IIT GANDHINAGAR

SAFETY MATTERS

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*A Quarterly issue from **Centre for Safety Engineering**(CSE), IITGN*

DIRECTOR'S MESSAGE

Sudhir K Jain
Director, IITGN

IIT Gandhinagar wishes to contribute towards addressing the key challenges that we face in nation building. More often than not, such challenges demand an interdisciplinary thinking for development of solutions, combining the skills of engineers, behavioral scientists, data scientists, policy makers, the medical profession and many others.

When we decided to establish the Centre for Safety Engineering (CSE) at IITGN, we committed to contributing to improving 'public safety scenario' in India, especially the safety in built environments, electrical and fire safety and road safety. In the area of fire safety in built environments, I am happy to share that our experts in chemical, civil and electrical engineering are working in close collaboration, and researching the causes and possible preventive measures.

Progressively, the Centre expects to be looking at challenges in areas like electrical safety and road safety. The CSE is also supporting Indian manufacturers in product development and innovation, through tripartite arrangements between the industry, government and the IITGN. As the CSE launches its maiden edition of 'Safety Matters' I wish the effort every success.

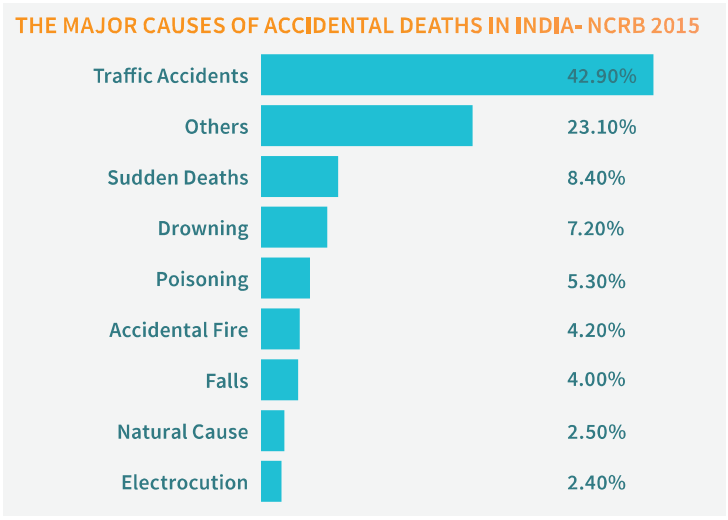
FROM EDITOR'S DESK

R A Venkitachalam
Advisor, CSE, IITGN

Urbanization has been acknowledged as a mega trend that is impacting every country and every society globally, bringing with it, promises of significant economic growth. It also brings with it, significant challenges, one of them being Public Safety. With very high densities of built environment and with public safety infrastructure trailing behind, it is important that city administrators, planners, city dwellers, builders, commercial establishments and everyone else listen carefully to 'what is the safety data speaking?'

The 'accidental deaths and injuries' data published by the National Crime Records Bureau of India (NCRB) presents a grim picture of public safety in our country. At a gross level, we lose about 4,50,000 lives every year due to causes that were preventable with policy measures, engineering interventions and better safety education. Lack of road safety alone claims almost 1,40,000 lives every year in India together with an additional 5-6 lakh serious injury victims.

Even as we rev up our economic growth engines and be the fastest growing large economy in the world, the key questions we are asking at the Centre for Safety Engineering are:



- What are the 'causes' for the accidental deaths and injuries? How can we use 'safety science' to better understand the causes and develop solutions?
- How do we build a reliable data repository on 'Safety Incidents' and their impact on Social and Economic indicators of India, thus helping policy formulation?
- What steps are needed in different areas engineering, policy deployment, governance, behavioral, financial, legal, safety education that can help improve public safety?

Promoting a Culture of Safety, 'Safety Matters' aims to advance the cause of Safety Engineering, emphasizing its interdisciplinary nature. By providing a platform for communication, knowledge dissemination and exchange of ideas, it brings together the various Safety stakeholders - Industry, Academia, Government, & Civic Society.

EXCERPTS FROM THE INTERVIEW WITH MR D K SHAMI, FIRE ADVISOR

D K Shami
Fire Adviser to Director General, Fire and Civil Defence, MHA, GOI

On Fire Safety and Smart Cities: It is essential that smart firefighting and fire protection with cyber physical systems be adopted as integral part of infrastructure for the smart cities. Heads of Fire and Emergency Services must interact with the concerned authorities to ensure the inclusion of adequate fire safety paraphernalia to provide fire safety cover to the smart cities.

On Challenges that the Fire Services face: Fire Services in many of the states fall within the jurisdiction of local bodies. The fire services in some states are operational only in the municipal jurisdictions and beyond that, there are virtually no fire stations available. Similarly, no uniform building byelaws and fire safety regulations are applicable in those areas.

On steps being initiated to strengthen the Fire Services: Standing Fire Advisory Council (SFAC) has prescr- ibed norms for establishment of fire stations, infrastructure, equipment, manpower and response time for emergencies. Under the centrally sponsored scheme of strengthening of fire & emergency service, a Fire & Risk Hazard Analysis of the country has been carried out to study the increasing number of fire incidents.

On the National Building Code, 2016: The NBC 2016 is an important step towards enhancing safety of buildings in general and fire safety in particular. As a result of the improvement brought about in NBC 2016, an updating of other reference codes and standards is also necessary which is being taken up.

Recently it has been resolved to write to the Bureau of Indian Standards (BIS) to update the National Electrical Code (NEC) and to the states to implement the condition of providing the electrical safety certificates issued by the certified Engineers before obtaining the Fire NOC. This is to reduce the fire caused by electrical installations.

CHALLENGES OF FIREFIGHTING IN LARGE INDIAN CITIES

M F Dastoor
Chief Fire Officer, Ahmedabad

Ensuring fire safety of citizens in large cities is always a challenge, more so when it comes to thickly populated large cities we have in India. Ahmedabad City is no exception and is a good example to consider, where the population densities are as high as 12,000 persons per sq. km (as per census 2011). Some of the key questions we are asking and initiatives we are spearheading in Ahmedabad are the following:

INCREASE CAPABILITY AND CAPACITY OF THE FIREFORCE

Depending on the type of occupancies and nature of activities, cities may need to have specialized firefighting teams – chemical fires, highrise building fires, rescue and relief operations, etc. The training imparted will also be more focused accordingly.

LEVERAGE TECHNOLOGY TO DECREASE RESPONSE TIME

Linking movement of fire tenders and ambulances with traffic signals can ensure quick access to the incident spot.

INNOVATIVE APPROACH TO ADDRESS LOCAL CHALLENGES

All metros in India have an 'Old City' portion that poses serious challenges – high population density, mixed occupancy which is warehouse/godowns plus residential dwellings plus commercial shops, noncompliance with codes, inadequate infrastructure, and many more. Given the poor access that fire tenders will have to such locations, we in Ahmedabad Fire Brigade have developed a 'mini vehicle' that can deliver water at high pressure to hoses that can reach difficult spots.

ENSURING COMPLIANCE TO SAFETY NORMS

The process of issuing NOC can be streamlined with adoption of technology, especially in ensuring compliance with NBC-Part 4, Fire and Life Safety 2016. This will help the citizen as well as drive the cause of Fire Safety. Buildings NOCs need to be renewed compulsorily

IMPROVING PREPAREDNESS TO FIRE INCIDENTS

Prevention is better than cure – this applies to fire incidents also. We need to understand the reasons for incidents and take preventive measures using fire forensics. Along same lines, atleast 25 – 35 % of the time of a Fire Officer must be in ensuring preparedness and preventive measures.

We are progressing along the above lines in Gujarat including a special project currently underway to revamp the training curriculum. The Center for Safety Engineering being in IIT Gandhinagar, I believe will provide a fillip to our initiatives. I wish Safety Matters every success in its maiden issue.

TEST FACILITY TO STUDY FACADE FIRES..FIRST OF ITS KIND IN SOUTH ASIA

The Centre for Safety Engineering, IITGN and Underwriters Laboratories have collaborated to establish a full scale test facility in IITGN campus to study facade fires. Given the increased use of facade systems globally and in India and with the growing incidences of fires with such systems, it was felt necessary to establish performance-based test facility for research and for development of codes and standards.

The three-storey steel building has the ability to accept different facade / glazing systems that can be studied for their behavior and performance when exposed to fire.

The copious generation of data in such test environments is also expected to help developing simulation and modelling tools. The building has firefighting systems built in to ensure the safety of the building and the surroundings. Tests in recent months have included different façade materials, new piping materials as well as fire stops. The Safety Mission of UL and the academic rigour of CSE/IITGN have come together in this facility to 'work for a safer India'. Leading industry partners such as Lubrizol, Godrej, Shah Bhogilal and many others have partneterd with this test facility in recent months for evaluating their products. The CSE looks forward to enhancing the cooperation with the industry for mutual benefit.

THE WILLIAM HENRY MERRILL FIRE ENGINEERING LABORATORY

Prof Sudhir K Jain, Director, IIT Gandhinagar and Mr Suresh Sugavanam, Managing Director, UL South Asia inaugurated the William Henry Merrill Fire Engineering Laboratory, which is part of the CSE, on December 7, 2017. Named after William Henry Merrill, the founder of UL and a pioneer in developing a scientific approach to Safety, the major capabilities of this lab include 'characterization' of physical and mechanical properties of materials as well as conducting bench-scale fire tests. This facility reinforces the commitment of both UL and IITGN in advancing the cause of Safety Engineering in India.

MESSAGE FROM
MR SURESH SUGAVANAM, MD, UL SOUTH ASIA

Suresh Sugavanam

Change is often proclaimed as an unstoppable force. However, change can bring progress only when people and institutions come together to nurture growth with the science and consciousness of safety, security and sustainability. The Henry Merrill Fire Engineering Laboratory, a collaborative initiative of IIT Gandhinagar and UL, a 124-year-old global safety science company, is a shining example of such an endeavor. With the common goal of assimilating resources and expertise, UL and IIT Gandhinagar share a long-standing relationship focused on furthering safety and sustainability through the application of science. Named after UL's founder, the Henry Merrill Fire Engineering Laboratory aims to address India's risks and challenges in built environment and renewable energy, with intention to expand into further areas like composite materials, medical devices and fire forensics. The initiative is an initial and definite step to realize the ambitious vision of propagating a culture of safety in India through academic rigor and experiential learning that will ultimately transform the laboratory into a Centre for Safety Education. I wish the members of the laboratory and colleagues at IIT Gandhinagar the very best in their future undertakings.

NEW FACILITY AT IITGN LAB

Chinmay Ghoroi
Associate Professor, IITGN

One important addition that was made to the test facilities in March 2018, is the Cone Calorimeter (FFT, UK; Model: iCone mini). This equipment enables us to measure the heat release rate (HRR) under different incident heat flux (maximum 100 kW/m^2) using ISO 5660-1. The present system can also quantify the combustion gases and smoke release rate along with mass loss, which is useful for fire modelling and predicting real scale fire behavior. The facilities in the Fire Research Laboratory are also used to validate the observations of the full-scale facade fire tests conducted at IITGN – UL Fire Testing facility. Some of the other experimental setups currently in use support CSE research in the areas of aerosol fire extinguisher, developing early detection for kitchen fire, burning rate evaluation of different materials, etc.

ARE WE CREATING MODERN LAKSHAGRIHAS?

Gaurav Srivastava
Assistant Professor, IITGN

'Lakshagriha' – the Palace of Lacquer – finds its mention in the Sanskrit epic of ancient India, Mahabharata. It was a palace designed for the Pandavas by the Kauravas with a highly inflammable material, lacquer, and was meant to annihilate the Pandavas in their sleep. Those who have seen lacquer work (e.g. in bangles and artefacts) may recall that it burns with a vibrant flame and melts as it burns just like wax.

Many modern buildings utilize energy efficient envelops, also called the facade system or curtain wall systems. They have two main purposes: (1) render a visually distinctive and attractive exterior to the building and perhaps more important, (2) to provide thermal insulation to the building. Low energy consumption is crucial parameter for a building to be 'rated' as green, hence thermal insulation is a key component in the design of modern-day HVAC systems. Thus, the facade materials are chosen for their higher 'R' value - a measure of how well a material resists flow of heat. Typical polymeric materials used for insulation such as polyurethane (PU), and extruded expanded polystyrene (XPS) have R-values ranging between 5-8 ft ^{2} °F.h/(BTU.in).

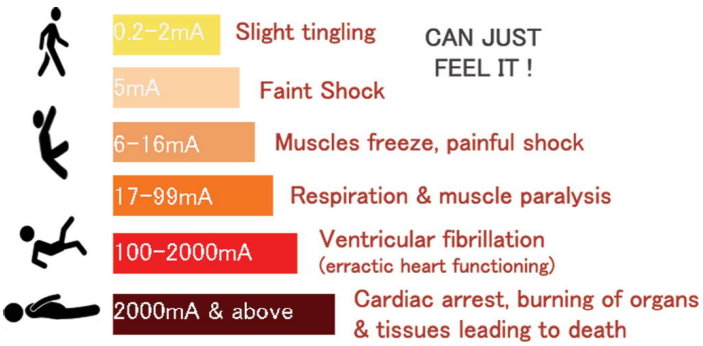
While these materials are excellent insulators, they are highly inflammable and catch fire easily at temperatures between 300-400 °C (lacquer burns at around 250°C). In India, where the use of façade systems is increasing with great speed, naive use of such materials can lead to large-scale and uncontrollable building fires, something that we must prevent through good Safety Engineering. Facade fires have been on the rise globally in recent years, one of the most devastating ones being the Grenfell Tower in London, which started on June 14 2017, completely gutting the newly installed insulation and facade system. The fire raged for more than 24 hours, taking away 72 life and causing many injuries apart from monetary losses.

India has also witnessed many façade related fires in recent times. At the Centre for Safety Engineering, recent research studies though life scale tests have clearly shown that a fire initiated at the ground level of a building with an 'inflammable facade system' can reach the second level in 5 minutes. This points to the need for tighter specifications for facade materials and their engineering. Greater collaborative work involving all stakeholders– architects, engineers, policy makers, regulators, contractors, educators and end users – is needed to prevent modern day Lakshagrihas.

WHAT DO YOU KNOW ABOUT ELECTROCUTION

Neha Modi
Project Assistant, CSE, IITGN

The danger from electrocution depends on how high the voltage is, how the current travels through the body, the person's overall health and how quickly the person is treated. With increasing current, the damage to the human body increases, as illustrated by the picture below.



ACCORDING TO THE NCRB-2015

- In India **9986** lives were lost due to electrocution
- This was a **4%** increase over 2014
- In the year 2015, out of the total accidental deaths **2.4 %** was contributed by electrocution
- The age group most affected by electrocution was bracket **18-30** years
- Maharashtra had the maximum number of registered cases of electrocution incidents

CSE SHORT COURSES

DESIGN OF REINFORCED CONCRETE STRUCTURES FOR EARTHQUAKE AND FIRE AS PER NBC 2016 | MAY 2 – 5, 2018

The recently updated National Building Code significantly impacts two important aspects of design of reinforced concrete structures: (1) earthquake resistant design and (2) design for fire safety. This course involved in-depth discussions of the new features of the NBC 2016 pertaining to earthquake and fire and included two hands-on sessions with several design examples to ensure proper appreciation of the revised provisions. More than 50 participants from various stakeholder groups actively participated in the short course.

UPCOMING COURSE ON PHA

PROCESS HAZARD ANALYSIS (PHA) FOR CHEMICAL PLANTS | DEC, 2018

Chemical process plants demand much higher levels of risk management and safety engineering as well as operator training for very obvious reasons. The PHA programs is designed to prepare those engaged with the chemical process industry, appreciate the critical factors involved and ensure preparedness. For more details, please visit safety.iitgn.ac.in