ASPACNEWS

QUARTERLY NEWSLETTER OF FIDIC ASIA PACIFIC

ISSUE 3 | December *2022*

INSIDE STORIES

- *Events*
- *Future Leaders*
- *Member's News*

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FIDIC ASPAC

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EDITORIAL

The Editorial Board is very happy and enthusiastic with the continuing improvement of the Newsletter, as reflected in this third issue- and on its being released in due time!
It is encouraging to find greater contributions from FIDIC ASPAC member associations, and specially from the future leaders.

It is our sincere hope that with travels increasing across the world with the gradual retreat of the dreaded Pandemic, members of FIDIC ASPAC region will be able to avail the benefit of attending events of interest in other member countries, as are being intimated through the Newsletter.

The retreat of the Pandemic is bringing in increased thrust on development works across our Region and the demands on the Consulting Industry are on the rise. Our industry has been able to withstand the challenges thrown on us by these inconceivable happenings with Lockdown and stoppage of all forms of travel fairly well, and that augurs hope for our future.

The Happy Season and the New Year will generate further thrust on new development, and the Editorial Board wishes all the readers great time ahead and a very promising NEW YEAR.

Dear Readers, we look forward to all of you contributing effectively for systemic growth of your Newsletter and we assure our full commitment to make this publication a lively link between the region and a messenger of hope and happiness.

Amitabha Ghoshal
On behalf of the Editorial Board

AmitabhaGhoshal

Chairperson-Editorial Board

POFILES of Member Associations from FIDIC Asia Pacific

JAPAN

Organization	**Engineering and Consulting Firms Association, Japan** (**ECFA**) was established in April 1964, for the purpose of contributing to the international development cooperation, through application and transfer of state-of-the-art technology. ECFA is a non-profit independent organization authorized by Ministry of Economy, Trade and Industry (METI) and Ministry of Land, Infrastructure and Transport. ECFA plays a major role in exercising overseas consulting services for Japanese CEs. Since the consolidation with the Association of Japanese Consulting Engineers（AJCE） in 2016, ECFA succeeded its FIDIC membership (since 1974) to represent CE industry in Japan.
Members	ECFA membership consists of 80 consulting firms in various fields of engineering and other practices. In particular, the consulting services cover social, financial and economic analyses, education, health, regional planning, transportation, agriculture, energy, environment and others that are necessary for infrastructure development. Detailed information on field coverage, country experiences and particular expertise which are provided by the ECFA members are disclosed in the following "ECFA Members' Directory": http://www.ecfa.or.jp/english/member.html
Future Vision - Our Challenges and Initiatives	CURRENT SITUATION and challenges. CE industry in Japan is facing following challenges: ➢ Restriction in ODA budget: Government ODA budget has been keeping similar level despite of increased demand. ➢ Low Profitability (Low Profit Ratio): Current procurement system leads to low consultant fee in which no clear-cut TOR is practiced in many cases. ➢ Digital Transformation: DX in CE services is necessary for further innovation and development TARGET SETTINGS for Consultant; ➢ Share of CE service: Approx. 95% of CE's sales is from Japan's ODA in overseas projects. To get out of this over-concentration, it is necessary to increase the share in non-ODA projects. ➢ Development of CE service: CEs should expand services not only in design, construction and supervision of facilities, but also in downstream such as O&M, PPP/PFI, in infrastructure projects. ➢ Promote innovation by Digital Transformation. ➢ Securing a reasonable profit and building strong business base is essential for sufficient investment for further growth.

Key Activities	➢ <u>Policy and Planning Committee</u> ● Initiate recommendations and policy to promote consulting industry and lobby government and related agencies for the development of CE industry. ➢ <u>ODA (Official Development Assistance) Committee</u> ● Collectively negotiate with government and Agencies (MOFA, METI, MLIT, JICA), financing institutions (JICA, JBIC), insurance body (NEXI) and International Organizations (World Bank, ADB, IDB etc.) to promote and facilitate ODA projects. ● ODA committee is composed of Yen Loan scheme Group, Grant Assistance Scheme Group, Technical Cooperation Scheme Group and JICA Contract affairs Group. ➢ <u>ECFA FIDIC Committee</u> ● Collectively supports FIDIC Committee (BPLC) and Councils (FLAC, DNSAC) and regional (FAP) activities and dispatch working and board members. ● Conducts FIDIC Contract Seminars and Workshops (Red, Yellow, Silver, White, Dispute Avoidance and Adjudication), for Training Contract Manager and Adjudicator. ● Translates FIDIC Suite of Contract and other FIDIC publications into Japanese (Red, Yellow, Silver Book) ➢ <u>Human Resources and Capacity Building Committee</u> ● Conducts Seminars on environmental and social impact study, diversity and inclusion, gender equality etc. ● Conducts Workshops such as economic and financial analysis ● Supports FIDIC/FAP FL activities through ECFA Future Leaders Group. Information Exchange / Sharing on Work-Life-Balance or working environment ➢ <u>Public Relations Committee</u> ● Conducts seminars and regional roundtable discussions for public and interested parties to advocate CE service ● Lecture in universities for recruitment of rookie consultants
Contact Details	**Toranomon Yoshiara Building, 8th Floor** **1-6-13, Nishi- Shimbashi Minato-ku** **Tokyo 105-0003– JAPAN** **HOTLINE : +81 3-3593-1171** https://www.ecfa.or.jp E mail- info@ecfa.or.jp

PEOPLE'S REPUBLIC OF CHINA

OVERVIEW

China National Association of Engineering Consultants (CNAEC) was constituted in 1992 as a non-governmental professional organization registered with the Ministry of Civil Affairs of PRC, composed of engineering consulting firms, consulting engineers and other related professionals. In 1996, CNAEC was admitted into FIDIC as a full member.
Enjoying a position of influence with the government and reputation of leader representative of the Chinese engineering consulting industry in the national and international arenas, CNAEC has been recognized as:
- the Voice of the engineering consulting industry,
- the Resource on business practices and,
- the Advocate for promotion and protection of their business interests.

OBJECTIVES

- Represent the Chinese engineering consulting industry nationally and internationally;
- Carry out national guidelines, policies, laws and regulations and uphold the principles of serving the nation, the society, its members and the industry;
- Implement the new philosophy of development and national economic development strategy;
- Regulate practice to improve quality of service and enhance self-discipline and integrity of the industry;
- Protect the legitimate rights and interests of members and make the voice of the industry heard by policy makers;
- Promote viable and sustainable development of the industry;
- Perform social responsibilities.

VALUES

- Independence
- Professionalism
- Impartiality
- Integrity

SERVICES

- Be the bridge and tie between government and firms, strengthen the development of the whole industrial chain of engineering consultancy, and perform the functions of "providing service,

reflecting demands, regulating practice and promoting harmony".

- In accordance with mandates from the government, participate in research and formulation of related laws, regulations, development programs, industrial standards as well as management of the industry.
- Formulate and implement the industrial code of ethics, regulate the conduct of members, promote integrity management, establish industrial credit evaluation system, improve the mechanism of industrial self-discipline and constraint, and maintain a fair and competitive market.
- Conduct survey and statistics, organize academic exchanges, follow up the latest development trends, collect and disseminate information, discuss and study the theoretical and practical issues pertaining to the industry like the goals, policies and management, and provide advice on industrial development and legislation to the government.
- Promote exchanges and dissemination of best practices among the members. Organize symposiums and training programs to improve the comprehensive quality of professionals, help them enhance innovation ability and improve management.
- Represent the Chinese engineering consulting industry in FIDIC, fulfill due responsibilities and obligations; conduct communications with international non-governmental organizations, enterprises and financial institutions; provide guidance and facilities for members' overseas networking activities.
- Participate in related investigations on behalf of the Chinese engineering consulting industry and mediation of disputes involving the industry. Report to the government the proposals and demands of the members and protect the legitimate rights and interests of the industry and the members.
- Undertake review and identification of Grade A qualification of engineering consulting firms,as mandated by the National Development and Reform Commission.
- Conduct National Professional Qualification/Proficiency Examination of Consulting Engineers and issue the Certificates of Consulting Engineers.
- Undertake registration for practice of consulting engineers.
- Organize judging and awarding of Engineering Consulting Excellence Awards on a biennial basis.
- Provide on-line and off-line training courses and workshops for continuing education of consulting engineers.

MEMBERSHIP

CNAEC's membership is categorized into corporate membership and individual membership. Any firm or individual professional who advocates the CNAEC Statues and is willing to follow the Convention of the Industry and the Code of Professional Ethics can apply for its membership.

Currently, CNAEC has about 1000 members across the country.

Events from Last Quarter

China	• In August 2022, CNAEC held a video conference on ‘Experience sharing meeting of Chinese engineering consulting institutions serving the national major infrastructure construction’. • In September 2022, while celebrating the 30th anniversary of CNAEC, the association cooperated with China economic guide, People's Daily, CCTV network and other authoritative news media to promote the innovation and development achievements of Chinese engineering consulting industry in nearly ten years, and its important role in "Belt and Road" Initiative and contribution. • In September 2022, CNAEC organized a video conference on the "Engineering Consulting Institutions serving the Rural Revitalization Experience Sharing Meeting", with the theme of "Service and Responsibility".
India	• Technical Talk on “Urban Transportation in India - Making it Affordable & Sustainable” - 12th Ausgust 2022 • Webinar on “Indian Cities and the Race to Zero” – 25th August 2022 • Conclave on “Exploring Business Opportunities Abroad for Construction & Design Engineering Consultancy, Engineering, Architecture & Environmental Services”- 2nd September 2022

Development Potential of ASIA-PACIFIC Countries

This article attempts to bring upon an overview of the development gaps, potential and key initiatives from individual governments of few of the Asia Pacific countries. Most of these information have been obtained from Country Partnership Strategy documents of Asian Development Bank.

Jitendra Kumar Singh

Malaysia

Key Development Gaps and Potential

Malaysia is a tropical nation in Southeast Asia, comprised of Peninsular Malaysia (West Malaysia) and East Malaysia. As of 2019, Malaysia had a population of around 32 million, and remains one of the most developed economies in the region. Around 22% of the population live in the greater area of the capital city, Kuala Lumpur. While poverty levels are comparatively low for the region, Malaysia has historically been characterized by high levels of income inequality, particularly evident in urban areas. In 2009 the World Bank estimated GINI in Malaysia at 46.3, indicating very high levels of income inequality. However, since then the Government of Malaysia has focused efforts to decline its GINI, suggesting movement towards a more equal society. As of 2018 Malaysia's economy was service sector dominated (54.5% of national GDP), underpinned by manufacturing (23% of GDP). These sectors also dominate national employment and, in contrast to other Southeast Asian nations, agriculture employs only around 11% of the labor force.

Malaysia faces substantial labour market imbalances and shortages of workers across the skills spectrum, with further difficulties expected under the impulse of automation and population ageing. Greater investment in education and training will be required to prepare the country for the future of work and help it move up the value chain. Adults need better access to up-skilling and re-skilling opportunities to ensure that their skills remain relevant.

Government Strategy

The Twelfth Malaysia Plan (2021-2025) focuses on the strategic priorities that will transform Malaysia. It is a critical compass for Malaysia during this time of unprecedented COVID-19 pandemic and the global economic uncertainty. The Twelfth Plan is anchored on three key themes, namely resetting the economy, strengthening security, wellbeing and inclusivity as well as advancing sustainability. Four catalytic policy enablers, namely developing future talent, accelerating technology adoption and innovation, enhancing connectivity and transport infrastructure as well as strengthening the public service will support the achievement of these themes. These policy enablers will form the foundation and building blocks of Malaysia's development over the next five years and beyond. The successful implementation of the Twelfth Plan will result in shared prosperity, enhance inclusivity and pave the way for a more sustainable Malaysia for future generations.

Sri Lanka

Key Development Gaps and Potential

Sri Lanka needs to maintain the momentum of growth to advance its status as a Upper Middle Income Country. To address the challenge, policies need to be pursued that facilitate manufacturing and export diversifications, increase productivity, enable Sri Lankan firms to become part of global supply chains, and create productive jobs. The small size of the domestic market (population of about 21 million) means that exports will be a key source of growth. With limited fiscal space, the government expects the private sector to drive the transformation of the economy. Accordingly, impediments to private sector development need to be addressed on a priority basis. To ensure inclusiveness of growth, it is important to take measures that narrow inequality, reduce the remaining poverty, and achieve geographically balanced development. Further, rapid growth and higher consumption are likely to add a burden on the environment, unless remedial measures are taken. Thus, environmental sustainability thus needs closer attention.

The country is vulnerable to the adverse effects of climate change, especially fluctuations in rainfall. Some areas experience flash floods, and others drought. Management of the environment and occurrence of disasters are linked. The country also faces pollution challenges because of unplanned urbanization and degradation of coastal regions.

Government Strategy

The long-term goals of the government are (i) creating 1 million jobs; (ii) enhancing income levels; (iii) developing the rural economy; (iv) ensuring land ownership to rural and estate sectors, the middle class, and government employees; and (v) creating a wide and strong middle class.

The Public Investment Program, 2017–2020 provided details of the allocation of government resources to priority areas, as well as the medium-term targets. The targets are to (i) arrest the decline in exports by improving productivity and competitiveness, (ii) promote the inflow of foreign investment through investor-friendly policies, (iii) pursue reforms for increasing government revenues and rationalize government expenditure, (iv) restructure public debt to decrease the annual debt servicing burden, (v) increase government expenditure for upgrading the quality of human resources, (vi) promote equity in the economic and social spheres, (vii) minimize regional disparities and poverty pockets, and (viii) provide special emphasis on environmental protection and natural resources conservation.

The government has developed a national policy on disaster management. Sri Lanka's Nationally Determined Contribution aims to reduce greenhouse gas emissions by (i) 20% in the energy sector; and (ii) 10% in the transport, waste, industrial, and forest sectors by 2030. It also aims to build resilience against climate change in the most vulnerable communities, sectors, and areas in terms of human health, food security, water and irrigation, coastal and marine areas, biodiversity, urban infrastructure, human settlements, and tourism.

Vietnam

Key Development Gaps and Potential

The lack of a competitive private sector lowers Viet Nam's productivity and efficiency. Sustaining high growth rates to achieve UMIC status requires a competitive private sector. However, Viet Nam's private sector is predominantly represented by household businesses, and micro and small enterprises. The country has a shortage of mediumsized and large domestic corporations to support and sustain economic growth. Regulatory barriers; slow SOE reform; absence of research and development capacity; and lack of access to finance, land, and skilled labor have all hampered private sector development.

Rapid economic growth has put stress on Viet Nam's infrastructure. Despite significant investment, the road network consists predominantly of unpaved, narrow, and local road sections. Only 65% of Viet Nam's total road network are paved in 2018. The Directorate for Roads of Viet Nam estimates that the current expenditure for road maintenance works meets only 44% of the minimum annual requirements. As a result, more than 65% of the national roads are not regularly maintained. The development of wastewater and sanitation infrastructure is a key measure of improving livability in urban areas. However, only about 15% of wastewater generated in urban areas is collected by centralized systems. Municipal solid waste generation is increasing rapidly. Viet Nam is facing twin challenges of meeting rapid energy demand growth with simultaneous decarbonization.

Climate change, natural hazards, and environmental degradation are impeding growth. Viet Nam was the sixth country in the world most affected by climate variability and extreme weather events in 1999–2018. It is also one of the world's economies that is most vulnerable to sea level rise

Government Strategy

Viet Nam's aspiration to become an upper middle-income country by 2030 is embedded in the Socio-Economic Development Strategy, 2021–2030.

Strategic directions for Viet Nam's investment and borrowing are specified in the Medium-Term Investment Plan (MTIP), 2021–2025, and the National Plan for Public Borrowing and Debt Management, 2021–2025. The MTIP aims to prioritize investment to improve the efficiency of the economy, and support a science-, technology-, and innovation-based economy. The National Plan for Public Borrowing and Debt Management targets mobilizing loans at appropriate costs and risks to meet the country's socioeconomic development needs and to balance the state budget.

Viet Nam is committed to climate change mitigation and adaptation. In its updated nationally determined contributions in September 2020, Viet Nam committed to reducing greenhouse gas emissions by 9% compared to business-asusual by 2030 with domestic resources, and 27% with international support. At the UN Climate Change Conference in Glasgow in 2021, Viet Nam pledged to achieve net zero carbon emissions by 2050. In line with its mitigation goals, the government is considering the use of carbon pricing instruments and an emissions trading system. 36 Viet Nam also aims to make the energy transition just and affordable.

The changing world of Professional Liability
A series by: Tony Barry, president, FIDIC

This article is a part of series of articles written by FIDIC President, Tony Barry, and first published in Infrastructure Global.

The editorial team is of the view that the readers will find these articles of immense interest and use.

Why professional liability matters

Until the late 1980s, the consulting engineer's liability was focused on negligence in the performance of their professional duty, where negligence was defined as being a breach of the standard of care reasonably expected of consulting engineers performing similar services. Big changes since then have big implications.

Why professional liability matters

Until the late 1980s, the consulting engineer's liability was focussed on negligence in the performance of their professional duty, where negligence was defined as being a breach of the standard of care reasonably expected of consulting engineers performing similar services.

In effect, the claims made by clients addressed engineering failures which resulted in death and injury and property damage. That was what liability insurance was for and generally the consultant's insurance responded to negligence claims and claims were settled or, in some cases, awarded through the courts.

The majority of liability cases at that time were limited to claims regarding death, personal injury and loss of quality of life and the direct cost of repair, replacement or rectification relating to property damage or construction works.

Where there were situations in which consulting engineers may have made mistakes which gave rise to variations on construction contracts, delays and changes on site during construction, these were often resolved between the clients and consulting engineers through fee concessions or future service provision at a discount.

There are a number of big changes that have changed professional liability and its significance to the profession and the industry. These are outlined below and addressed in following articles.

Changes in project delivery

In the 1980s, project delivery methods, which involved a contractor taking primary responsibility for design, construction, maintenance and sometimes operations, began to emerge. These were described variously as design & construct, design, construct and maintain or design construct maintain and operate. These forms of contract were also embedded in public-private partnerships.

The very significant impact of these forms of contract was that the contractors assumed nearly all risks involved in delivery of the infrastructure and governments and principals ensured that the contractors did so through often bespoke contract terms. For contractors, these contracts went a long way to preventing any claims against the principals under the contract. The contractor's primary opportunity to recover from adverse risk outcomes was to make claims against the contractors subcontractors and designers. Recognising this opportunity, contractors moved to pass on head contract conditions to their subcontractors and consultants and to develop conditions of contract which imposed very significant obligations on design consultants and created avenues for potential claims against designer consultants and others.

Innovation in contractual obligations

Typically in the oil and gas, mining, food and beverage manufacturing industries, process designers owned the intellectual property rights to their process designs and the fees charged to clients reflected the value of and research and development put into these technologies. Clients relied on these processes as being core to their business and sought 'fitness for purpose' warranties and guarantees form the process designers.

Fitness for purpose obligations began to appear in bespoke design and construct contracts and eventually were passed from head contractor to design consultants. These fitness for purpose obligations placed on design consultants were also broadened to cover functional performance, technical requirement compliance, buildability, cost effectiveness and programme compliance obligations assumed by the head contractor. These appeared in multiple forms in bespoke agreements between head contractors and design consultants.

Changes in consumer protection and competition law

While supportive of consumer protection and competition, laws regulating these areas have had a significant impact on the liability exposure of many professionals as well as removing the ability of bodies such as member associations to work on these issues collaboratively with industry participants or publish standardised fee scales. Consumer protection legislation in many cases also include provisions relating to false and misleading misrepresentations.

Provisions relating to misrepresentations have created a potential avenue for parties to make claims outside the contract between the client and consulting engineer. This has had a profound effect in the sense that errors and misstatements can be treated as false and misleading. More importantly, these provisions have been used to step around limits of liability which may be agreed under the contract of service between client and consulting engineer.

Why are these issues important?
Our industry needs to deliver new infrastructure at an unprecedented scale and there is a real problem with risk limiting the ability of an industry to design and deliver effectively.

It is not unusual for firms to respond to excessive risk exposure by restricting the scope for innovation practices and innovative solutions and rather focus on compliance and adoption of tried and tested methods, even where the opportunity may exist to design an alternative solution for everybody's benefit.

Consultants have also responded by establishing substantial legal capabilities, liability management capabilities and rigorous project procedures to limit their practical exposures to risk. Firms have developed strong risk management capability and project procedures to manage project risk effectively. This has come at a cost which is passed on to projects and clients alike, reducing the potential to improve the overall return on investment of the project.

Notably, in markets where legal jurisdictions are difficult, where 'design construct maintain (and operate)' are prevalent, claims against consultants are commonplace and the cost and terms under which professional indemnity insurance is provided has become more problematic and very much more costly where available.

07

Tall Buildings – Overview of Design Issues

Dr. Nirmalya Bandyopadhyay
Independent Consultant

Abstract:

With the increasing demand on land in urban areas, the buildings have been naturally growing in the vertical direction. Development of design and construction technology is resulting in building taller and efficient buildings. This paper discusses the design issues associated with Tall Buildings.

The world over, in large cities, where land availability is restricted and thus at a premium, tall buildings have become the order of the day. To keep space with that, there have been tremendous developments in the planning, analysis, design and construction and maintenance methodology of buildings as they soared towards the sky. New building materials, construction technology also developed together with the advancement of technology for providing water, electricity, plumbing, HVAC, elevators, communication and monitoring systems, fire safety and fire-fighting measures all to make the tall buildings more safe and secure. The stone and brick masonry buildings whose height were restricted to eight to ten story height are becoming a thing of the past.

The definition of 'Tall Buildings' (i.e., which building could be called a tall building) has evolved over the years. What was called a tall building or even a skyscraper are now, after a few decades merely referred to as multi-storied building. The 54m tall LIC Building in Chennai was the tallest building in the country in 1960 and now

it is one of the many multi-storied buildings. The tallest building in the country at present is the 88-storied Palais-Royale Building in Mumbai which stands 320m tall. As per the current version of IS:16700 (Structural Safety of Tall Concrete Buildings) a 'Tall' building has to be more than 50m high, although this definition varies where the lower limit is considered as 100m or even 150m.

The practice of constructing modern Tall Buildings started in North American cities like New York City and Chicago in the second half of the 19th century. It coincided with the availability of structural steel products and the

development of electrically operated safety elevators. Structural Steel frames with riveted connections replaced the thick masonry load-bearing walls and allowed the engineers to build taller structures. Masonry walls were used only as curtain walls. The availability of elevators made climbing higher stories feasible. Over the years, the height of the buildings increased from ten stories to twenty stories culminating in the 380m tall 102-storied Empire State Building in New York City in 1931. After the gap created by the Second World War, the pursuit of taller and lighter structure continued not only in North America but also in major Asian cities besides Europe. Tall Buildings are usually situated in city centers where the price of land is high, and where it makes economic sense to build upward so as to minimize the cost of the land vis-à-vis the total floor area of a building. They provide a high ratio of rentable floor space not just for commercial usage but also for residential purposes per unit area of land. Hong Kong has very restricted land to build on, hence, it now has more than 500 buildings that are taller than 150m. Mumbai at present has more than two hundred such tall buildings and many more are being constructed.

Planning, Design & Construction

The planning, design and construction involve creating safe, secure, habitable spaces in structures that must support their weight, resist wind and earthquakes, and protect occupants from fire and other natural elements. Yet they must also be conveniently accessible, even on the upper floors, and provide utilities and a comfortable climate for the occupants. The problems posed in planning and design are considered among the most complex encountered given the balances required between economics, engineering, and construction management. The major planning and design issues are:

- Planning
- Geotechnical Design
- Structural Design
- Elevators/ Vertical Transportation
- Services like Water Supply, Sanitation, Plumbing, HVAC, Electrical, Communication, etc.
- Fire Safety& Fire Fighting
- Energy Conservation

For Life Cycle Planning and Design, two issues should also be considered during the initial planning and design stage.

- Disaster Mitigation – Safe evacuation of occupants in case of a rare event of explosion or catastrophic damage.
- Dismantling at the end of usage life – a possible safe method of dismantling of the building without any damage to neighbouring structures.

Loading

The load a tall building experiences is largely on account of the building materials themselves. In most building designs, the weight of the structure is much larger than the weight of what that has to support. In technical terms, the dead load, i.e., the load of the structure, is larger than the live load, the weight of things in the structure (people, furniture, etc.). As such, the amount of structural material required at the lower levels of a tall building will be much larger than the material required at higher levels.

This is not always visually apparent. For masonry (Brick or Stone) buildings the wall thickness required to support just the vertical loads on lower floors becomes too large. Hence a masonry building taller than eight or ten stories becomes practically infeasible. The normally adopted framing system of tall buildings can be categorized as steel frames, concrete cores, tube within tube design, and shear walls.

Buildings are usually subjected to static loads, such as occupants' weight, equipment, furniture, and the weight of the structure per se. However, two important environmental loads that are different in nature may act on the buildings during their lifetime– they are the forces imposed by Wind and Earthquake, which are different from the static load. Even if they could be expressed as equivalent static loads, tall buildings and flexible structures may amplify the internal loads resulting in additional inertia loads which can affect the serviceability and the comfort of the people inside, or even lead to a complete collapse. When it comes to dynamics and load-structure interaction, inherently low damping in buildings is a key parameter that can be used to control the behaviour of a structure under such dynamic loads. In addition, the building's orientation change can result in wind response and reduction of wind forces acting on it.

Developments in structural materials and design technology in engineering have led to designs that satisfy strength requirements but often result in a very flexible structure which can cause unfavorable vibrations when the structure is subjected to wind or earthquake loads. These vibrations may lead to serious structural damage and affect the comfort of the occupants. The dynamics of buildings greatly depend on the characteristics of the external excitation as well as the physical properties of the building in terms of generalized masses, frequencies, and damping. Wind loads are characterized by low frequencies while earthquakes usually contain higher frequency force components. Tall Buildings have a fundamental frequency range of 0.1 to 0.3 Hz which is close to high values of spectra of crosswind excitation. While low rise buildings generally have a fundamental frequency range of 1 to 5 Hz that often matches the high values of the seismic spectra. Most of the dynamics associated with damage and discomfort in buildings are referred to as excitations close to the first few modes. In super tall buildings, however, first modes are likely to have low frequencies which make them mostly affected by wind loads rather than earthquakes. On the opposite, short buildings are more likely to be affected by dynamics-associated damage under earthquake loads which are likely to occur at the dominant frequencies of these type of structures. In order to control the swaying of tall buildings different approaches are sometimes employed. One such approach is installing Tuned Mass Dampers (TMDs) at the top level.

Wind Loads

Wind can be low, moderate, strong, and extremely destructive. While low and moderate winds are beneficial for pollution dispersion and electric power generation, extreme wind events can cause devastating effects on the infrastructure.Extreme winds may cause damage to low-rise buildings viz. windows damage, roof loss, or even complete collapse of timber structures. In tall buildings, however, both cladding loads and the dynamics of the structure become a concern. High-rise buildings are amongst the more wind-sensitive structures. The lateral wind load imposed on super-tall structures is generally the governing factor in the structural design. It is inevitable that the response to wind would be of concern to structural engineers and attract the interest of early experimenters, both in the wind tunnel and in full-scale testing. Wind loads and the associated structural responses are a governing factor in the design of the steel framing system of many high-rise buildings. Wind load capacity is also a key factor in determining the overall strength of towers. In addition, the design of high-rise buildings should take into account the comfort criteria due to wind-induced vibrations.

Wind-induced response to the loading on structures depend, among other factors, on:

1) Terrain or mean wind velocity profile and turbulence characteristics,
2) Building's aerodynamic shape,

3) Wind speed (which should not be always very high to cause damage),
4) Wind direction, and
5) Structural properties that may magnify wind loads at resonance.

Not only the wind approaching buildings is a complex phenomenon, but the flow pattern generated around buildings is also complicated too. The flow pattern is distorted by the mean flow, flow separation, the formation of vortices, and the development of the wake. Large wind pressure fluctuations due to these effects can occur on the surface of a building. As a result, large aerodynamic loads are imposed on the structural system and intense localized fluctuating forces act on the façade of such structures. Under the collective influence of these fluctuating forces, a building tends to vibrate in rectilinear and torsional modes. Along-wind loading and response of buildings due to buffeting can be assumed to consist of a mean component due to the action of the mean wind speed (the mean hourly wind speed) and a fluctuating component. That is the basis of the so-called 'gust-factor' approach, which is treated in many design codes. The mean load component is evaluated from the mean wind speed using pressure and load coefficients. The fluctuating loads are determined separately by a method that makes an allowance for the intensity of turbulence at the site, size reduction effects, and dynamic amplification. The dynamic response of buildings in the along-wind direction can be predicted with reasonable accuracy by the gust factor approach, provided the wind flow is not significantly affected by the presence of neighboring tall buildings or surrounding terrain.

Cross-wind oscillations can be very significant especially if the structural damping is small. The most common source of cross-wind excitation is that associated with 'vortex shedding'. Tall buildings are bluff (as opposed to streamlined) bodies that cause the flow to separate from the surface of the structure, rather than follow the body contour. The asymmetric pressure distribution, created by the vortices around the cross-section, results in an alternating transverse force as these vortices are shed. If the structure is flexible, oscillations are transverse to the wind. The conditions for resonance would exist if the vortex shedding frequency coincides with the natural frequency of the structure. Such a situation can give rise to very large oscillations and possibly failure. In buildings experiencing wind motion problems, objects may vibrate, doors and chandeliers may swing, pictures may lean, and books may fall off shelves. If the building has a twisting action, its occupants may get an illusory sense that the world outside is moving, creating symptoms of vertigo and disorientation. In more violent storms, windows may break, creating safety problems for pedestrians below. Sometimes, strange and frightening noises are heard by the occupants as the wind shakes elevators, strains floors and walls, and whistles around the sides.

A vital part of the design of modern tall buildings is the prediction of wind-induced motion and the assessment of its effects on occupant comfort. One of the primary purposes of wind engineering research is to predict wind-induced forces on structures. Wind-induced forces are dependent on structure shape, location of the structure, and the characteristics of wind (such as wind speed and angle of attack). Traditionally, wind loading on buildings can be evaluated analytically using some codes and formulas. However, these standards provide little guidance for the critical cross-wind and torsional loading. This is partially attributed to the fact that the crosswind and torsional responses, unlike the along-wind, result mainly from the aerodynamic pressure fluctuations in the separated shear layers and the wake flow fields, which have prevented, to date, any acceptable direct analytical relation to the oncoming velocity fluctuations. Also, these methods have some limitations especially when some other tall structures exist in the vicinity of the building under consideration. Moreover, the evaluation process depends on many assumptions. To alleviate these problems, wind tunnel tests and full-scale measurements of wind are used to provide more reliable wind loads on buildings. Despite recent advancements in computational fluid dynamics, wind tunnel simulation of a scaled model is still the most common tool used to predict wind loading. Ideally for a cluster of tall buildings, multiple analyses are required to assess the wind forces during different stages of construction.

Seismic Loads

When the ground shakes, buildings respond to the accelerations transmitted from the ground through the structure's foundation. The inertia of the building may cause shearing of the structure which can concentrate stresses on the weak walls or joints in the structure which could result in its failing or perhaps total collapse. The type of shaking and the frequency of shaking depend on the structure. Tall buildings tend to amplify the motions of longer periods when compared with small buildings. Taller buildings also tend to shake longer than short buildings, which can make them relatively more susceptible to damage. Fortunately, many tall buildings are constructed to withstand strong winds and some precautions have been taken to reduce their tendency to shake. They can be made resistant to earthquake vibrations too.

Preparing structures (either new or old) for earthquakesis expensive and the level of investment is a social and political decision. The choice of building design is a compromise between appearances, function, structure, strength, and of course, cost. Standards are instituted through the establishment of Building Codes, which regulate the design and construction of buildings. Most of the building codes are designed to protect first the building occupants, and second the building integrity. Building codes are usually drafted to meet the demands of the expected shaking in a given region that are summarized by seismologists and earthquake engineers in hazard maps (e.g., IS:1893). Hazard maps are constructed by examining:

- The earthquake history of the region to estimate the probability of an earthquake,
- The expected shaking intensity produced by the earthquake (often expressed as a peak acceleration),
- The frequency of the shaking, the distance from the fault, and
- The regional geology and site conditions.

Thus, rigorous analyses for estimating the response to the expected wind and seismic excitations are a requirement for the safety of the occupants and the structure. It has been found that generally tall buildings designed for wind maybe safe under moderate earthquake loads.

Structural Framing

The first structural steel framed building was constructed in Chicago in 1885. It was a ten storied 42m high building. The architect, Major William Le Baron Jenney, created a load-bearing structural frame. In this building, a steel frame supported the entire weight of the walls, instead of load-bearing walls carrying the weight of the building. This development led to the 'Chicago skeleton' form of construction. In addition to the steel frame, the Home Insurance Building also utilized fireproofing, elevators, and electrical wiring, key elements in most high-rise buildings today. Even the tall 102-storied Empire State Building was built on this concept. It was almost the limit of such a type of structural framing reaching the limits of column spacing and size on the lower floors.

This constraint was overcome by Bangladeshi-American Architect/ Engineer Fazlur Rahman Khan in the early 1960s with his concept of framed tubes. He is considered to be the father of modern skyscrapers. The framed tube structure is defined as "a three-dimensional space structure composed of three, four, or possibly more frames, braced frames, or shear walls, joined at or near their edges to form a vertical tube-like structural system capable of resisting lateral forces in any direction by cantilevering from the foundation". Closely spaced interconnected exterior columns form the tube. Horizontal loads (primarily wind) are supported by the structure as a whole. Framed tubes allow for fewer interior columns, and so create more usable floor space, and about half the exterior surface is available for windows. Khan's concept was that the building's external envelope could – given enough trussing, framing, and bracing – be the structure itself. This made buildings even lighter. The 'bundled tube' meant buildings no longer need to be boxlike in appearance: they could become sculptures. Tube structures cut down costs, at the same time allowing buildings to reach greater heights. The tubular systems are fundamental to tall building design. Most buildings over 40-stories constructed since the 1960s now use a tube design derived from Khan's structural engineering principles.

Khan pioneered several other variations of the tube structure design. One of these was the concept of

X-bracing, or the trussed tube, first employed for the John Hancock Center. That concept reduced the lateral load on the building by transferring the load onto the exterior columns. The John Hancock Center was designed in 1965 and completed in 1969. One of the most famous buildings of the structural expressionist style, the skyscraper's distinctive X-bracing exterior is a hint that the structure's skin is indeed part of its 'tubular system'. The idea is one of the architectural techniques that building have used to climb to record heights - the tubular system is essentially the spine that helps the building stand upright during wind and earthquake loads. The John Hancock Center was far more efficient than earlier steel-frame structures. Where the Empire State Building (1931), required about 206 kilograms of steel per square meter, the John Hancock Center required only 145 kg/ sqm.

The development of the Tube concept led to many advancements and variations in the concept of framing ultra-tall buildings which are:

Bundled tube: An important variation of the tube frame is the bundled tube, which uses several interconnected tube frames.

Tube-in tube: Tube-in-tube system takes advantage of core shear wall tubes in addition to exterior tubes. The inner tube and outer tube work together to resist gravity loads and lateral loads and to provide additional rigidity to the structure to prevent significant deflections at the top.

Outrigger and belt truss: The outrigger and belt truss system are a lateral load resisting system in which the tube structure is connected to the central core wall with very stiff outriggers and belt trusses at one or more levels.

Concrete tube structures: Khan also adopted concrete as a material of construction instead of steel and built tall buildings as concrete tubes.

Shear wall frame interaction system: Khan developed the shear wall frame interaction system for mid-high-rise buildings. This structural system uses combinations of shear walls and frames designed to resist lateral forces; the sharing is based on their relative stiffness. Most of the tall buildings in India are built with this concept, with the elevator and staircase shafts acting as shear walls.

Elevators

The invention of the elevator was a precondition for the development of tall buildings, given that most people would not (or could not) climb more than a few flights of stairs at a time. The elevators in tall buildings are not simply a necessary utility, like running water and electricity, but are closely related to the design of the whole structure: a taller building requires more elevators to service the additional floors, although the elevator shafts consume valuable floor space. If the service core, which contains the elevator shafts, becomes too big, it can reduce the profitability of the building. Architects must therefore balance the value gained by adding height against the value lost to the expanding service core.

Various non-conventional elevator arrangements have been adopted especially super tall buildings to alleviate this problem.

Services

Planning and design of HVAC, Water Supply, Plumbing, Waste Disposal, Electrical, Communication, and Fire Fighting of tall buildings are often quite different from that of low-rise buildings and energy intensive.

For example, potable water supply in a 30 storied building would call for pumping water to 100m height. The capacity of such a pump or the wall thickness of the pipe will become highly economical. The usual practice in such buildings is to place a series of interconnected break tanks at different levels to supply potable and fire fighting water to all levels. Even for disposal of waste water or rain water from such heights, the designer has to make proper arrangements. Similar issues are there for operating central air conditioning in tall buildings. The system design and equipment for services in Tall Buildings are quite different from normal low-rise buildings and requires careful planning and execution.

Environmental Issues

Constructing a single tall building requires large quantities of materials like steel, concrete, and glass, and these materials represent significant embodied energy. Tall Buildings are thus material and energy-intensive buildings. They have considerable mass, requiring a stronger foundation than a shorter, lighter building. In construction, building materials must be lifted to the top of a tall building during construction, requiring more energy than would be necessary at lower heights. Furthermore, a Tall Building consumes much electricity because potable and non-potable water has to be pumped to the highest occupied floors, Tall Buildings are usually designed to be mechanically ventilated, elevators are generally used instead of stairs, and electric lights are needed in rooms far from the windows and windowless spaces such as elevators, bathrooms, and stairwells. In the lower levels of a Tall Building a larger percentage of the building floor area must be devoted to the building structure and services than is required for lower height buildings:

- More space for the structure – because it must be stronger to support more floors above.
- The elevator conundrum creates the need for more lift shafts—everyone comes in at the bottom and they all have to pass through the lower part of the building to get to the upper levels.
- Building services – power and water enter the building from below and have to pass through the lower levels to get to the upper levels. The solid and liquid waste disposal systems, etc. also have to be planned and provided.

The building sector accounts for approximately 50% of greenhouse gas emissions, with operational energy accounting for 80-90% of the building-related energy use. Operational energy use is affected by the magnitude of conduction between the interior and exterior, convection from infiltrating air, and radiation through glazing. The extent to which these factors affect the operational energy varies depending on the microclimate of the tall building, with increased wind speeds as the height of the building increases, and a decrease in the dry bulb temperature as the altitude increases.

The embodied energy associated with the construction of Tall Buildings varies based on the materials used. With embodied energy quantified per unit of material, Tall Buildings inherently have higher embodied energy than low-rise buildings due to the increase in the material used as more floors are built.

Like with all other buildings, if special measures are taken to incorporate sustainable design methods early on in the design process, it is possible to obtain a green building rating, such as a Leadership in Energy and Environmental Design (LEED) certification. An integrated design approach is crucial in making sure that design decisions that positively impact the whole building are made at the beginning of the process. Because of the scale of Tall Buildings, the decisions made by the design team must take all factors into account, including the impact of the building on the surrounding community,

the effect of the building on the direction in which air and water move, and the impact of the construction process, must also be taken into account. Several design methods could be employed in the construction of a tall building that would take advantage of the height of the building. The microclimates that exist as the height of the building increases can be taken advantage of to increase the natural ventilation, decrease the cooling load, and increase daylighting. Natural ventilation can be increased by utilizing the stack effect, in which warm air moves upward and increases the movement of the air within the building. If utilizing the stack effect, buildings must take extra care to design for fire separation techniques, as the stack effect can also exacerbate the severity of a fire. Tall Buildings are considered to be internally dominated buildings because of their size as well as the fact that a majority are used as some sort of office building with high cooling loads. Due to the microclimate created on the upper floors with the increased wind speed and the decreased dry bulb temperatures, the cooling load will naturally be reduced because of infiltration through the thermal envelope. By taking advantage of naturally cooler temperatures at higher altitudes, tall buildings can reduce their cooling loads passively. On the other side of this argument, is the lack of shading at higher altitudes by other buildings, so the solar heat gain will be larger for higher floors than for floors at the lower levels of the building. Special measures should be taken to shade upper floors from sunlight during the overheated period to ensure thermal comfort without increasing the cooling load.

Sustainable design of Tall Buildings is a major issue and should be seriously taken into account at the conceptualization stage well before the structural design of the building commences.

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1. *Ali, Mir (2008). "Overview of Sustainable Design Factors in High-Rise Buildings" Council on Tall Buildings and Urban Habitat.*

2. *Aly Mousaad Aly (2014). "Design of Buildings for wind and earthquake", The 2014 World Congress on Advances in Civil, Environmental and Material Research (ACEM14)*

3. *A. Vijayasree (2019). "A Study of Challenges in Designing and Construction of Skyscrapers" International Journal of Engineering Research & Technology (IJERT) Vol. 8 Issue 12*

This article was first published in Indian MA, CEAI's quarterly newsletter VIEWPOINT September 2022 edition.
Recent editions of VIEWPOINT can be accessed at https://ceai.org.in/publication/viewpoint/

Regional News

Key Takeaways from COP 27

The 27th United Nations Climate Change conference or **Conference of the Parties of the UNFCCC**, more commonly referred to as **COP27**, was held from 6 November until 20 November 2022 in Sharm El Sheikh, Egypt. It took place with participation of more than 92 heads of state and an estimated 35,000 representatives, or delegates, of 190 countries.

The key outcomes of this event last month can be summarized s:

Creation of Loss and Damage Fund:

The parties reached a historic decision to establish and operationalize a loss and damage fund, particularly for nations most vulnerable to the climate crisis.

While many details remain to be negotiated, the fund is expected to see developing countries particularly vulnerable to the adverse effects of the climate crisis supported for losses arising from droughts, floods, rising seas and other disasters that are attributed to climate change.While the negotiated text recognized the need for financial support from a variety of sources, no decisions have been made on who should pay into the fund, where this money will come from and which countries will benefit. The issue has been one of the most contentious on the negotiating table.

Countries failed to decisively move away from fossil fuels

Countries repeated the "phase-down-of-coal" phrase featured in last year's agreement at COP26 in Glasgow. While the final text does promote renewables, it also highlights "low emission" energy, which critics say refers to natural gas - still a source of GHG emissions.

There were continued concerns about rising emissions

The key result of the climate COPs is the final agreement, which is deliberated by delegates from almost 200 countries. This is usually the focus of intense negotiations, and this year was no exception, with talks lasting until last day of the conference. The final agreement did mention "the urgent need for deep, rapid and sustained reductions in global greenhouse gas emissions" to limit global warming to 1.5°C above pre-industrial levels, the most ambitious goal of the Paris Agreement. Yet there were concerns that no real progress was made on raising ambition or cutting fossil fuel emissions since COP26. That was considered bad news for a rapidly warming world.

Climate finance was front and centre

Climate finance was, as expected, a key part of COP27. The final agreement highlights that "US$4 to $6 trillion a year needs to be invested in renewable energy until 2030 – including investments in technology and infrastructure – to allow us to reach net-zero emissions by 2050."

States are turning more to technology

Two UN Bodies, the Technology Executive Committee and Climate Technology Centre and Network – announced plans to accelerate the deployment of "transformative" technologies to counter the climate crisis. The UN Secretary-General unveiled a US$ 3.1 billion plan to ensure everyone on the planet is protected by early warning systems in the next five years.

Methane emissions are in the crosshairs

UNEP announced the launch of a new satellite-based system designed to detect methane emissions, a potent greenhouse gas. Experts have long said that massive amounts of the gas routinely escape from oil and gas installations around the world. Colourless and odourless, methane is responsible for more than 25 per cent of the global warming the Earth is experiencing today. UNEP will use the satellite detection to notify governments and companies of methane leaks, helping them to take action.

Donors offered support for adaptation

An array of states, regional governments and development agencies pledged US$230 million to the Adaptation Fund to help vulnerable communities around the world adapt to climate change. Governments also made incremental progress on the Global Goal on Adaptation, a pivotal part of the Paris Agreement designed to help countries contend with the fallout from the climate crisis.

Reviving damaged ecosystems featured prominently

The Global Peatlands Assessment was launched by UNEP in Sharm el-Sheikh. The first comprehensive global assessment of peatlands in almost 15 years, the report highlights the importance of peatlands to both biodiversity and sequestering carbon. It found that the world loses 500,000 hectares of peatlands a year, while already drained and degraded peatlands contribute around 4 per cent of annual global human-induced greenhouse gas emissions.

Young people were in the spotlight

A pavilion at COP27 was devoted to children and youth for the first time, underlining that younger generations will suffer the most from the climate crisis. The conference also featured the first youth-led climate forum, which included several senior policymakers. In the closing agreement, delegates urged countries to appoint young people to the negotiating teams for future climate talks.

Leaders were pressed to do more

Hanging over COP27 was the spectre that despite decades of meetings and landmark accords, like the Paris Agreement, the world was still not doing enough to slow the climate crisis.

In summary, while many have praised the creation of the fund, many also worried not enough was done at COP27, to reduce the greenhouse gas emissions (GHG) responsible for the climate crisis.

References:

https://www.unep.org/news-and-stories/story/cop27-ends-announcement-historic-loss-and-damage-fund#:~:text=Climate%20finance%20was%2C%20as%20expected,%2Dzero%20emissions%20by%202050.%E2%80%9D

Upcoming Events

FIDIC/MA	Date	Event/ Topic
FIDIC	9th February 2023	Tomorrow's Transport and the decarbonisation challenge (State of the Art Webinar)
	21st March 2023	Impact of Covid-19 on projects – pandemic or endemic, where are we now? (FIDIC Contracts series webinar)
Australia	17th February 2023	Role of the Superintendent (online)
	28th Feb-1st Mar 2023	Contracts for consultants (online)
	2nd -3rd Mar 2023	Disputes and Claims for Consultants
	14th Mar 2023	Role of the Superintendent (online)
	15th-17th Mar 2023	Contracts for consultants (online)
China	12th January 2023	New Infrastructure Construction and Digital Transformation (FIDIC Asia –Pacific webinar)
Singapore	17th Feb 2023	ACES-Danfoss Seminar
Thailand		Meeting for BIM Contract on every other Friday. Meeting for Government procurement law on every other Friday. Meeting with other engineering and architectural associations every other month.

WEBINAR

New infrastructure Construction and Digital Transformation

January 12th,2023

Chen yubo

Coca-Cola Chair Professor, Senior Associate Dean, and Director of Center for Internet Development and Governance at School of Economics and Management, Tsinghua University

Wu xiaojian

CEO of Marketing & Consulting Department, Huawei Technologies

Tuk lal adhikari

Board Member, FIDIC Asia Pacific President, Society of Consulting Architectural and Engineering Firms (SCAEF), Nepal

Dr.ernesto s. de castro, ph.d.

Vice President, Council of Engineering Consultants of the Philippines (CECOPHIL)

Xiao guangrui

Founder and CEO of Bridata, a company focusing on the application of digital technology in infrastructure investment and financing
Senior Public-Private Partnership (PPP) Specialist of Asian Development Bank

Dr.hare ram shrestha

Executive Director, Sustainable Infrastructure Development Foundation (SIDeF)
Past President, Society of Consulting Architectural and Engineering Firms (SCAEF), Nepal

Huang licheng

Chief Consultant of China Mobile Digital Transformation Ltd.

Yang Yahan

Chief Expert of ZTE Global Service Digitization, Senior Project Management Director

Click the link to join the meeting via Zoom:

programme

Thursday, Dec 15, 2022 Beijing Time	
New Infrastructure Construction and Digital Transformation	
2:00 PM - 2:20 PM	**Opening Remarks**
	Mr. Chen Xiaoxing, Vice Chairman of CNAEC
	Mr. Anthony Barry, President of FIDIC
	Mr. Sudhir Dhawan, President of FIDIC ASPAC
2:20 PM - 3:20 PM	**Session 1 - Keynote Speech: New Infrastructure Construction**
	Digital Economy and High-quality Development of Chinese Economy
	Dr. Chen Yubo, Professor, Qinghua University
	Construction of tunnel for Bheri Baha'i Diversion Project Using TBM Technology
	Dr.Hare Ram Shrestha, Executive Director, Sustainable Infrastructure Development Foundation (SIDeF)
	China Mobile and new infrastructure
	Dr. Litchi Huang,Chief Consultant of China Mobile Digital Transformation Ltd.
3:20 PM - 4:20 PM	**Session 2 - Keynote Speech: Digital Transformation**
	Upgrade Together, Lightning Up The Digital Future
	Mr. Wu Xiaojian, CEO of Marketing & Consulting Department, Huawei Technologies
	The Application of Digital Technology in Infrastructure Investment and Financing in China
	Mr.Xiao Guangrui, the co-founder and CEO of Bridata
	Digital Project Management in Construction
	Dr Ernesto De Castro, VP of CECOPHIL
	The ultimate Cloud company's road
	Ms.Yang Yalan, Chief Expert of ZTE Global Service Digitization, Senior Project Management Director
4:20 PM - 4:50 PM	**Session 3 - Panel Discussion**
	Dr. Chen Yubo, Professor, Qinghua University
	Mr. Wu Xiaojian, CEO of Marketing & Consulting Department, Huawei Technologies
	Mr. Xiao Guangrui, the co-founder and CEO of Bridata
	Mr. Tuk Lal Adhikari, President of SCAEF
	Moderator: Mr.Chen Xiaoxing
4:50 PM - 5:00 PM	**Closing Remarks**
	Mr. Sudhir Dhawan, President of FIDIC ASPAC

BEST LOCATION FOR CONSTRUCTION JOINTS

Eng. Rohana Dasanayake
M.Eng(UWE)
MIEAust, MASCE(USA), MSEI(USA), AMSSE(SL)

BEST LOCATION FOR CONSTRUCTION JOINTS IN CONCRETE BEAMS

Construction joins are not able to eliminate in most of occasions in the construction field. There are various reasons and requirements to have construction joints while concreting. Obviously a construction joint create a weak zone relative to a monolithic cast. But, the impact need to be minimized and engineering judgment is required to minimize negative results from having construction joints. Location of construction joints is significantly important to optimize results.

Best guideline for construction joints has been given in **"ACI 318: Building code requirements for Reinforced Concrete" clauses 6.4.3, R6.4.3 and 6.4.4.**

Main forces are to be transferred over a beam are "Bending moments" and "Shear forces". Bending moment is a result of tensile and compressive stresses with their acting lever arm distance. Compressive stresses are safe at a joint because there act only compressive forces which are perpendicular to the joint plane. Tensile stresses are also safe at a joint because tensile forces are carried by reinforcements and reinforcements are continued at joints. Therefore, bending moments at a construction joint are not important to consider.

When consider the shear forces, concrete shear is a main fact which consider in the design process. Concrete shear resistance "v_c" called **"Design concrete shear stress" as mentioned in the Table 3.8, in BS8110-Part1**. This value will be reduced at construction joints and directly impact to the shear resistance. Hence, construction joint can significantly influence for the shear resistance.

It is important to select locations for construction joints where shear forces are minimum. As per ACI 318; the typical zone for construction joints is as below (middle third region).

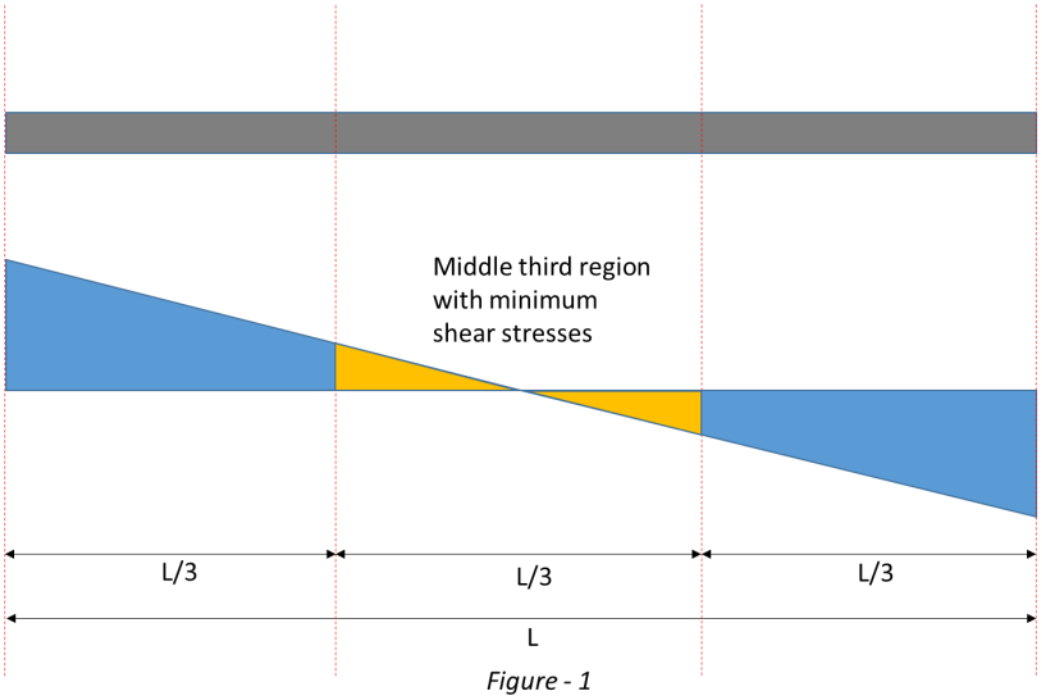


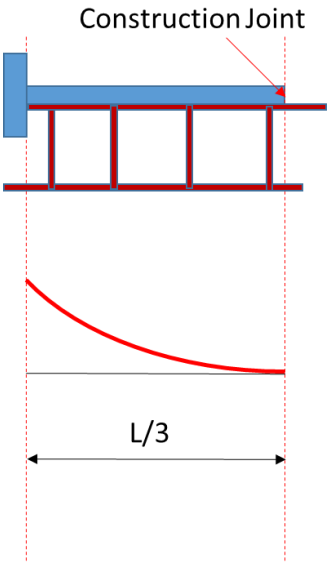
Figure - 1

The best location for construction joint is the mid of a beam where shear forces are become zero. However, the code allows to use anywhere in the middle third region, the first third or last third positions are the extreme ends of given limitations. Therefore, first and last thirds positions are not appropriateregions to make construction joints.

There are two types of construction joints based on the purpose.

1. Termination of structure for future construction
2. Termination the work until continue soon (within a short time such as a day or two)

Termination of structure for future construction



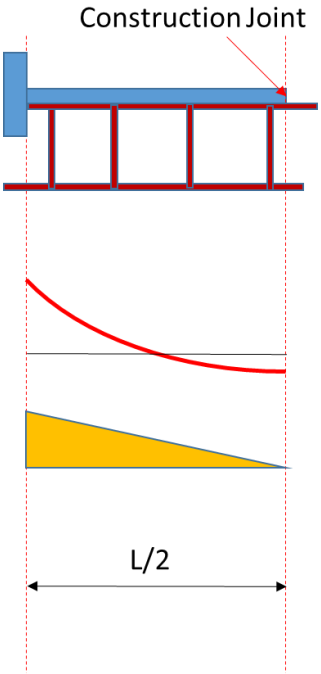
After release the formwork supports, the beam segment acts as a cantilever. However, it is safe because top reinforcement bars have been placed for the both one thirds at ends. But this joint is placed where shear stresses act. Therefore, a shear key or steel rods need to be embedded for increasing the shear stress that already reduced due to the joint.

Bending moment diagram

Figure - 2

However, this is for a typical condition with fixed ends. It should be particularly analyzed when the supporting system is changed or for a different loading conditions.

Termination the work until continue soon



Formwork and supports can be removed only after completed the element and achieved the required strength by the lastly casted concrete. This is the best location for a construction joint with minimum negative impacts.

Bending moment diagram

Shear force diagram

Figure - 3

Mid of a beam is the best location to create a construction joint for a typical beam. This is applicable for symmetrical arrangement. However, a particular analysis should be done for a critical and different loading arrangements.

Summary

Point of contra-flexure has no relevancy for deciding the location of construction joint and the governing criteria is shear stresses. Best location to be selected where the shear stresses are becoming zero or minimum. In any practical difficulties while doing the construction (such as figure-2), the position of the construction joint can be shifted away from the mid, but must be within the limit of middle third segment. However, particular analysis is required when the arrangement is beyond the typical arrangement.

References:

1. ACI 318: Building code requirements for Reinforced Concrete
2. BS 8110-Part1: Structural use of concrete – Code of practice for design and construction

MEET A FUTURE LEADER

MASAO YAMAKAWA

Masao YAMAKAWA is a Professional Engineer, Japan, employed as an Electrical Engineer at International Division of Yachiyo Engineering Co., Ltd. in Japan. He holds Master in Engineering Design from Kyoto Institute of Technology and has 11 years of experience in the Survey, Planning, Design Supervision and Evaluation of projects concerning Generation, Transmission, Transformation, and Distribution.

He has been contributing to the consulting engineering industry as a member of FIDIC Future Leaders Advisory Council, the current vice chairperson of FIDIC Asia Pacific Future Leaders' Executive Committee, and a member of ECFAJ Future Leaders. In ECFAJ Future Leaders, he was in charge as a vice chairperson for 2 years.

He has been working for the projects in the field of electricity from micro-grid, renewable energy, to poverty reduction through rural electrification in the region of Africa, Pacific and Asia.

As a Manager at the office, he focuses on team building to create working environment where the team members communicate to balance their work load, and to establish a platform to share knowledge among the team. As an Engineer he favours renewable energy projects and rural electrification projects. On holidays, he enjoys playing or watching football and spending time with his family at home or camping.

Member News

NEPAL

Congratulations and Best Wishes to Mr. Tuk Lal Adhikari for being appointed as a Board Member of FIDIC Asia Pacific

With Mr. Y J Lee (South Korea) completing his 3-years tenure as the board member of FIDIC Asia Pacific, the FAP GAM 2022 appointed Mr. Tuk Lal Adhikari, the current president of SCAEF for the vacant position. Mr. Adhikari has joined the board from October 01, 2022. SCAEF ardently believes that this event highlights the international recognition of Nepalese consulting industry and is very humbled by the appointment. SCAEF EC has congratulated to Mr. Adhikari with best wishes for his successful tenure.

INDIA

MEMBER NEWS

FIDIC Credentialing Limited, the Certification Body for Global Consulting Professionals have declared Mr. Alok Bhowmick, to have successfully participated in the FIDIC Certified Consulting Practitioner Exam which was held on the 25 November 2022 and that obtained a score of 80% which is higher than the pass mark which was set at 65%. FCL while congratulating him have said *"on your efforts to enforcing and improving industry standards as well as equipping yourself with the most relevant tools for success"*. ***Mr Alok Bhowmick is now a professional Certified Consulting Practitioner***. Mr. Bhowmick is Vice President, CEAI and is Managing Director, B&S Engineering Consultants Pvt. Ltd.


Credentialing

CERTIFICATE

This is to certify that

Alok Bhowmick

has successfully completed the requirements of the Certified Consulting Practitioner Programme and is recognised as a

FIDIC CERTIFIED CONSULTING PRACTITIONER

MEMBER NEWS

CEAI partner in "Business Opportunities Seminar" (Bos) with the Asian Development Bank

ADB funded projects in India and other countries, offer many business opportunities for Indian business community. The Government of India and ADB are keen to support participation of good quality contractors, consultants and suppliers in ADB financed projects both within and outside India, to facilitate successful implementation of the projects.

In order to disseminate information on business opportunities available in ADB funded projects in India, ADB conducted a ***"Business Opportunities Seminar"*** (BOS) on 21th July 2022 at the Taj Palace Hotel, New Delhi.

The seminar mainly focused on:

i. access to ADB's business opportunities through an online demonstration of ADB website;

ii. presentations by Government agencies implementing ADB funded projects on business opportunities available in their respective projects; and

iii. presentation of case studies on how to bid successfully in ADB funded projects.

The seminar also provided an opportunity for participants to interact with ADB's Procurement Specialists.

ADB had invited Dr. Ajay Pradhan, President CEAI as a partner organization to present the views as one of the main stakeholders for ADB-funded projects. Dr. Pradhan presented the capabilities of consulting engineers and their strength in supporting projects being funded in India and ADB member countries. He also discussed the diversity of priorities, funding, and solutions with respect to the Sustainable Development Goals of the UN (SDG) in addressing Environmental Social and Governance (ESG). He stressed and explained the very important role of consulting engineers in implementing and achieving the desired goals.

CEAI Annual National Awards for Excellence in Engineering Consultancy Services 2021

Engineering consultancy services play a major role in the development of a Nation and its infrastructure. It is the primary engine that drives or enables the project execution process and forms the basis for further contracting/ construction activities.

Recognising the important role played by engineering consultancy, the Consulting Engineers Association of India or CEAI (Member Association of the International Federation of Consulting Engineers or FIDIC), instituted the ***CEAI Annual National Awards for Excellence in Engineering Consultancy Services***.

A. Lifetime Achievement Award

The Lifetime Achievement Award is conferred on Individuals on the basis of their track record of over 35 years at national/ international levels in engineering/ consultancy and exceptional service to the country for technological, economic or social development. Selection is made on the recommendations of a Search Committee.

The Lifetime Achievement Awards for 2021 were conferred on

a. Mr. Amitabha Ghoshal, former Advisor, STUP Consultants Pvt. Ltd.

b. Mr Arun P Mull, Former CEO & MD, TCE Consulting Engineers Limited

for their extraordinary contribution to the engineering consultancy profession.

Mr. Amitabha Ghoshal receiving the Life Time Achievement Award

Mr. Arun P Mull receiving the Life Time Achievement Award

National Awards in Engineering Excellence awarded for different categories were:

1) Organisations

Category A: Project Engineering

Group 1: Turnover less than 50 crores

Tandon Consultants Pvt. Ltd., Delhi

Project Title - Chennai Metro Rail Project – Consultancy Services for Design and Construction of Underground Stations and Associated Tunnels

Group 2: Turnover above 50 crores

a. **Consulting Engineers Group Ltd., Jaipur**

Project Title - Consultancy Services for Rajasthan Road Sector Modernization Project (RRSMP) funded by the World Bank under IDA credit

b) **Mott MacDonald Pvt. Ltd., Noida**

Project Title - Engineering Services for SRF State-of Art Chemical Complex at Dahej, Gujarat

c) **WAPCOS Ltd., Gurgaon**

Project Title - Extension of Lake Victoria Pipeline from Tabora, Igunga and Nzega Towns, Tanzania

Category B: Engineering Innovation

Group 1: Turnover less than 50 crores

Chempro Expertise Pvt. Ltd., Mumbai

Project Title - Detailed Engineering of the CSP Expansion Project at Nagpur

Group 2: Turnover above 50 crores

Reinforced Earth India Pvt. Ltd., Delhi

Project Title- Rehabilitation of landside location with slope protection and drainage improvement at Tindharia on NH-110 in Darjeeling, West Bengal

2) Individual

Category: Engineering Innovation

Mr Satyam Gupta, B&S Engineering

Project Title - Construction of ROB at Railway KM 1429/6-8 between Ghaziabad and Maripat Railway Station on NH-24 at KM 20.213 (Part of Delhi-Meerut expressway package-II)

The Member Associations are invited to share their feedback and inputs for next publication of newsletter. The next issue will be in the last week of March 2023 and entries are welcomed by 15th March 2023.

Member Associations may like to circulate this newsletter to their members and seek articles, news and information related to past and future events for wider participation and publication.