKO/NH-24B (Raebareli Ring Road)/2019-20 date

Tender Brief: Bid For Balance Work Of Construction Of Ring Road For Raebareli City On Eastern Side Of Nh-24B (Phase-I) In The State Of Uttar Pradesh On Epc Basis .

State: Uttar Pradesh

Publish Date: 24/10/2019

Due Date: 09/12/2019

Tender Opening Date: 10/12/2019
Tender Value: INR 114.05 Crore

3) Tendering Authority: Jharkhand State Building Construction Corporation Limited

Tender Brief: Construction Of Museum, Open Air Theatre And Auditorium In Dumka Town Under Dumka District.

State: Jharkhand
Due Date: 04/12/2019

Tender Value: INR 30.39 Crore /-

4) Tendering Authority: Ministry Of Road Transport And Highways

Tender Brief: Tender For Periodical Renewal Of Nh-54 In The State Of Mizoram Under Annual Renewal Program (ARP)
For The Year 2019-20 From Km 70/00 To Km 95/00 (25 . 00 Km) .

State: Mizoram
Due Date:13/12/2019
Tender Opening Date:16/12/2019
Tender Value: INR 17.98 Crore /-

5) Tendering Authority: Kerala State Electricity Board

Tender Brief: Construction Of Hospital Block of Taluk Head Quarters Hospital , Karunagappally Along With All Associated Mep Services And Utilities For Health And Family Welfare Department .

State: Kerala
Due Date: 26/11/2019 **Tender Value:** INR 61.63 Crore /-

1)Dalmia Cement Bharat Limited

Role	:	Long Arm Technical Force
Qualification	:	Diploma/ BE Civil Engineering
Location	:	Kollam & Alappuzha
Monthly CTC	:	Rs 18000 + Rs 5000 Reimbursements
Experience	:	0 to 2 Years (Freshers can Apply)
Preference	:	Candidates from only Kollam & Alappuzha

2)Company: Hindustan Construction Company

Job Location	:	Jammu & Kashmir
Qualification	:	BE/B.Tech in Civil Engineering
Experience	:	15 Yrs. & above
Designation	:	Deputy Project Manager
Desired Profile	:	Candidate should have relevant Experience in roads,tunnel,hydro etc Candidate should have hands on Experience in Planning,Scheduling,Budgeting etc Candidate must have working knowledge of MS Project-Knowledge of Primavera is desired

3)Company: Cochin shipyard

Qualification	:	Junior Technical Assistant (Civil)
Job Location	:	Kochi, Kerala
Salary	:	₹23,500 - ₹77,000 a month
Experience	:	more than 4 years
No	.	of Vacancies: 01

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