SEPTEMBER 2019

VIEWPOINT

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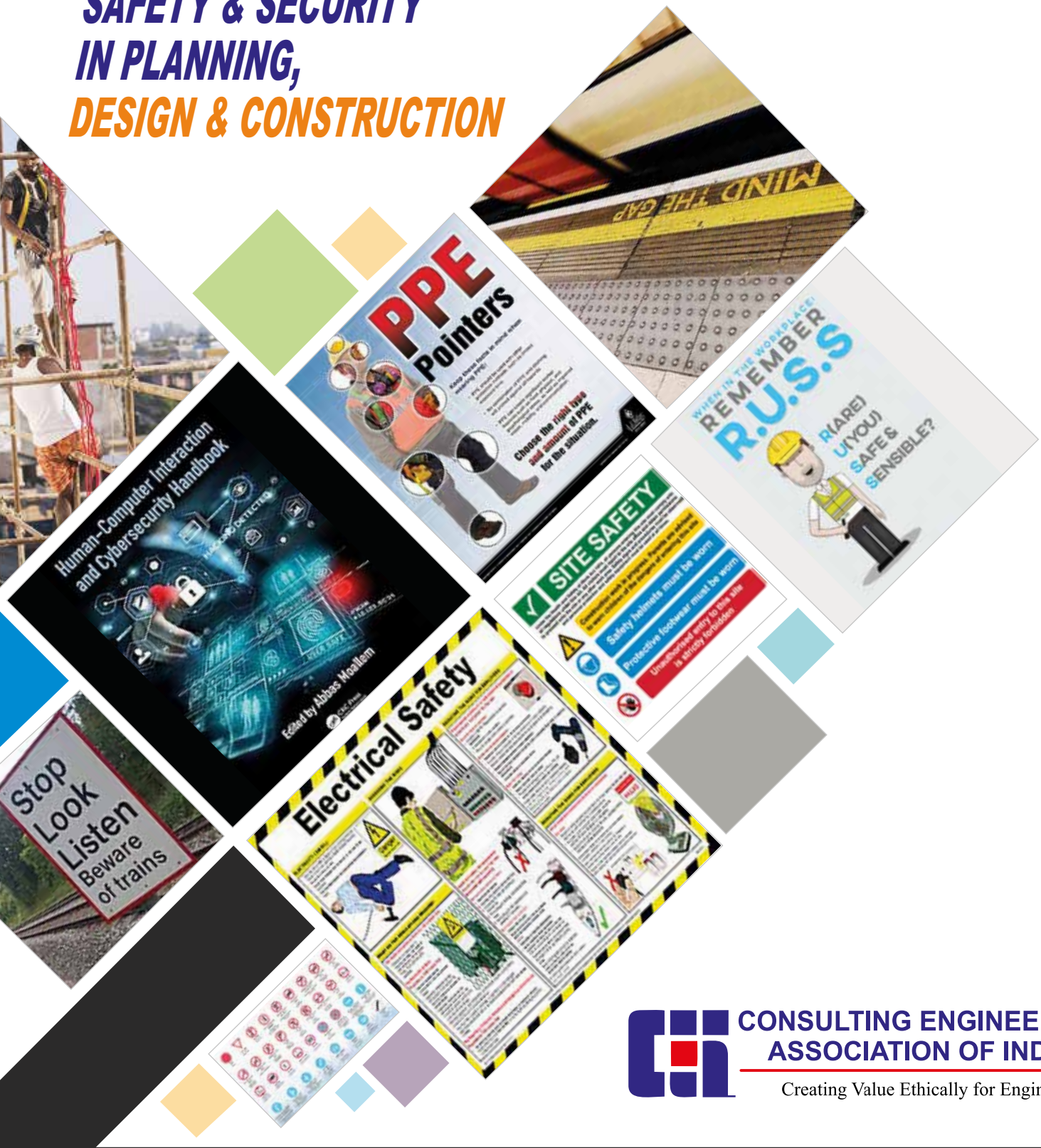
SAFETY & SECURITY IN PLANNING, DESIGN & CONSTRUCTION



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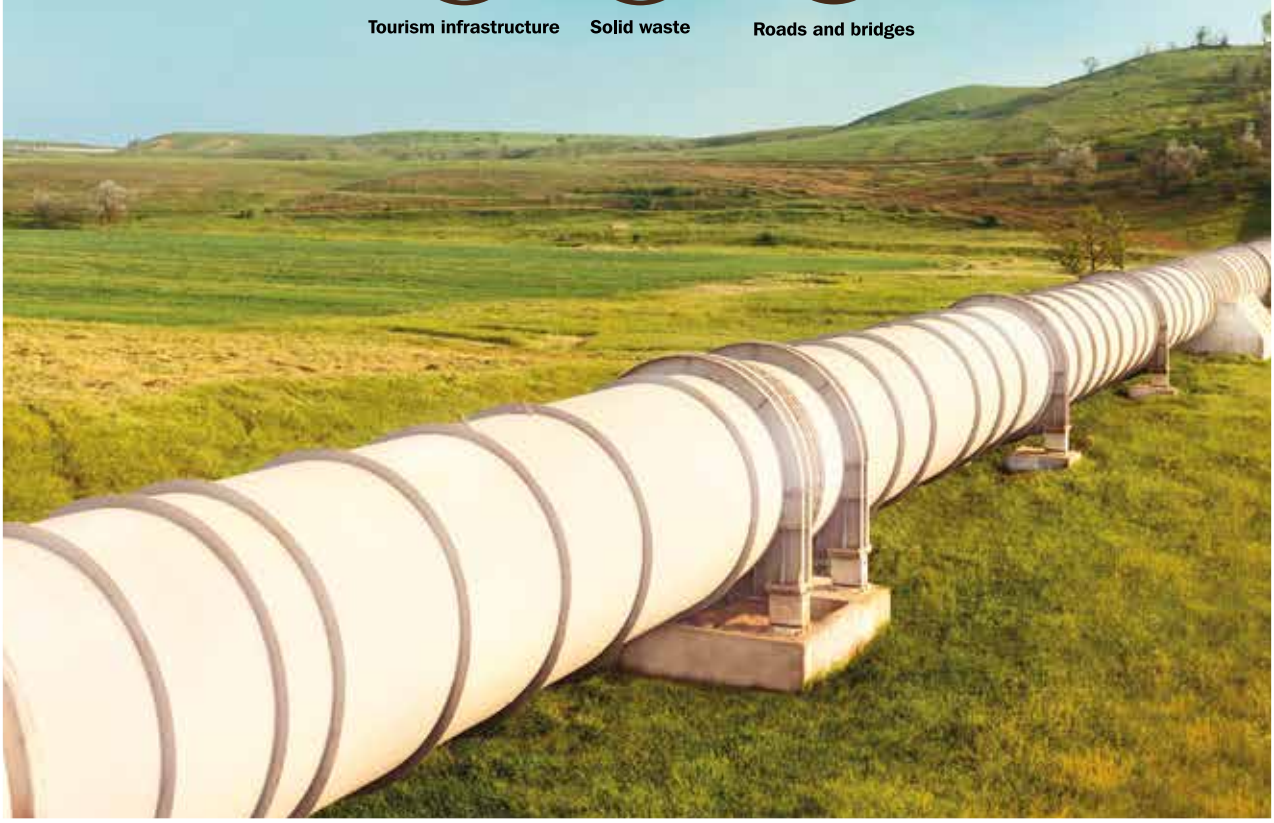

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We are one of the foremost construction companies in India having expertise in design and construction of Long Span Bridges such as Cable Stayed Bridges, Extradosed Bridges, Cantilever Bridges, Steel Superstructure Bridges across mighty rivers / creeks / water bodies and Elevated Metro Rail Corridors, BRTS, ROBs, RUBs in densely populated areas of cities. In last 22 years we have successfully completed over 300 projects in India, some of which includes:

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MESSAGE FROM CHIEF EDITOR

Dear Fellow Consulting Engineers,

From the beginning of time humans have sought Safety and Security as is evident from the evolution from tree dwellers, cave dwellers and so on to today's house dwellers. The intent has always been to ensure safety and security from the elements of nature, animals and fellow humans. However, the monsoons this year have again proved that Nature is supreme. The deluges have resulted in flooding, landslides, building collapses and the like, all of which have been playing havoc for the past few months in many parts of the country. Once again this year, as in the past, Safety & Security of habitants in the country have been breached. The question arises as to why everyone pleads helplessness even when a cursory review would show that most of it is the result of human actions over the years. Encroaching on water bodies, marshes, rivers, and sea has been going on along with that on green and forest areas. As was to be expected Nature's backlash has been and is occurring the world over and India is no exception.

Studies of the consequences of any land usage planning covering a large area seem to be missing the issue of stormwater run-off and its management. With software available to simulate stormwater run-off and the drainage network, these studies are now not difficult to perform as they used to be when hand calculations and manual drawings had to be done. These MUST form a part of every project big or small since even small building plots must be able to either store or drain the rainwater in a planned manner. In areas where development has already taken place, flood detection systems could be linked to alarm systems and also warn road and rail traffic. Deploying drones would provide visuals of larger affected areas and steps taken to rescue the stranded.

Smart Cities are the talk of the day. For them to be truly SMART and remain Smart their planning, design and functioning MUST ensure that they can function at 100% efficiency 24 hours a day right through the year and not go under water. TV transmission and mobile phone signals go for a toss whenever there is thunderstorm; these and other similar matters need to be addressed.

This issue of Viewpoint on "Safety & Security in Planning, Design & Construction" is not limited to just civil works but also covers industrial and chemical plants. Fires caused by leakage of inflammable material, blasts, electrical short circuit etc. are the major causes of accidents in such premises and lead to loss of lives and property. The recent catastrophe at ONGC's plant in Uran, near Mumbai is a case in point. Although the exact reason is not yet known, the theories as reported in the Press as the cause were that *"Highly inflammable naphtha overflows from underground storage tank's manhole to the storm water drainage channel flowing*

into village. Fire broke in it and whooshed into the plant" and the second theory was "Fire broke out when a CISF constable turned the ignition key of a fire tender". Both imply human failure in terms of planning, design and training. One is left to wonder how the hazard analysis was done, and if it was updated for the plant and its operations. Process safety especially in oil & gas and chemical plants is extremely important since the repercussions can be enormous and affect a large area extending beyond the plant boundaries. A lesson from such an event is that the safety and hazard studies must be periodically revisited and updated. The periodicity ought to be lesser for hazardous plants. Newer people ought to be inducted into the team so that there would be new perspectives, ideas and questions. In such plants security must go hand in hand with safety analysis to provide the best solutions.

Moving on to the more routine and widespread works such as the civil works and services/ utilities for buildings, bridges, towers and other structures, water/ sewerage treatment plants, pipelines, etc. there is ample and detailed guidance available in terms of statutory requirements, manuals and guidelines, which if adopted and followed would reduce the accidents drastically. Problems arise when short cuts are taken and result in disasters. The National Policy on Safety, Health and Environment at Workplace (NPSHEW) which was formed as per the "Directive Principles of State Policy" of the Constitution of India and International instruments and issued by the Ministry of Labour & Employment, Government of India was to create safety and health culture in the country and enhance the well being of employees. Thus, although there are legislations that cover Occupational Safety and Health at workplaces, how many professionals are aware and comply with them is a question mark. All recruits need to be trained in all the aspects of Safety and Health and be made aware of their duties and responsibilities. Refresher courses must also be held and checks done to verify implementation of all the rules. It's only then that over a period of time positive results would be seen.

Road traffic is an area where accidents are frequent. In India the roads and highways are used not just by motor vehicles and pedestrians but also by bicycles, handcarts, bullock carts, horse drawn carriages, etc. Animals such as stray cats, dogs, cattle, donkeys, etc. are also found on the roads. This mixed usage creates enormous problems in actual usage. Speeding, rash and drunk driving coupled with the urge to be 'me first' are the main causes. Use of digital sensors, cameras and/ or radars mounted on and also in the vehicles cabin would help in drastically reducing accidents. The external ones which are already provided in some high-end vehicles cars warn of collision with other vehicles. Similar sensors, cameras and radars should also be mounted in the rear and the sides so that a 360° view is provided to the driver, all in one screen. In goods vehicles they could also be provided on the top to warn if the clearance below bridges, height barriers, etc. is inadequate. These sensors, cameras and radars should also be programmed to sense humans and animals plus street furniture and fixtures and initiate action to prevent an accident. The internal sensors and cameras should be to check on the driver for alcohol consumption, abnormal behaviour, taking on mobile, or any other distraction. If detected the system should initiate slowing down the vehicle and also inform the police. Some of these features may already be available in vehicles in other countries but in India they are a rarity. Autonomous vehicles would any way have to have all the external features and more. Infact the features mentioned above ought to be made mandatory in construction vehicles, goods carriers, passenger busses and the like. These provisions would give Make in India's electronics business a big fillip. The recently amended Motor Vehicles Act 1988 which provides for more stringent action against traffic violations is a good step, however, it should also be ensured that traffic guiding and control systems and procedures are uniform at least within a city if not the state and the country. Road markings and signals change from intersection to intersection and at very busy intersections constables override the road marking and signaling system. That creates confusion in the mind of the road users as to what is the correct traffic manoeuvre to adopt at other times since different constables give different instructions.

Railways are another sector which needs to gear upto reduce accidents and fires. The advances in engineering and technology can help in detecting rail fracture, signal failures, presence of another train on the same track, etc. The accidents due to fires or equipment failures are mostly manmade and attributable to improper workmanship and hence need to be tackled by stricter checks and controls plus educating the workmen of the consequences of not following the correct procedure and practice.

Aircrafts of late have been in the news for accidents which are mostly attributable to design failures and over reliance on automation. It needs to be understood that AI is based on data of human experience and thus will have limitations. Hence, unbridled reliance on automation is not the right thing to do. AI cannot replace the spark of human ingenuity to provide "Eureka" moments.

Safety and Security are issues which cover all facets of our lives including the digital part. For the latter, cyber security is essential for all digital media and usage. As digitisation coupled with automation pervades more and more into the lives of human beings, security of all the data, information, process algorithms, etc. is crucial.

This issue of Viewpoint covers limited aspects which are informative, thought provoking and pointers for where the Profession ought to be heading vis-à-vis Safety and Security. They are issues which can be discussed for any length of time. However, this issue has finite capacity and hence the numbers of articles are limited.

Consulting Engineers and other Professional Engineers, be they in the controlled environment of a design office or those braving and bracing against Nature's elements at the site, are the ones who plan, design and execute all the large projects and it is therefore their duty and responsibility to keep all health, safety, security and sustainability aspects in mind right from the word go. Engineers also come in during the long years of Operation and Maintenance and it is also their duty and responsibility to abide by HSE et al requirements during that period.

The Engineering associations and bodies sorely need a legal mandate to govern the activities of the engineering professionals without which they have no teeth to regulate and rein in erring professionals. A National Register of Engineers would help in keeping track of everyone from the time that a Diploma or Degree is awarded and the CV starts to get populated. The experience record should be filled up and updated annually, after being duly certified by the employer, in the same register so that falsification and misrepresentation by an individual at a later date can be easily detected. As has been pointed out in the past issues of Viewpoint a Legislation for Engineers would go a long way in making the Engineering Profession ethical and Safety & Security conscious and take it to new heights since the Registering Bodies/ Associations would then have the authority to bar a person from practicing as an Engineer for any ethical breach.

Happy Reading and Learning

A P Mull

Dear Member,

This Engineers Day

let us Pledge to Engineer

as per Sound Engineering Practices

what is SAFE & SECURE

for use by one and All

in keeping with

Tenets of Sustainability

CEAI

Engineers' Day: PM Narendra Modi says human progress incomplete without their innovative zeal

Times of India; September 15, 2019

NEW DELHI: Prime Minister Narendra Modi hailed the contributions of engineers on the occasion of Engineer's Day.

"Engineers are synonymous with diligence and determination. Human progress would be incomplete without their innovative zeal. Greetings on #Engineers Day and best wishes to all hardworking Engineers.

Tributes to the exemplary engineer Sir M. Visvesvaraya on his birth anniversary," the PM tweeted.

https://timesofindia.indiatimes.com/india/engineers-day-pm-narendra-modi-says-human-progress-incomplete-withouth-their-innovative-zeal/articleshow/71133289.cms

WHY SAFETY BY DESIGN MAKES BUSINESS SENSE?

Sindhu Nair
DGM - Structural
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Abstract

Safety and Quality are the pillars of a project well-envisaged and well-executed. While the construction industry reels under the burden of having the largest number of accidents (industry wise), it is of great concern to note that 99% of these accidents, and eventually deaths, are avoidable. Responsibility of ensuring safety rests with each of one who is a part of this industry. Introduction of safe practices can be done, both at the design phase and the construction stage of a project. This paper explains why incorporating safety in design helps in reducing the number of unwarranted incidents, with least impact, in terms of cost and time.

INTRODUCTION

Ensuring safety, during and after construction is the responsibility of every individual working in the industry. Construction industry is one of the major contributors to the economic growth of any nation. It is also the largest creator of employment in the developing world. Records indicate that, in India, an average of 7 people died every day from 2001 to 2015 due to construction related failures[1]. It is alarming to note that 99% of these accidents were preventable.

While safe practices need to be reviewed and implemented at every stage of a project, it is interesting to note that the maximum advantage is obtained by planning and incorporating these initiatives at the design stage of a project.

Causes of Design Failures

1) Inadequate identification of requirements: Often, it is seen that design is carried out without clearly understanding the requirements of the project. Planning for design is an important step that is missed.
2) Incorrect input to software: Dependence on software for design is the norm of the day. Many a times, the inputs provided to the software program are incorrect and consequently result in incorrect output and design results.
3) Inadequate review: Review of designs and drawings by an experienced professional is a critical activity which is often ignored or surpassed in the interest of time. However, the impact on the subsequent time and cost that execution of incorrect details presents, is overlooked.
4) Less importance given to temporary structures: Design of temporary structures is given least importance. Often, these are left to small time contractors, who do not have the capability to design adequately. Many failures happen because of inadequately designed shuttering, lifting equipment, etc.

5) Multiple changes in design: Frequent and multiple changes in design could result in inadequacies and chances of missing incorporating the correct changes/ information in all the related details. This could thus result in incorrect details being executed.

RISK ASSESSMENT

As in any other activity carried out on a project, identification, assessment, control and mitigation of risks involved in design are imperative. Critical elements of design, probable failure modes, etc. need to be identified at the onset and monitored at each stage of design viz. concept, schematic and detailed design stages to ensure elimination or effective mitigation. It is ideal to have stage closure meetings were critical details are discussed and effectively reviewed.

Risk Assessment Process

Risk Mitigation and Control Measures

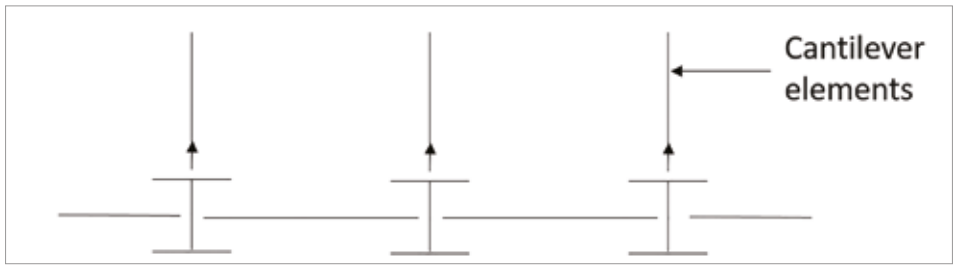
1) Planning for design: Identifying the parameters based on which the design needs to be carried out, is one of the most important first steps in ensuring correctness of design. Creating a basis of design that is reviewed and approved by various stakeholders gives a thoughtful review of the requirements. Expected life of the structure, materials envisaged to be used, functional requirements, etc. need to be identified at the onset of design.

   For e.g. deciding the material for internal partitions or external cladding is important. Weights considered for structural design are highly dependent on these parameters. Fire requirements or environmental factors could also affect the choice of materials. Redesign may be warranted if light weight cladding/partition elements are considered, but heavier elements are warranted as per architectural design.

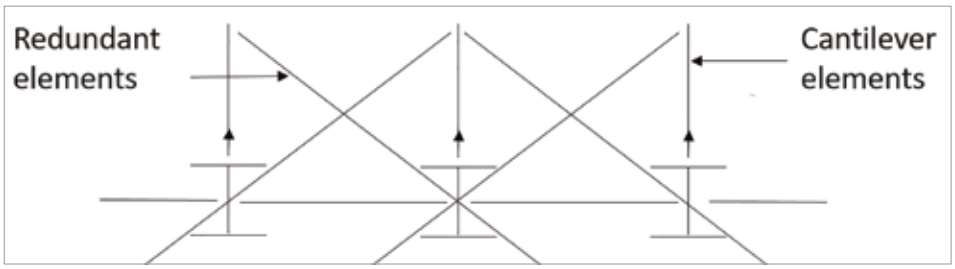
2) Ensuring thorough review: 'To err is human'. The age old adage stands tall even today. No amount of reasoning can negate the importance of a proper review carried out for any design. Unlike machines, where one design holds good for a number of products, in the building industry, every design is different. Careful review of the designs, ensures that many untoward incidents are avoided during and after construction. Revisions to designs and drawings take less time and effort, while implementing a change at site proves to be costlier and time consuming.

3) Redundancies: Building redundancy in a structure is like having a back-up plan for a crisis. Having alternate structural load paths for critical structural elements are advantageous. In case of failure of the critical element, instant collapse of the structure is averted. Sufficient time and warning is available for taking necessary remedial measures.

The figures attached below show a cantilevered structure and the second cantilevered structure with built-in redundancies. The inclined elements would help prevent an immediate collapse, in case the cantilever joints fail. These types of measures could be considered in case of very large cantilevers or for areas where collapse would endanger human lives.



Cantilevered structure



Cantilevered structure with built-in redundancies

4) Design review by qualified consultants: In addition to the design of permanent structures, it is prudent to entrust the consultant with review of all temporary structures. This will ensure safety of the miscellaneous structures designed by the contractors. It is always a good practice to involve consultants for occasional site review, checking of shuttering systems, review of proper storing of material on constructed structure, etc.

5) Interdisciplinary co-ordination: Co-ordination of designs and drawings from various disciplines is an important activity. Thorough co-ordination ensures that the requirements of one discipline are incorporated in the design of the other. This helps site function smoothly. If the co-ordination of all disciplinary drawings is left to the site team, often, the requirements are not understood clearly and cannot be incorporated in a correct manner. For e.g. clashes due to different services converging at a single point, can be effectively resolved, in the design stage by re-routing or changing levels of different services which will be a difficult activity at site.

6) Use of technology: Construction industry is one of the few industries which does not utilize the advancements in technology, to the optimum. Leveraging the advantages provided by the advanced 3D-software for three dimensional modelling of buildings and all its elements is the need of the hour. These help in identifying probable errors in design and drawings effectively and efficiently. The information stored in the form of the models helps the site execution and later it can be utilized at any given point in the life of the structure for understanding the design intent as also for carrying out any modifications to the structure.

7) Understanding execution sequence and methods: Discussions and close interaction with the site execution team helps in understanding the execution sequence and methods that would be employed. This could be used to make any modifications required to the design to accommodate the requirements of the construction stage. The execution team can also be made aware of the assumptions and design considerations, so that they consider suitable construction methodologies.

   For e.g. in case of construction of steel or precast elements, if the erection methodology entails placing heavy duty cranes on a particular floor, the floor needs to be designed for the additional load. Such discussions need to be carried out at an early design stage to avoid issues at a later date.

8) Structure specific requirements: Special structures have special requirements. For e.g. a structure that houses any machinery should consider the static and dynamic effects of the equipment on the structure. Check for resonant conditions should be carried out. Similarly, for tall structures, dynamic effects of wind are critical and these must be considered. The collapse of the Tacoma Narrows Bridge due to resonant wind conditions is a well-known example2.

Collapse of Tacoma Narrows Bridge

9) Expert opinion: The value added to design, by opinion from experts can never be equaled. Experience helps them identify the critical elements and failure points. Peer review of designs, atleast in the concept stages could benefit the project as a whole. It could identify good systems for design and also provide safer design alternatives. Especially for unconventional designs, it is a good idea to run the designs through the eyes of an expert in the field.

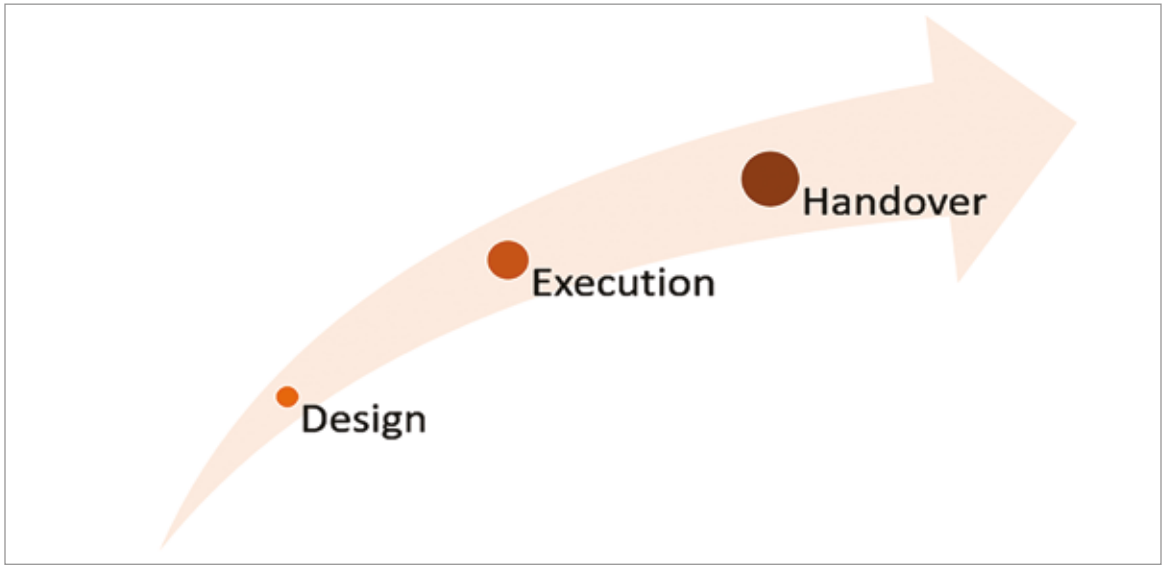
10) Maintenance: The life of a structure is defined by the quality of construction as much as the quality of its maintenance. However, once the building is handed over, often, it is seen that the occupants are unaware of the check points and the frequency at which these maintenance activities need to be carried out. It is a good practice to have a maintenance manual prepared by the design team, identifying the various check-points, checklist enlisting the elements to be checked and the frequency of such checks. Regular checks help in identifying any safety hazards. Distress in elements, excessive deflections, cracks in structure, leakages or seepages etc. which may affect the durability of the structure can be identified at an early phase.

CONCLUSION

Initiation of design with safety in mind helps make buildings safe. Designers, who think of the Safety of occupants and the Safety of the workmen, help in building safe structures. Safe details thus get incorporated in design, and hence get implemented at site.

Efforts should be taken to design 'First Time Right'. This helps avoid the errors associated with changing details frequently.

The cost of making small modifications to design to ensure safety at the design stage is much less than the cost of incorporating these at the execution stage. Costs do not increase linearly, they increase exponentially.



Cost associated with implementing changes for safety at each stage

Safety lapses and accidents end up taking away valuable lives of many. The costs associated with safety lapses are also unreasonably high. Many construction firms have got wiped off after occurrence of major accidents.

While safety practices need to be implemented at every stage of a project, the advantage gained by incorporating these at the very initial stages of design, outweigh others, making perfect business sense.

Responsible Designers Build Responsible Habitats!

REFERENCES:

1. *Data from the National Crime Records Bureau (NCRB)*
2. *Masayuki Nakao (Institute of Engineering Innovation, School of Engineering, The University of Tokyo),* ***'Collapse of Tacoma Narrows Bridge – November 7, 1940 in Tacoma, Washington, USA'***

SAFETY CHALLENGES IN CONSTRUCTION

Josy John
Corporate Safety Head
Tata Consulting Engineers Limited

The construction industry in India is the second biggest employer after agriculture and one estimate puts the numbers employed in this sector around 50 million presently and slated to grow to 90 million in the next 5 years. Most of the people working in the construction sector are unskilled with little or no education/ training and the job is of a casual nature. Agriculture is mostly working at grade whereas construction involves working at heights or depths as the height and complexity of structures become more challenging as the years roll on. The industry is fraught with inherent hazards and the attendant risks that go with it added to the workforce not fully aware of the hazards and mitigating steps needed to prevent injury at the place of work.

THE SAFETY CHALLENGE IN CONSTRUCTION

The biggest challenge in the construction industry is to ensure that human lives are not affected by the various activities and tasks that form part of construction. Being a labour intensive industry it is imperative that a large number of people must be deployed on the work site to deliver the project. The tasks that a person employed at site undertakes puts his health at risk and in some cases, life is also at risk when working in hazardous and high-risk areas like working at heights, deep excavations, confined spaces and even underwater. The term accident is associated with construction related as much as with traffic accidents since the reach of this business sector is far and wide.

The Government of India acknowledging that construction is also an industry by itself and the construction workers are unorganized and are exposed to occupational hazards with very little legal protection, passed the B*uilding and Other Construction Workers Act* in 1992 and amended it in 1996. The States were asked to prepare their own rules to be enforced by an appropriate authority appointed for their enforcement. Some States brought it under the Inspectorate of Factories and others under the Labour Officer. The Government of India is currently bringing together the Factories Act 1948, Building and Other Construction Workers Act 1996 and other relevant Acts (dealing with Mines, Dock Workers are two other important Acts) dealing with occupational health and safety at the workplace and is proposed to be called the Occupational Safety and Health Act spanning across all sectors where human effort is exposed to hazards. This would ensure that sectors that were not included earlier would be included under the new act and include both big and small businesses, contractors, plants, etc.

Traditionally the labour for the construction industry is from a rural background and are exposed only to agricultural work. During the break from the work on their land they turn to taking up work at the construction sites. They arrive at the construction sites with no prior skill in working as a tradesman in the carpentry, steel fixing, bricklaying, tile fixing, and painting, etc. trades. Therefore, it results in a steady turnover in the workforce in the construction industry with workmen available only for short periods of three to four months maximum in a year on site for work, resulting in construction companies having to constantly equip the workforce with the necessary skills to carry out work.

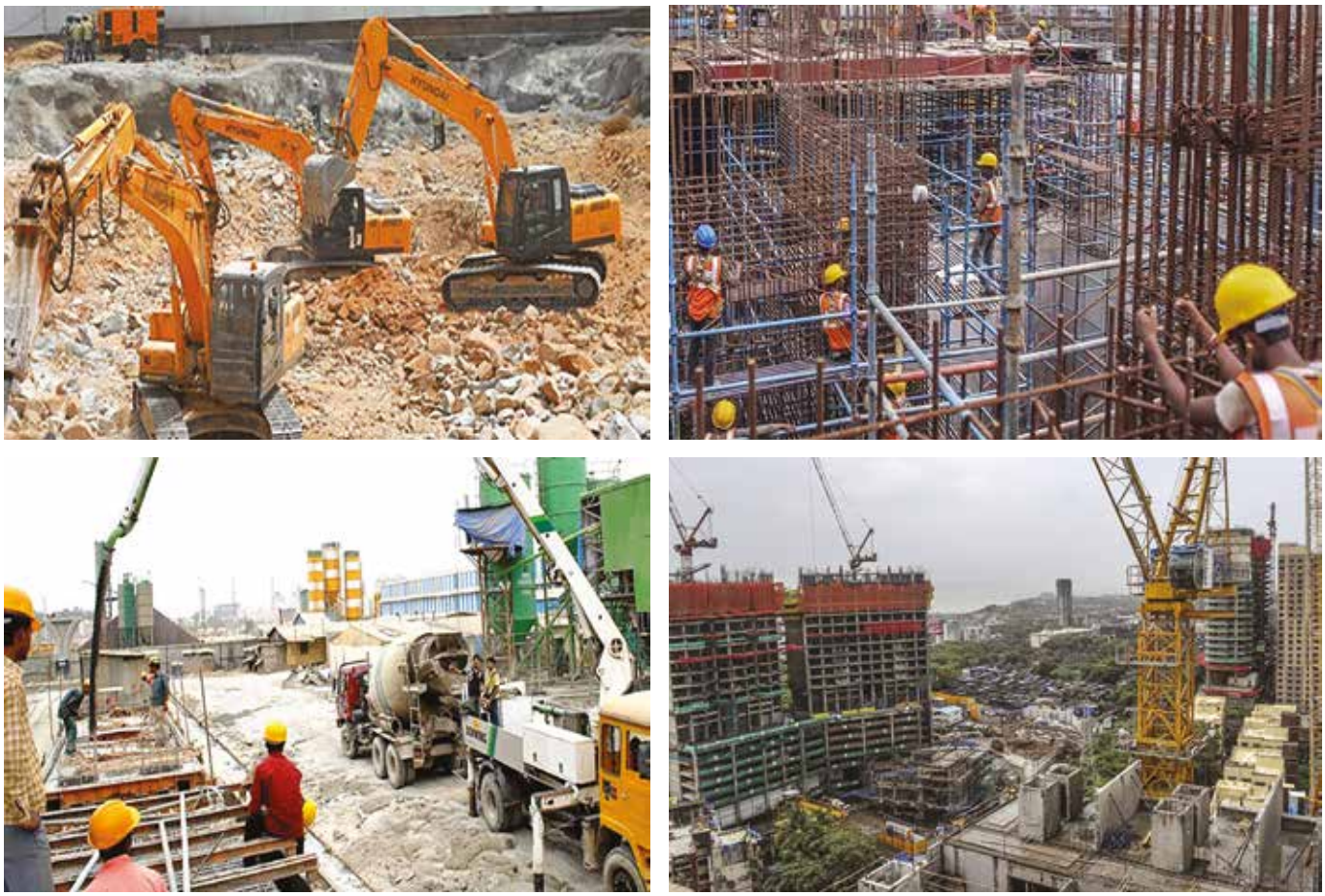
Today in India the construction industry is at par with global companies in the deployment of latest machinery and equipment. Gone are the days when only manual labour was involved in excavation of canals, lifting of material in buckets to higher elevations – all by forming a human chain.

Indian cities are growing rapidly with more and more people moving into them for work and demand for office space and residential accommodation keeps growing. Cities are growing vertically due to space constraints in preferred areas of cities; hence construction of taller buildings/ towers is the most favored by all stakeholders. Vertical construction needs methods of shifting men and material to higher elevations and they must work at heights, a couple of hundred meters and more, as the buildings rise from just single storied ones to multi-storied cloud enveloped skyscrapers. The construction industry records the maximum number of accidents with serious injuries and fatalities due to fall from heights globally and India is not behind in this area.

The way it was

Earthmoving equipment have enabled speed and safety in excavations; large excavations can now be done with minimal human effort and exposure to manual and ergonomic hazards of the worker is eliminated. The men operating the earth moving and rock breaking equipment are trained to operate them in a safe manner with the training being provided by the manufacturers themselves, a mix of classroom teaching and at site demonstration and practice on the equipment.

As the size of the building/ structure increased the demand for concrete increased multiple times and traditional mixers were not sufficient to deliver the quantities. Therefore concrete batching plants with large capacities of production per hour were installed. The concrete is transported in transit mixers to the location where a pump is provided either static or truck mounted, and the concrete pumped to the final location through pipes. The construction of taller buildings or high-rise buildings requires powerful pumps and suitable piping for delivery of the concrete.



The present scenario

This requires securing leading edges to prevent fall of men and arrangements to prevent fall of material from higher elevations during construction. Shifting of material is now done mechanically with cranes and hoists for shifting material unlike earlier when it was all manual, and the height was a couple of stories only,. Workers are transported vertically using passenger lifts with large carrying capacity (20 to 30 persons capacity for the car).

Tower cranes with very long booms providing a wider reach are also a common sight and communication between the operator and the signalman is by walkie talkie and CCTV for better communication as the crane operator would not have visibility of the signalman to ensure safe operations of the crane. Some sites have multiple tower cranes (15 and more) since the size of the plot is huge and work is being carried out simultaneously and multiple cranes are required for coverage of the entire plot. In such a situation anti-collision device are fixed since there is a likelihood of overlap of the cranes area of coverage. The erection and dismantling of these cranes are a high-risk activity and requires special training and skills to carry out the task.

Case 1

Case 2

Case 1: The Tower Crane was installed in a building, which while under construction came in the path of Cyclone Fani which hit the eastern coast of India. The severity of the wind led to the anchor bolts, provided for fixing the tower crane, coming off and the crane crashed across the road (no loss of life was reported).

The crane was pulled out of its anchors due to the bolts being unable to withstand the wind load and the accompanying gusts, the result being that the top anchors gave way and a cascading failure occurred. Within minutes the whole crane was pulled out of its anchors and it crashed.

The anchors for cranes are to be designed and embedded whilst casting the concrete either in the form of bolts or a base plate to which an end plate fixture can be used to connect the cranes horizontal fixing arm and the concrete beam/ column as per site condition and design. The lesson was clear - the enabling structures/ facilities must also be designed for the conditions they could encounter while in use.

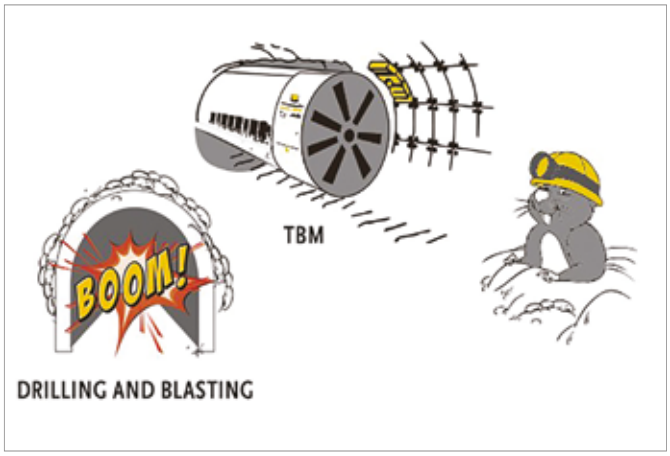
Case 2: In the second picture above the crane is shown to be damaged due to external forces. The luffing jib crane was fixed to the adjacent building tower structure and the height difference between the two buildings was around 125 m.

During the crane jumping operations the boom (approximately 40 m long) on the adjacent building broke as the pins were not in place correctly to connect the mast and the boom. This resulted in the mast dipping down and shearing the pins causing the entire boom and the top of the crane falling down on to the adjacent building under construction and damaged that crane also.

In this case it was an error attributed to the persons engaged in the activity that led to the crane collapse.

The first was a case of design inadequacy and the second a case of human error.

Construction of road and rail networks often requires the route to be through hilly and rock terrain or underground in congested urban areas where the ground space is limited. Tunnels provide the answer and also reduce the distance between two points. In the past the method adopted was to use blasting with explosives which was time consuming. The introduction of Tunnel Boring Machines using state of the art technology has increased the speed of construction of the tunnel resulting in quick commissioning of facility.



Safety in construction projects starts with the planning phase when all the use and space requirements come together, the plans are drawn up and the design engineer carries out the structural design in accordance with the codes. Compliance with the codes is normally enough to ensure the safety of the design, however the designer must consider the various parameters like wind, earth quake zoning, live load, of late fire load, blast loading plus any other condition that would have an impact on the performance of the structures in. The next is the performing phase and the actual works commence with a planning of the various sequences and resources in a phased manner and ensuring the workers are not exposed to hazards and the accompanying risks. Systematic training programs are done, and regular inspections are also carried out. Depending on the type/ size of the project various parameters are developed to measure and monitor the project.

In the present digital era and use of new technology for capturing data, remote control accessing and monitoring of construction sides has improved the overall delivery of the project. Equipment are more reliable with increased micro processor controls and the presence of cameras at multiple locations aid in monitoring a construction site 24/7 on large screens. The use of planning tools to predict what could possibly go wrong in a given scenario has led to reduction of accidents on construction sites.

Consultant engineers are fully responsible for the design and supervision of safety and have a legal duty to ensure compliance with the codes and statutory regulations.

Arbitration bill gets RS approval

TIMES NEWS NETWORK

New Delhi: The Rajya Sabha on Thursday passed the Arbitration and Conciliation (Amendment) Bill that seeks to make India a hub of arbitration for settling commercial disputes within a stipulated time. It proposes to cut the fee of arbitrators who delay decisions and to give incentives to those who decide cases before prescribed time.

The Upper House also cleared the bill for setting up the New Delhi International Arbitration Centre. Union law minister Ravi Shankar Prasad said the Amendment of Arbitration Act proposes to establish an Arbitration Council of India which shall accredit proper institutional arbitrators for domestic and international arbitration.

Probing data leak, says govt

The government said on Thursday that it was probing a leak of unemployment data and that efforts were being made to identify the person who was responsible. Minister of state for planning and statistics termed it as "serious" and said the data was leaked ahead of its announcement in May this year. TNN

They will grade the institutional arbitration centres and institutions dealing with arbitration. The bill proposes that arbitrators must complete the defence within six months and complete the proceedings in 12 months.

Full report on www.toi.in

ROAD SAFETY MEASURES TO REDUCE CRASHES

Suvendu Seth
Transport Planner and Road Safety Consultant

GLOBAL SCENARIO OF ROAD CRASHES

Road traffic crashes are a major problem all over the world. Every year about 1.35 million people are killed and 50 million are seriously injured due to road crashes. It is the number one killer among the 15 – 29 years age group. Worldwide, 80% of the traffic fatalities occur in countries in the lower to middle income group, which account for 76% of the population and 59% of the registered vehicles.

Considering traffic crashes as a global challenge, the United Nations have taken it into consideration in the Sustainable Development Goals, wherein Goal 3 on "Good health" is to "ensure healthy lives and promote well-being of all ages". Target 3.6 is that "by 2020 halve the number of global deaths and injuries from road traffic accidents".

Goal 11 – states "make cities and human settlements inclusive, safe, resilient and sustainable." Target 11.2 states "by 2030 provide access to safe, affordable and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons."

INDIAN SCENARIO OF ROAD CRASHES

According to data published (refer data.gov.in), nearly 4.7 lakh road crashes were recorded in 2017. The number has remained relatively constant over the past five years, with 2015 recording over five lakh crashes. The number of fatalities has risen from 1.37 lakh in 2013 to 1.48 lakh in 2017.

Analysis of crashes by road category reveal that most crashes occur on "other roads" (Major District Roads, Other District Roads and Village Roads), followed by National Highways and State Highways. This indicates that emphasis is to be given on improving safety of other roads.

Analysis of age profile of victims reveals that 25 – 35 years age group is the most susceptible, (26.7% of all accidents) followed by 18 – 25 years age group (23.2%). This indicates that the young, productive people are the maximum victims.

As a signatory to the 2015 Brasilia Declaration, a global conference on road safety sponsored by the World Health Organisation, India has committed itself to reducing the number of road crashes and fatalities by 50 per cent by 2020.

MITIGATION MEASURES INITIATED

The Ministry of Road Transport & Highways (MoRTH), Government of India have started taking several mitigation measures to reduce the number of road crashes. These measures are:

- Engineering
- Vehicular safety standards & IT enabled safety measures
- Education and awareness
- Post-crash response and trauma care

The engineering measures that have been initiated are:

- Identification and rectification of accident black spots
- Road safety audits at feasibility, design, construction and operation stages
- Installation of crash barriers
- Training and capacity building

This paper describes engineering measures to reduce road crashes.

Role of Engineers in road crash reduction

All engineers working within the highway and transportation environment are ideally placed to make a significant impact in helping to reduce the number and severity of road crashes.

There are two complementary approaches to this work – crash reduction and crash prevention.

- Crash Reduction: it involves measures designed to reduce the number and severity of crashes based on an existing known pattern.
- Crash Prevention: it relates to the application of measures to prevent crashes from taking place in the future.

Both are part of Road Safety Engineering. It influences road user behavior through engineering measures and by communicating the measures. Communication helps the user to take a series of correct decisions. The design of road features is done such that even if the user makes a mistake and a crash occurs, the severity is reduced. This is the principle of Forgiving design.

The main features of Road Safety Engineering are:

1. WARN road users of any possible hazards
2. INFORM road users of the type of unexpected conditions
3. GUIDE road users through sections of a route
4. CONTROL road users through conflicts
5. FORGIVE errant vehicles and behaviour of road users involved.

How is road safety engineering different from traditional engineering?

Traditional Engineering	Road Safety Engineering
• Traditional engineering is concerned with the capacity and speed on the road.	• Road safety engineering sacrifices speed and capacity for safety.
• Traditional engineers are concerned with structural aspects like pavement, bridges.	• Road safety engineers are concerned with features like signing, marking.
• Traditional engineers provide footpath on bridges & culverts for pedestrians.	• Safety engineers recommend hard shoulder for non-motorised vehicles & pedestrians.

Data is integral to decision making related to safety. It is needed for prioritizing investments, for analyzing cost effective techniques and interventions needed. Measuring, storing and analysis of crash related data is therefore very important in reducing crashes. The critical data that is required to be measured are: Crash, Traffic Volume and Road Characteristics. Other supplementary data that is also required.

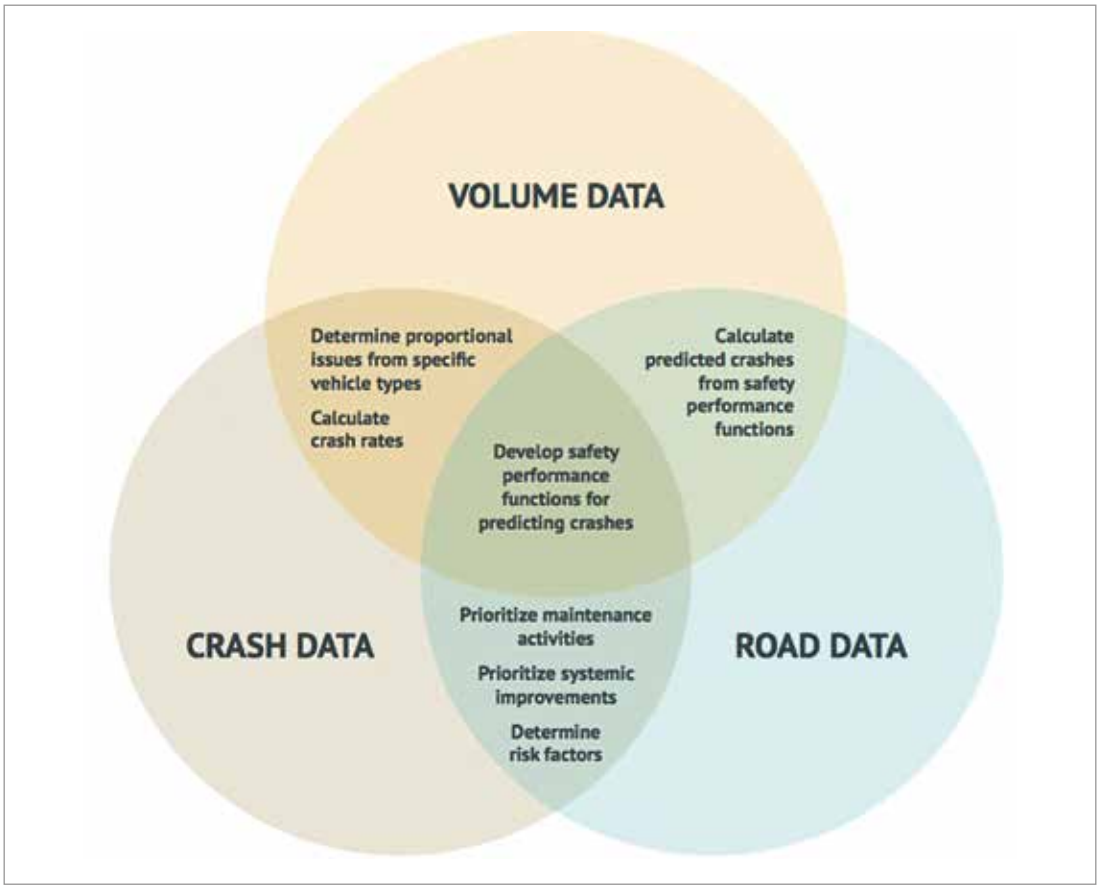
Precautions to be taken in design

Critical Data

- Crash data
- Traffic volume
- Road characteristics

Traffic Volume Data

- Annual Average Daily Traffic (AADT)
- Average Daily Traffic (ADT)
- Total entering traffic (for intersections)
- Turning movement counts
- Pedestrian counts
- Bicycle & non-motorised vehicle counts
- Percentage of traffic for specific vehicle type (e.g. heavy truck, motorcycle)



Crash Data

- Crash identification – unique identifier
- Date and time
- Jurisdiction
- Classification – where it occurred – on carriageway or outside
- Type of intersection
- Location – Geographic Information System or Linear Referencing System
- Roadway surface
- Contributing circumstances
- Weather conditions
- Environmental conditions
- Light conditions
- Manner of crash / collision impact
- Narrative and sketch

Road Characteristics Data Road segment

- Road classification
- Paved surface characteristics
- Number and type of lanes
- Shoulder, median and roadside descriptions
- Pedestrian and cyclist facilities

Alignment

- Curve and grade information

Junction

- Traffic control devices
- Intersection features
- Interchange and ramp descriptors

Supplemental Data

- Conflict & avoidance maneuver
- Injury surveillance and emergency medical system
- Driver history
- Vehicle registration
- Citations and enforcement
- Behavioral observation

Adopting Forgiving design can reduce chances of crashes. Treatment of roadside is very important in reducing crashes.

The pictures shown below illustrate the Unforgiving features present on highways.

Abrupt placement of crash barriers especially concrete/ masonry with no crash cushion.

Un-protected side slopes, with no hard shoulder markings, that result in loaded trucks toppling over.

Un-protected side drains that can cause crashes.

Inconsistency in communication to the user

Un-protected minor bridge, vehicles can fall down between the parapets

Poor visibility on both sides at a junction. Mirrors needs to be provided.

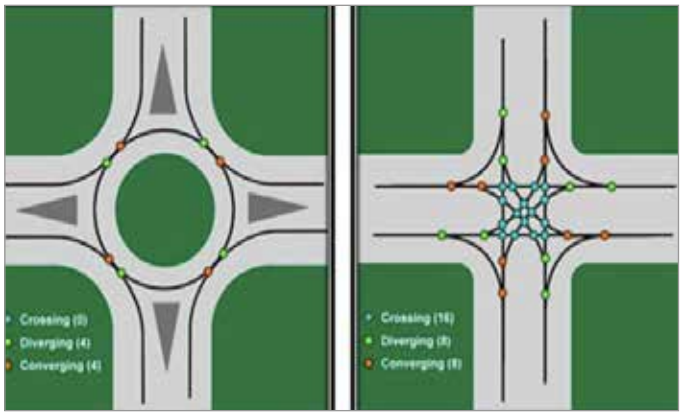
Restricted site distance

Multiple signs with confusing messages. The signage is not prominently displayed and is partly hidden by foliage.

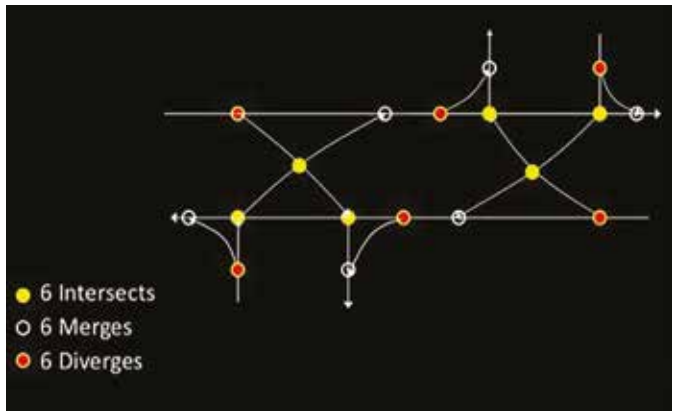
Features that help in reducing crashes are shown in the pictures below.

Rumble strips provided to alert driver of drifting away and carriageway and to prevent run-off crashes

Pictorial signs are effective on high speed roads



Roundabouts are safer than four legged intersections. They reduce the number of conflict points.



Staggered intersection reduces the conflict points and makes it safer.

WORK ZONE TRAFFIC SAFETY

Traffic management during construction is a very neglected area in India. Several crashes occur due to improper signing, marking and guidance in the construction zone. IRC: SP: 55 -2001 *"Guidelines in Traffic Management in Construction Zones"* provide detailed instructions on how to control traffic in the work zone areas. Road Safety Audit during construction can help in improving traffic management during construction and reduction in crashes.

CONCLUSIONS

Worldwide, road traffic crashes are a major cause of deaths. It is a severe problem in India. Road safety engineering can help in reducing crashes. Forgiving design and paying attention to the safety needs on roads as just the traditional issues like capacity and speed will improve safety and reduce crashes. Work zone safety is neglected in India. Road Safety Audit during construction can help in reducing crashes. Road safety engineering along with enforcement, education and emergency response can reduce fatalities on the road.

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Rs 30,000-crore road projects identified under built operate transfer

Source: Business Standard; September 20, 2019

In sync with the norms on hybrid-annuity and engineering-procurement-construction (EPC) contracts, the National Highways Authority of India (NHAI) has identified stretches of approximately 935 kilometres across India, which will be constructed on built operate transfer (BOT) toll mode. These stretches, with an indicative project cost of Rs 30,000 crore, have been selected in Andhra Pradesh, Haryana, Maharashtra, Karnataka, Tamil Nadu, West Bengal, Chhattisgarh, and Madhya Pradesh on the basis of existing traffic plying on the carriageway.

"These new norms have been uniformly formulated with the hybrid-annuity and EPC projects," a senior official said. A presentation regarding the same would be made to the road ministry on Thursday. To give opportunity to the private sector for diversification of their investment, NHAI has decided to invite the proposal for annual pre-qualification for construction of four, six lanes of national highways.

Annual pre-qualification will streamline the process for the applicants during the bid for individual project on BOT (Toll) mode and shall be applicable for current and next financial year. While inviting the proposal, special emphasis has been made to discard the non-performing parties for timely completion of the projects.

https://www.business-standard.com/article/economy-policy/rs-30-000-crore-road-projects-identified-under-built-operate-transfer-119092000033_1.html

BALANCED ROAD ELEMENTS DESIGN FOR ALL MODES TO SAVE LIVES

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Abstract

With the increase in "disposable income" in India from the beginning of the 21st Century; the number of vehicles, particularly cars and motorcycles have increased over the years at uncontrollable rates in millions. However, there is neither adequate infrastructure capacity to accommodate nor a standard national design manual to make their use safe. The increase in drivers and vehicles has resulted in road accidents of over 125,000 per annum and more than 500,000 are seriously injured; some of the injured completely lose the ability to work or move, which is a tragedy. With projections of the economy trying to reach the 5 Trillion plateau by 2025; it is necessary to make attempts to have a balanced road design for all modes and pedestrians on the tens of thousands of kilometers of roads to be built by the Ministry of Road Transport and Highways and State Agencies. The loss of life and property should be considered as a loss to the country and they should commit to make road safety an important and integral part of their program. Road Safety Audit was introduced but is being implemented at a slow pace by MoRTH since 2014. This paper attempts to provide recommendations to maximize benefits and minimize costs associated with street design considering safety. The impact of "human factor" also needs to be taken care.

1.0 INTRODUCTION

The objective of this paper is to provide Designers, Planners and Engineers who are looking for tools to provide flexibility within their existing street standard to make it safe. To assist agencies who lack the resources to undertake a major revision of their manuals or don't have a manual to look for proven examples to adopt and assist them to re-tool their current manuals or start new one. The focus is on agencies to adopt the latest thinking in street design from a safety perspective for all modes and pedestrians; avoid accidents and loss of property.

This paper provides some of the basic principles of good design, as well as a significant number of conceptual drawings to understand and implement. It also provides the design concepts that can be used to create construction documents for bidding purposes. In some areas, the paper presents different types of cross sections of streets in different neighbourhoods and in combinations. The paper suggests that designers should stay away from rigid standards that do not work and adopt new concepts applicable to all modes and safety of pedestrians.

2.0 BACKGROUND

In India road accidents account for over 125,000 to 150,000 people being killed per annum and more than 500,000 get seriously injured; some of the injured completely lose the ability to work or move. *That's more than 40 people per day or close to two persons every hour. It's the equivalent of 3 or 4 fully loaded jumbo jets with people crashing-with no survivors-every single month; probably we would be very alarmed with the air travel safety. But we do not seem*

to look at fatalities on the road in the same "big picture." We let this trend of poor design, lack of accountability and enforcement continue unchecked.

Most of the developing countries in South-East Asia (India, Pakistan, Bangladesh, Malaysia, Vietnam, Sri Lanka, Cambodia, etc.) have the potential to grow, but attention must be paid to planning and design of their urban areas and the new sub-urban areas that are developed to accommodate the surging urban population. India is a prime example where in around six decades the urban population rose nearly six (6) times. In 1960's 1 in 5 Indian lived in a city (8.1 crore in 1960), but today 1 in 3 live in the city (50 crore, 2017). This has put a tremendous pressure on the administrators and the infrastructure; as there is lack of capacity with administration to find solutions, the existing infrastructure do not have the capacity to handle the influx of new people and new vehicles joining the urban growth.

3.0 EXISTING SITUATION AND HUMAN FACTOR

In order to meet this sudden surge of urban population and vehicles; new roads and expressways are built in a "rush" without proper design and safety elements accompanied with lapse of quality control. This result in tragic death of innocent people and the accident rate keeps rising at a steady rate. In order to curb this trend and reverse it the Authorities should pay attention to proper planning and have a balanced approach to accommodate both the people and vehicles.

The problem of proper planning and design is further exasperated by the lack of a National Manual for Planning and Design of Roads and Expressways as in most developing countries. There are publications from the Indian Road Congress (IRC) on many of the elements required for better road and expressway design, but it needs to be consolidated and enforced along with Road Safety Audit. The newly created manuals should be adapted to the local conditions and modified if other manuals are used as a guideline. These manuals should encourage multimodal transportation and the use of technology such as Intelligent Transportation System (ITS) in the design.

3.1 HUMAN FACTOR

The glaring observation while travelling through developing countries is the impact of "human factor" on local traffic. That is either due to lack of understanding (education) or enforcement, there is no respect when it comes to traffic laws since they are not uniformly and equitably enforced. In addition, the "practise" that exists in letting offenders of traffic laws get away without proper due punishment and process adds to the problem. Therefore, educating the public and the Police Department in handling the traffic related issue must be addressed.

4.0 ROAD DESIGN

Major cities such as New Delhi, Mumbai, Calcutta, et al. are discovering that roads and public spaces are freely available for many aspects of daily life from reaching their destinations to making a lively hood and living (autos, taxis, private busses, trucks, dumpers, vendors, extension/ overflow of shops, etc. along the road). All these defeat the purpose that streets are meant to allow people to safely walk along or cross and link up with their neighbourhoods. Streets also enable mixed use developments - both residential and commercial premises. As more people desire to be able to walk or ride bicycles in their neighbourhoods, it is important that these roads be safe to travel for the young school going children as well as elderly people.

As a result, the cities are modifying the way they design their streets. Sometimes due to lack of updated standards the agencies are stifled by old and outdated standards and guidelines that prevent them from making the changes they should be making. Some want to modify their standards and manuals, but don't know how, or don't have

the resources. In developing the communities, they should focus in designing their streets for safety, liveability, sustainability, and designed per the Complete Streets principles enumerated below

- Obstruction of sight distance at junctions (transformers/ poles/ trees/ shrubs/ police booths) should be removed
- Discourage high speed by being too wide and without lane and turning lane markings and speed signs.
- Avoid streets with narrow sidewalks which force people to walk on the road. Discontinuous sidewalks (suddenly no sidewalks) should also be avoided.
- All footpaths should be safe for walking by the elderly and children going to school.
- Each road should have proper design speed based on its classification.
- Proper lighting during night times is a must for safety.
- Provide transit bays or safe way to alight and take passengers
- Design storm water drains so that water logging during heavy rains doesn't happen.
- Design to assist the "physically challenged" at intersections to cross the roads.
- Avoid too many furniture's along the pedestrian paths (light poles, trees, etc.)
- Provide proper intersection control for controlling the traffic flow.
- Implement proper access management along the roadway for all land uses.
- Take the input of stakeholders in designing the roads in neighbourhoods
- Have proper traffic calming and enforcement at all junctions.

Figures 1 to 5 show the various deficiencies in designing a road; Figure 6 shows a properly designed road with lane markings and provision for parking on the roadside with markings.

Figure 1: *Illegal Parking Loss of Roadway Capacity*

Figure 2: *Fixing of Uneven Footpath*

Figure 3: *Signs are Non-Standard – Obstruct Sight Distance*

Figure 4: *Providing Bus Bays*

Figure 5: *Lack of Stop Bar at Signalized Junctions (a car is in the path of pedestrians)*

Figure 6: *Road with Proper Lane and Parking Markings*

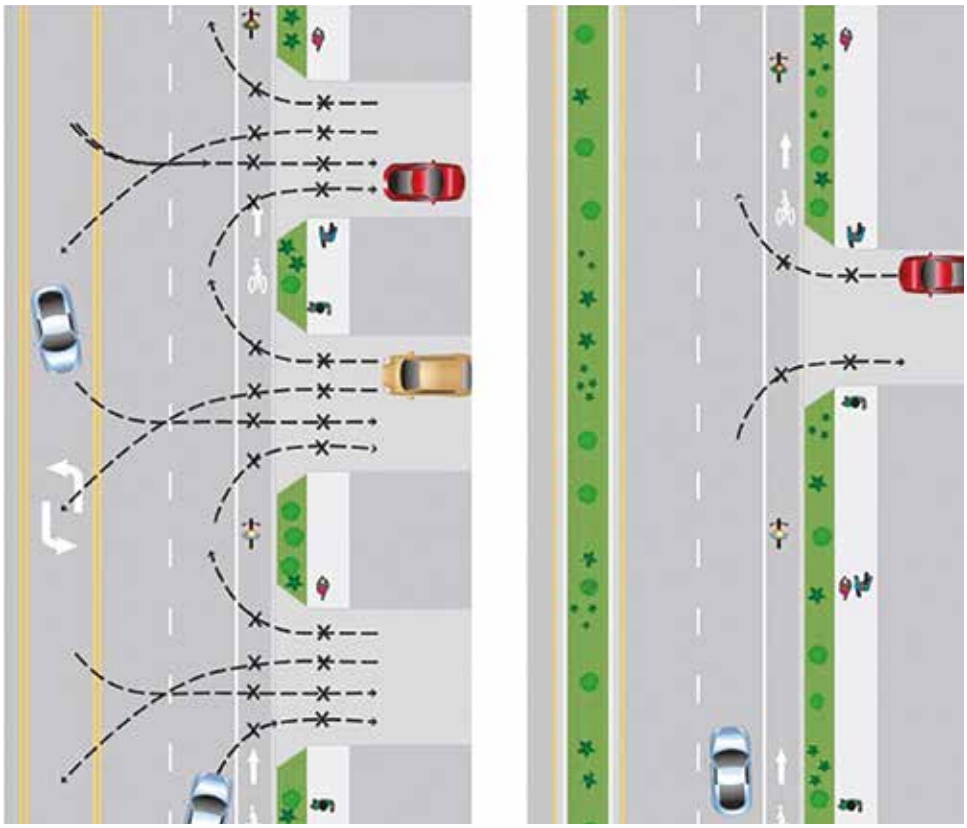
Source: *Rodic Consultants*

Many studies have shown that a well-designed street network goes beyond safety; they entail environmental, social, and economic gains. Sustainable street networks shape land use markets and increase the land use value. They also assist in making development compact and reduce the number of accidents and loss of property. The properties around these streets are desired by the community since they are safer to live in.

The economic and social activity would be shared by such communities. By providing opportunities for all modes of travel, an ideal street network enhances social equity and provides an ideal setting for high quality design. The resulting communities can be some of the most beautiful places with the highest values in the world. The most important factor is the safety of citizens living in these communities.

5. ACCESS DESIGN AND MANAGEMENT

For a balanced design of roads, it is important to have proper access design and management. Most of the accidents are due to improper access management and control of traffic through an access. For example, places such as Metro Stations, Bus Stations, Mall Entrances, Conference Halls, etc. should have proper access management for smooth and safe transition of vehicle from the roads to the land use. Also, in mixed land use situation with both residential and commercial uses.



BEFORE AFTER

Figure 7: *Consolidating Driveways to Reduce Conflict Points*

Too many driveways in addition to the intersections create additional conflict points between vehicles entering or leaving a street plus conflict with bicyclists and pedestrians riding or walking along the street. Therefore, eliminate or consolidated driveways where possible, it would assist in reducing the conflict points and reduce accidents. Figure 7 shows consolidation of driveways to reduce conflicts.

6.0 MEDIAN DESIGN AND FUNCTION

Medians are one of the most important elements of a good road design. They are used on urban streets to provide access management by limiting turn movements into and out of land uses depending on which side of the road is the access. The medians provide pedestrians with a refuge as they cross the road, and provide space for landscaping, lighting, and utilities. These medians are usually raised and curbed. Landscaped medians enhance the street or help to create an aesthetic look for the entire road.

For majority of major roads and highways it is necessary to have proper medians with barriers as shown in Figures 8 and 9. Also, during design proper openings are to be provided in the median for pedestrians to cross the street based on type of traffic control.

Figure 8: *Median as a Refuge for Pedestrians*

Figure 9: *Median Barrier to Avoid Pedestrian Conflict*
Source: *Rodic Consultants*

Figure 10 shows the design of a median at an intersection with a refuge island.

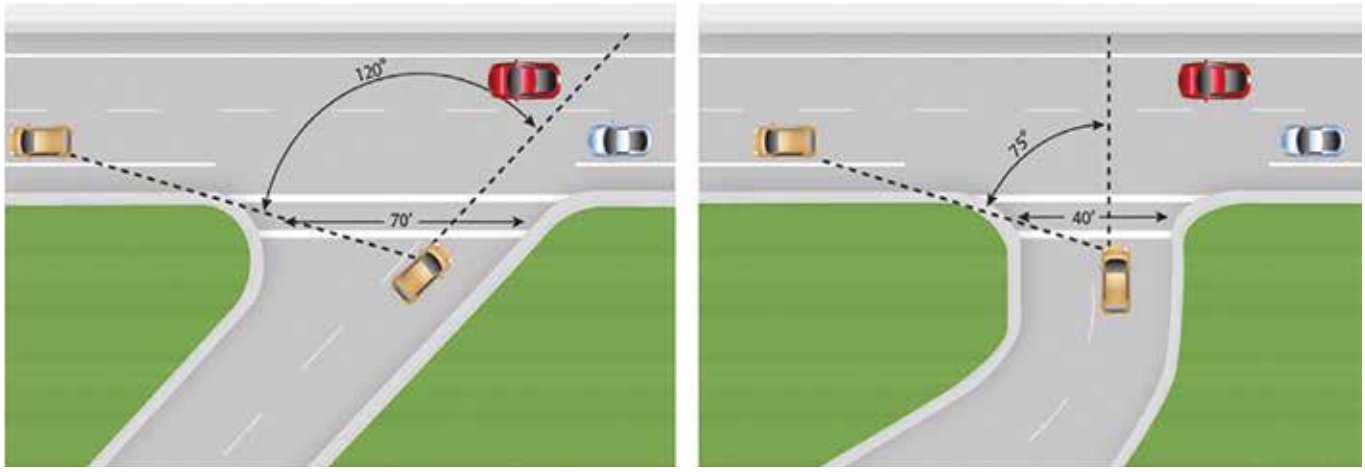
7.0 INTERSECTION DESIGN

It is important to note that intersections are where majority of the conflicts occur and lead to accidents. A well-designed intersection lets the vehicles approaching an intersection view and decide as to what they must do and what the conditions are at the intersection. At an intersection the conflicts for pedestrians and bicyclists are more due to the speeds of approaching vehicles, type of traffic control and time of day, including any visibility problems.

This section discusses design considerations in intersection geometry and intersection control, as well as stop signs, signalization, roundabouts and other traffic controls to improve safety, accessibility, and mobility for all users. The benefits and constraints of each feature type of intersection and design. In designing an intersection, the following should be considered:

Figure 10: *Traffic Channelization plus Refuge Island for Pedestrians*

- Make the intersection as compact as possible; wide intersections should be avoided.
- The geometry of an intersection is very important as it determines the distances travelled by the vehicles and the pedestrians.
- Reduce number of conflicts at an intersection, if there are land uses nearby.
- Avoid skewed and multi-legged intersections.
- Allow for controlled flow movements to provide access for pedestrians.
- The correct type of intersection control should be implemented such as stop sign, signal, roundabout, yield, etc.
- Sight Distance, Safety and Comfort to be ensured for all users of the intersection.



BEFORE AFTER

Figure 11: *Re-design of Skewed Intersection with Improved Sight Distance*

Figure 11 shows the re-design of a skewed intersection by reducing the width of the intersection and thus allowing the pedestrians to cross a lesser distance. Also, the re-design allows for better sight distance. since the visibility is improved at the intersection.

Figure 12 shows design methods that could be used to tighten the intersection to reduce speed and also enable lesser distance for the pedestrians to cross.

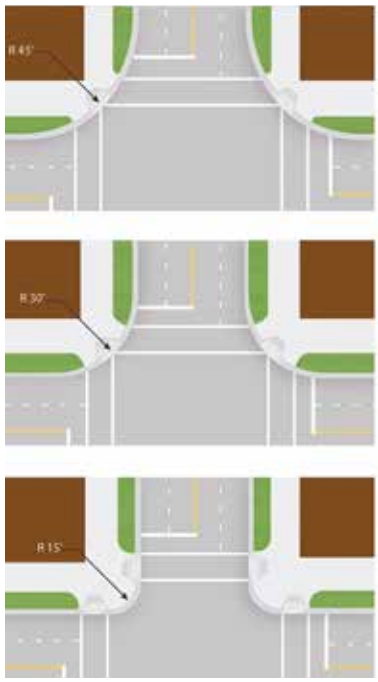


Figure 12: *Slowing the Vehicles and Reducing Crossing Distance*

This intersection geometry is important because it has significant impact on the comfort and safety of both vehicles and other users. For example, having a smaller corner radius provides the following benefits:

- Reduces the walking distance for pedestrians
- Makes vehicles cross slowly at the intersection
- Simpler design at land use areas where pedestrians are present.

Figure 13 shows a well-designed intersection with channelization based on the requirements of the intersection. Notice the turning lanes for left turns and right turns along with through lanes marked properly.

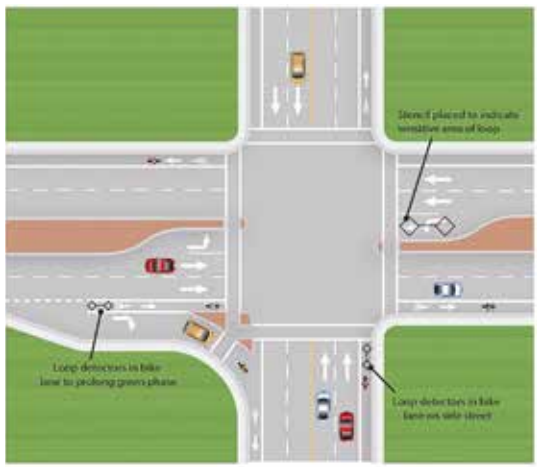


Figure 13: *Intersection with Channelization and Bike Lane Detectors*

8.0 PARKING DESIGN

Parking is one of the major problems that is required by the increasing vehicles on roads. It has an immense impact on the transportation system. The availability of less space in urban areas has increased the demand for parking space especially in areas like Central Business District (CBD) and other areas surrounding the cities. The lack of requsite public transit coupled with inadequate infrastructure; the problem of parking has become great in many cities across the globe.

In designing roads, it is important to think of parking as an integral part of the design considering the land use nearby. Figure 14 shows one type of parking provision near residential and mixed-use land use (residential and commercial). Similarly, Figure 15 shows the plan for developing parking along design roads with proper space for pedestrians and vehicles.

Figure 14: *Parking Design*

For many cities with exponential growth of cars and motorcycles like in India; it is essential that proper parking studies are done to provide adequate parking areas, so vehicles do not park illegally as shown in Figure 1 and take away capacity of the road and thus lead to congestion. The local governments should provide permanent parking structures at critical locations and develop revenue stream from these parking lots to maintain them. Ignoring such problems would only lead to congestion throughout the day as vehicles would be parked illegally and take away the available travel. Such actions impact the "local economy" as merchants would prefer to leave the area and settle in new areas where there is less congestion. *The local Government loses on the taxes from the businesses.*

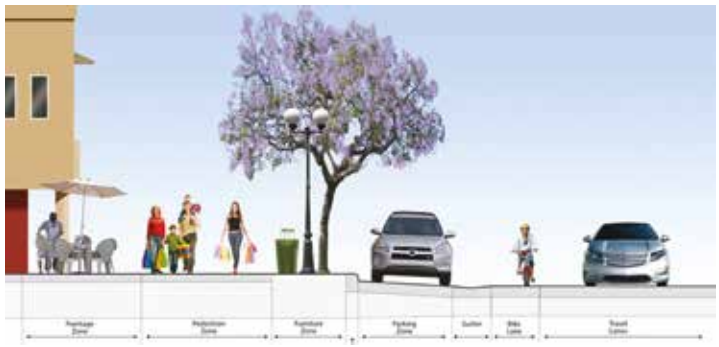


Figure 15: *Typical Roadway Design with Kerbside Parking Zone*

9.0 DESIGNING FOR PHYSICALLY CHALLENGED

Another important element that is missing in most developing countries is the provision for the movement of "physically challenged person". It is important to incorporate factors listed below into every road design while considering them for pedestrian improvement:

- The walking environment should be safe, inviting, and accessible to people of all ages and with limited physical abilities (including people with limited vision).
- The walking environment should be easy to use and understand along with easy access.
- The roads should seamlessly connect people to places. They should be continuous, with complete sidewalks, well-designed curb ramps, and well-designed street crossings with maximum safety for all users.

For example, under Title II of the "Americans with Disabilities Act (ADA) of 1990", State and Local Governments and public transit authorities in the USA must ensure that all their programs, services, and activities are accessible to and usable by individuals with disabilities. They must ensure that new construction and altered facilities are designed and constructed to be accessible to persons with disabilities. State and local governments must also keep the accessible features of facilities in operable working condition through maintenance measures including sidewalk repair, landscape trimming, work zone accessibility, and snow removal. Similar kind of policies should be developed by the Central, State and Local Authorities in India.

In planning for physically challenged persons with wheelchair and scooter:

- There should be no uneven surfaces that obstructs movement
- Rough surfaces must be avoided since they need more effort and cause pain, especially for people with back injuries
- Steep uphill slopes that slow the user and cause pain
- Steep downhill slopes that cause a loss of control and lead to injury
- Cross slopes that make the assistive device unstable for movement
- Narrow sidewalks that impede the ability of users to turn or to cross paths with others
- Devices that are hard to reach, such as push buttons for walk signals and doors
- The lack of time to cross the street; if it is uncontrolled or signalized

The above features in design apply for people with disability using walking-aid and having limited vision (Figure 16). For people with visual impairments, roads should be designed such that they can distinguish edge of sidewalk from the street; have markings to stay on correct path. Some of the above elements apply to school going children along busy streets and also the elderly.

Pedestrian push button placement (Credit: Michele Weisbart

Figure 16: *Intersection Design for Vision Impaired (notice the yellow mat for touch and feel)*

10.0 TRAFFIC CALMING DESIGN AND FUNCTION

Many of the traffic conflicts are between vehicles to vehicles and between vehicles and pedestrians. They are mostly caused by vehicles travelling at higher speed than posted based on hierarchical classification of the road. There is therefore a need to use "Traffic Calming" as a tool to reduce the negative effects of motor vehicle use, attempt to alter driver behaviour, and improve the conditions for non-motorized street users and make an overall road using experiences safe for all. Traffic Calming is applicable on all street types where pedestrians are allowed. Even on other roads it would help.

Traffic calming assists to control the vehicle speeds and change the driving habits of vehicle users. The visual impact of reduced speed is shown in Figure 17 which shows the peripheral vision the driver at different speeds of travel. At lower speed they have wider field of vision. The Charts in Figures 18 and 19 show the impact of different speeds on breaking and injury rate.

Peripheral Vision at 15 mph

Peripheral Vision at 30 mph

Peripheral vision decreases at higher speeds. (Credit: Michele Weisbart)

Figure 17: *Field of View at Different Speeds*

Figure 18 shows that it takes a longer distance to brake and come to a full stop as speeds increase. As observed in Figure 19, a collision at 40 kmph (25 miles per hour) or less; the rate of injury, including fatality drops. This is because of the lower kinetic energy of the vehicle and the pedestrian at lower speeds.

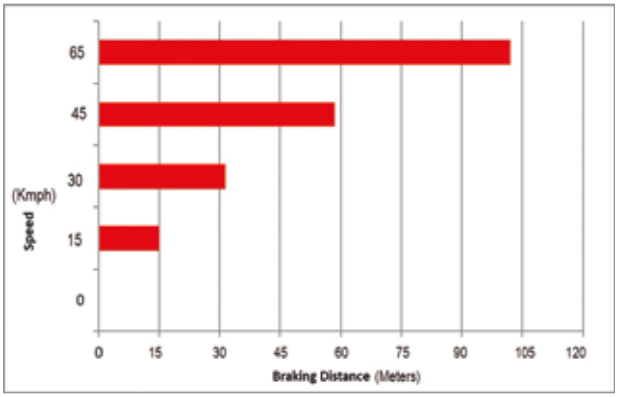


Figure 18: *Speed vs Braking Distance*

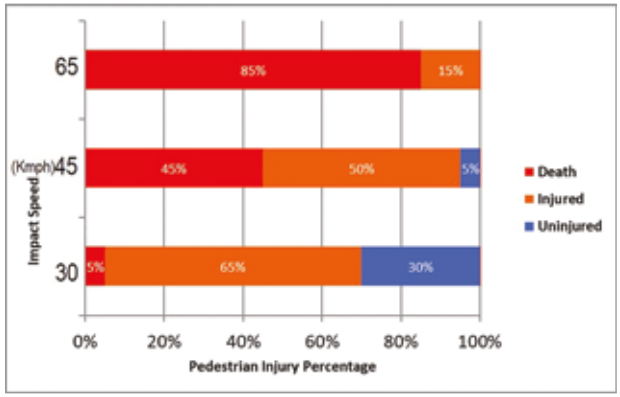


Figure 19: *Speed vs Pedestrian Injury Rate*

10.1 SAFE ROUTES TO SCHOOL

School children should be protected from accidents, particularly near their school area and the neighbourhoods they use. Traffic calming measures are should be employed with other strategies and changes to create safer walking and bicycling routes to school by slowing traffic and allowing children to use the routes safely. Each school area should be surveyed and investigated, and proper traffic calming measures developed. Figure 20 shows "table-top" pedestrian crossing used as a traffic calming device, which acts as a restraint for vehicles to slow as they cross the pedestrian crossing point.

Figure 20A: *Existing Conditions*

11.0 CONCLUSIONS AND RECOMMENDATIONS

Some of the main conclusions are:

1. Roads should be designed properly so that they are **"safe by design"** and not **"dangerous by design"**. They should be planned and designed to save loss of lives and property; improve quality of life.
2. A balanced approach for planning and design should be used at all levels for all users.
3. The major obstacle to saving lives is the ***"human factor"*** in developing countries; both design and enforcement should be done with accountability of offenders of traffic laws and effective and equitable enforcement by the agencies concerned.

   All basic elements of design for a road based on "hierarchical classifications" should be studied and final plans should be developed.
4. Roads should be designed for all users including the "physically challenged."

5. Elderly and School Children should feel safe to use roads with comfort; techniques such as traffic calming should be used to reduce the speed of vehicles based on area type.
6. The designs as discussed are easy to adopt to build better and safer roads. Most can be implemented even in the existing urban areas.

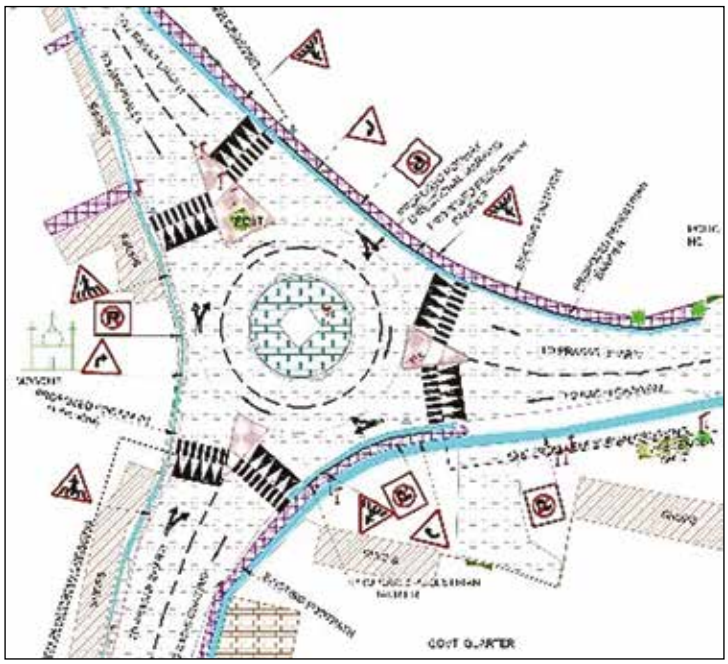


Figure 20B: *Intersection with Traffic Calming – Table-top Crossing*

Source: *Rodic Consultants*

11.1. RECOMMENDATIONS

Just as a society is jolted "people were getting killed" due to aircraft accidents, the same seriousness should be exercised for road accidents since every week close to 3 Jumbo loads of people are getting killed on roads in India. The recommendations can be summed up as:

1. Develop uniform guidelines and manuals for all road transportation related elements as described in the paper such as access, signs, parking, median and intersections, heights of curbs, widths of pavements, storm water drainage, ducts for services, etc. including management aspects to be used across the country with minor changes as per local requirements.
2. The "Engineering and Environment" can be taken care of by the members of the profession but the "Education and Enforcement" has to be by the Government and Authorities at all levels.
3. Cities need to first and foremost consider what problems they want to solve, and then develop model solutions.
4. The "Smart Cities" project in India should look into "good design" practices and adopt them and not what has not worked to date. Infact the models adopted ought to be sustainable and hold good for at least the next century since infrastructure is expensive, time consuming and difficult to rebuild.
5. The "fines" imposed should be proportional to the "traffic law" broken by the offender and should be made accountable to change the behaviour of vehicle users.

Acknowledgements & Credit

Figures 6 to 8 and 10-19 are from the manual "Model Design Manual for Living Streets," (www.modeldesignmanulforlivingstreets.com) for the Los Angeles County Renew Programme by Ryan Snyder and Associates, Los Angeles. The other Figures are from Rodic Consultants.

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PLANNING, DESIGN & CONSTRUCTION - SAFETY & SECURITY POLICY

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INSIGHT

Based on experience in the design, planning, and construction, it can be said that the construction period is the riskiest part of a project where safety policy and practices need to be paramount and followed by all. As per Wikipedia, *"Construction is a high hazard industry that comprises a wide range of activities involving construction, alteration, and/ or repair."* In her 'Fact Book', Sharon Szymanski explains that within the Construction Industry there are three vital traditional works relating to the built environment and can be divided into three sub-sectors: *"1) the construction of buildings, 2) road, highway and other infrastructure construction, and 3) specialty trades."* It is well known that the Construction Industry is evolving around the world; it symbolizes a country's development, improving its economy, and creating employment for many trades in the market landscape.

The Construction Industry does not differ on the principles of how to manage people, the practice of which is described on all construction management books such as the PMI's PMBOK Guide, which is a Standard/ Code of Practice. One must know the written ordinances applicable as per the local Codes and Standards. They are the ones which serve as references throughout the construction period. Other international standards are also adopted nowadays. According to the PMBOK, the construction industry may be defined as *"comprising those organizations involved in the design, production, alteration, renovation, maintenance, facility management, demolition and recycling of building and civil engineering works, including the supply of resources."* It includes all internal and external stakeholders' aspect that in some way or the other promote the industry's policies, procedures, practices, and culture. Additionally, Ofori clearly defines construction industry development as *"a deliberate and managed process to improve the capacity and effectiveness of the construction industry to meet the national economic demand for building and civil engineering products, and to support sustained national economic and social development objectives."*

Reports, trend analysis, and construction studies are necessary and essential references coupled with the latest information concerning the Engineering and Infrastructure Framework for business decision. However, in the design, planning, and construction, computer models are being used to direct real-life construction. The feedback from the site is updated by sensors designed and strategically placed in the buildings as part of the construction process. The sensors send back information on the way that materials are affected by changing climates and the passage of time. Safety aspects during the planning and design stages can be studied using BIM (Building Information Modelling) which provides visuals of the changes in the behaviour of structures behave under different forces (loads).

PLANNING, DESIGN, AND CONSTRUCTION JOB SAFETY

A job safety analysis must precede any task since it helps in integrating of accepted safety and health principles and practices by an individual into a particular task or job operation. In the job safety analysis, each basic step of the job

must be adheres to so that potential hazards are identified recommendations sought for the safest way of doing the task. In other fields, this procedure has been described as a job hazard analysis or job hazard breakdown.

Some individuals prefer to expand the analysis into all aspects of the job, not just safety, but a total job analysis approach. The methodology is based on the idea that whereas safety is an integral part of every job and is not a separate entity.

The terms "job" and "task" are used interchangeably to mean a specific work assignment, like for example "operating a grinder," "using a pressurized water extinguisher," or "changing a flat tire". Job hazard analysis is not suitable for jobs that have been defined too broadly such as, "overhauling an engine"; or defined too narrowly, like "positioning a car jack." For such cases, the method used is to observe and guide a worker when he actually performs the job. The advantage of this method is that it does not rely on individual memory and that observing or performing the process prompts in the recognition of hazards which could accidentally occur. For infrequently performed or new jobs, observation may not be the correct way to go about since the worker and the supervisor could both be untrained.

In all steps of planning, design and construction there must be a group of experienced workers and supervisors to facilitate the process to complete the analysis of the scenarios that emerge during discussion. The advantage of this method where most persons involved would have adequate experience and help promote a more acceptable work procedure. In to the group mentioned above, the assigned members of the Health and Safety Committee must also participate in the process to simplify and ratify the approach.

The benefits of doing a job hazard analysis become evident during the analysis process per se since it would identify hazards which were earlier not foreseen. The process also helps to increase the job knowledge for all the participants. While Safety and Health awareness gets highlighted, nevertheless, communications between workers and supervisors have to be improved, and compliance with safe work procedures that have been agreed must be promoted.

The job hazard analysis results in better understanding on it and helps to update the written work procedure. It can serve as a teaching aid for initial job training or as a briefing guide for infrequent jobs. It could also be used as a standard for Health and Safety inspections or observations. Most importantly, a job hazard analysis would guide and assist in a comprehensive accident investigation of the task.

The job hazard analysis, involves, four basic stages relating to all aspect of Planning, Design, and Construction. It must be understood with respect to the job to be analyzed, the work breakdown structure that has been tabled, identifying any potential hazards, and determining the required preventive measures so that they may overcome any of the implied hazards.

CONSTRUCTION AND PREMISES HAZARD ANALYSIS & LIABILITY

In a construction area, Site Security MUST provided to the level that the activities being performed require. The site, needless to say, MUST be insured. Security and insurance are necessary since the site may attract intruders and must thus secure the workers employed at the site, the plant and equipment, and the building structure. However, all facilities do not require the same degree of security. Those with access to the public such as hospitals, hotels, and offices buildings need to have different controls as compared to industrial or commercial properties to comply with NFPA 101 requirements. For a building the security features might include within the unoccupied periods with ease of access such as designed fences, gate controls, access controls, and other designed features through the use of physical security devices, intruder alarm systems, CCTV, lighting and guarding facilities. In the design and

planning, security should be appropriate to the required occupancy in the designed facility as per NFPA 730 'Guide for Premises Security' and the NFPA 731 'Standard for the Installation of Electronic Premises Security Systems'.

Controls need to be provided depending on type of occupancy, the history of the land (whether it a filled land, presence of asbestos, PCB or other environmental contaminants) and facilities within the premises such as water body and/or swimming pools, etc. which need to be properly protected and maintained.

Risk mitigation can be done in the building facility with adequate visitor controls, and security protections for site yards and building construction areas. Along with those regular facility inspection, housekeeping, and prompt corrective action program would go a long way to reducing accidents on the construction premises.

EMPLOYEE ORIENTATION AND EXPECTATION

Employees must be properly educated and trained regarding health and safety policy and practices in the planning, design, planning, and construction stages of a project with emphasis on protecting an individual's health. Whenever an employee joins the organization or wherever transferred into a new job. Safety implementation must come first to individuals while performing any task, because it has been found that inexperienced workers, in general, are involved in accidents most likely at a higher rate than others. An experienced and good worker can only be developed by working over a period of time, health and safety education and job skills training must be imparted regularly to improve the ability of an individual. Orientation and training sessions to meet the construction perspective would include:

- Emergency procedures.
- Location of the First Aid stations.
- Health and Safety responsibilities, including those specified by legislation.
- Reporting of injuries, unsafe conditions, and acts.
- Use of personal protective equipment.
- Right to refuse hazardous work.
- Hazards, including those outside own work area.
- Reasons for each Health and Safety rule.

An employee or even a newly hired employee is expected to absorb a certain amount of health and safety information; however, a brochure could be helpful as an advisory in outlining the points necessary in the design, planning and construction job which would serve as a checklist for employees, who are new on-site or in the offices where they are working, for securing protection and productive output from their activities.

CONSTRUCTION SITE SECURITY AND EVALUATION

The management has to take the first steps to gain and maintain an effective site security planning by means of an in-depth risk assessment and analysis mostly of the construction operations. The assessment would entail a systematic effort to identify any potential threats and other assets that need to be protected within the facility. Determining

and justifying the likelihood and consequence of the severity would help prioritise the appropriate protective actions. Construction sites with hazardous materials and processes would require special protection and security considerations that might affect the entire facility. However, for enterprise and commercial offices, people, property, and information are the tangible asset that need to be protected. Intangible assets, such as goodwill and branding, are also critical, and must be protected. For the protection of assets, legal, regulatory and liability considerations are also essential issues, for the stakeholder to take in to account for on-site security planning for the protection and safety of the common goods.

Evaluation aspect for security requirements are defined for people assets, property assets and informational assets involving design, planning, and construction tasks. As far as people assets are concerned, these would include employees, visitors, contractors, the surrounding community, building built-environment and others associated with the business operation. The property assets would range from building, machinery, and utilities to operations, equipment, and systems implications. Informational assets comprise the computer systems, processes and confidential business operation and information, such as trade secrets and other proprietary business information. The risk assessment must identify the vulnerable assets in each of the form of work or categories. Identifying and evaluating such vulnerability would require careful assessment for each risk factors identified and the potential threats to secure safety in the workplace for the design, planning, and construction operations. Moreover, these threats could be ranged from the usual or routine threats of break-ins and thefts within the construction area similarly to the previously overlooked threats which now occur - terrorism, espionage, and sabotage. Although, these threats were inconceivable in the past now, they are being considered for possible prevention and protection of all employees within the construction premises.

PERSONAL PROTECTIVE EQUIPMENT (PPE) PLANNING IN THE CONSTRUCTION ENVIRONMENT

Hazards exist in every workplace and stations wherever a job is performed. With all the job operations, the built-environment construction operation is riskier in many different forms in every corner and area, such as sharp edges, falling objects, flying sparks, chemicals, noise, and other myriads that are cause of potential danger in every situation. It is with this kind of environment in mind that the Occupational Safety and Health Administration (OSHA) had been formulated to set a standard that requires all employers to provide mandatory protection for employees from the workplace hazards to prevent and maintain a healthy environment. Thus controlling a hazard, within the built-environment, at its source is the most prevalent way of protecting employees especially in the construction area. The kind of hazards or worksite conditions would depend on the design, planning and construction operations and from those could be determined, with the help of OSHA, the recommended work practices prescribe the controls on how to manage or eliminate hazards to the possible extent.

According to the Occupational Safety and Health Administration's (OSHA's) Voluntary Protection Programs (VPP), the worksite analysis based on the working environment is one of the four elements that apply. The worksite analysis is an essential element necessary to establish the processes which aim & at identifying safety and health hazards in the worksite conditions by analyzing the identified risks. However, in the construction industry, an effective safety management system would identify the required safety and health hazards by proactive analysis of the workplace condition, and thus arrive on the controls by reducing or eliminating hazards through team approach, review and provide input on the given programs, initiative processes, and procedures.

Construction companies have their procedures to facilitate and conduct a thorough worksite analysis, through systematic processes that would provide information as needed to recognize and understand the hazards and potential hazards of the entire work programme within the construction environment. One of the possible types of worksite

analysis could be by making an inventory of potential hazards within the workplace of the construction environment by using the PPE (Personal Protective Equipment) assessment.

Within the construction environmental practice, the required workplace safety is the process of protecting and preventing employees from the work-related illnesses and injuries that could occur. It may start with the development of an institution's Environmental, Safety and Health Policy statement, principles and the work implementation with a safety plan and program for the protection of individual employees.

The essential use of Personal Protective Equipment (PPE) in the construction job would help to reduce and maintain employee's exposure to identified hazards when the engineering and administrative controls are not feasible or effective in reducing risks to acceptable levels as mandated. The PPE is a mandatory use within the construction environment especially when hazards are present. However, using PPE has a limitation in that it does not eliminate the source and may result in exposure if the PPE fails.

Effective management of employee's safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related cost impact. In fact, the creation of an effective safety and health program forms the basis of good employee protection, which can save time and money, as well as increase productivity, reduce employee injuries, illnesses and related workers compensation costs.

To assist employers and employees in developing effective safety and health programs, OSHA has published the recommended Safety and Health Program Management Guidelines on various applications, i.e. the construction environment.

CONSTRUCTION PROJECT COMPLETION EXPERIENCED

Every project needs to end according to the timeframe; from start to finish that's what project completion eyes, however, the last phase of the project is normally the hardest stretch. The whole point of a project is to deliver what has been designed and making sure that all stakeholders are satisfied with all the results and all required acceptance criteria met including those on safety and security.

In most cases, when project completion stage is often the most neglected phase since once the project is almost over, the project team starts to pack things up, clean up and stash files in a drawer or the computer system and start moving right into the next projects initiation phase. This attitude needs to be guarded against. The Project Team MUST handover the project to the Owner's or Facility Operator's team, area by area, system by system and at the same time ensure that as built drawings of the structure and systems, documents, vendor manuals, etc. are all catalogued, indexed and filed (hard and soft copies) properly so that retrieval in an emergency is easy and quick. These would also be needed when the project life is over and the facilities need to be rehabilitated and refurbished for different purposes.

A CASE STUDY – VENDOME MALL PROJECT - QATAR

The Vendome Mall - Snowpark and Family Entertainment Center is currently in progress. The contracted work discussed herein deals with the supply and installation of MEP Services (HVAC, Firefighting, Water Supply, Drainage, and Electrical Systems). The designed intent is to create an entertainment facility to be rated as one of the most fascinating and majestic structures (Photo-1). The Snowpark and Family Entertainment Center soars to a height of 17-meters inside the building as shown in Photo-3. The Vendome Mall building stands (Photo-2) on an artificial island in the Lusail area near to the West Bay Doha, which can be reached in just 15-minutes' drive from City Center

of Doha. The Main Contractor was awarded the MEP contract to provide a unique services engineering solution that would match the unique construction requirement and challenges for the Snowpark, Family Entertainment Center, and the entire project safety requirements.

CASE STUDY SOLUTION IN THE IMPROVEMENT OF THE CURRENT PROJECT

During the construction process, working hand in hand with the Project Main Contractor and the Project Consultant the MEP Sub-Contractor suggested improvements in the design drawings for securing better safety and healthy environment.

Photo-1: *Designed Snowpark and Family Entertainment Center (courtesy- CRC/MSAZI)*

Photo-2: *Vendome Mall Aerial View (courtesy- CRC)*

Amongst the myriad challenges that occur in the construction industry, an MEP Sub-Contractor faces multiple issues during the ongoing installation/ construction. Hence, careful consideration was given to the designs, to satisfy the requirement in a safety manner, of all engineering works before starting site construction.

Since the MEP Sub-Contractor is in the forefront for all the systems works they have initiated the safety policy and review for providing solutions to achieve the target.

RESPONSIBILITIES

For effective control the construction responsibilities have been allocated for the improvement of the organization of the construction activities. They comprise the following:

- The Main Contractor awarded the contract to the MEP Sub-Contractor who is responsible for the overall implementation of the work procedures as specified.
- The Construction MEP Project Manager along with his Discipline Engineers, Site Supervisors, Surveyors, and Foreman are to ensure that all the works are carried out according to the approved Specifications, Drawings and Method Statements.

Photo-3, *Snowpark and Family Entertainment Center Construction in progress (photo by rvgomeseria)*

- The Quality Assurance and Quality Control (QA/QC) Manager along with the QC Engineer ensures that all the works are carried out as per Specification; Issued for Construction (IFC) Drawings, Method Statement and Inspection Test Plan (ITP). The QA/ QC Manager must coordinate with the site for off-site tests related to the Contracted Works.

- The Health, Safety and Environment (HSE) Manager along with the Safety Officer are to ensure the implementation of all Safety Procedures and Safety Measures related to the nature of works being carried out within the construction environment and in accordance to the Health, Safety and Environment (HSE) plan.

The full work force is deployed on site all the requisite materials and equipment are ordered and engineering works submission and approvals are quickly resolved on all issues in the design via shop drawings submission and approvals to meet the project timeframe and thereafter executing the work promptly. Thus, the resulting efforts by the team produces work with reliability and accuracy, in fact improves on them since it is wastage has also been minimized.

SAFETY HAZARDS AND PREVENTIVE MEASURES IN THE CONSTRUCTION

The hazards associated with the installation of MEP/ Building Services and all related work activities are controlled as per the required risk assessment of the followings;

1. PPE Requirements

As a minimum requirement as discussed above, the following PPE has been used by the Staff and Labour employed on the construction site:

- Safety Helmet
- Safety shoes
- Coverall
- Hand gloves
- Full body harness
- Ear plugs
- Eye protection/ goggles
- Special respiratory mask/ dust mask

2. Information to Personnel

- Safety induction has is done in accordance with the HSE Policy prior to start of the work on the construction site.
- Job Stat Card known as the 4C (Control, Cooperation, Communication, Competence) and the Safety Tool Box is carried out prior to starting work.
- The Method Statement and the Risk Assessment briefing are convened and attended by all personnel assigned to do the task within the construction environment and all risk associated with the works are explained.

- The Safety Personnel and the designated Responsible Person ensure that all works on site are carried out and all statutory requirements are complied with before any works commences.
- Since the work is in the construction area, all measures are in place for minimizing/ eliminating dust exposure.
- Emergency evacuation plan is explained to all workmen to deal with emergency situation on the construction site.
- Periodically a Hazard Analysis is done for safety.
- All personnel are trained with the correct equipment set up on site.

THE CASE STUDY BENEFITS

The Vendome Mall - Snowpark and Family Entertainment Center is one of the most important landmarks in Qatar. Considering the harsh climate conditions and the construction standards set up for achieving high quality MEP/ Building Services for the facility not only to meet the client's expectations but try to exceed them.

In the ongoing construction, the principle is meeting the strength requirements they have provided by securing a total designed solution environmentally which will result in expanding life expectancy for the building structure, design safety and energy conservation.

Conclusion

At a Construction Site the Construction Project Manager is responsible for the Safety and Health of the employees on behalf of the Owner while still having to complete the project as per the approved design plans, scope of works and specifications. The Project Manager faces challenges from the grass-roots level since he is responsible for the overall success of delivering the owner's physical development within the constraints of project cost, time, quality, environmental and safety requirements

With the increase in complexity of projects and consequently of the construction processes ensuring awareness of Safety, Health and Security is extremely important. The processes and practices must be adhered to inspite of increasing nuisance from non-stakeholders since Owners demand accountability and proper guidance during the entire planning and construction process, all as approved by an authority.

The Project Manager must be technically competent and be able to adapt to the changing requirements of the built environment by relying on the knowledge and skills acquired through training, education, and hands-on experiences. The Project Manager needs to also have skills to meet play the roles and bear the responsibilities to create wisdom, distribute the wisdom, and identify hindrances to knowledge acquisition.

With PMI defining project management as *"the application of knowledge, skills, tools, and techniques to a broad range of activities in order to meet the requirements of a particular project."* HSE covers all phases of a project. In today's competitive environment, the construction technological aspects need to be designed for timely information to enable preparation of engineering works, procure the required materials from the market and deploy the necessary labour, plant and equipment so that productivity remains high. The processes discussed earlier provide an essential compendium in the construction industry for securing safety for all practicing engineers, designers, planners and other practitioners since Safety, Security and Health encompass all the phases of planning, design, and construction from start to finish.

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Xi'an-Chengdu high-speed railway wins global award

CHENGDU: 13 Sept 2019: A high-speed railway in western China has won the award of FIDIC Outstanding Project of the Year, its design company said.

The 658km-long railway that links Xi'an, the capital city of Northwest China's Shaanxi province, and Chengdu city, the capital of Southwest China's Sichuan province, was opened to traffic in 2017.

The railway, running through the Qinling Mountains, a natural boundary between the country's north and south, helps reduce the travel time between the cities to three hours from 16 hours. It can transport 100,000 passengers at most per day.

The award is praised as the Nobel Prize of the engineering industry, which is given by the International Federation of Consulting Engineers (FIDIC). — China Daily/ANN

Read more at https://www.thestar.com.my/news/regional/2019/09/13/xian-chengdu-high-speed-railway-wins-global-award#hvCRSmmA3hcfKcog.99

SAFETY & SECURITY IN CONSTRUCTION OF PROJECTS - A CASE STUDY FROM THE RAILWAYS

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BACKDROP

This case study pertains to the construction of a Road over Bridge (ROB), with approaches on both ends accessible through congested areas. The construction involved using a standard Bow String Steel Girder of 60 meter span, weighing 390 MT, over railway tracks, at a height of 10 m above the rail level.

Consulting Engineers have to be conscious of the fact that adherence to safety and security policies is the key to ensuring quality of the construction. They are excellent investment of time, money and resources, and eventually a critical factor to enhance the professional reputation of the Consulting Engineers. It is axiomatic that this component should be taken seriously, right from the start of the project. Indeed, this should be factored into even the initial plans and well before materials have been ordered. The endeavour should be to ensure that later, in the construction phase, issues of safety are given the highest attention. This is essential both for achieving quality of construction and build the company's reputation.

SITE DATA

As mentioned above, the construction of the ROB was planned by launching 60-meter Bow String Steel Girders to carry a 12 meter clear carriageway (two lanes) including footpath of 1.5 meters on each side, to be supported on Pot PTFE bearings placed on RCC abutments. Both ends of the bridge site were accessible via approach roads.

The height of the Girder was 10 meters, weighing approximately 390 metric ton. The soffit of the girder, from the rail level, was approximately 7 meters. The erection of all temporary structures as well as the launching of the girder was to be executed over existing railway tracks under the Power Cum Traffic Block. The operation proceeded in various stages.

Temporary staging: A temporary support frame was constructed using reinforced concrete pedestal for resting the cribs prepared with steel angle cross bracing. A custom cap beam was fabricated with steel channel and plate. The cribs columns were braced diagonally to reduce the effects of strong winds. Over the ISMB 600 beams, rails were placed and fixed. For sliding the Girder, PTFE strips were glued at a spacing of 1.2-meter centre to centre. The bottom beam of the girder was guided with angle and channel to restrict the lateral movement or slide of the girder while allowing only horizontal movement in the direction in line of the permanent bearing location.

The staging of the girder was prepared in two main spans. A 72-meter span was used as an erection and assembling platform for girder. The length of this span was planned to be greater than the span of girder to control the tail cantilever effect. Another staging for span of 60-meter was prepared just above the permanent bearing locations and alignment.

Erecting and Assembling of Girder: The structural elements of the assembled steel girder at site were lifted and placed on the launching platform with a 60 metric tonne capacity crane and hydra. The elements were placed in position as per the drawing and welded as per design.

Sliding Mechanism: For sliding of the assembly, use of low friction pads, with application of grease for smooth skidding, were adopted. Two 40 metric tonne capacity man-operated winches with wire rope were used for pulling of girder and one 20 metric tonne winch was used on the rear side (North side) to control the travel speed of the girder as a restraining winch.

Lowering of Girder over Bearing: After successfully pulling the girder to the bridge location, it had to be lowered to the bed block through a drop of approximately 1650 mm, for which a supporting arrangement was made with steel stools and wooden packing (2000x250x100mm) to ensure that the movement of the girder did not occur in any eventuality. All four girder ends were supported with 200 metric tonne capacity jacks. All jacks on each side were synchronized for uniform lowering operation at each end. The lowering of the Bow String Girder was followed, lowering by 100 mm and removing a 50 mm wooden packing. This process was repeated till the Girder assembly rested over the bearing level above the bed block of the abutment. Lateral adjustment was controlled with the help of a 50 mt hydraulic jack, in case required to keep the Girder in position on bearing.

UNFORTUNATELY, THINGS DID NOT GO AS PER PLAN.

While lowering the girder assembly in stages, one side of the supporting system (the steel support) and the jack system toppled and the steel girder on one end suddenly dropped on to the bed block and fell onto the abutment wall.

LESSONS LEARNT AND OBSERVATIONS

In retrospect, the use of steel stools for lowering of girder was not the correct choice. In such cases support with Hard wood timber block, bundle tied with steel strips could have been a better option. In addition, calibration and leakage of all the mechanical jacks must be done to check for their proper functioning, before putting them to use.

It was also clear to the consulting engineers and the investigating team that several safety norms had been either violated or paid inadequate attention. These included:

1. Ignorance of workers regarding work procedures.
2. Carelessness of workers in performing their assigned task.
3. Lack of financial allocation for safety management.
4. Regular Training of Safety officer and the officer's presence at Site.
5. Lack of experience of workers on safety matters.
6. Lack of awareness among workers, being casual appointment workers.
7. Defective equipment or tools used by the workers.
8. Defective design of supporting system used for launching method.
9. Lack of staff for safety management.
10. Lack of promotion on safety matters.

PROBLEMS IN SAFETY PRACTICES AT CONSTRUCTION SITE

The objective of any construction or consulting engineer's company must be to ensure zero accidents and complete well-being of the personnel on site. While the safety policy emphasized that Safety, Health and Environment (SHE) was everyone's responsibility, the accident cast a very different light on the standard of compliance.

One of the major problems identified was the lack of awareness on safety matters among workers and the management team. Some of the workers did not wear safety helmet and safety belts while performing their tasks because they felt uncomfortable wearing it. Sometimes the Contractor tends to overlook these issues and does not take any action against the workers who violate safety rules as they are treated as casual labour and not even on the permanent rolls of the company. This results in unacceptably low levels of awareness among the team. Site experience reveals that greater commitment is required from the management to deliver information on safety to the workers. Level of supervision all the time must be by a very senior and experienced person at Site.

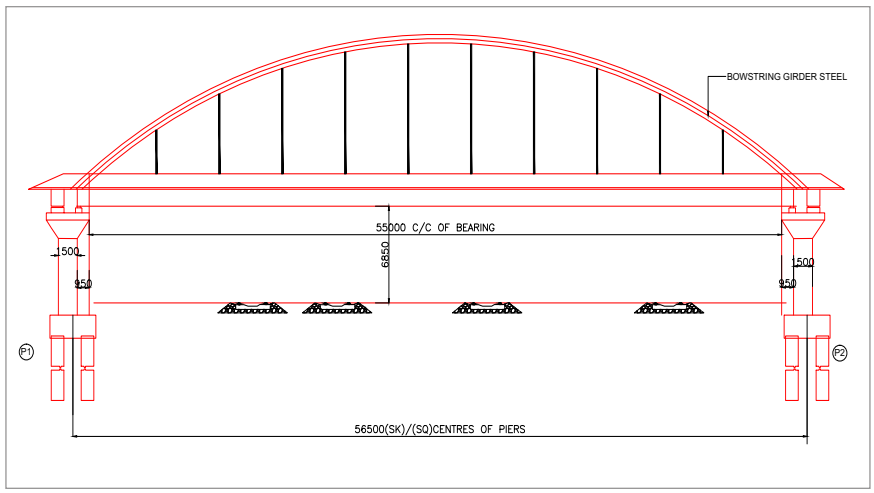
Strategies to Reduce Problems at Construction Site

In relation to the problems that have been encountered in safety practices at construction site, site experience suggests that the following strategies can assist to reduce the problems.

1. To inculcate the awareness of the workers and the management team of the Contractor working at Site.
2. Provision of Safety manual, safety warning signs and safety booklets.
3. Systematic information delivery among the management team and workers.
4. Enforcing safety rules strictly by imposing penalty on the workers who violate the safety rules and regulation. On the other hand, give reward to workers who exhibit excellent safety performances as a positive reinforcement.
5. Enough provision of financial budget for safety management.
6. Provision of Personal Protective Equipment (PPE), such as safety helmets, safety boots, Safety belts (in case of working at height), gloves and others.
7. Emergency support and safety measuring devices such as first aid, medical assistance for common injury, fall protection systems such as handrails, guard rails, safety net and catch nets.

CONCLUSION

Generally, Contractors do not given serious attention to safety practices, namely safety policy, education and training, site safety inspection, safety auditing, safety meeting, site safety organization, personal protective equipment's, Emergency support and safety devices, fall protective systems and safety promotions. The suggestions cover three aspects for the implementation of safety practices, i.e. awareness of workers, commitment of top management and the allocation of resources.



SAFETY AND SECURITY IN SMART CITIES

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EXECUTIVE SUMMARY

In today's world it is important to use the technology for the betterment of the people especially for those living in the urban areas where life moves at a fast pace. Safety and security of the people is of utmost importance. Many monitoring and control solutions are available to provide safety for the people with small add on cost to the available solutions. Integration of different security solutions to the Integrated Command and Control Center (ICCC) and collaborative monitoring is important to achieve safety and security. Government departments are utilising many technology solutions for monitoring and control in silos. These need to be integrated to provide a comprehensive real time safety and security solution for all the habitants. The article mainly focus on the various safety and security solutions/ technologies, which can be implemented in smart cities to provide safe and secure environment for the citizens.

INTRODUCTION

About 31% of India's Population lives in Urban Areas contributing 63% to the GDP of the country (as per 2011 Census data of the Government of India) and half of the world's population lives in urban areas and by 2050 it is expected that almost 70 percent of the world's population will be in cities. The vision for smart cities is to enhance the efficiency and effectiveness of urban services and there by improve the quality of life and includes infrastructure development, IT connectivity, e-governance, efficient mobility, energy, water, waste management and citizen safety and security.

In the past few decades, the evolution and rapid growth of information technology, sensing, big data, Artificial Intelligence and information-based products has drastically changed the lifestyle of the people. Smart phones providing anytime anywhere access to information, services and communication have helped people to adapt almost seamlessly to a new way of living. Meanwhile smart city technologies of sensing different parameters, information management and control are significantly improving the efficiency, quality and cost of providing city services. At the same time, safety and security of people, information and assets gain importance; they pose unique challenges.

Across the world, governing bodies are focusing on converting the cities in to smart cities. Huge investments are being made to improve the infrastructure and introduce other smart features to improve the lives, provide luxury and safety for the people. However, safety and security are way behind while implementing the smart city program. The focus in this paper is more on the safety and security features for smart cities, with innovative solutions to provide more sustainable living since the smart features would reduce the risk and the damage to the society and ecosystem. Satisfying the basic needs is not the only way one should look at development of urban areas since the major cities and towns around the globe are increasingly becoming targets for a wide range of threats, ranging from terrorism,

violent crime to natural disasters and other emergencies such as traffic accidents, fires, etc. That brings us to the challenge – how can city authorities protect their citizens and ensure quick and effective responses to all the above?

To ensure enhanced safety and security of the citizens, collaborative use of safety and security technologies has to be done, by creating an integrated security surveillance system with centralized information management and response mechanism. An integrated public security system should ideally have three main elements – Monitoring, Communication and Response system. These aspects are linked together by the fourth element – an Integrated Command and Control Center Solution (ICCC) to mitigate risk across the city by providing actionable intelligence and enabling speedy security incident resolution.

Figure below shows the commonly used safety & security solutions to protect the habitants from different threats.

Figure 1: *Solutions for Safety & Security*

All the systems and technologies mentioned above play a vital role in providing safety and security for the citizens.

At present most of these solutions are implemented, monitored and controlled in silos by different authorities. However, by integrating the various security technologies, the city authorities get a holistic picture of the threats and/ or breaches in security, accidents and disturbances, in turn facilitating quick responses. Hence an ICCC and collaborative monitoring of all safety, security, control and response solutions become most important to provide a safe and secure place to live for the habitants. ICCC provides integration between different solutions through integrated data visualization. Individual monitoring and management systems such as Utility, Traffic, Transportation, Video surveillance, Access Control, Public Address System, Building Management System, Parking Management System, Environmental Monitoring, Fire Alarm, Early Warning and Detections, Lighting Control and many more are integrated together to provide a consolidated, comprehensive dash board and response mechanism based on tailor made standard operating procedures for response and redressal. Collaborative Monitoring is most important, where different government departments would monitor these integrated solutions from a single central location (and its mirrored locations) and provide the response to the incidence based on Common Standard Operating Procedures.

A few features of some of these systems/ technologies which would have impact on safety and security of the citizens are highlighted.

Video Surveillance

The CCTV surveillance is a major system to curb crime and should be provided with advanced analytics which would ease the burden of the police and other security agencies for detecting and taking prompt action. In order to achieve this, police should be provided with a TAB which they would carry while patrolling and be able to view any live situations by selecting a camera. Even the surveillance system should be provided with artificial intelligence such as situational analytics, preventive analytics and behavioral analytics to automatically detect untoward incidences and sounds, which could automatically popup the respective camera view where such incidence is detected. Use of artificial intelligence in a video surveillance system reduces 80% of the burden on the monitoring personals and increases efficiency in the response mechanism. Body and Facial recognition could also be incorporated.

Access Control System

Access Control System would allow the access to the premises to only authorized persons and restrict unauthorized person to enter. This would help to keep buildings/ premises safe and secure by restricting access to unauthorized persons without identification. Access control could be based on the biometric and/ or personal identification with an electronic barrier linked to an access validation process. Many biometric identifications are used for access control system such as finger prints, iris, vein, palm and face recognition.

Public Information & Grievance Redressed

This is also very important part of a smart city support system in providing safety for the public. People may have issues related to hygiene, quality of food items, poor service in health centers, transportation, etc. A Smart City would provide an accessible platform where people can register their issues online and have them resolved without having to run from pillar to post.

Citizen Engagement

Whenever any infrastructure development project is planned, Citizen can be engaged to provide their valuable inputs and suggestions related to their area. Local people would provide practical inputs related to their day to day requirements.

Waste Management

There are various health related issues which are caused due to poor management of waste. Use of a CCTV system with advance analytics would enable to curb littering, improper disposal, monitoring collection of waste with minimum efforts and manpower.

Early Warning and Detection System

There are many safety, security and life support systems to protect infrastructure and personal losses which serve as a deterrent to misconduct, prevent personal and economical losses, provide early warning in case of disaster and aid in investigation. An Early Warning System is based on multinomial logical model by using real time and historic data. Early Flood Warning System provides real time information to the residents of the city and prevents losses to properties and lives of people and livestock.

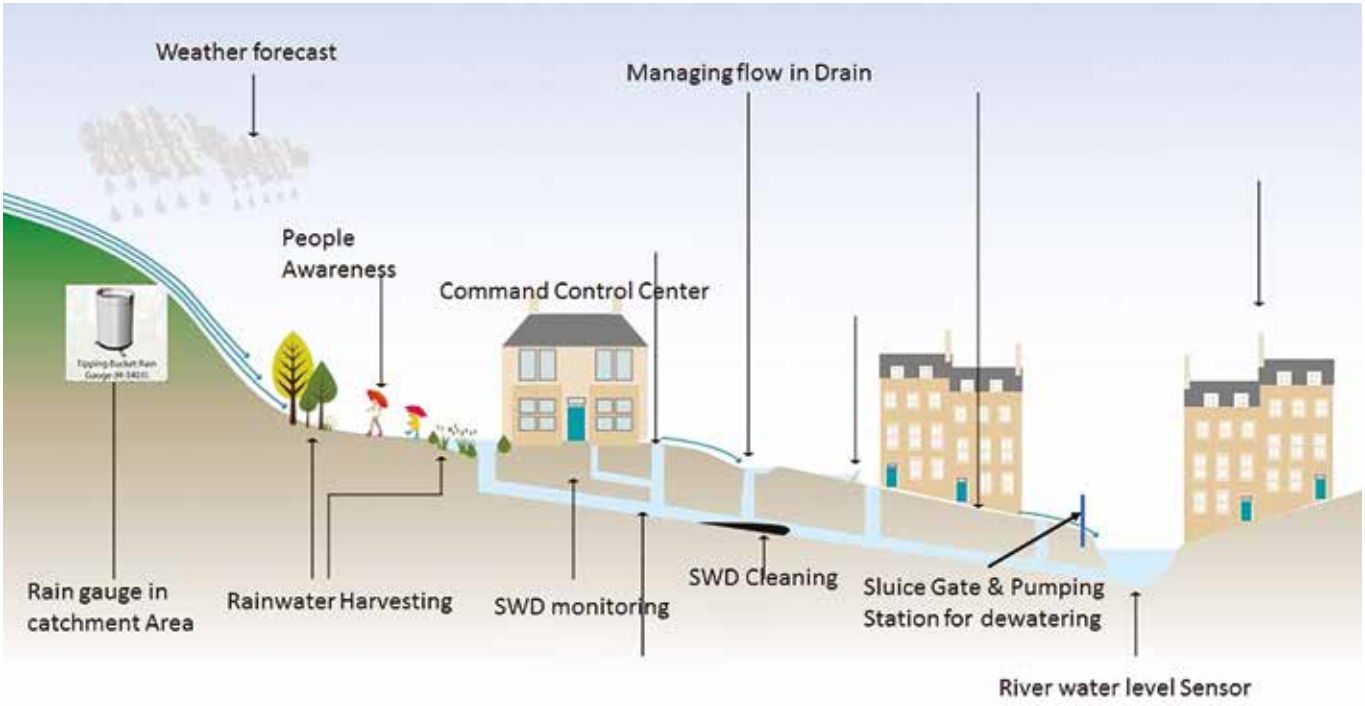


Figure 2: *Flood Management System* [1]

Early Flood Warning System is based on the hydraulic model of the city and has sensors to collect real time data on water level, rain fall, and weather forecast in the catchment areas and would be a real boon for the areas contingent to rivers, nullahs, lakes.

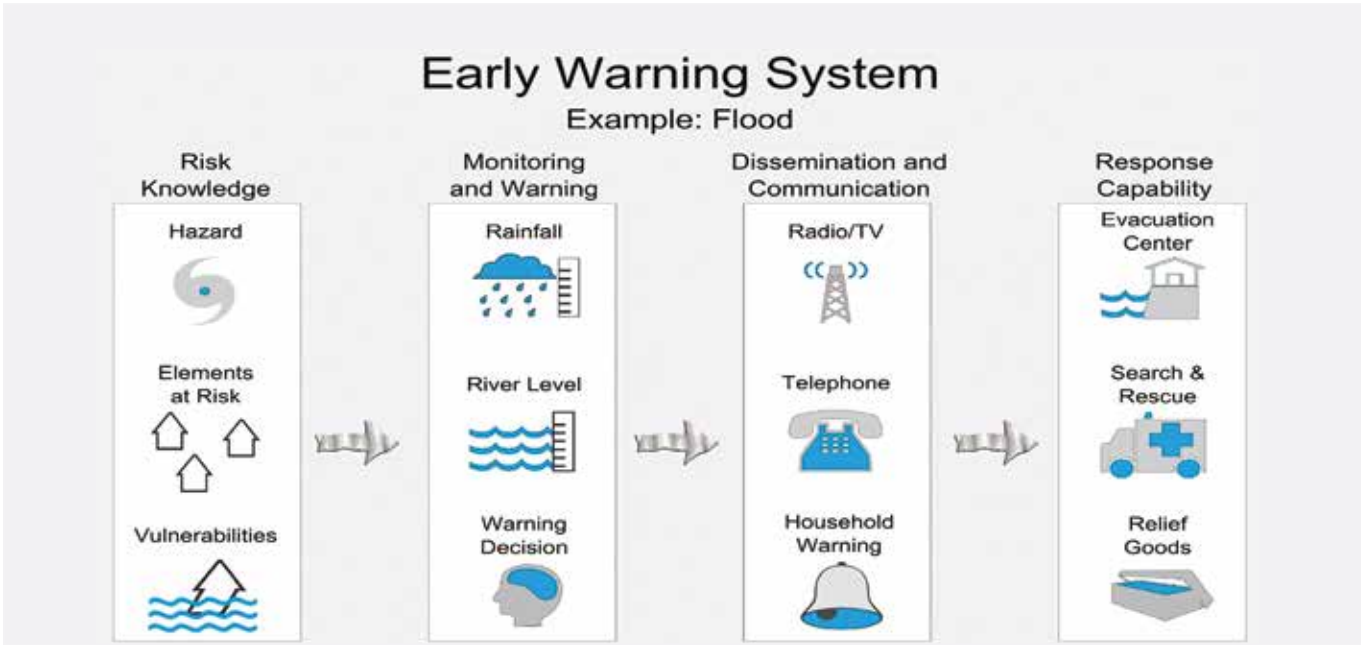


Figure 3: *FMS Flow Diagram* [2]

The catchment area is determined by hydraulic study and contour levels, and rain gauges are installed in the entire catchment area. Data from different sensors is transmitted to a central server via different communication modules such as GSM/ GPRS or wired communication through telecom service provider's network. Data of water levels, rain fall in the catchment area is transmitted to central Flood Management System (FMS).

The FMS's provides predictive analytics by simulating the historical data and real time rain fall data, water level data and weather forecast data along with GIS. It predicts the expected water levels in the water bodies based on simulations, rain fall rate, weather forecast and accordingly provides information to the Disaster Management team and the residents through different communication media such as SMS, Radio, TV, local announcements, by citizen mobile app, etc. The Disaster Management team is kept on high alert before the alert levels are reached and people can be relocated well in advance to avoid any kind of causalities.

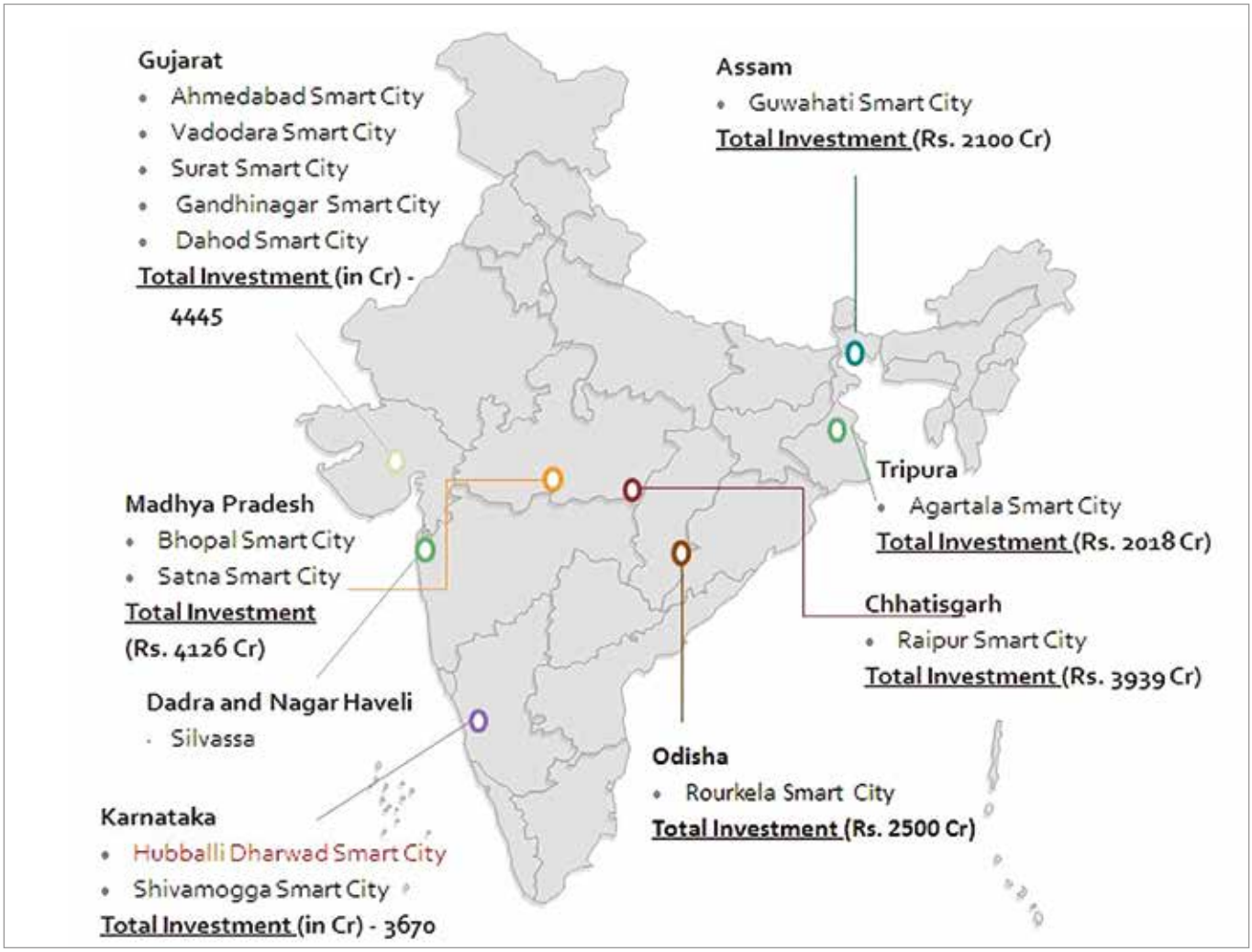
Video Surveillance System also complements the Flood Management System with finding out water logged area and helps in rescue operations. Public Address System installed within the city could be used to share information with the people from ICCC for corrective measures and response mechanism. Social media apps are also used to get information and also share it among the people. The people in distress could be in touch with the Command Control Center.

Figure 4: *Water level monitoring at River* [3]

There are many safety and security solutions which have been implemented/ under implementation in various smart cities across the world. Some of the safety and security features discussed above where implemented/ under implementation in smart city projects in Indian cities such as Ahmedabad, Vishakhapatnam, Bhopal, Mumbai and Guwahati.

Tata Consulting Engineers Limited (TCE) is Project Management Consultant for 14 Smart cities and three green field Smart Cities under Delhi Mumbai Industrial Corridor Development Corporation (DMICDC). City wide sensor network is proposed for green field City of Dholera in Gujarat developed along the Delhi Mumbai industrial corridor, more than hundred thousand IoT sensors are planned with an Integrated Command Control Center to monitor and keep a bird's eye view on the city. Major Safety and Security solutions include Information Communication Technology (ICT) based solutions have been designed and are under implementation for the cities of Guwahati, Dholera in Gujarat, Dadri - Greater Noida, Ahmedabad and Rourkela. The provisions mainly include Integrated Command Control Center, City Surveillance, City wide wireless network, Intelligent Transport Management System (ITMS), Intelligent Traffic System (ITS), Smart Parking, Emergency & Disaster Response System, Flood Management System, Water levels and leak detection, environmental and metrological monitoring system, etc.

A snap shot of TCE's engagement as PMC in Smart cities in India is shown below:



The Integrated Command and Control Center play a very important role in collaborative monitoring from all government departments and in collectively providing responses as and where needed. Other than the solutions and technologies discussed above there are various safety and security solution available which are directly or indirectly providing safe and secure environment to the citizens. Actual deployment of these solutions would be based on the detailed study and requirements specific to the city. ICCC could also provide customized standard operating procedures as per city requirement and available infrastructure.

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PROCESS SAFETY MANAGEMENT STUDIES

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Unintended releases of toxic, hazardous, flammable materials from chemical processes are matter of great concern. Several accident investigation reports by statutory agencies repeatedly point to deficiencies and non-adherence to safety management procedures as the cause of disaster. Process safety studies form an integral part of chemical process industries. Identification, analysis and evaluation of project risks are useful when undertaken during the process design phase. Safety Studies are aimed to provide suitable control measures so as to contain or reduce or eliminate potential risks and avoid the undesired events. This paper provides an overview of various techniques used in the process safety management studies.

ELEMENTS OF PROCESS SAFETY STUDY

Process safety studies are initiated to identify, analyse and evaluate potential risks arising out of each step of the plant operations covering human errors and automation failures. A Safety study provides a systematic platform for understanding of risks, their causes, possible consequences, probability and helps in categorising/ ranking of the risks. More than one study technique may be desired for the complex applications. The objectives of process safety studies are:

- Elimination of risks
- Evaluation of alternate or substitute designs
- Designing suitable controls and procedures to mitigate hazards

For carrying out the process safety studies, various techniques are employed at different lifecycle stages of the project. Techniques used in safety studies can be based on qualitative approach or quantitative approach.

A qualitative criterion is applied for this classification which combines the severity of consequences with occurrence probability and evaluates the resultant risk level.

Quantitative methods classify risk levels based on the estimation of values of each consequence and their probabilities. A quantitative study may not be desirable or every time possible due to lack of system design data information, lack of experience/ information regarding quantifying the influence of human factors. Under such circumstances, qualitative methods are considered to be effective.

Various process safety study techniques are discussed below:

HAZID STUDY

HAZID- 'Hazard Identification' study is a qualitative technique which is conducted at the earliest possible time at the beginning of a project. It is used for the early identification of potential hazards and useful in providing key inputs to decide further project development options. It helps in accessing overall safety of the selected process technology. It also helps in design related decision planning so as to reduce the consequences and probabilities of identified hazardous incidents which would have a detrimental impact to the operating personnel, plant assets and surrounding environment.

Since this study is conducted at an early engineering phase of the project, it is generally restricted to safety evaluation based on process flow diagrams and overall plot plans. The process and processing area is grouped in a logical manner having similar hazard sources and consequences. Potential threats and hazards are identified for each equipment shown on the process flow diagram. Hazard identification, possible safety threats and its effects are based on standard 'Guidewords'. For every identified hazard, the team analyses and suggests suitable control scheme as a mitigation measure.

Major benefits of HAZID study are:

- Opportunities for inherent safety can be identified at early design stage of the project,
- Early identification of important safety issues related to Fire, Radiation, Explosion, Dispersion, Toxic and Flammable releases help in providing mitigating measures,
- Depending on the severity of the identified hazard, process intensification or process modifications can be initiated, and
- Preparations and planning for emergency response systems.

HAZAN STUDY

Hazan stands for 'Hazard Analysis' study which is conducted for systematic and logical evaluation of process based on its operating conditions. The main objective of Hazan is to analyse potential causes and consequences of undesired events that can occur during the operations. Hazan study is focused on identifying the consequences from undesired hazardous events and the analysis of every hazard consists of the following major steps.

- Estimating the frequency of occurrence of hazardous incident,
- Estimating the probable consequences of the hazardous event including personnel and environmental impact, and
- Based on the frequency and severity of the consequences, decision on acceptability of the risk is taken.

The study utilizes quantitative approach and estimates the risk levels based on severity and probability of the event. The start point of quantitative analysis requires selecting targets for average annual cost of the accident. For example, if an accident is likely to cost INR 100,000 worth of damage and is likely to occur once in 100 years (Failure Rate) then the average cost of accident is considered as INR 1000. Risk can be estimated as product of severity of the consequence and the frequency of occurrence. The Severity Index can be classified as incidents causing Catastrophe, Hazardous, Major, Minor, or having No Safety Effect. Accordingly, the values in descending order are assigned to each type. Similarly, occurrence frequency is classified such as Probable, Remote, Extremely Remote, or Improbable and values are assigned in descending order for the above classification.

WHAT-IF STUDY

As the name suggests, the What-If technique is based on questionnaire around process section or around a selected piece of equipment. The process is suitably divided in areas based on either processing sequence or based on the type of unit operation and or fluids handled. A brainstorming session is conducted for safety evaluation. These sessions are assisted by the standard 'what-if' type of questionnaire prepared wherein each question is represented by a potential failure in the process equipment, Instrumentation or operational procedure. Answers to such questions help in identifying likely deviations from the intended design operation and safety threats.

This is the simplest of all the methods used for safety studies and can be widely used for gross evaluation of the process. It can be used at any lifecycle stage of the project. For a quick review of design changes in a given system, what-if analysis provides quick safety evaluation. However, the technique relies heavily on customization of questionnaire applicable to the given process. General questionnaire consists of questions such as what if a control valve fails, what if operator forgets to align the valves or what if the reaction approaches run away conditions, etc. The success of the technique is dependent on the experience of the team participants. This method is not based on a very structured approach and used for limited cases; especially repeat project cases having past operating experience of the system.

CHECKLIST METHOD

The Checklist Method uses several lists prepared to address issues of identifying hazards, potential risks or control instrumentation failures. These checklists are generally prepared based on past experience of design and operation of the specific process under consideration. This method can be used at any lifecycle stage of the project. The checklists are generally relied on asserting compliance to the existing practices and procedures. The answers to the checklist questions are generally provided in "Yes/No" format.

Typical questions covered of few of the checklists are illustrated as below.

- Process Equipment Checklist: Is process equipment properly supported? Is the equipment designed to meet the objective? Is the equipment provided with a relief device sized to address all applicable contingencies? Are appropriate wind loads considered in design? Is the equipment protected from corrosion issues?
- Effluent Checklist: Are effluents segregated as per their hazardous nature? Are all statutory norms for emissions are satisfied? Are all sources of ignition controlled? What provisions are made for monitoring and controlling emissions?
- Instrumentation Checklist: Are instrumentation designed for fail safe mode? Does this control loop require redundancy? Are control transmitters used for trip function? How to differentiate between normal, pre-trip, emergency alarms?

Checklist methodology is one of the simplest methods for hazard analysis. This method is effective to capture the lessons learnt. However, it is not helpful in identifying new hazards. Checklists need to be updated and audited periodically so that they can be used on similar projects in future.

HAZOP

Hazop is the abbreviation for Hazard and Operability Study and is one of the most frequently used technique in process safety management. It can be conducted at various lifecycle stages of the project. Basic premise of Hazop considers that all hazardous incidents are instigated by a deviation from the intended or desired operating conditions.

The main objectives of the Hazop study are to identify causes and the consequences arising due to deviations from original design intent while operating the facility. Design integrity of various plant components such as equipment, piping, control systems, etc are evaluated to check the plant response when it deviates outside the intended design envelope. Hazop methodology not only considers the application of relevant standard design codes but also correctly raise questions to evaluate need for additional safeguards to mitigate/ eliminate the likelihood of hazardous scenarios.

The Hazop team is formed to represent from various disciplines and chaired by an experienced person who is not part of the design or operations.

Unlike Hazid study, Hazop is based on P & I diagrams which are logically divided in several nodes based on the Process Flow sequence. Each node is then subjected to detailed evaluation by applying deviations to the intended design objective. Typical list of deviations includes Flow, Temperature, Level, Pressure, Composition, Start up, etc. For every deviation, guidewords such as No, Less, More, As well As, Reverse, etc are applied to identify hazardous scenarios. Risk is estimated using qualitative methods based on severity and likelihood of occurrence. For high risk cases, appropriate recommendations are suggested. The study is documented in the form of Hazop worksheet. Typical example of a worksheet is as indicated in Table 1 below.

Node Number		**Session Number**	**Date**			
Design Intention						
Deviation	(Example Flow, temperature, pressure, Level, Composition, Start Up, etc)					
Guideword	Causes	Consequences	Safeguards	Risk Ranking	Recommendation	Action By

Table 1: *Example of Typical Hazop Worksheet*

Hazop study reports form an integral part of plant's safety records and are further used as a reference while establishing/ revising standard operating procedures (SOPs). This method is considered as primary safety requirement and hence widely used. Close out actions of all the recommendations are also systematically documented. Existing operating facilities undergo a periodic hazop sessions to update operations as per latest codes or from lessons learnt.

HAZOP CASE STUDY

To stress the importance of close out of Hazop actions, reference is made to a case study (7) published by the ''Chemical Safety Board, USA" of an accident that occurred in 2013 involving fire and explosion in 'Williams Geismar Olefins Plant' at Louisiana. An additional reboiler was added in parallel to a distillation column to take care of downtime due to fouling and maintenance of the existing reboiler. The system was designed with an isolation valve on the reboiler return lines to facilitate maintenance of any one of the two reboilers. The reboiler return line valve on the standby reboiler was kept in closed position which isolated the reboiler from the safety device mounted on the distillation column top. The standby reboiler's isolation valve on the heating medium was also kept in the closed position. During the design, Hazop study was conducted which had recommended to either lock open the isolation valve on the reboiler return line or provide another safety valve on the reboiler return lines. This recommendation was somehow not implemented. During the changeover operation, the Operator opened the isolation valve on the heating media line to the standby reboiler. There was some residual process material available in the standby reboiler which received heat input. The isolation valve on the reboiler return line in closed position caused over pressurization of the standby reboiler. Against the Hazop recommendation, the standby reboiler remained isolated from the safety

device resulting in fire and explosion killing two operators, injuring 167 personnel due to blocked in conditions. The accident could have been avoided if the Hazop recommendations had been duly incorporated.

SIL

Automatic process controls play an important role in the management of hazards in chemical plants. There are various layers of protection provided to ensure safe plant operations. Emergency Shutdown systems (ESD) is one such layer which is governed by system independent of normal basic process control system (e.g. DCS). ESD system consisting of safety instrumented protective functions must be analysed thoroughly in a systematic manner to determine their reliability and integrity. The main objective of the SIL (Safety Integrity Levels) study is to define and verify safety integrity levels for all instrumented protection functions. This study is conducted based on guidance provided in international standard IEC 61511.

SIL study is followed immediately after Hazop study. SIL study workshop focuses on consequences based on Probability of Failure on Demand (PFD) of safety instrumented systems. The targets for risk reduction and PFD for various SIL levels are specified in IEC 61511. The SIL assessment determines the risk reduction required for each safety instrumented function by providing adequate safeguards.

Various methodologies can be used to rank the risks by accessing potential for personnel injury, potential for environmental damage, potential for asset. The environmental impact and the economic losses will generally arise because of the loss of containment. Some of the commonly used methods are LOPA (Layers of Protection Analysis) and Risk Graph Method.

The SIL study is documented in the form of a SIL assessment report which determines the required SIL levels for each safety instrumented function. Further, the instrumentation system needs to be verified based on PFD data furnished by instrumentation component suppliers to check compliance and satisfy the SIL levels as identified by the SIL assessment report.

FMEA

FMEA or ‘’Failure Mode and Effects Analysis’ is a systematic method to identify potential failures which may present within the process design. This method is used to evaluate potential hazards in the form of cause and effect and helps in preventing the possible safety incidents. It is a quantitative technique and generally used as additional or supporting technique with other methods for specifically identified operation, scenario or product.

Failure modes define specific reasons for a likely process failure. Effects define hazardous or unsafe consequences of such failures.

The stepwise analysis is carried out to quantify the risk and the quantification is based on Severity, Likelihood and Probability of Detection of hazard. This method calls for assigning numerical values for these three component failure modes. A score on a scale of 1 to 10 is assigned for these three variables after classifying them in categories as:

(A) Severity is used to assess impact of the failure which can be classified under various categories such as No Effect, Very Minor, Minor, Very low, Low, Moderate, High, Very High, Hazardous. Score of 1 represents the least safety concern and 10 representing highest safety concern. Generally, for the cases with severity score of 8 and above are further recommended for detailed evaluation by the ‘Fault Tree Analysis’ method.

(B) Likelihood is used to assess the probability of occurrence of the failure. Likelihood is further categorised such as 'Remote, Low, Moderate, High, and Very High'. Low score represents the lowest probability. For example, for a failure that would probably happen once in five years, a score of 1 is assigned.

(C) Detection is used to assess the probability of detecting the failure. Lower scores define lesser probability of detection.

Risk level can be then estimated as product of scores of Severity, Likelihood and Detection.

FTA

Fault Tree Analysis is a quantitative method which is used as an additional supporting method for detailed analysis of a specific hazardous event identified as a high-risk event. In this method, an accident investigation approach is followed. The analysis starts from the definition of the accident. Causes of the given accident are worked out by adding probable causes of the same using "AND" and "OR" combinations leading to the accident event. A logic diagram consisting of various possible causes using "AND/OR" combination is prepared to detect the fault.

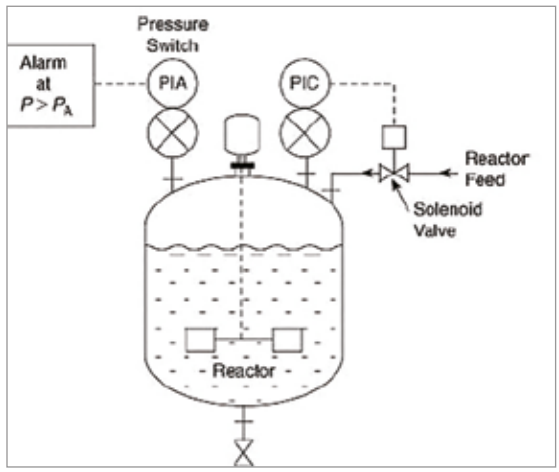

Figure 1: *Sample Reactor Pressure Control System*

As an example, referring to Figure 1, a reaction system is provided with a pressure control valve on feed line and an independent high-pressure alarm.

Fault Tree Analysis starts with an accident which damages the reactor due to overpressure. The logic diagram can be constituted for the causes that lead to this overpressure scenario. The causes are:

(a) Failure of control system

AND

(b) Failure of alarm alert system

The control system failure can be caused due to:

(a) Failure of solenoid valve

OR

(b) Failure of pressure transmitter

The failure of alarm alert system is caused by:

(a) Transmitter failure

OR

(b) Alert light failure.

Thus, a logic diagram with "AND / OR" gate can be prepared.

Any equipment failure can occur due to the interactions of the individual components in a given system. Depending on the type of the component involved in the system, average time for failure of that component can be estimated from published literature. The failure probability and reliability of a component can be calculated using quantitative methods from its known failure rate.

ETA

In any failure or accident, the safety systems can succeed or fail. The ETA or 'Event Tree Analysis' method can help to obtain useful information on how a failure can occur. This is a graphical method used to display number of accident scenarios resulting from an initiating event. Similar to the FTA technique, this method also starts with an initiating event. It postulates the failure or success of the applicable safeguards provided to mitigate or prevent hazardous accident. ETA can be used at any lifecycle stage of the project or process.

For example, consider a typical reactor having a cooling coil provided for removing heat of reaction. The system is designed with automatic shuts off of reactor feed stream and dumping the reactor contents to a blowdown system if the temperature exceeds the preset value. A typical ETA starts with an initiating event such as failure of cooling system. Sample graphical representation using success and failure criteria of control systems is shown in Figure 2 below.

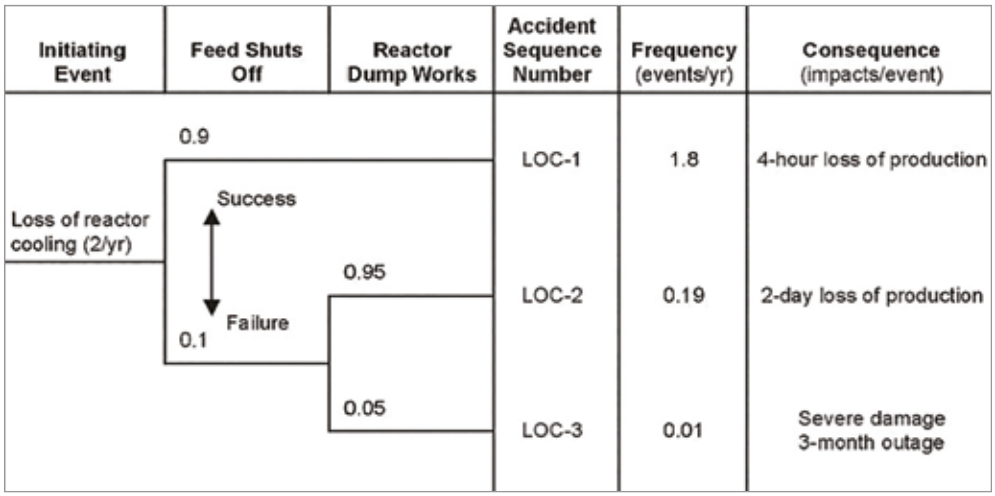

Figure 2: *Sample graphical model for ETA* [6]

This graphical representation is based on binary logic built by considering an event that either has or has not occurred. ETA is an effective method when multiple safeguards are provided as protective function.

Case Study using ETA Technique

A typical chemical plant batch reactor control system overview is shown in Figure 3. The Reactor was provided with a cooling coil for removing heat of the exothermic reaction by using cooling water. The control system provided for the reactor temperature control through an automatic throttling control valve provided on the cooling water line. An operator alert alarm was configured in case the reaction temperature exceeded the safe operating temperature. The system further needs to be analysed for identifying risks when the cooling system fails.

The ETA technique is selected for analysis as the case needs to investigate the cause and effects based on an event. Failure of the cooling system is a defined event in this case study. On failure of the cooling system, the following four operations would occur.

- OPERATION A: High temperature alarm would pop up to alert the operator (0.02 failures per demand; 1 occurrence per year)
- OPERATION B: Operator should acknowledge the alarm (0.25 failures per demand; 1 occurrence in 100 years)
- OPERATION C: Operator should restart the cooling system (0.25 failures per demand; 1 occurrence per year)
- OPERATION D: Operator should shut down the reactor if unsuccessful in controlling temperature rise. (0.1 failure per demand; 1 occurrence in 10 years)

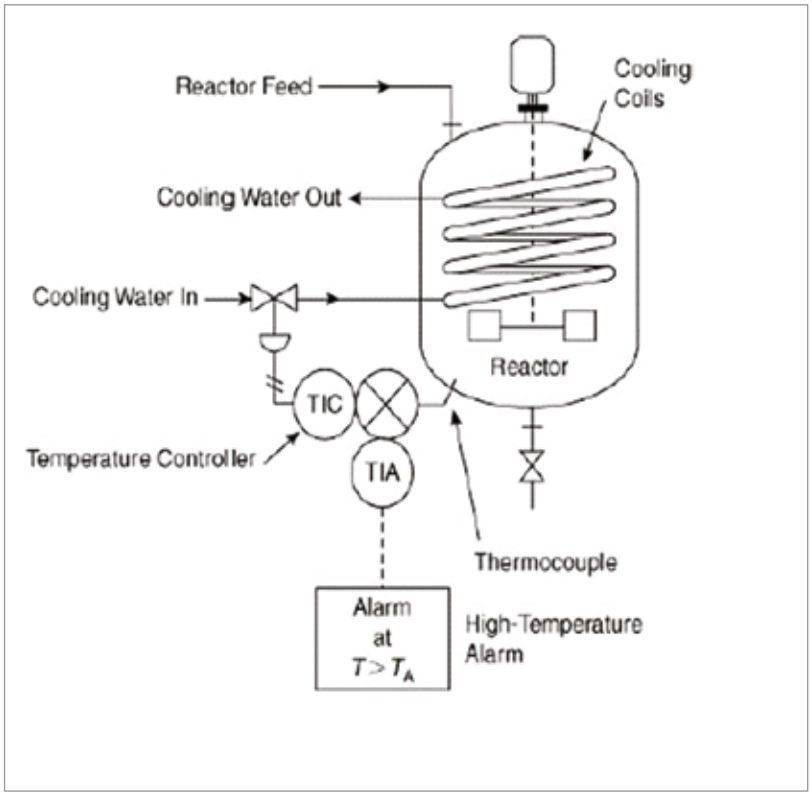

Figure 3: *Batch Reactor Temperature Control System*

The Graphical Event Tree could be built for this as demonstrated below.

The probability of failure on demand for each of the above four operations are required to be defined. The basis and values of PFD and likelihood are indicated in bracket for all the four operator safety actions. It is considered that the main event of loss of cooling happens once in a year.

Operation A involves alert alarm pop up.

- The value of 'Success' function for this operation is equal to {(1-PFD) * No. of occurrence per year} or {(1-0.2) * 1} = 0.98. Therefore, the value for 'Success' is shown as 0.98 in the Event Tree diagram.
- The value of 'Failure' function for this operation is equal to {PFD * No. of occurrence per year} or {0.02) * 1} = 0.02. Therefore, the value for 'Failure' is shown as 0.02 in the Event Tree diagram.

Similar procedure is adopted for Operations B, C and D. Refer Figure 4 for the 'Event Tree' built for all the four operations.

From the above diagram, it can be noted that

- The total "Runaway Reaction" would occur {1/(0.02+0.0025+0.01)} once in 3.1 years. Since, this is very high rate, an automatic shutdown of the system could be recommended.
- Similarly, the operator manual "Shut Down" would happen once in 66.6 years which is an acceptable value.
- On failure of cooling systems, the operations would be continued only once in 1.3 years.

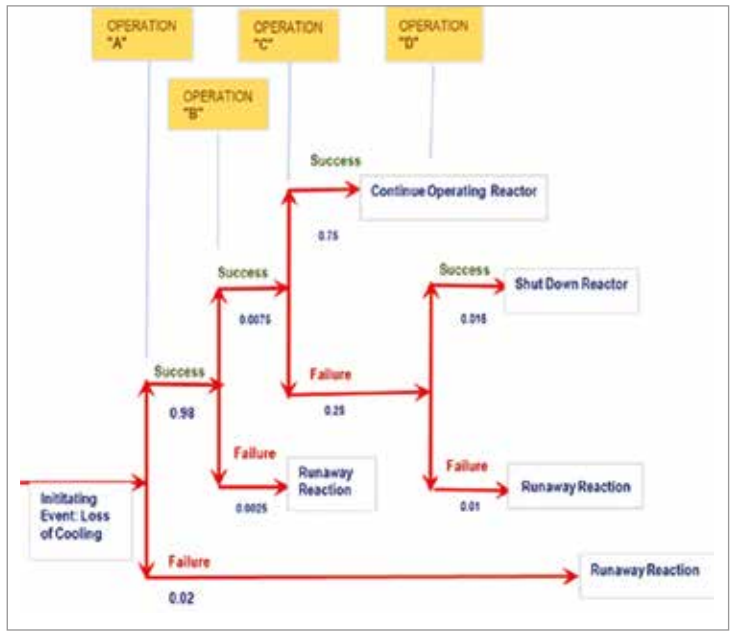

Figure 4: *Event Tree Diagram*

Concluding Remarks

Prevention of human injury and avoiding significant environmental damages form the core of process safety management studies. Effects of accidental releases could be catastrophic. Flammable or explosive nature of the releases would affect nearby communities severely. Process safety studies are essential to identify, control and mitigate events leading to such failures. Another reason for need of an effective safety management program is due to the fact that the plant designs are not only becoming complex in nature but are also increasingly dependent on automation systems. When the automation systems are not available or fail, the complexity may result in number of human errors while controlling the operations. Safe operating culture of chemical process plants would help in boosting productivity and ensuring safe production without significant downtime.

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MITIGATING THE UNKNOWN - RISKS IN CONSTRUCTION & DEMOLITION (I)

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1.0 INTRODUCTION

Construction and Demolition (C&D) waste which forms one of the main components of solid waste is generated whenever any construction/ demolition activity takes place, such as, building roads, bridges, fly over, subway, remodeling, etc. It consists mostly of inert and non-biodegradable material such as concrete, plaster, metal, wood, plastics, etc. A part of this waste goes to the municipal disposal system and the other part gets blown off into the atmosphere as dust. These wastes are heavy, of high density, often bulky and occupy considerable storage space either on the road or communal waste bin/ container. It is not unusual to see huge piles of such waste, which is heavy as well, stacked on roads especially in large projects, resulting in traffic congestion and disruption in most urban areas.

Proper handling, storage and treatment of non-hazardous and hazardous wastes is crucial in order to protect the fresh water resources (rivers, lakes, wetlands and ground water) and prevent degradation of productive land due to disposal of industrial and domestic wastes. C&D and municipal waste is one of the biggest waste channels in most countries and disaster looms large if they are not managed correctly.

C&D wastes could be recycled; codes like IS: 383(1970) have been amended in 2016 to provide for solid waste (from concrete and masonry) to be processed and refined into recycled aggregates, which could substitute natural aggregates in a range of user applications like road construction, landscaping and concrete production. This would save natural resources, in many cases, reduce the cost of transportation, minimize the waste sent to landfills and even re-absorb CO_2 from the air through increased carbonation. In Europe, more than 500 million tonnes are generated annually and approximately the same amounts are estimated to be generated in India according to a recent study (Satpathy et al, 2016), many times higher than the more common estimate of 25-30 million tonnes. The recycling level in Europe varies from less than 20% to more than 90% material recovery. However, some countries in Europe have been the forerunners on C&D waste recycling (e.g. The Netherlands) and significant efforts on research have been made. Proper handling, treatment and utilization of C&D waste will therefore have significant impact on resource optimization/ conservation and environment, in particular in urban areas, where space is limited [1].

2.0 BRIEF DESCRIPTION

The personnel in the construction industry are arguably in poor health with the rates of occupational illness being statistically significantly higher than for workers in any other industry. Despite growing awareness that the 'slow burn' of occupational health requires alternative management approaches than those made to secure safety, health remains neglected. Work activities in construction and demolition release dust and may therefore also release particulate materials in the micro and nano scale levels - for example, casting, cutting, drilling and sanding during construction, and explosive methods and concrete crushing at demolition.

A recent report suggests that micro materials may not be harmful when retaining the properties of their parent bulk materials. However, nanomaterials including nanoparticles and nanofibers released though such activities which are generally still attached to fragments of the underlying matrix are presumed hazardous, but the number of studies in this area is too small to draw firm conclusions. Hazard means the potential impact on workers, other people, and environment – from new substances; but the question is, 'how toxic or dangerous is this material to those who may come into contact with it?' The application of nanomaterials, containing particles 1000 times smaller than the thickness of a human hair, is increasing but uncertainties persist regarding their potential health effects. A key concern about the health risk from nanomaterials relates to their relatively high surface area, which increases their reactivity. For example, non-nano titanium dioxide might have a surface area of around $2m^2/g$, compared to nano titanium dioxide with a surface area of perhaps $175m^2/g$ depending on the particle size and structure. It is not only the surface areas that are different, there are substantial differences in their toxicity as well. Health risk varies with the chemical composition, it also differs between materials with the same chemistry but different physical dimensions. For example, one type of nanomaterial which has caused concern is carbon nanotubes (CNTs), largely because of their fiber like structure and their bio persistence, factors which they share with asbestos. But Carbon in the form of carbon black-a micro material by comparison, has a very different structure. It has been used in tyres for around 100 years and is considered to be one of the lower risk nanomaterials, carrying toxicity comparable to that of other respirable dusts [4].

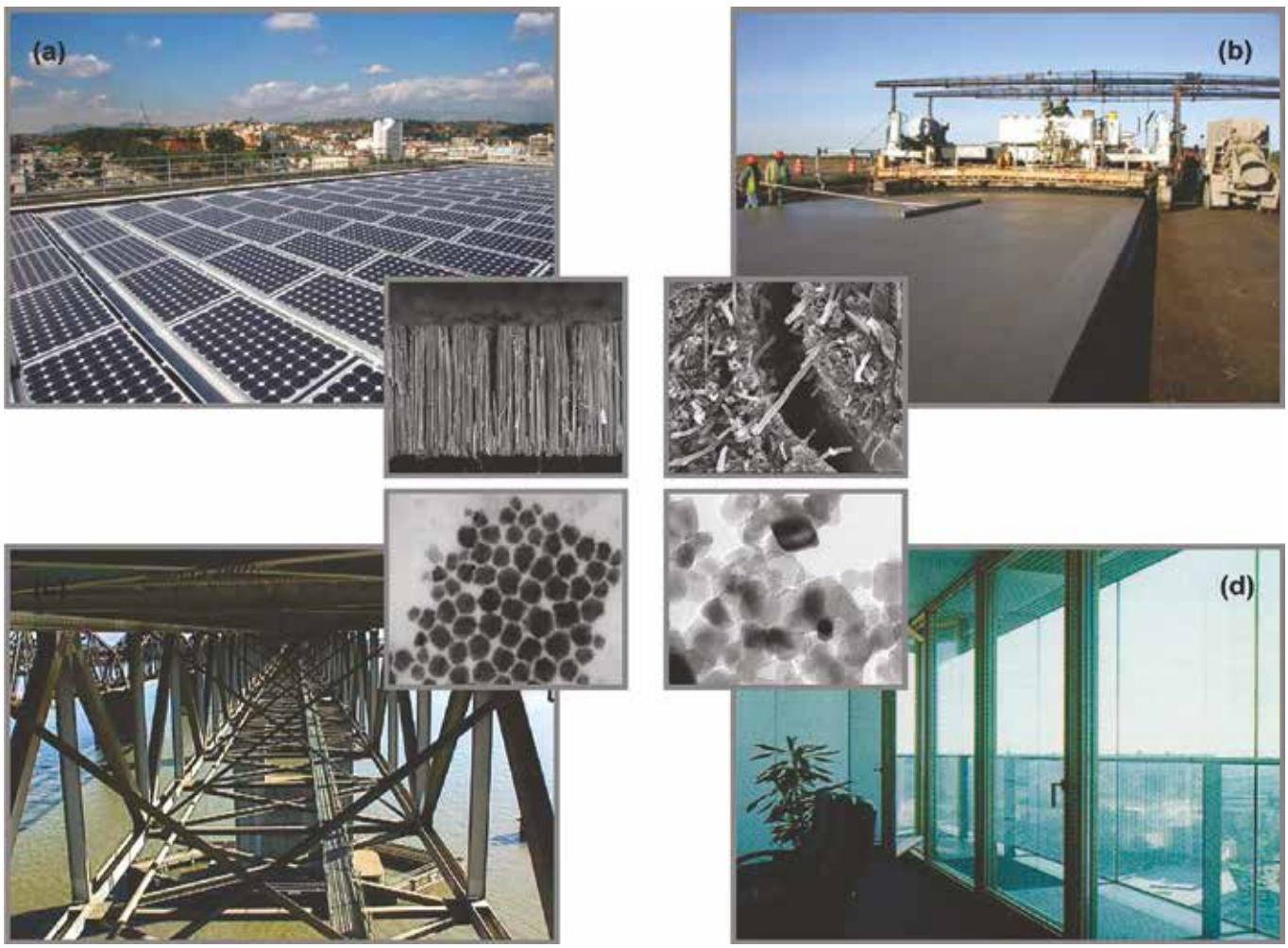

Figure 1: *Examples of Manufactured Nanomaterials used by the construction industry. (a) Rooftop solar panel (source: National Renewable Energy Laboratory (NREL)). Inset: Arrays of silicon/TiO2 nanowires (source: Lawrence Berkeley National Laboratory (LBNL)). (b) Concrete pavement. Inset: Carbon nanofibers (source: U.S. Department of Transportation Federal Highway Administration). (c) Steel bridge (source: California Department of Transportation). Inset: Copper nanoparticles (source: Air Force Research Laboratory). (d) Building window (source: LBNL). Inset: TiO2 nanoparticles [2].*

CNTs themselves show wide variation – they may be single walled (a single, rolled sheet of graphene, with a diameter of around 1 nm) or multi walled (multiple tubes inside one another, and a diameter between 2 and 100 nm). They may also be short (<5 μm in length) or long (typically 5-50 μm but potentially much longer); straight or tangled; and may or may not encapsulate additional substances such as heavy metals. All of these characteristics influence toxicity, and there is similar variation for other nanomaterials. For example silica (silicon dioxide) exists in two forms – crystalline, which is found in its non-nano form in cementitious products and is a major cause of ill-health in the construction industry; and amorphous which is a less hazardous material, and is the form more commonly used at nanoscale proportions (for example as 'silica fume' used in many high performing mortars and concretes). Other materials such as titanium also exist in multiple forms.

Construction management is made difficult by uncertainties regarding which nanomaterials may be used and where. Most products which contain nanomaterials are not required to be labelled as such, and safety data sheets do not typically include this level of detail. A database in the United States (CPWR 2015) has identified around 400 construction products which might be nanoenabled based upon similar criteria, but is unable to identify the nanomaterial supposedly contained in most of these. One current study initially identified around 150 products which were believed to contain nanomaterials (based, for example, on the name, properties or description of the product, or on manufacturers' claims) but on testing 20 of these it was found that 16 contain either a small or very small amount of nanoparticles and the remaining four contained none[4].

Figure 2: *Typical Construction and Demolition activities, releasing concrete dust [5].*

To understand the risks which might arise, there is need for a good understanding not just of how hazardous particular materials are, but also what the potential is for exposure in construction. There is the need to know the quantities of materials being used and the likelihood of particle release at various stages of a building's life – construction, maintenance and modification, demolition, and recycling. Unfortunately, the evidence regarding potential exposure to nanomaterials is even less substantial and conclusive than that relating to their hazard profile (Savolainen et al. 2010). Assessment of particle release needs to be performed on real construction products, as it is influenced by many factors such as the nature and quality of the materials themselves and the matrix in which the nanomaterials are contained, as well as the methods and tools used. Planning such experiments is made more difficult by the lack of certainty with which products are nano-enabled.

A particular issue in exposure assessment is how to take account of degradation over time. Epoxy resins, often used in paints and coatings for example, can break down under the influence of ultra violet light, potentially leading to embedded particles being more easily released from the matrix that they are secured in. There is evidence that the combination of weathering and machining processes (as might occur from sanding or drilling) can lead to free CNTs being released from composite materials (Hirth et al. 2013). This is of particular concern in demolition where materials may have been exposed to the elements for many years, but it is difficult and expensive to replicate these processes accurately in a laboratory environment.

Finally, there are challenges regarding the actual measurement of nanoparticle release, particularly differentiating between released particles and background levels. Broekhuizen (2011) measured particle release from a task involving the drilling of nano-enabled concrete but found that cigarette smoking in the vicinity had a far higher impact on particle counts. Also, nanoparticles may be released from products even though they were not added during manufacture. For example, the demolition of ordinary (non-nano) concrete results in the release of particles of all sizes, including a high proportion of nano sized ones (Kumar and Morawska 2014). Again, this emphasizes the importance of those working in construction continuing to implement good practices to protect workers against both the known and unknown risks.

Health and safety risk from new materials and processes should be addressed early to ensure that risks are properly understood before they are introduced on a widespread basis. History contains numerous examples of hazardous materials being identified only in retrospect, when those working with certain substances developed particular diseases. Examples in construction include Chromium VI, lead and silver paints and of course asbestos; examples in wider society include tobacco, 'trans fats' in foods, and environmental pollutants such as chlorofluorocarbons (CFCs).

There is little doubt that nanomaterials are being used and released in the construction industry and that this is likely to increase - it has been suggested that 50% of building products are likely to be nano-enabled by the year 2025 (AECOM 2014). It is arguable whether this expansion is advisable, given the lack of clarity over the materials in use and the difficulties. The issue of timing is well illustrated by the addition of CNTs to concrete - in the early stages of our study it appeared from the academic literature that this was potentially quite widespread, taking advantage of the strengthening and electrically conductive characteristics of the nanomaterial. This was a cause of concern given the evidence that some forms of CNT are particularly hazardous, and the lack of information regarding exposure potential during the various stages of demolition. It appeared that the technology had progressed without adequate assessment of the risks, and without consideration of the control measures which might be appropriate. However, it became subsequently apparent that the high cost and practical challenges associated with CNTs had delayed their transition from laboratory to industry, though scaling of operational cost was prevalent. Only in recent months have there been reports that field testing of CNT-enhanced concrete was taking place with a view to commercialization,

way back in 2016 (Eden Energy 2014); therefore testing is required now to improve understanding of their risk profile throughout the life cycle of the product and to provide proper guidance to those who might work with them. The hazardousness of each nanomaterial can be influenced by many characteristics including size, shape, solubility, aggregation state (whether and how the particles clump together), surface charge, and many other factors. This makes it difficult to draw firm conclusions regarding health effects, particularly as many health risk studies do not describe the nanoparticles used, to this level of detail.

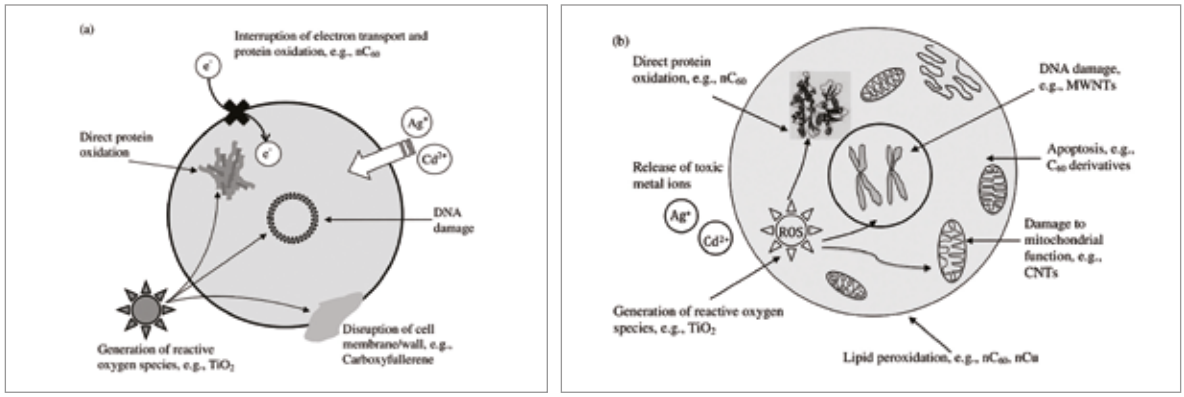

Figure 3: *Possible Microbial Toxicity Mechanisms for Manufactured Nanomaterials (MNMs) for (a) Prokaryotes-Single Celled Organism and (b) Eukaryotes-Multi Cellular Organisms. Different Nanomaterials may cause Toxicity via. one or more of these Mechanisms [2].*

The unique properties that make nanomaterials so promising for use in construction may also produce unforeseen environmental and human health impacts. MNMs released from nanoenabled construction materials (see Figure 2) could pose a toxicological risk to microorganisms (which provide valuable ecosystem services including primary productivity, nutrient cycling, and waste degradation) as well as to higher organisms via multiple mechanisms. These include cell wall disruption {e.g. single-walled nanotubes, (SWNTs), DNA/ RNA damage (e.g. multiwalled nanotubes, MWNTs), direct cell membrane oxidation (e.g. aqueous C60 aggregates), dissolution of toxic metal components (e.g. quantum dots (QDs)}, and ROS induced oxidative stress (e.g. TiO_2) (See Figure 3 & 4).

Carbon nanotubes (SWNTs and MWNTs) of respirable sizes pose a potential hazard because they exert pulmonary toxicity, such as inflammation, fibrosis, and epithelioid granulomas in mammals. Both SWNTs and MWNTs can also exhibit antibacterial properties. The mechanism of microbial toxicity of SWNTs appears to be direct damage to cell walls, while MWNTs cause toxicity via oxidative stress.

TiO_2 irradiated with UV light or sunlight produces ROS, which cause inflammation, cytotoxicity, and DNA damage in mammalian cells. TiO_2 morphology, which can differ significantly, affects uptake through cell membranes and stimulation of phagocytosis cells,73 as well as endogenous ROS generation as immune response within the cell matrix. Solar irradiation enables the antimicrobial activity of TiO_2 toward various bacteria, including *Escherichia coli, Micrococcus luteus, Bacillus subtilis, and fungi, such as Aspergillus niger*.

SiO_2 nanoparticles have been reported to exert carcinogenic activity. Exposure to nanosized SiO_2 triggers lipid peroxidation and membrane damage on human lung cancer cells and induces tumor necrosis genes in rats. Nanosized silica is also hazardous to bacteria via ROS generation.

Copper or copper oxide nanoparticles induce oxidative stress and DNA damage in bacteria, algae, yeasts, mice, and human cells.

C60 fullerene's water-stable aggregates (referred to as nC60) display broad antimicrobial activity independent of the preparation method, that is, solvent-mediated, sonicated, or prolonged stirring in water. Recent studies confirmed that nC60 toxicity to bacteria was due to direct oxidation of the cell upon direct contact rather than by ROS-dependent oxidative stress. Oxidative stress exerted by nC60 leads to lipid peroxidation, which is also responsible for cytotoxicity in eukaryotic organisms. C60 derivatives such as fullerol and carboxyfullerene, designed to enhance its aqueous availability, are capable of puncturing the cell membrane and behaving as oxidizing agents in biological systems.

Quantum dots contain toxic heavy metals such as cadmium, lead, and zinc in core/ shell configurations. The release of core metals has been accepted as the predominant mechanism of QDs toxicity toward mammalian cells as well as bacteria. While surface coatings attenuate core decomposition and the resulting heavy metal dissolution, some coating materials themselves may also be toxic to mammalian cells. Also, some coatings are readily hydrolyzed resulting in the release of toxic metal ions. The internalization or membrane association of QDs in eukaryotic cells caused oxidative stress, nucleic acid damage, and cytotoxicity [2].

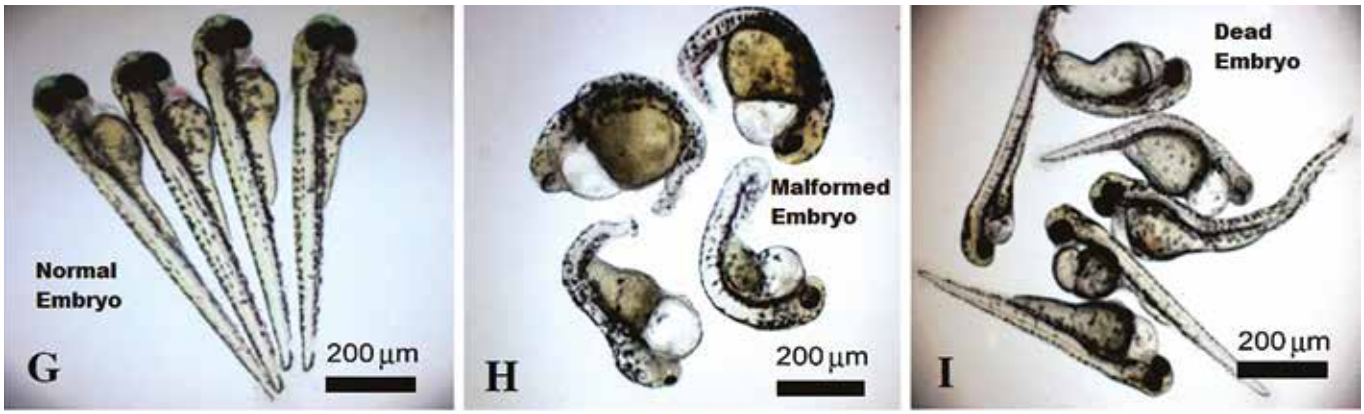

Figure 4: *Optical micrographs of normal and healthy control larvae at 72 hpf (G), deformities in silver nanoparticles-starch treated (H) and silver nanoparticles - bovine serum albumin treated (I) larvae (conc. 100 µg ml^{-1}) [6, 7]*

3.0 CONCLUSION

In a bid to increase the use of modern technology in the construction sector, Prime Minister Narendra Modi announced 2019-2020 as the year of construction technology. With the country's fast urbanization, the need for more houses is being felt, and to meet the demand and to transform the housing sector, the government has implemented programmes such as the Pradhan Mantri Awas Yojana, Deen Dayal Antyodaya Yojana, National Urban Livelihoods Mission, HRIDAY, AMRUT and Smart Cities. Accordingly, the Real Estate (Regulation and Development) Act, (RERA), has improved consumers' confidence in developers and brought transparency in the real estate sector and changes were also made in tax laws so that the middle class can save more money to buy a house.

Recently the GST on affordable housing has been reduced from 8 per cent to 1 per cent, while GST on under-construction projects has been reduced from 12 per cent to 5 per cent. So, in construction sector, there has been a change in the approach.

Efforts are on to make roads, residential apartments and commercial buildings eco-friendly and energy efficient and thus in the future there will be a huge generation of C&D wastes in India. But we should be eventually prepared for any adverse or unforeseen circumstances arising out of it.

To be able to identify in which materials are nanomaterials present is a challenging task though there is no requirement under European or UK law for most nano-enabled products to be identified, except the hazardous ones.

Engineering control (e.g., ventilation systems and dust collectors) and personal protective equipment (e.g., masks, coveralls, and gloves) should be provided for enclosed manufacturing facilities, along with personal monitoring and medical check-up on dermal, respiratory, and optical exposure. Since construction activities predominantly occur in outdoor environments, construction personal shielding devices such as air filter masks, gloves, safety goggles, and visors may be appropriate.

In India, the issue of nanotechnology risk regulation has been raised in terms of the concerns related to human health safety, environmental pollution, toxicity and towards general societal impacts relating to labor dislocation and livelihood disruption. Regarding the regulatory aspects many researchers are of the view that unlike how the Atomic Energy Regulatory Board (AERB), Department of Atomic Energy (DAE) was established, the government is lax in establishing a regulatory body to oversee the safe development and commercialization of nanotechnology products *(Chowdhury 2006; Sarma 2011; Jayanthi et al. 2012)*. Others have also raised the issue of labelling of nano-based products to enable people make an informed choice. In fact, on the sidelines of an International Conference on Nano Science and Technology (ICONSAT) in 2010 itself, Prof. CNR Rao, Nano Mission Council Chairman, said that 'as Indian industries are coming with various nanotechnological products including water filters, biomedical products, chemicals, cosmetics and paints, we are in the process of forming a regulatory body for the nanotechnology to regulate the products for the safety and benefit of the society' (Business Standard 2010).

According to a researcher, "While leading nanotechnology nations are debating on the best strategy to ward off risk, Indian government has so far adopted a "learn by doing" approach in nanotechnology development. However, it is high time India's science and technology research bodies showed some seriousness towards nanotechnology risk governance." (Jayanthi et al. 2012)

The Government of India should proactively formulate a policy for usage of not only nano-materials but all materials that are potentially hazardous.

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REPORT ON CAETS CONFERENCE 'ENGINEERING A BETTER WORLD: THE NEXT 100 YEARS'

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Global challenges were on the agenda when engineers and scientists from all over the world met at the CAETS Conference (Council of Academies of Engineering and Technological Sciences), organized by the Swedish Academy of Engineering Sciences (IVA). The Conference was held during 24 – 28 June 2019 at Stockholm, Sweden and coincided with Centenary Celebration of the Swedish Academy of Engineering.

TOPICS OF DIFFERENT PRESENTATIONS

A number of international thinkers and experts in areas of great significance for the immediate future were invited to address the Conference.

For three days, the role of science, technology and engineering in meeting global societal challenges was in focus. To shed light on some of the most acute challenges facing the society and explore possible solutions, the Swedish Academy had put together a cross-disciplinary program. It was really a unique way of conducting a conference, which turned out to be a meeting place for everyone working within or interested in science, technology, engineering and societal issues.

'Engineering a Better World: The Next 100 Years' was a Conference within the framework of the CAETS international network of academies of engineering sciences.

The conference consisted of a series of sessions, each devoted to a specific topic of immediate concern. The first session reflecting 'Progress' included the opening presentation on 'The first 100 Years' provided an overview of developments since the inception of the Swedish Academy. The session also included presentations on 'Internet – Engineering for Society'; and 'LIGO – Engineering for Science'.

The second session entitled 'Challenges' covered 'Energy System of the Future – Evolution or Revolution'; 'Unequal Cities'; 'Antibiotic Resistance – a Multiple Systems Failure'; and 'Water as Leverage – from Risk to Reward'.

The third session was on 'Creative Chaos' included presentations on 'Engineering the Climate'; 'Sustainable Transition Pathways for Plastics' and a Panel Discussion on: 'Future Health – Are New Business Models Required?'

The fourth session on 'Digital Dawn' dwelt on 'Productivity and Performance in a Digital Age'. It covered the impact of technologies like AI and Machine Learning.

The fifth session on 'Effective Education' had presentations on: 'The Changing Face of Global Engineering Education and Logic', and 'Landscape of the 'Knowledge System – Implications for the Educational System'.

The session on 'Inclusive Infrastructure' included 'The All-Embracing Transportation System'; 'Design and Engineering for Sustainability Transitions', and 'Society 5.0 – a Human-Centric Strategy'.

The Conference concluded with panel discussions on 'Policy Advice for the Future' and 'Industry – Academy Collaboration for the Future'.

MAJOR TAKEAWAYS FROM THE CONFERENCE

The major takeaways from the Conference are summarized below:

I. When considering the global challenges that are being faced today, it is felt that they are graver than ever before. However, historical records 100, 500 and 2000 years old suggest that people have always felt that their current problems are the worst ever. And yet, humankind has always been able to put things right and the world has become progressively a better place, than before.

II. New, powerful technological solutions are the key to solving many of our current challenges but at the same time, the technology is perceived as a threat by many people in the turbulent labour markets. Many fears about the loss of jobs and of losing control over ones lives by technological advances like automation, robotics and artificial intelligence, have to be innovatively addressed.

    Engineers would have to make efforts to convince people that new technology would help lead a better life, otherwise they would be very vulnerable to demagogues declaring new technology as "wrong and dangerous".

III. One clear message from the speakers at the conference was that there will be a need to put people at the center of all efforts, engage them in discussions and involve them in the decision-making process, concerning the effects and implementation of different emerging technologies.

    The focus of national development should not just be technology-driven but human-centered and based on the core values of openness, open to criticism and suggestions, sustainability and inclusion.

    Inequalities between regions, countries and citizens are a huge obstacle for reaching the climate goals. The fundamental issue would be to find a balance between the environmental and the social agendas.

IV. The world is becoming more complex, globalized and very difficult to grasp in its entirety. The current economic models predicting future trends tend to fail to account for e.g. intangible assets important in the digital world. There are also long implementation and restructuring lags with the introduction of new technology before people experience long-lasting positive impacts, in their lives.

    Inclusive innovation, collaboration and prosperity shared by all would be needed to overcome the obstacles of increasing fear about technology.

V. Due to the complexity and the scale of the challenges, what is needed in the world is perhaps first and foremost cooperation and sharing between scientists, engineers and the policy-makers – between scientists and engineers from different fields, and between scientists, engineers, the political decision-makers and the general public.

To solve problems, one must learn to manage complex collaborations.

VI. There is a need to reach a common understanding of the problems faced and the ways in which they could be solved. The longer arguments go on, the more likely it will be that unforeseen tipping points could be reached, which can't be reversed. The high speed of development gives genuine hope but only as long as institutions are capable of changing, in response to the call of the times.

Tomorrow's leaders need to have a multidisciplinary, integrated approach, clarity of vision and a big focus on equality. Mentoring the future leaders who are inclusive and trained in necessary engineering skill sets that is, dealing with complexity, uncertainty and decision-making even in the face of a lack of complete scientific understanding of real-life problems, should be on the immediate agenda.

VII. The engineering academies must play a pro-active role and find ways and means to create appropriate linkages (and partnership, if possible) with the policymakers to be able to facilitate technology transitions – for example, today to renewable energy, electrification, digital transformation and a fossil-fuel free, people-centric public transportation. Another role the engineering academies must play is to inspire the next generation of emerging leaders to take up engineering as a profession and solve challenging problems facing society. Need for appropriate changes in the engineering education system including internships, increasing exposure to industry and enhancing academia-industry collaboration were also discussed as one of the key responsibilities of engineering academies.

India's first state-of-the-art "Metro Rail Academy" launched in New Delhi

Source: Urban Transport News; September 19, 2019

New Delhi (Urban Transport News): To provide world-class training facility to metro rail personnel, the Delhi Metro Rail Corporation (DMRC) on Wednesday launched **"Delhi Metro Rail Academy (DMRA)" in New Delhi.**

The Delhi Metro Training Institute which was functioning since 2002 at Shastri Park Depot will now be merged with the Delhi Metro Rail Academy. The existing Training Institute has so far imparted training to around 25,000 Delhi Metro personnel and 2,000 personnel from other Metro Railways in India and also of neighboring countries.

Launching the new Metro Rail Academy, Dr. Mangu Singh, Managing Director of Delhi Metro Rail Corporation (DMRC) said,

"The Delhi Metro Rail Academy will further raise the bar in the quality of training in the field of Mass Rapid Transit System (MRTS). The Academy will now be headed by a Dean and each department will be led by a Professor. The faculty will be strengthened by a team of full-time Professors, Associate/Assistant Professors, and Lecturers".

Read more at: https://urbantransportnews.com/indias-first-state-of-art-metro-rail-academy-launched-in-new-delhi/

CEAI NEWS

FIDIC ASPAC 2019 INTERNATIONAL CONFERENCE

Consulting Engineers Association of India (CEAI) hosted the FIDIC ASPAC 2019 International Conference from 7th to 9th July 2019 at New Delhi. The topic of the conference was **Quality Infrastructure for Clean and Sustainable Development.** About 300 delegates from Australia, China, Japan, Korea, Malaysia, Morocco Nepal, Sri Lanka, Thailand, Vietnam, Indonesia, Switzerland, Nepal and India attended the conference.

Four important members of the FIDIC Board participated in the event thus lending it an additional aura.

During the inaugural session, Mr. Sudhir Dhawan, Chairman of the Conference Committee, accorded a warm welcome to all the dignitaries and participants from India and the ASPAC Region. He drew attention that the theme of the Conference was not only pertinent for the members of the Infrastructure fraternity, but for all humankind. It was a reflection of the growing urgency shared by FIDIC and by its constituent members, with agencies all over the world, for addressing concerns about the development processes, to ensure that these are compatible with and would lead in the final analysis to sustainability.

Dr. Samarjit Chatterjee, Chairman of Technical Committee, briefed regarding the themes that would be discussed in the focus sessions during the two days of the conference. He expressed that most of the Asia Pacific Region countries failed behind the rest of the world in their Developmental Index over the past couple of centuries. However, the countries have been working hard to narrow the gap and presently the infrastructure growth in this region has surpassed the rest. It is necessary to sustain these growths and enhance them further through regional cooperation.

Mr. Amitabha Ghoshal, President CEAI, in his Presidential Address, expressed that ASPAC countries today account for majority of the investments in the infrastructure sector, and that was not an accident. It was a historical happening, after centuries of stinted growth and misguided developments during the colonial era. He pointed out that while countries like India and Malaysia were burdened with infrastructure needed for export of raw materials like, coal, ore and rubber, China, even though not colonized, had to suffer from an Opium war that was foisted on them from colonial interest. However, today the situation has changed and all countries of the region are busy developing their infrastructure for the overall development of their populace and the growth would continue for many more years. Having missed on the fruits of industrial revolution, the countries are making up with by means of the digital revolution that we are passing through. Mr. Ghoshal thanked all the participants for responding to the invite and to make this conference a memorable ASPAC event.

Ms. Sangeeta Godbole, Director General of Services Export Promotion Council (SEPC), addressed the participants and explained about the services of SEPC, which was set up by the Government of India (GOI). The objective of SEPC is to help Indian companies to export services. GOI gives incentives through SEPC which are about 5 to 7% of the net foreign exchange earned, which is a blessing for Indian companies. Last year GOI gave Rs. 4,000 crore to about 5,000 companies. She requested the Indian participants to become member of SEPC to avail the incentives. She also briefed that SEPC organises B2B meetings of foreign buyers with Indian sellers and one such meeting was being organised jointly with CEAI, along with the ASPAC Conference.

Dr. Nelson Ogunshakin, OBE, FIDIC CEO, delivered the keynote address during the inaugural session. He presented the activities of FIDIC and added that FIDIC represents the consulting industry globally and enhances the image of the consulting engineers and maintains the FIDIC forms of contract as best practice. The vision of FIDIC is to work closely with stakeholders across the world to improve the business climate in which members operate and enable them to contribute to making the world a better place to live in now and in the future. He mentioned that FIDIC represents more than 100 countries with over 80,000 firms worldwide. FIDIC is signing agreements with Multinational Development Banks (MDBs) to open up new markets and projects to FIDIC Member Associations and their members.

Mr. Irawan B Koesoemo, Chairman of ASPAC, thanked the participants from India, ASPAC countries and also from FIDIC. He appreciated the Conference Committee for organising such a big International ASPAC event.

Mr. Piyush Goyal, Hon'ble Minister of Commerce & Industry and Hon'ble Minister of Railways, was the Chief Guest at the Conference. During his special address, he expressed hope that the two days conference would help in exchange of new technologies between India and ASPAC Countries. He said that India has, over the years, been looking at the infrastructure sector quite

seriously but for the first time ever, the Finance Minister had read out a roadmap in her Budget presented on the 5th July 2019, when she articulated the vision of the Indian infrastructure growing by about Rs. 100 lakhs crores in the next five years. The Railway budget for expansion and development, laid down a vision for investment of Rs. 50 lakh crores in the next 10 to 12 years. They showed that India is the destination for large scale infrastructure investment.

The presentations were spread over the seven sessions on 8th and 9th July 2019.

Plenary Session: Infrastructure Industry Revolution

Focus Session 1: Urban Mobility

Focus Session 2: Coastal & Marine Development

Focus Session 3: Energy and Quality of Life

Focus Session 4: Young Professionals Open Forum

Focus Session 5: Business Opportunities with Regional Cooperation

Focus Session 6: Technological Developments

Snap shots of the workshop are given below.

Mr. Amitabha Ghoshal, President CEAI and other dignatories inaugurating the Conference

Welcome address by Mr. Sudhir Dhawan

Dr. S Chatterjee briefing on the Conference Theme

Presidential Address by Mr. Amitabha Ghoshal

Keynote Address by Dr. Nelson Ogunshakin, FIDIC CEO

Adress by Ms. Sangeeta Godbole, DG SEPC

Dignitories with Hon'ble Minister Mr. Piyush Goyal

Hon'ble Minister Mr. Piyush Goyal, delivering the special address

Vote of thanks by Mr. Irawan B Koesoemo Chairman of ASPAC

View of Participants

Mr. Anthony Barry, FIDIC Vice President, chairing Session on Infrastructure Industry Revolution

Mr. Jae Wan Lee, Former President FIDIC

Mr. Kenichi Yokoyama, Country Director -ADB

Prof. S S Chkraborty, Chairman, SVBTC India

Mr. Katsuo Matsumoto, Chief Representative JICA India

Dr. Anne Kerr, Global Head of Cities, Mott MacDonald, Hong Kong

Mr. Amitabha Ghoshal, President CEAI chairing session on Urban Mobility

Mr. Jose Laffond Yges, Diretor Transport Plng, Typsa Spain

Mr. Lincoln T Satkunarajah, President & CEO, Linkay Technologies Inc, USA

Mr. Virender Kumar, Chief Engineer, NCRTC

Mr. Max Meyer, Group Technical Officer, VSL International, Switzerland

Mr. Jean Marc Deplaix, France

Mr. Moncef Ziani, GM, Conseil Ingenierie Et Development, Morroco

Dr. Ajay Pradhan, Vice President CEAI

Dr. Ratnakar R Mahajan, Regional Technical Manager, Meccaferri

Dr. Rajashekhar R Malur, Chief Technology Officer, Tata Consulting Engineers Ltd, chairing session on Energy & Quality of Life

Mr. Vaibhav Agwan, Vice President, SIEMENS

Dr. Bibek Bandyopadhyaya, Former Director, National Institute of Solar Energy

Mr. Prashant Kapila, COO, ICT Pvt Ltd Charing Session on Young Professionals open Forum

Mr. Pradeep Chaturvedi, Consultant

Mr. Alok Nanda, CTO GE South Asia and CEO GE India Technology Centre

Dr. Cosmin Tobolcea, Chair, FIDIC YPFSC, Romania

Dr. Ayanangsu Dey, Kolkata Representative ICE UK.

Mr. M Rajathurai, Sr. Manager, Bentley Systems

Dr. ZHOU Sheng, Chair of FIDIC ASPAC YPF. China

Mr. K K Kapila, CMD, ICT Pvt Ltd chairing session on Business Opportunities with Regional Cooperation

Mr. Anil Srivastava, IAS, NITI Aayog

Mr. Sundeep Singh Chauhan, Director, Consulting Engineers Group Ltd

Prof Muhamad Abduh, Associate Professor, Institute of Teknologi Mandung- Indonesia

Dr. Lin Wang, Sr Manager, Chuo Kaihatsu Corporation Japan

Mr. Pradeep Khanna, ED Asia Pacific, VRARA

Dr. Narasimha Murthy, Associate Director, RODIC Consultants

Mr. Ashwani Gupta, Scientist G, DSIR

Mr. Gaurav Panwar, Wirtgen India Pvt Ltd

ASPAC Award 2019 presented to Mr. Jae Wan Lee, Former President of FIDIC.

B2B MEETING SUPPORTED BY SEPC

As a part of the FIDIC ASPAC Conference, a B2B meeting was organised by the Services Export Promotion Council (SPEC) of the Ministry of Commerce, Government of India on 8th July 2019. About 30 buyers from Asia, Africa and Europe interacted with the Indian Companies.

Hon'ble Minister Mr. Piyush Goyal with the B2B participants

This was an excellent opportunity for companies, both big and small, to explore the Overseas Market.

CEAI NATIONAL AWRDS 2018 – AWARD CEREMONY

The CEAI National Awards Ceremony 2018 was held on 8th July 2019 during the GALA DINNER of the ASPAC Conference held at Hotel Le Meridien, New Delhi.

The awards for the year were selected by an independent Jury headed by Mr. B N Singh, Ex Member, NHAI, Dr. Shilpa Paul, Professor, Delhi Technological University, and Dr. M R Ravi, Professor, IIT Delhi.

To make the competition fair, the Committee had categorised according to the turnover of the companies.

The Award for **Excellence in Engineering Consultancy** for Project Engineering was presented to Category A: Group 2 to **B&S Engineering Consultants Pvt. Ltd.** for the project "2 x 4 Lane Bridge over River Yamuna for Delhi-Meerut Expressway".

Mr. Alok Bhowmick and team receiving the award on behalf of B&S Engineering Consultants

Innovation Engineering Awards were presented to the following organisations:

Category B: Group 2 - **J P Mukherji & Associates Pvt. Ltd.** for the project "New Concept of Pressure Devices, Moisture Control Unit (MCU), for Milling Plant Capacity and Performance Improvement.

Dr. M S Sundaram and team receiving the award on behalf of J P Mukherji & Associates

Category B: Group 3 - **STUP Consultants Pvt. Ltd**. for the Project "Feasibility Study, Detailed Design and Supervision of Construction for 2nd Bhairab & 2nd Titas Railway Bridges in Bangladesh"

Mr. Amitabha Datta receiving the award on behalf of STUP Consultants Pvt. Ltd.

Life Time Achievement Award

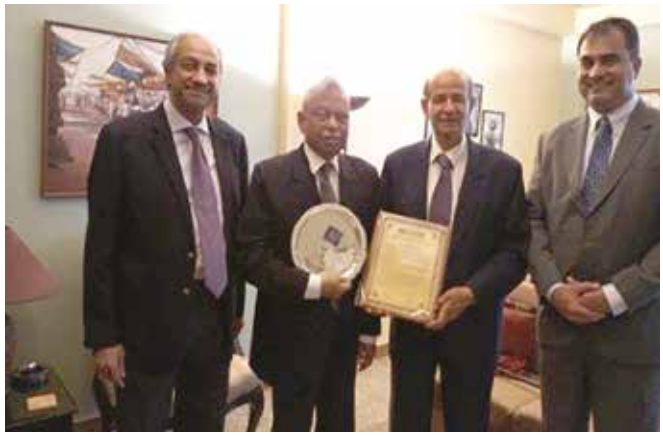
The CEAI Awards Committee conferred the Life Time Achievement Award on the following:

1. Dr. Abjijit Dasgupta, Joint Managing Director, M. N. Dastur & Company (P) Ltd

Dr. Abhijit Dasgupta receiving the award

2. Mr. Syamal Gupta, Former Director TATA Sons/ Chairman, TCE, MD & Chairman Tata Group Companies

Mr. A P Mull receiving the Award on behalf of Mr. Syamal Gupta



Office Bearers of CEAI- Western Region Centre handing over the Award to Mr. Syamal Gupta in Mumbai

3. Mr. Deepak Dasgupta, Former Chairman, National Highways Authority of India

Mr. Deepak Dasgupta receiving the award

Professional Excellence Award

Professional Excellence Awards were conferred on:

1. **Dr. Tessy Thomas**, DS & Director General, Aeronautical Systems (Aero), DRDO

Dr. Tessy Thomas

2. **Shri Rajiv Mittal,** Managing Director & Group CEO, VA Tech Wabag Ltd.

Mr. Ashok Kumar, receiving the award on behalf of Mr. Rajiv Mittal

FIDIC TRAINING PROGRAMMES

CEAI organised in-house training programmes on the Module Understanding of FIDIC Conditions of Contract for Construction (Red Book), Plant & Design-Build (Yellow Book), and Multi-lateral Development Banks' 2010 Harmonised Conditions of Contract.

The training was conducted for the employees of Comptroller and Auditor General of India and National High Speed Rail Corporation Limited.

a) Comptroller and Auditor General of India (CAG), New Delhi, on 25-26 July 2019

CAG Participants with the Trainer

Distribution of Certificates

b) National High Speed Rail Corporation Limited, New Delhi, on 9 – 10 August 2019

NHSRCL participants with the Trainer

FIDIC Conditions of Contract are being increasingly used by the international Construction Industry throughout the World. The Multi-Lateral Development Banks, including The World Bank, the African Development Bank, the Asian Development Bank and others have adopted the 1999 FIDIC Conditions of Contract for Construction with modifications known as Harmonised Conditions Contract.

The program was designed to offer a complete up-to-date overview of the effective understanding and use of the 1999 FIDIC Conditions of Contracts and the 2010 Harmonised edition being used by the Multi-Lateral Development Banks. The training was intended that those who attend be able to adopt and would develop adequate understanding for the practical use of the FIDIC conditions of contract.

Dr. Dhaval Parikh, a FIDIC accredited trainer, conducted the trainings. Dr. Parikh has more than 28 years of professional experience with a doctoral degree in Civil Engineering; a Master's degree in Civil Engineering from U.S.A. and bachelor's degree in Civil Engineering from India.

His professional experience in the procurement, administration and supervision of FIDIC based construction projects around the world and having worked on overseas projects for more than 10 years on a variety of major infrastructure works, particularly IFI supported projects in Asia, Africa and Pacific made him the right choice.

FORTH COMING FIDIC TRAINING PROGRAMS

CEAI is organizing the next open Training Course on the module "Practical Use of the FIDIC Conditions of Contract" on 14 - 15 October 2019 at Royal Plaza, New Delhi.

The training will be imparted by Mr. Bogdan Oprea, FIDIC Accredited Trainer from Romania. Mr. Bogdan received degrees in civil engineering from the Institute of Civil Engineering, Bucharest, Romania, and from L'Institute Nationale de Science Apliques, Lyon, France where he was awarded a Diplome d'Etudes Aprofondies (DEA).

Mr. Bogdan is a Member of the Dispute Resolution Board Foundation, of the Romanian Association of Consulting Engineers and other organizations. His name is also listed on the DRBF President List of Dispute Boards Member, Romanian national list of adjudicators, and he is an accredited mediator.

Course Fee

Members - Rs. 28,000/- + *GST @ 18%*

Non-members - Rs. 30,000/- + *GST @ 18%*

- It is a Non Residential Course.
- An early bird discount of 5% is applicable for registration with payments made **before 25th September 2019.**
- 5% Discount would be extended if there are 4 or more participants from one organization.
- FIDIC Certificate will be issued by CEAI to those who attend and complete the two day training programme.
- For more details please contact CEAI Secretariat.

NEW STRATEGIC PLAN FOR CEAI

For taking CEAI forward, new strategic plan has been formed by the core committee led by our Chairman Emeritus, Mr Mahendra Raj. The committee has submitted the final report and the same has been accepted by the Governing Council. The list of contents and Executive Summary of the strategic plan are being reported below for wider understanding of future of CEAI.

We look forward to views / suggestions from readers regarding this document, which has immense importance to the future of Consulting Engineering Industry.

LIST OF CONTENTS

EXECUTIVE SUMMARY

The Consulting Engineers Association of India (CEAI) has been in existence for over 20 years under this name and almost for 60 years before merger of its erstwhile predecessors. It has had a long history and well recognised in the industry and Government circles in India and overseas. However, its growth has been modest in terms of membership and revenue and perhaps it has not been able to leverage its standing as per its weight of a long-standing professional body of engineers. With the current spurt in infrastructure investments in India and other developing countries, new horizons have opened up for the association and its members. Under the decision of the Governing Council a Strategic Plan has been developed with a perspective of six years to propel the association from the current membership growth of 3% to 15% CAGR to reach a membership base of 1200, and the revenues to grow from 7% to 12% CAGR to touch Rs. 3 Crore per annum.

The Strategic Plan Committee (SPC) formed for this purpose has looked into various aspects of relevance to the consulting engineering community. It has identified twelve areas that need to be addressed. Each has been assigned to a Task Group comprising of members from the SPC. The reports submitted by the Task Groups have been studied by the Core Group (CG), chaired by Mr. Mahendra Raj and have had several meetings spread over the past one year, averaging about 2 meetings per month. Out of these Task Groups, 5 of them have focused

on revenue generating activities and the remaining 7 on non-revenue supporting functions for image building, Government interaction, policy, ethics and quality.

The Business Plan proposes a revised Organisational Structure to be more agile, reaching out to all parts of the country through 4 Regional Centres and associated City Chapters. The headquarters to support the outreach structure with logistics and seed funding. However, eventually each of the Regional Centres and City Chapters are to chalk out their own activities and events to become self-reliant.

There is a special focus on Young Professionals to help them to develop as future leaders. A range of activities through the use of webinars and social media are planned for them and largely driven by their own initiatives.

A major thrust of CEAI is on Events on topics of interest to the engineering consulting community. The events include conferences, seminars, workshops, training programs, technical talks and round table meetings. Events being an important revenue source for CEAI, a great deal of effort by the secretariat and the Regional Centres are devoted to this activity. In due course the City Chapters would also be integral to the plan for holding events. To extend reach it is proposed that events be planned with other institutions with similar agenda.

As a Member Association of FIDIC, CEAI has the responsibility in India to train and sensitise stakeholders on the FIDIC Conditions of Contract and the value proposition that FIDIC holds. FIDIC training programs and workshops also contribute significantly to CEAI's bottom line.

A new focus is being given in the Section on Technology, Research, Training and Consultancy. This is much needed in an increasingly competitive environment with global challenges to have industry-oriented Research and Technology Development so that Indian consultancy can be at the forefront of engineering. Based on this endeavour CEAI has plans for knowledge development and institutional consultancy.

Though the quality of activities undertaken by the association is of a high order, more needs to be done to communicate to the members - actual and potential - and to the larger community of stakeholders and decision makers. The Section on Communication, Publication & Social Media addresses this need. Our regular publications, viz., Viewpoint and Newsletter are well accepted. However, it is felt that the use of digital media needs to be scaled up.

An important finding of the study is that the ratio of expenditures on the key activities of CEAI to the fixed administrative overheads is approximately 1, as computed from the Balance Sheet figures of one of the best performing years for CEAI, FY 2017-18. This does not bode well for the organisation, as the expenditure on activities as per its mandate is equal to the administrative fixed overhead. It implies that there are inefficiencies in its operations and the existing resources are not being utilised optimally. The need of the hour is to improve on this ratio significantly.

The chapter on Implementation Strategy addresses this issue for re-inventing CEAI through a program called 'STELLAR' – Sustainable Transformation of Engineering services delivery based on Lifelong Learning, Advocacy & Research. The first mantra is for the members is to get involved by taking ownership. The Young Professionals must be encouraged as they have the most to gain from the process of Lifelong Learning and interaction with their peers and seniors. To improve efficiencies investment on IT Infrastructure has been recommended, including productivity management tools, CRM, VoIP based communication, platform for Webinars, dynamic website, use of social media and emphasis on innovation and ideation. Advocacy with the government and decision makers is required, to be acknowledged as the 'Voice of the Consulting fraternity'. This position is built on the pillars of practice of Ethics and Quality by the members of the association.

The last chapter titled 'Looking Ahead' attempts at crystal gazing into the future for CEAI and its members.

FIDIC NEWS

REPORT ON FIDIC INTERNATIONAL INFRASTRUCTURE CONFERENCE 2019

Dr. S Chatterjee, Dr. Ajay Pradhan

'2019 International Infrastructure Conference' the annual conference of FIDIC was held in Presidente Intercontinental, Mexico City from 8th to 10th September 2019. The official delegation of CEAI was led by Dr. S. Chatterjee accompanied by Dr. Ajay Pradhan. Other CEAI Members who joined the conference were, Mr. K. K. Kapila, Mr. Prashant Kapila, Dr. Dhaval Parikh and Mr. Jitendra Kumar Singh, (YP Member). The conference was very well attended with over 700 delegates, mostly international delegates.

The Directors and Secretaries (DNS) meeting was held between 08.30-13.00 hrs. on 7th September 2019. CEAI was represented by Dr. S. Chatterjee, Dr. Ajay Pradhan and Mr. Prashant Kapila in the meeting. The DNS is a very important annual meeting for discussing the current policy initiatives and functioning of FIDIC and lays down the base for the Board to consider towards making FIDIC more responsive and effective for the members' need. The meeting was chaired by Mr. John Gamble of Canada and co-chaired by Mr. Chris Campbell of South Africa. The current initiatives and actions were presented.

Dr. Nelson Ogunshakin, CEO, FIDIC stated that a fresh look was being taken on the functioning of various committees and complete restructuring of those was being considered for making FIDIC more efficient and effective for the engineering consultancy fraternity and the Member Associations (MAs). He mentioned about the formation of a DNS Advisory Council of five members, however, due to late decision in the matter only two nominations were received from the MAs. Hence, the nominee of ACEZ (Zambia), USIC (Switzerland) and CEAI's nominee Mr. Prashant Kapila were declared elected to the Council. It is a good opportunity for CEAI to enhance its outreach with FIDIC.

The DNS meeting was followed in the afternoon by the FIDIC President's meet, which in a way sequel to the DNS meeting.

The FIDIC Best Business Practice Forum meeting was held, in the morning of 8th September 2019, with all the chairs of various FIDIC Committees. It was chaired by Dr. Nelson Ogunshakin. Each Committee chair presented a brief on the status, vision and mission of his/ her respective committee, with some audience participation and comments by the chair of the session.

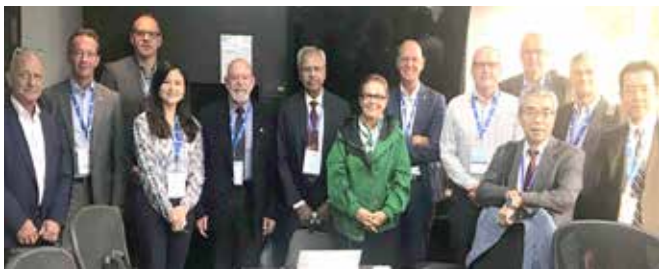
The Business Practice Committee meeting was held from 06.45 to 08.30 hrs on 9th September 2019, prior to the start of Inaugural Session of the Conference at 08.45 hrs. It was attended by 14 of the 16 members; the other two joined over conference call. CEAI's representative, Dr. S Chatterjee had decided to retire from the Committee after the meeting, hence he had already proposed to the Chair, Mr. Andrew Read of New Zealand, to include Dr. Ajay Pradhan in his place. Dr. Ajay Pradhan was therefore invited to join the BPC meeting as an observer. The meeting was very productive and the Chair recorded high appreciation for Dr. S Chatterjee's contribution over the last twelve years. Dr. S Chatterjee was given a standing ovation. Mr. Read also mentioned that as per the FIDIC practice, Dr. Ajay Pradhan's inclusion to BPC would have to be finally approved by the FIDIC Board.

The two-day Conference was well structured, with distinguished speakers to cover the diverse but connected topics. Two Cabinet Ministers of the Government of Mexico, that of Transportation & Communication and of Urban Development delivered the Key Theme topics for two important sessions. Participation was very good throughout. The associated exhibition also had good participation. The social programmes - Welcome Reception and Gala Dinner on the evenings of 8th and 9th September 2019 respectively were attended by all the CEAI delegates. The Welcome Reception was held in the historic building that houses the Public Works Department of Mexico.

On 10 September, GAM was held at 4.30 pm and was attended by Dr. Chatterjee, Mr. Kapila and Dr.

Ajay Pradhan as CEAI representative. Voting for the two positions in the Board, in place of the two retiring members had been closed earlier. The results were announced in the GAM. Dr. Sarwano H from Indonesia and Mr. Luis Villarroya of Spain were declared elected. At the end of the GAM the first Vice President (President Elect) Mr. William Howard of USA was installed as the new President FIDIC, in place of the retiring President, Mr. Alain Bentejac of France. Mr. Tony Berry became the first Vice President and Mr. Liu Luobing of China was elected by the Board to be the second Vice President.

Overall the Conference was very well organized and provided high level of networking opportunity with key members of the stake holder authorities/ industries.



Dr. S Chatterjee with other FIDIC Business Practice Committee Members

Mrs. Poonam Kapila, Mr. K K Kapila, Dr. S Chatterjee at Gala Dinner

Dignitaries on the Dais

Cultural program

International Federation of Consulting Engineers
The Global Voice of Consulting Engineers

Geneva, 27 September 2019

Mr Samarjit Chatterjee, *India*
scacpl@gmail.com

FIDIC Business Practice Committee – Letter of recognition to retiring member

Dear Samarjit,

The International Federation of Consulting Engineers (FIDIC) would like to express its gratitude to you for your long-term dedication and successful engagement as member of the Business Practice Committee of FIDIC throughout the years 2007-2019 and making a great contribution to the development of the Federation.

We hereby present this appreciation letter in recognition of your dedication and commitment.

Sincerely yours,

Dr. Nelson Ogunshakin OBE
FIDIC CEO

OTHER NEWS, VIEWS & NOTES

CEAI OUTREACH

As part of an ongoing process, CEAI is continuously expanding its outreach by way of providing support to other professional events and promoting its own to reach out to new members. One such event is:

- Municipalika and CAPEx 2019 – 16th International Exhibition & Conference on Smart & Sustainable City Solutions, scheduled from 28 to 30 November 2019 at Bangaluru. For more details, please contact Mr. V Suresh, President, Good Governance India Foundation, Mumbai. Ph: +91 22 45558555, Email: contact@municipalika.in Website: www.municipalika.com

OBITUARY

With profound grief, it is to inform you that Dr. Tuhin K Roy, former President of NACE, breathed his last a few days back at the age of 96.

He was instrumental in formation of NACE at the instance of Planning Commission and was the first President, representing member companies. He was an eminent Chemical Engineer with PhD from MIT and had his own engineering consultancy company, Chemical & Metallurgical Design Company Pvt. Ltd.

VIEW POINT

The themes for the next four issues of Viewpoint spread over a year would be:

(a). **Pollution** (December 2019)

(b). **Building Services** (March 2020)

(c). **New Materials & Systems for Buildings** (June 2020)

(d). **Stakeholder Management in Public Infrastructure Projects** (September 2020)

Considering the experience of CEAI members and various stakeholders in the subjects, CEAI would be happy to receive articles on the above themes.

Authors could share their knowledge and experience by providing case studies of the works executed or in execution, firsthand accounts of the challenges faced, practical issues experienced and the solutions to those, etc. Photographs, charts, diagrams, drawings, etc. would benefit our readers for better appreciation of the issues encountered and addressed.

The articles for an issue need to reach CEAI at least 6 weeks prior to the end of the month of the Viewpoint issue.

Articles need to be in Times New Roman 12 with single line spacing with before and after 6 pt and normal margin on A4 size. A recent clear and bright passport size photograph of the author is to be sent along with the article.

Tech Quiz

1. Who invented traffic rules?

a. Edgar F Copell
b. Burton W Marsh
c. William P. Eno
d. Wilbur S Smith
e. Matthew Porosky

2. What was the first traffic signal lit with?

a. Kerosene
b. Electricity
c. Candles
d. Gas
e. Waste

3. Which year did the Motor Vehicles Act come in to force?

a. 1988
b. 1941
c. 1955
d. 1947
e. 1990
f. 1989

4. When did the President give assent to The Motor Vehicles (Amendment) Act, 2019

a. 07-07-2019
b. 09-08-2019
c. 12-08-2019
d. 08-08-2019
e. 31-07-2019

5. Under which Article does the Constitution of India covers safety and health?

a. Article 39
b. Article 24
c. Article 40
d. Article 35
e. Article 43

6. When was the Building & Other Construction Workers Act enacted?

a. 1996
b. 1948
c. 2018
d. 1940
e. 1977

7. When was the First Factories Act passed?

a. 1931
b. 1890
c. 1745
d. 1881
e. 1948

8. When was the document establishing ICAO signed?

a. 1947
b. 1954
c. 1959
d. 1963
e. 1944

9. When was SOLAS first adopted?

a. 1960
b. 1965
c. 1914
d. 1948
e. 1929

10. When were the Trinity House regulations drawn up?

a. 1846
b. 1840
c. 1914
d. 1880
e. 1920

The first person who mails the correct answers to CEAI ***info@ceai.org.in*** will get a congratulatory mail and will be acknowledged by publishing the persons photograph in the next issue.

Contributed by A P Mull

Answers to Tech Quiz June 2019 issue

1(a), 2(e), 3(b), 4(c), 5(a), 6(a), 7(d), 8(c), 9(b), 10(a)

Prof. Mainak Ghosal, Consultant is the winner of the Tech Quiz with full/ maximum marks.

TATA CONSULTING ENGINEERS LIMITED

Infrastructure:
- Built Environment
- Water & Waste Water
- Transportation

Power:
- Nuclear
- Thermal
- Renewable

Resources:
- Mining & Metallurgy
- Hydrocarbons & Chemicals

Tata Consulting Engineers Ltd is proud to have been associated with some of the most prestigious projects around the world. We add value through innovative engineering solutions. We offer concept to commissioning and asset life cycle management solutions in key sectors.

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STUP Consultants Pvt. Ltd.

STUP, established in 1963, an Indo-French organization of international repute which provides design, construction engineering, technology transfer and project management services for multiple sectors.

Sectors

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02. Environmental and Public Health Engineering
03. Energy, Telecommunication and Space Infrastructure
04. Roads, Highways, Expressways
05. Urban, Rural and Industrial Development including all Types of Buildings
06. Bridges & Flyovers
07. Railways
08. Offshore, Harbour and Coastal Engineering
09. Metros
10. Water Resources and Agricultural Development
11. Construction Engineering, Project Management and Technology Transfer
12. Rehabilitation of Structures and Heritage Buildings


01


02


03


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