

CEPT CONFERENCE

TALL BUILDINGS IN INDIA

ORGANISERS

CRDF CEPT RESEARCH
AND DEVELOPMENT
FOUNDATION

CEPT
UNIVERSITY

COMPENDIUM / 2023



INSTITUTIONAL PARTNERS



The conference received support from institutional partners Council on Tall Buildings and Urban Habitat (CTBUH) and Gujarat Institute of Housing and Estate Developers (GIHED) CREDAI Ahmedabad. Their collaboration brought expertise, networks, and resources, amplifying impact and fostering credibility among diverse audiences.

CTBUH, established in 1969, envisions future cities and promotes sustainable global urban development. With a vast network of professionals, it serves as the authority on tall building height, providing valuable data and insights.

GIHED, part of CREDAI Ahmedabad, has played a pivotal role in elevating Gujarat's real estate profile. Through events like the 'GIHED CREDAI Property Show,' it facilitates business opportunities and promotes sustainable development initiatives. Supported by governmental and private entities, GIHED CREDAI drives innovation in the real estate sector, shaping Ahmedabad's landscape and contributing to India's growth trajectory.

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CEPT CONFERENCE **TALL BUILDINGS** IN INDIA

30th NOVEMBER 2023

COMPENDIUM
/2023

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CEPT CONFERENCES

CEPT Conferences aim to promote knowledge exchange, collaboration, and interdisciplinary research in urban design, planning, and policy and management. By bringing together stakeholders from diverse backgrounds, the conferences facilitate the advancement of sustainable and equitable urban development. The platform provides a forum for unbiased discussions, advances knowledge and new ideas, influences positive change in public policy, exposes students to professionals and policymakers, and offers networking opportunities. CEPT Conferences are dedicated to working towards solutions to India's urban challenges through collaboration and collective action.

The CEPT Conferences are organised by CEPT Research and Development Foundation (CRDF), the research arm of the University, engaged in research projects, advisory assignments and capacity building initiatives aimed at solving critical problems in the built environment and human habitats.

#CEPTconferences
#TallBuildingsInIndia

ABOUT CONFERENCE

CEPT University and CEPT Research & Development Foundation announces the CEPT Conference on the theme "Tall Buildings in India" as the first in its series of Conferences in Civil Engineering. This conference seeks bring together professionals to discuss the value added and challenges faced while designing and constructing tall buildings in India.

The conference is a platform for engineers to probe the multi-faceted world of tall buildings currently transforming India's urban landscape. These towering structures redefine city skylines and contribute significantly to urban development, addressing the pressing challenges of space constraints and population growth. Engineers play a pivotal role in the design, construction, and maintenance of these towering structures and there is a need for discussing and sharing their knowledge and experiences.

The conference aims to establish a platform for practising professionals, namely architects, engineers, urban planners, developers, policymakers, and researchers to share their expertise and experiences concerning the design and construction of tall buildings in India.

The conference will focus on real projects and the experiences gained from them. Projects will be discussed from the points of view of various participants namely developers, architects, engineers, academics, and learners.

The conference essentially aims to provide a forum where professionals, academics, policymakers, and students meet.

Industry professionals will share their experiences through one or more projects that they have been involved in. What were the challenges? And how were they overcome? What did they learn and how can these learnings be applied by others in the future. Some of the possible topics that could be covered are as follows...

Engineering Excellence: Presenting cutting-edge engineering solutions and construction techniques, including seismic resilience and eco-friendly materials.

Architectural Innovation: Exploring creative and sustainable architectural designs for tall buildings, emphasising their visual impact on city skylines.

Urban Integration: Discussing the integration of tall buildings into the urban fabric, considering factors such as transportation, traffic issues, infrastructure, and public spaces.

Sustainability: Analysing sustainable practices and technologies in tall building construction and their role in reducing environmental impact.

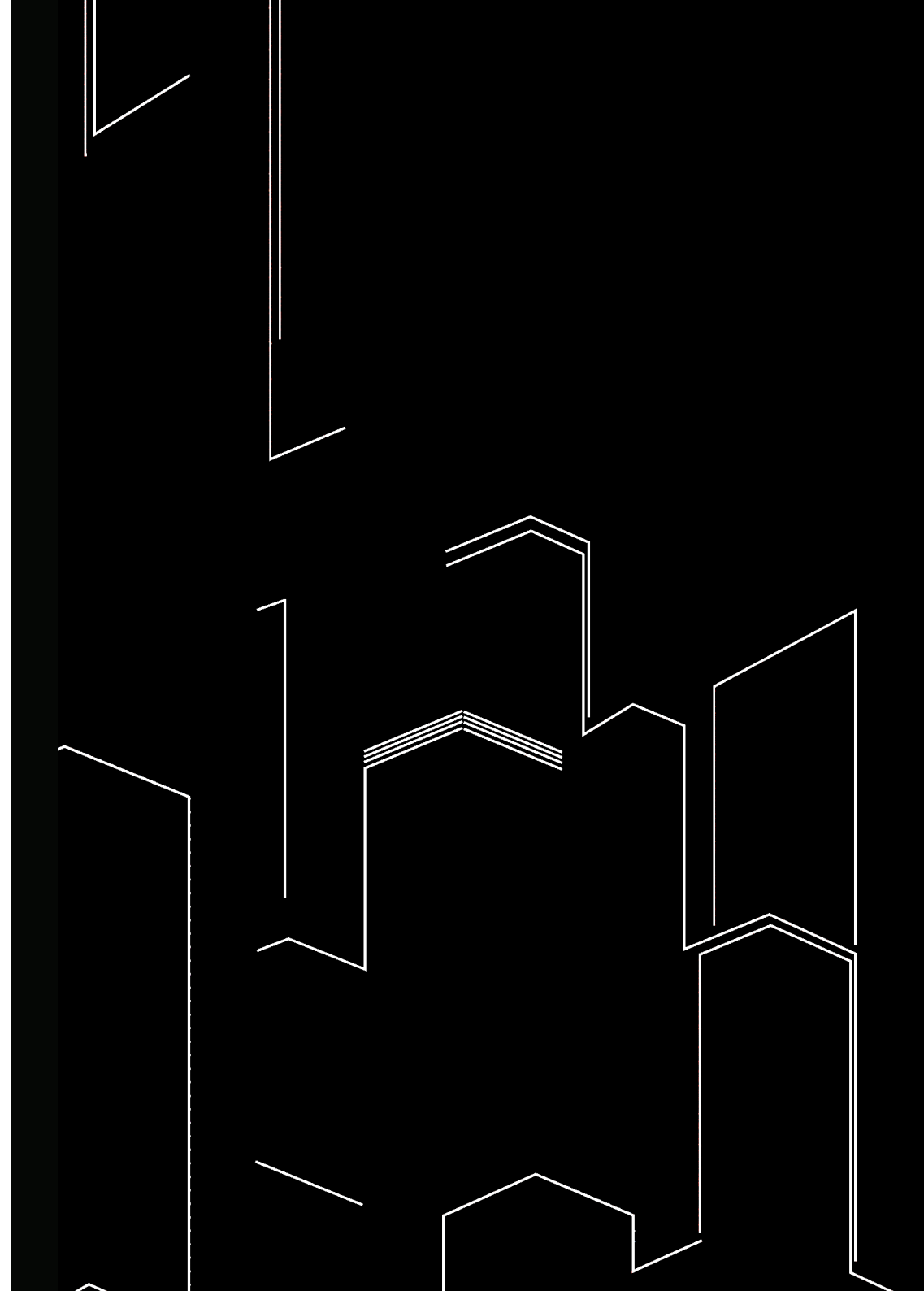
Societal Implications: Examining the social aspects of tall buildings, including affordability, community engagement, and the role of tall buildings in addressing urban housing needs.

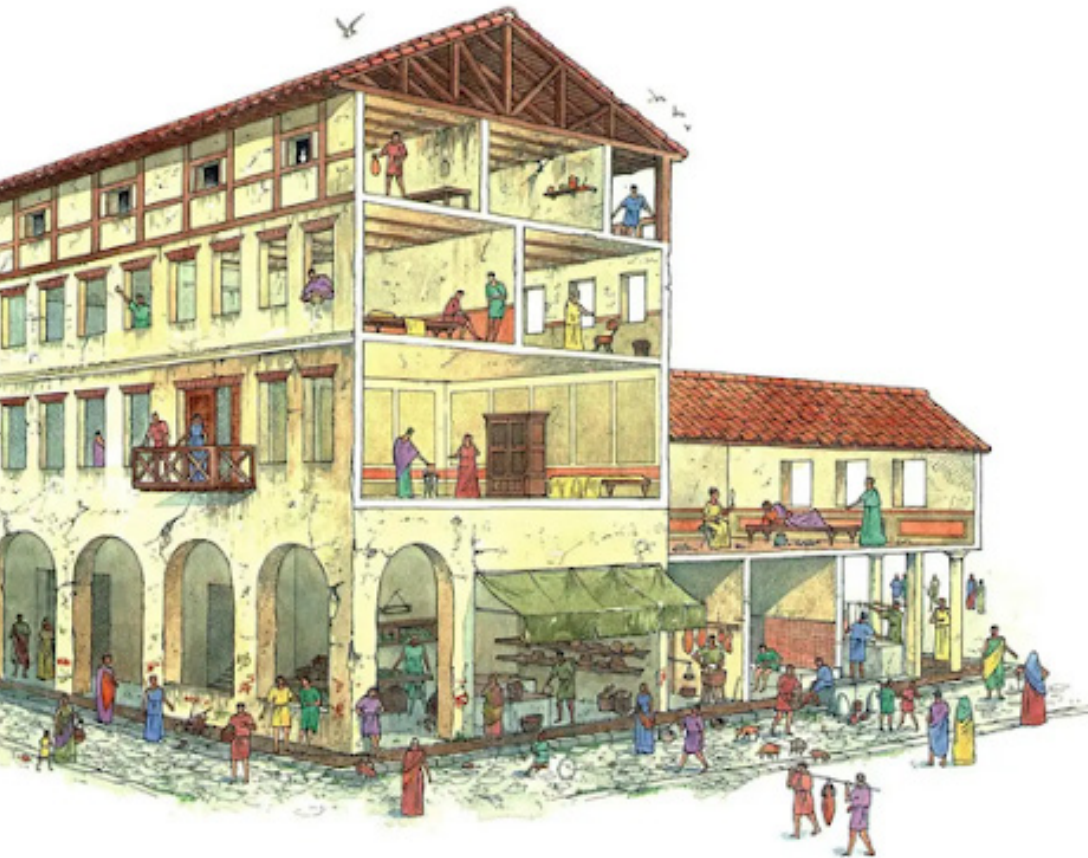
Regulations and Policies: Evaluating the regulatory framework for tall building construction in India and proposing improvements to support responsible development.

Through informative case studies, the conference will showcase tall-building projects from diverse Indian cities. These case studies will celebrate architectural and engineering achievements and offer valuable insights into the design strategies, obstacles overcome, and lessons gleaned from the development process.

The conference will be relevant for a diverse audience, including but not limited to:

- Practicing Civil and Structural Engineers
- Practicing Service Engineers
- Government Officials and Policymakers
- Academics and Researchers
- Real Estate Professionals
- Construction Industry Representatives
- Urban Planners and Developers
- Practicing Architects and Designers
- Student





OVERVIEW OF THE CONFERENCE

The first CEPT Civil Engineering Conference on the theme of tall buildings in India took place on 30th November 2023 at BNB Hall, CEPT University, Ahmedabad. The conference followed a narrative which included various points of view followed by a panel discussion.

The conference was opened by **Dr Bimal Patel**, president CEPT University. Doctor Patel spoke about the special position occupied by CEPT University since it was a collaboration between professionals and academics. Financed by farsighted philanthropists of Ahmedabad, it was completely autonomous and financially independent. CEPT University's focus was on human habitat and the CEPT Conferences

This was followed by a welcome address from **Suren Vakil**, vice-chairperson, CRDF. Mr Vakil welcomed the participants and spoke about tall buildings from a citizens perspective.

Humankind has always been fascinated by tall structures and they have been around for millennia. However, tall buildings today our orders of magnitude larger can the buildings of less than 100 years ago. From a layman's perspective tall buildings give citizens and countries a sense of pride in their cities and are also held up as objects of prestige.

For civil engineers tall buildings push the envelope of technology both in terms of design as well as construction. Whereas in the recent past most tall buildings were centered in the Western countries, today over 50% of the tallest buildings in the world are in China, South East Asia and the Middle East. However, it is interesting to note that even though many of the buildings are geographically situated in these places, the designers and engineers still come from the West.

CONFERENCE AGENDA

30th November 2023

Venue – Balwantrao N. Brahmbhatt Lecture Hall, CEPT University, Ahmedabad

8:30 a.m. – 9:40 a.m. Registration and breakfast

9:45 a.m. – 10:00 a.m. Address by **Dr. Bimal Patel, President, CEPT University**
Program Overview by **Suren Vakil, Vice Chairperson, CEPT Research & Development Foundation**

10:00 a.m. – 11:15 a.m. Session 1: The Context

Pavan Bakeri
Managing Director, Bakeri Group

(20 mins) A developers perspective

Girish Dravid
Director, Sterling Engineering Consultancy Services

Utsav Shah
Director, Ducon Consultants Pvt. Ltd.

Anal Shah
Partner, NK Shah Consulting Engineers,

(20 mins) A discussion on the code for structural safety of tall buildings – IS 16700

Mihir Vora
Senior Partner, KBM Engineering Research Laboratory
Design Challenges – Geotechnical and Foundation Design

(20 mins)

11:00 a.m. – 11:15 a.m. Q&A

11:15 a.m. – 11:45 a.m. TEA BREAK

11:40 a.m. – 1:00 p.m. Session 2: Design

Girish Dravid
Director, Sterling Engineering Consultancy Services

Amit Surlekar
Vice President, Sterling Engineering Consultancy Services

(20 mins) Design Challenges – Structural Design

Utsav Shah
Director, Ducon Consultants

(20 mins) Design Challenges – Structural Design

Sooraj Nair
Director and Co-founder, Grune Designs

(20 mins) MEP - Services Design

1:00 p.m. – 1:15 p.m. Q&A

1:15 p.m. - 2:15 p.m. LUNCH BREAK

2:15 p.m. – 3:45 p.m. Session 3: Design and Construction

S Dutta
Project Director at Larsen & Toubro

(20 mins) Construction aspects of tall buildings

Jairam Panch
Vice President & Managing Director, Turner International

(20 mins) Project Management of Tall Buildings

Ronak Shah
Structural Engineer, Arup

(15 mins) A young civil engineer's perspective

3:30 p.m. – 3:45 p.m. Q&A

3:45 p.m. – 4:15 pm TEA BREAK

4:15 p.m. – 5:30 p.m. Panel Discussion with all speakers on the podium –
Moderated by **Suren Vakil and Prof. Aanal Shah**
Vote of Thanks – **Prof Aanal Shah – Dean, Faculty of Technology – CEPT University**

CEPT University Winter Exhibition Tour





Session 1: The Context

Pavan Bakeri
Managing Director, Bakeri Group

A developers perspective

Girish Dravid
Director, Sterling Engineering Consultancy Services

Utsav Shah
Director, Ducon Consultants Pvt. Ltd.

Anal Shah
Partner, NK Shah Consulting Engineers,

A discussion on the code for structural safety of tall buildings
– IS 16700

Mihir Vora
Senior Partner, KBM Engineering Research Laboratory
Design Challenges – Geotechnical and Foundation Design

THEME:
A DEVELOPERS PERSPECTIVE



Pavan Bakeri
Social Entrepreneur
Bakeri Group

With over 20 years of experience in construction and real estate development in India, he is also a serial entrepreneur. He initiated an alternative energy firm exploring wind and solar energy. Additionally, he founded a software firm that developed Voice over Internet Protocol (VoIP) solutions and was involved in the early development of voice recognition technologies.

A staunch advocate for using technology and design to address social issues, he is currently engaged as an investor and mentor with various start-ups in fields such as education, logistics, e-commerce, and the environment. As a co-founder of Ideal Choice Homes, a company dedicated to designing and developing precast concrete solutions for mass housing in emerging markets, he has also played a role in founding technology-based ventures. These include Z-Axis Unmanned Machines, involved in manufacturing UAVs (Drones) for civilian and military use; cloud computing company Fx Data Labs; Original Dimension, a venture in Virtual Reality; Intellimat Technologies, a nanotechnology venture; and Artemis Cast Stone, engaged in the manufacture of various types of elements, including building elements involving an IP-based process (patent pending) using quarry dust.

An alum from the prestigious Massachusetts Institute of Technology (M.I.T.), U.S.A. Notably, he has recently been nominated to receive one of France's highest civilian honours, l'Ordre National du Merite, by the President of France.



THEME:
**A DISCUSSION ON THE CODE FOR
 STRUCTURAL SAFETY OF TALL
 BUILDINGS – IS 16700**

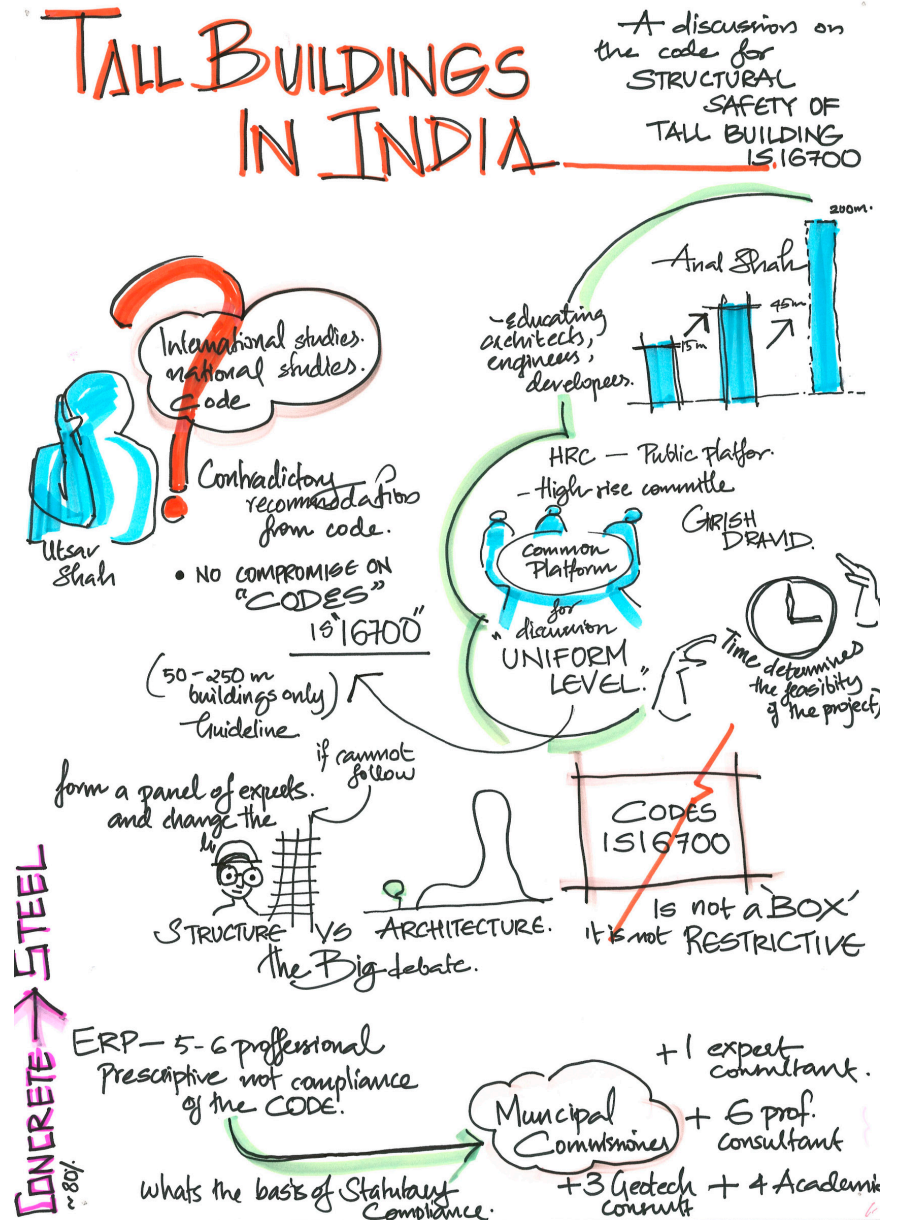


Girish Dravid
 Director
 Sterling Engineering Consultancy Services
 Pvt. Ltd.

As the Chairman of CTBUH India, he has played a pivotal role in promoting Council on Tall Buildings and Urban Habitat (CTBUH) objectives in India since 2013. As the Director of Sterling Engineering Consultancy Services Pvt. Ltd., a leading structural engineering firm in India, he oversees consultancy services in major Indian cities and international locations. A Mumbai resident, he keenly understands the challenges associated with high-density development in the city.

An alumnus of IIT Bombay, he holds a 33 years of career marked by leadership in designing diverse projects, with a special focus on high-rise buildings. His innovative structural solutions, including outriggers, post-tensioning, composite construction, and damping systems, highlight his commitment to construction-friendly designs.

Some of this noteworthy projects include the Grand Chola Hotel in Chennai, Palais Royale in Mumbai, and the ICICI Regional Headquarters in Hyderabad. Girish's expertise lies in achieving systemic project optimization while minimizing structural intrusion in spatial experiences.



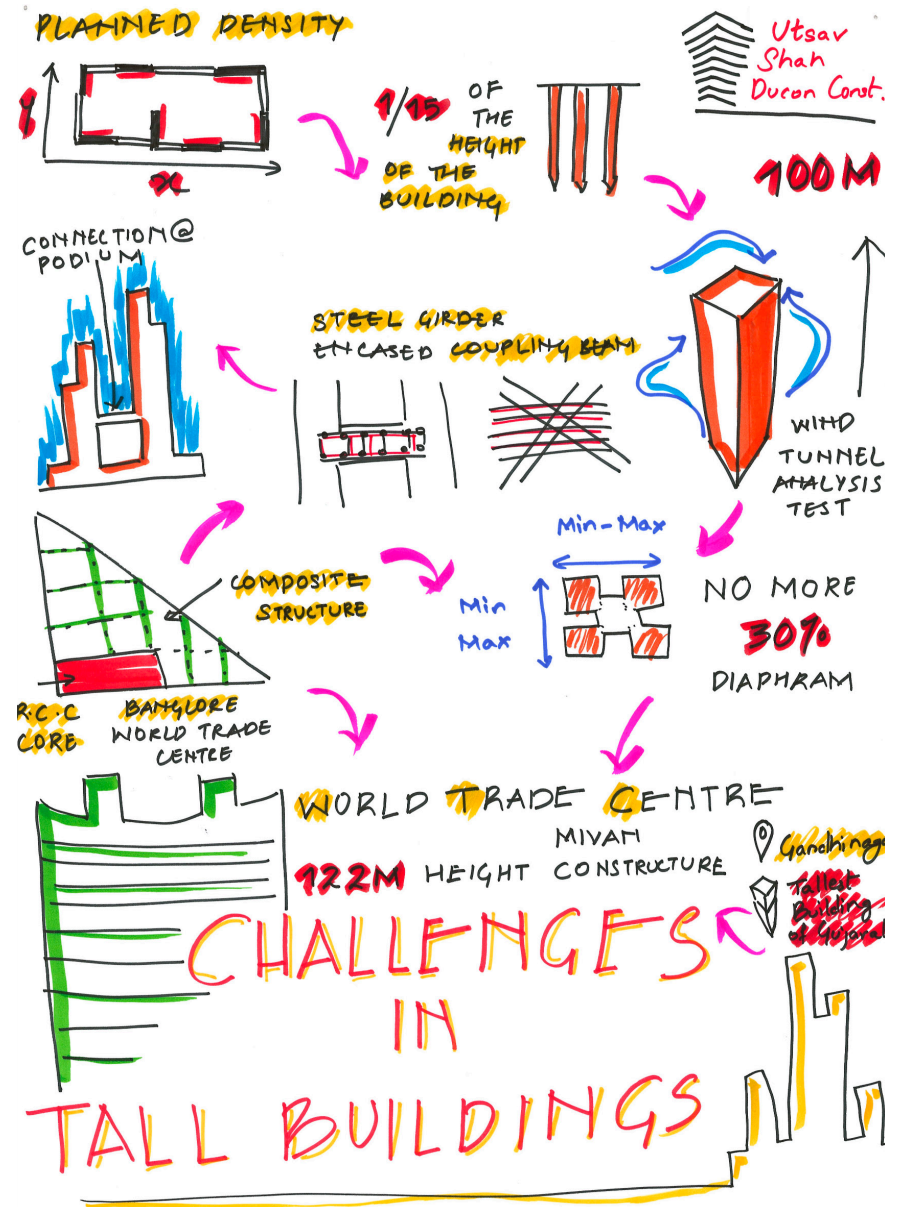
THEME:
**A DISCUSSION ON THE CODE FOR
 STRUCTURAL SAFETY OF TALL
 BUILDINGS – IS 16700**



Utsav Shah
 Director
 Ducon Consultants Pvt Ltd

With over 15 years in the industry, he leads a strong team of over 100+ professionals in a 34-year-old structural design firm. He did his masters in structural engineering from the University of Florida. He is part of the state-level committee responsible for highrise building designs and its guidelines and approvals. He also has been part of the recently published documentary by DISCOVERY+ 'Bhuj-the day India shook' as a structural expert.

Presently, he is designing several highrise projects across the country including several steel composite projects, museums and the Gujarat sports complex which is the showcase project for India's bid for Olympics 2036.



THEME:
**A DISCUSSION ON THE CODE FOR
 STRUCTURAL SAFETY OF TALL
 BUILDINGS – IS 16700**



Anal N. Shah
 Partner
 N K Shah Consulting Engineers LLP

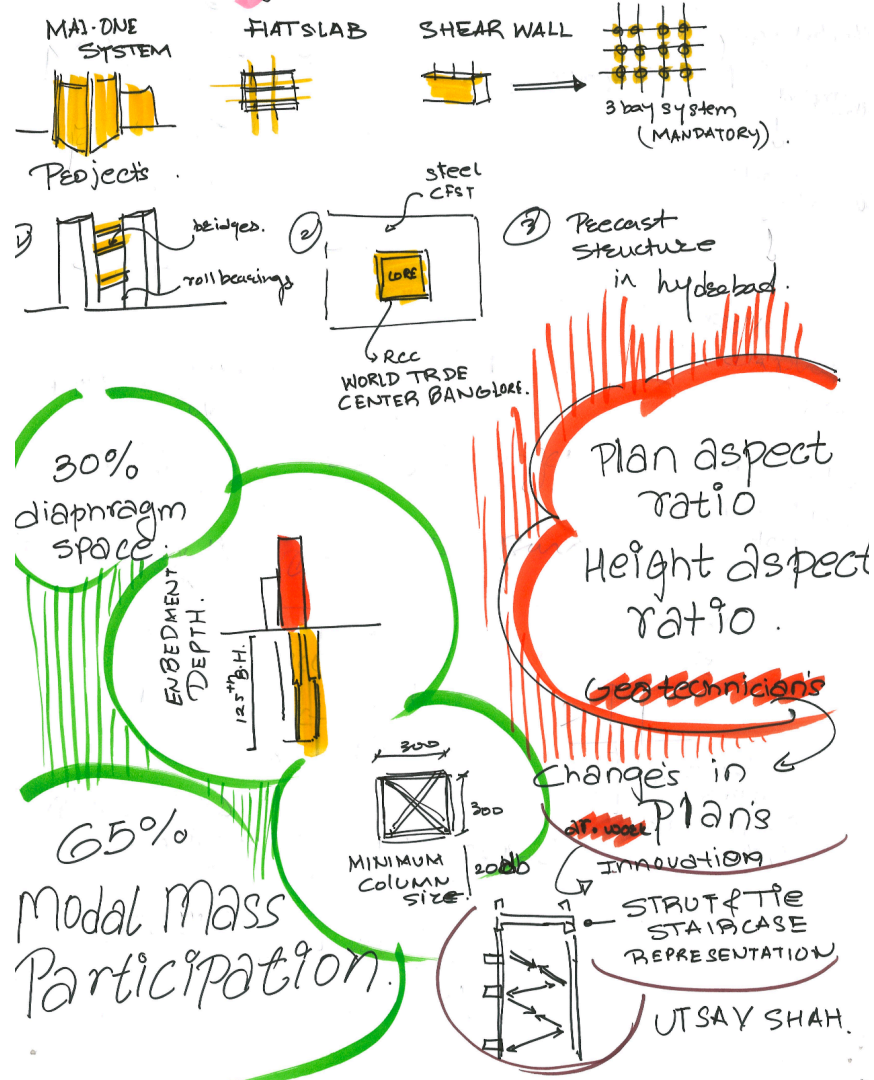
A professional with Bachelors in Civil Engineering from Gujarat University and Masters of Science in structural Engineering from the University of Texas at Austin.

His professional career of 27 years include many challenging and iconic structures of India. His structural design work includes Institutional Buildings, High rise buildings and Industrial Buildings.

His signature projects include structural engineering for New Parliament Building and other Central Vista buildings -New Delhi, Kashi Vishwanth Corridor - Varanasi, IIT-Gandhinagar, IIT-Hyderabad, IIM-Ahmedabad, Flame University-Pune, Chief Ministers' Office Gujarat and KHS machineries which earned him many awards for structural engineering.

He has received many National Awards in recognition of his projects from Consulting Engineers Association of India for Young consultant and Outstanding Engineering Practice, INSDAG, Indian Concrete Institute, Ultratech including outstanding structural engineer from Indian Association of structural engineers.

Design CHALLENGE



THEME:
**DESIGN CHALLENGES:
 GEOTECHNICAL & FOUNDATION
 DESIGN**

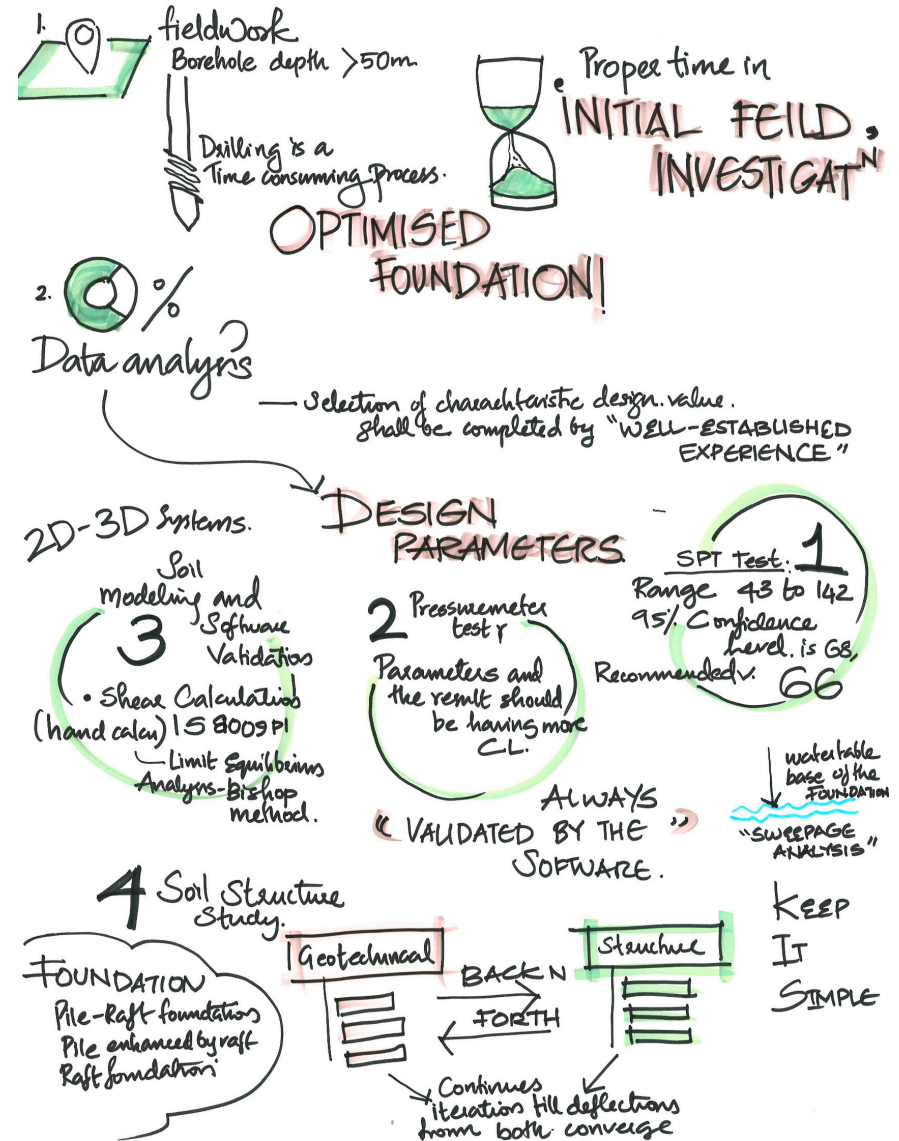


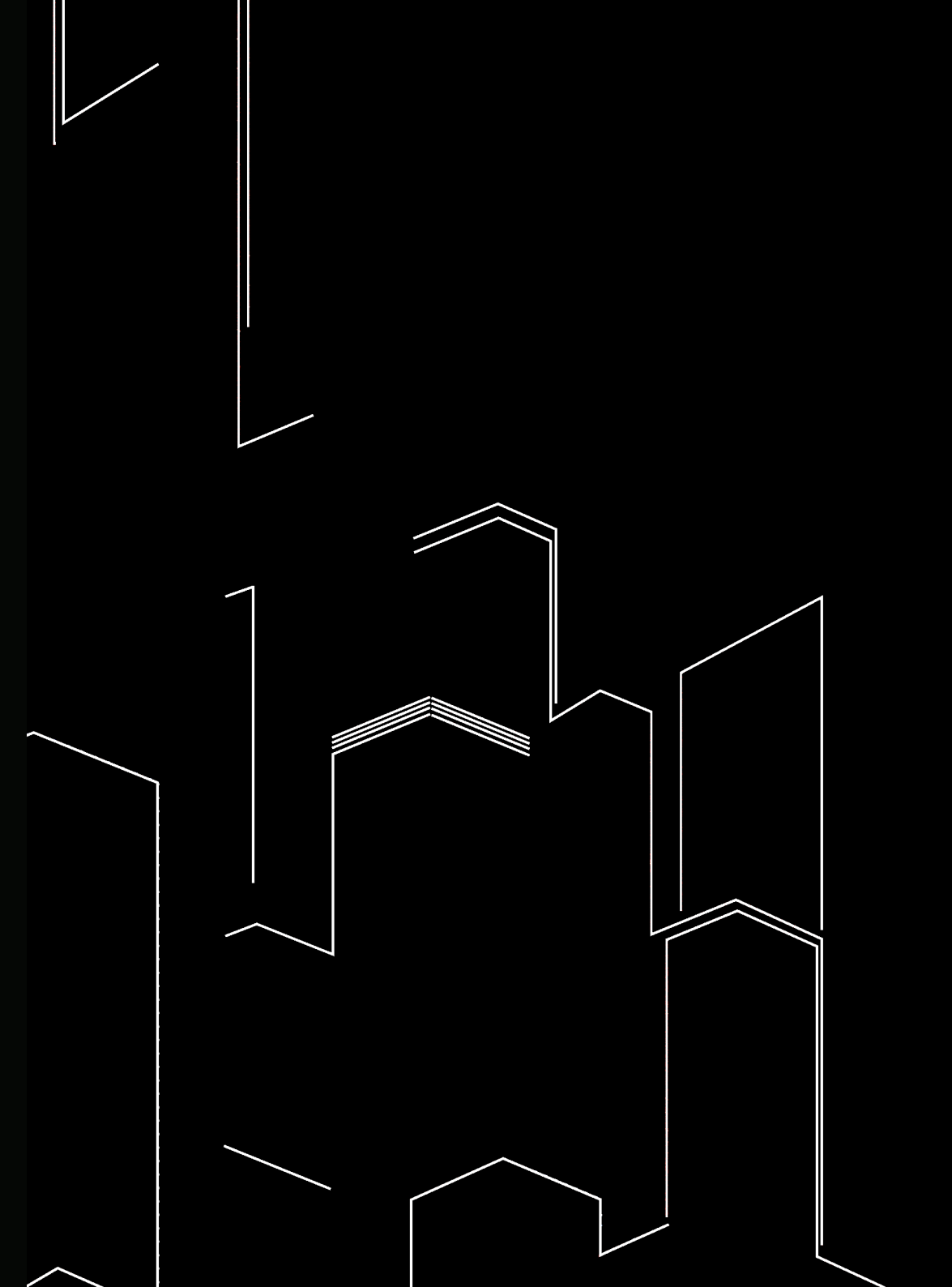
Mihir Vora
 Senior Partner
 KBM Engineering Research Laboratory

A professional with over 30 years of diverse experience in geotechnical engineering, concrete and material technology, and quality management, holds the position of a senior partner at KBM Engineering Research Laboratory (KBMERL) in Ahmedabad, Gujarat, India. Serving as the CEO and Partner, he has played a pivotal role in establishing KBMERL as a trusted institute for government and private clients, excelling in geotechnical and material testing services.

His expertise covers the planning, management, and execution of field and laboratory testing operations for over 3000 projects. Mihir is instrumental in implementing safety and quality procedures, as well as providing geotechnical consultancy on various issues, including ground improvement, retention systems, pile capacities, settlement analysis, and stability analysis. His consultancy services extend to esteemed organizations globally, with a dedicated focus on adhering to EN Standards for international projects.

Geotechnical Challenges





Session 2: Design

Girish David
Director, Sterling Engineering Consultancy Services

Amit Surlekar
Vice President, Sterling Engineering Consultancy Services
Design Challenges – Structural Design

Utsav Shah
Director, Ducon Consultants
Design Challenges – Structural Design

Sooraj Nair
Director and Co-founder, Grune Designs
MEP - Services Design

THEME:
DESIGN CHALLENGES:
STRUCTURAL DESIGN



Amit Surlekar
 Vice President
 Sterling Engineering Consultancy Services
 Pvt. Ltd.

A distinguished Civil Engineering graduate from the University of Mumbai, completing his studies in 2004. With a remarkable 19-year journey at Sterling, he has played a pivotal role in prestigious projects for renowned developers such as Oberoi, Lodha, Bengal Ambuja, Tata Realty, Mantri, and Kalpataru.

His involvement spans diverse projects across India, providing invaluable experience collaborating with international architects and structural consultants. Some of the notable projects in his extensive portfolio include Oberoi Commerz I, Four Seasons Residences, Lodha New Cuffe Parade, City Center 2, ITC Apartment, and Ramanujan IT City.

SUMMING UP

PRINCIPLE CHALLENGES:

- ↳ Timelines ⌚
- ↳ Flexibility of structures
- ↳ Design

PANEL

- ↳ Girish David
- ↳ Utsav Shah
- ↳ Anil Shah

"NEW TECH"

"TIMEFRAME OF PROJECT" (PERT & CPM)

UTSAV SHAH

PATH BREAKING WAYS:

- ↳ Steel structure for **COMMERCIAL** buildings
- ↳ Innovation for buildings
- ↳ Shear wall
- ↳ Friction damper & Viscous dampers

GIRISH DAVID

- * No more reasearch in structural Engineering 😞
- * Learn from surrounding IDEA 😊

CHALLENGES

- ↳ Shape
- ↳ Location
- ↳ Socio-economic factor

Without friction dampers

With friction dampers

Viscous dampers

THEME:
MEP - SERVICES DESIGN

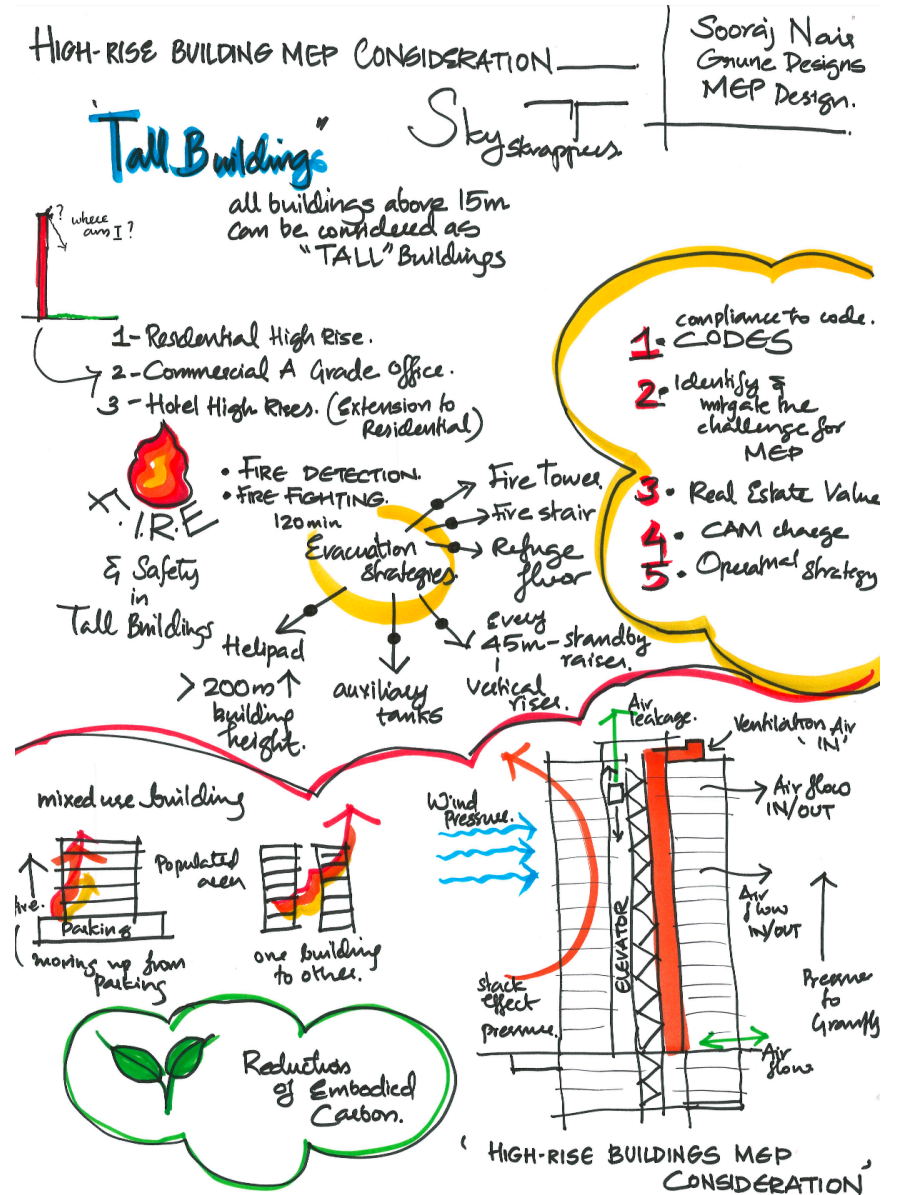


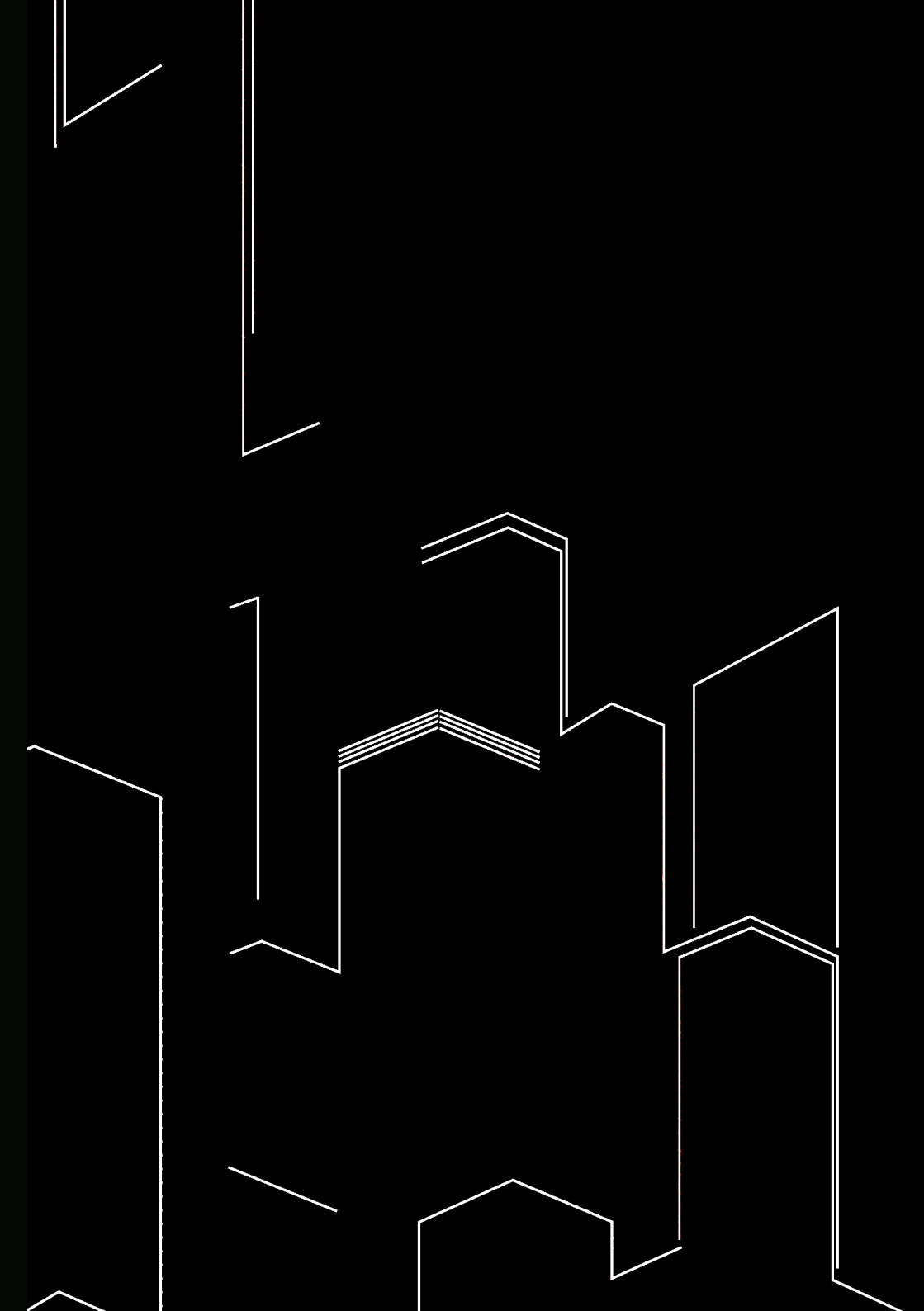
Sooraj Nair
Director and Partner
Grune Designs

A professional with over 25 years of experience in a wide range of building sector specialisations. He is the Founder Director of Grune Designs, an Engineering Consulting Design Firm providing MEP, Sustainability and Wellbeing Solutions.

He has experience in the field of MEP design and construction management and has worked in some reputed international consultancy firms.

Sooraj has international construction exposure in the MEP field with his stint in Dubai, where he was involved in building the world's tallest Hotel Building, the JW Marquee. He has the right mix of design and construction experience and has his own Building Engineering and Sustainability Design Consulting practice, Grune Designs Private Limited, Located in Mumbai, Bangalore, and Pune - India.





Session 3: Design and Construction

S Dutta
Project Director at Larsen & Toubro
Construction aspects of tall buildings

Jairam Panch
Vice President & Managing Director, Turner International
Project Management of Tall Buildings

Ronak Shah
Structural Engineer, Arup
A young civil engineer's perspective

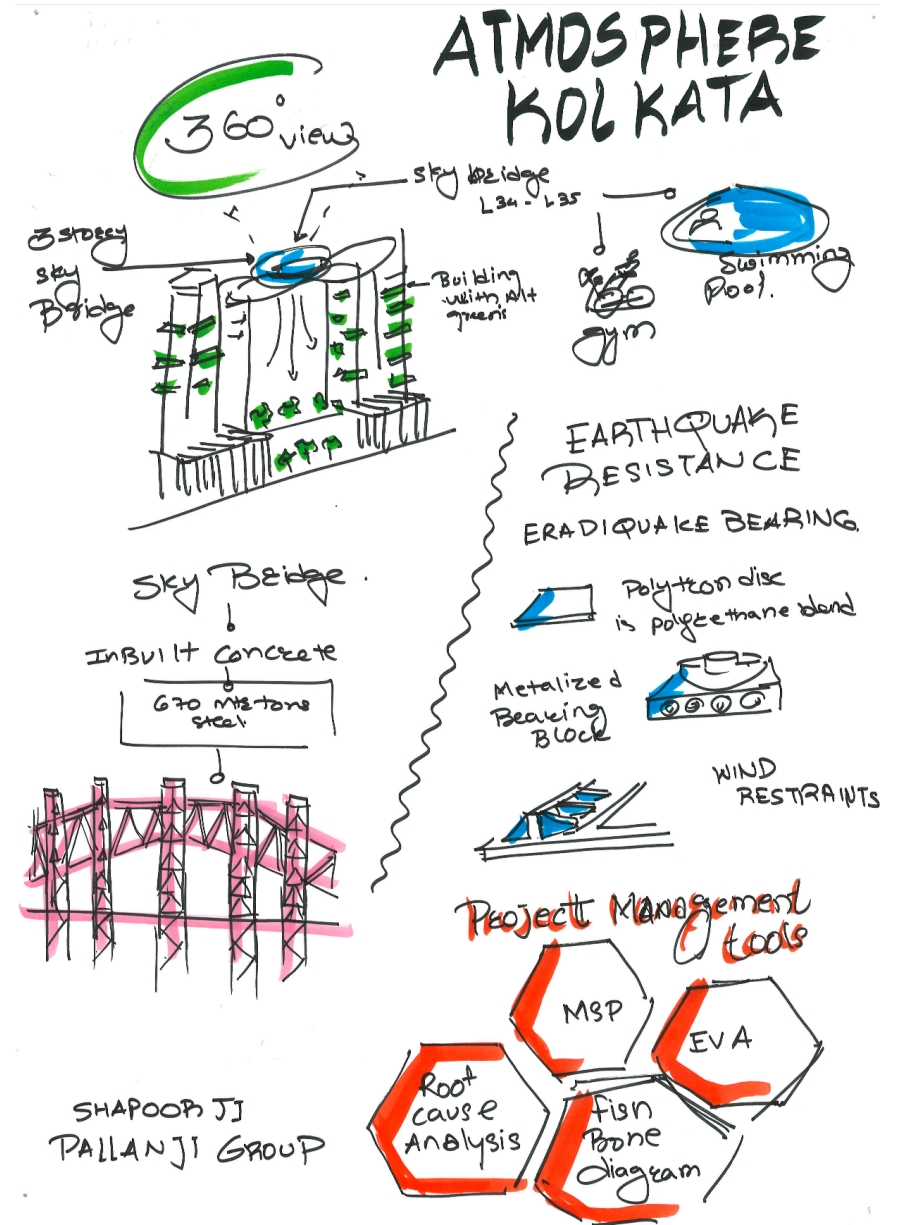
THEME:
CONSTRUCTION ASPECTS OF TALL BUILDINGS



Subrata Dutta
Project Director
Larsen & Toubro

With over 30 years experience of project management in construction industry, he currently serve as the Project Director at Larsen and Tubro. He has been pivotal in reputed projects, including construction of the world's largest stadium in Ahmedabad. His expertise spans high-rise buildings, five-star hotels, mega convention and exhibition centers, glass and other factories, offshore breakwater works, and extensive precast projects, including erection.

He has successfully completed several projects ahead of schedule, earning recognition in Nat-Geo's mega-structure program for constructing the Twin Towers, ATMOSPHERE, in Kolkata. His track record reflects proficiency in managing diverse construction endeavours and achieving notable milestones in record time.

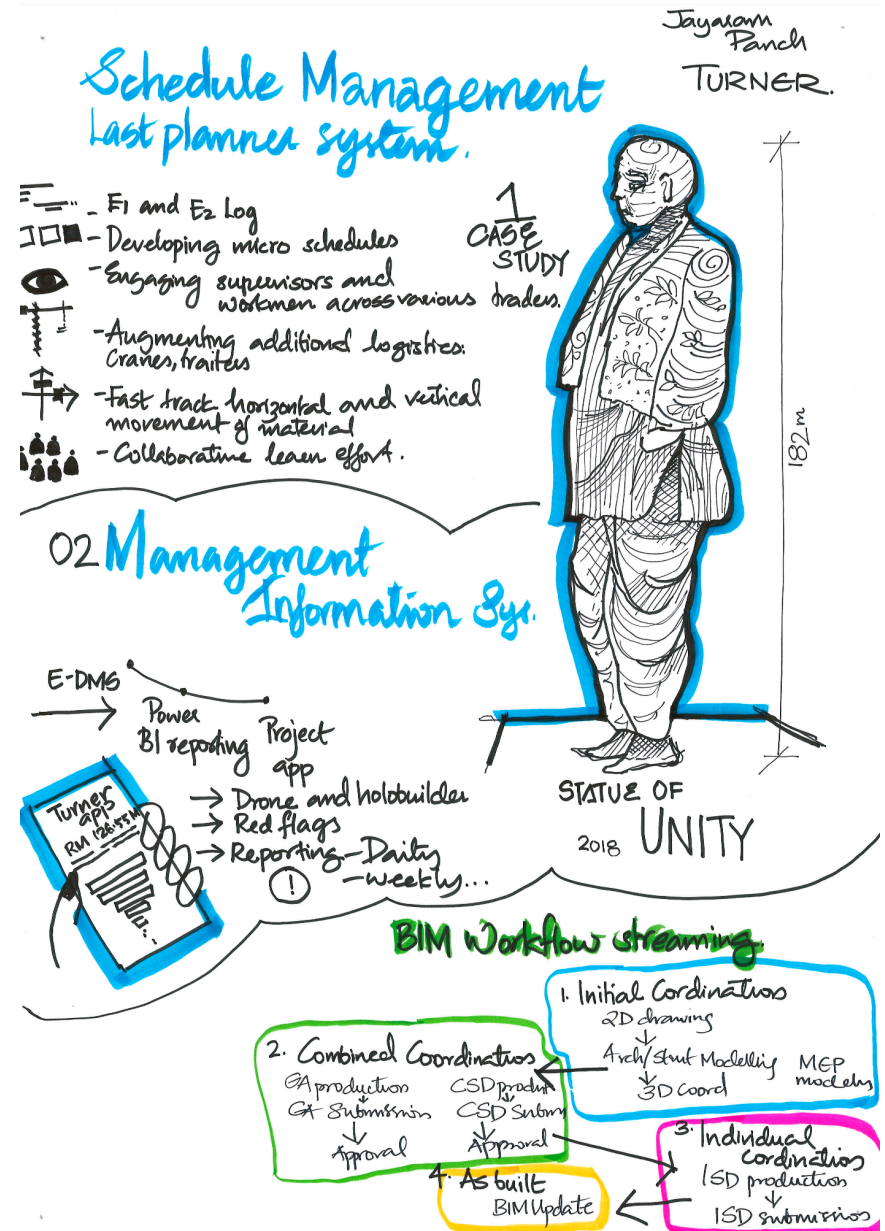




Jairam Panch
Vice President & Managing Director
Turner International

An Architect-Urban Planner by profession with executive management education from Kellogg School of Management. He brings over 30 years of industry experience, occupying various leadership roles at project and corporate levels. Since 2007, he was instrumental in establishing and growing Turner brand in India, a wholly owned subsidiary of Turner International specializing in delivering world-class program management, project management and construction management consultancy services.

Some of his notable contributions include Statue of Unity, Kempegowda airport Terminal 2 expansion, National War Memorial and Delhi International airport (ongoing). He strongly believes in University Industry connect and actively participates in various real estate, business federations, AMCHAM, ET India Leadership Council and Thought Leaders of India.



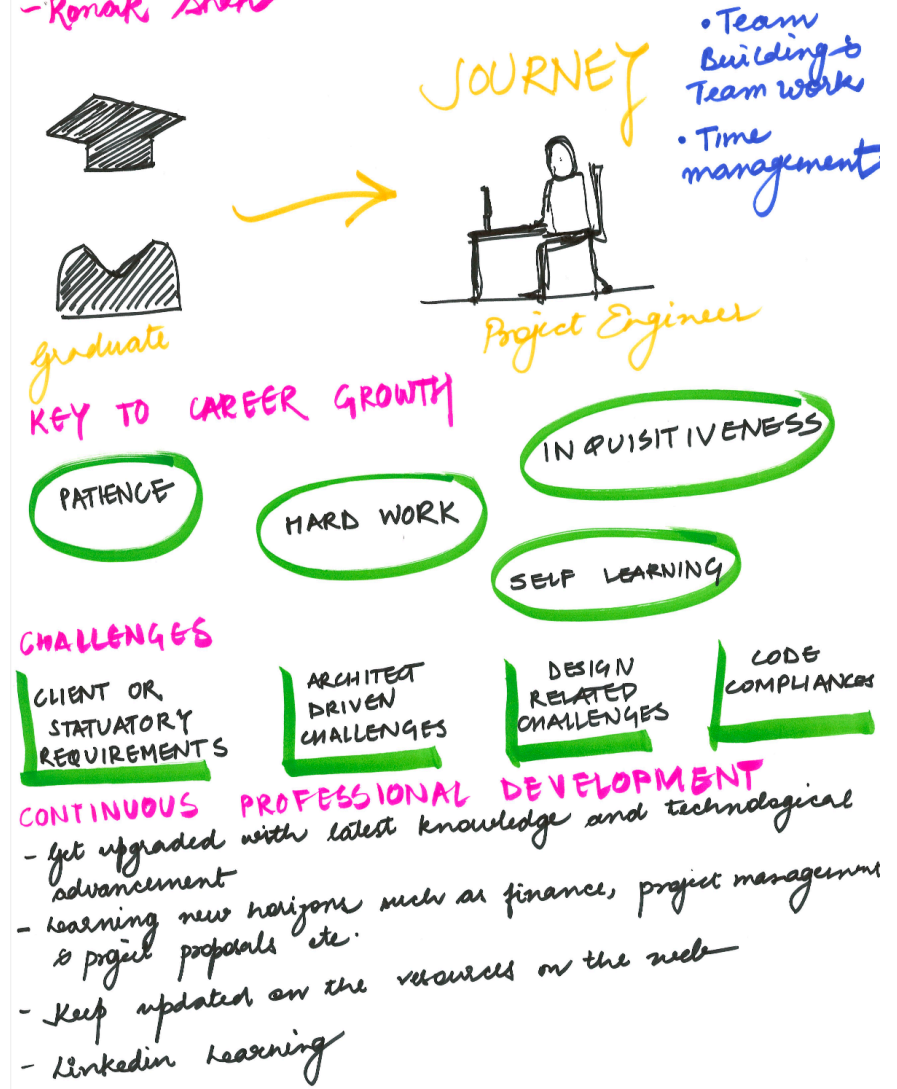
THEME:
A YOUNG CIVIL ENGINEER'S PERSPECTIVE



Ronak Shah
Structural Engineer
Arup

A highly accomplished Structural Engineer with a strong educational background and a wealth of professional experience. His career in structural engineering took off with Larsen & Toubro as a Student Trainee, followed by roles at various prestigious firms like TR Engineering Consultancy, Buro Happold Engineering, and Arup. His experience includes projects related to seismic retrofitting and design, makes him a well-rounded representation of the young engineer's perspective.

A YOUNG ENGINEER'S PERSPECTIVE
- Ronak Shah





**KEY INSIGHTS
& TAKEAWAYS**



Mr. Pavan Bakeri from Bakeri group gave a “developers perspective”. Some of the salient points made by Mr. Pavan Bakeri are as follows.

Local statutory regulations can be amongst the greatest challenges posed to developers.

Often the height of buildings is governed by statutory, socio-economic, psychological, and financial/market governed factors. He also emphasised the timeless adage that location was perhaps the most important consideration for a developer promoting real estate projects.

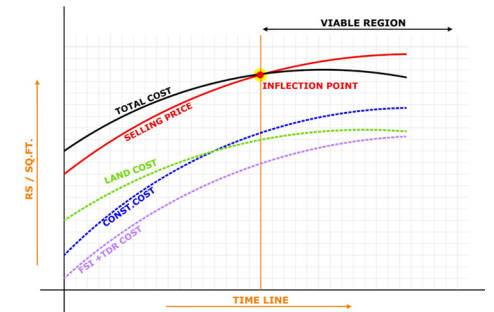
Statutory limits to height include rules and regulations set by the airports authority of India, FSI available, planning and building regulations, zoning and fire regulations. These statutory limitations to building height differ in various cities and also in different areas of the same city.

Following on from statutory and legal limitations, it is important for a real estate developer to have a strong grasp of the socio economic factors affecting his target customers. For example, it is difficult for a developer to sell the upper floors of tall buildings for low affordable housing in the poorer parts of a city. This was mainly to do with perceived risk of elevator malfunction and also psychological reasons. Conversely the upper floors of high end developments in the more affluent parts of a city where selling points included the view, light and ventilation and reduced noise levels are considered more desirable and therefore command higher prices. Furthermore he noted that the age profile of buyers was important with younger generations preferring the upper floors, whereas seniors preferred the lower floors.

Finally, financial and market driven considerations often govern the floor plate and height of real estate developments. In cities like Mumbai, where land availability is very limited due to physical constraints, high land costs make it necessary to develop upwards and there is an almost universal acceptance of living and working in apartment or office blocks. This is not always the case with other cities where the land costs are lower and therefore the cost of building upwards does not necessarily result in cost savings.

Foundation and construction costs of buildings increase as they become taller and so does the construction period which then has knock on effect on interest costs. As a result it becomes necessary for developers to sell such projects quickly in order to reduce interest costs.

Selling prices and therefore financial viability of projects are governed by the land acquisition cost, cost of full and special FSI (Floor Space Index – Ratio of the land area to permissible built-up area for a location), construction cost, finance cost and opportunity cost



VIABLE REGION MAY SHIFT LEFT OR RIGHT DEPENDING ON FINANCE COSTS

Unit cost vs Time for various parameters

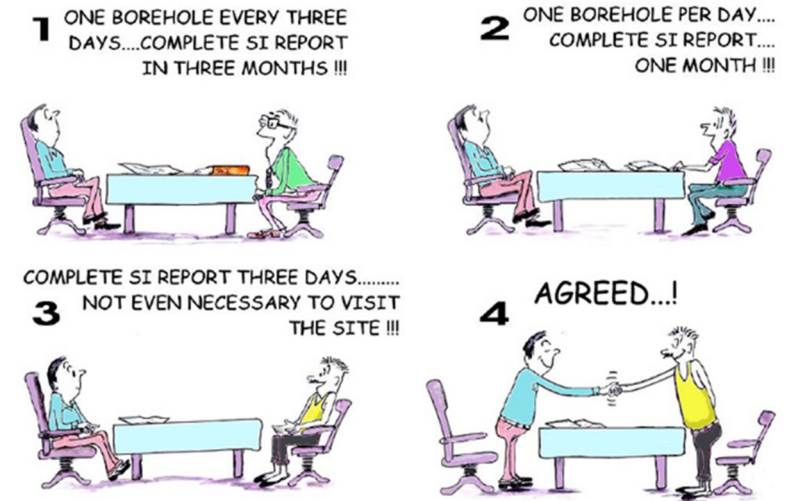


GIFT City – Gandhinagar

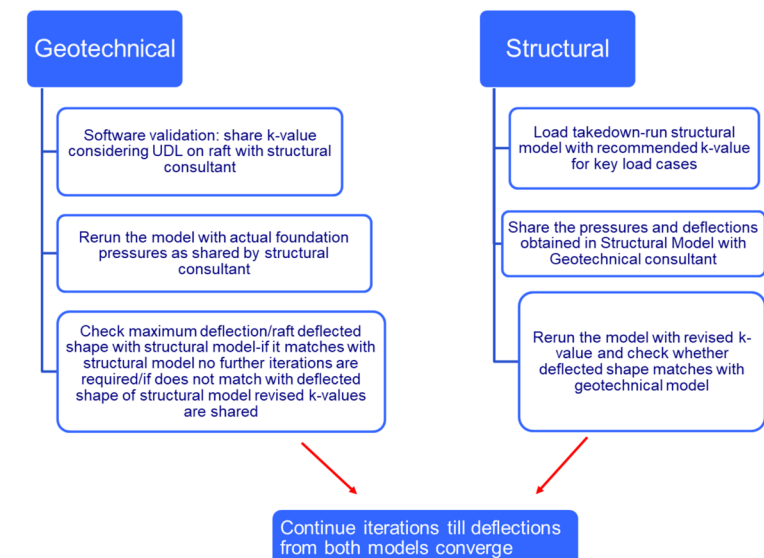


Mr Mihir Vora then spoke about to geotechnical and foundation aspects for tall buildings. He made a number of important points including...

- He stressed upon the importance of a number of areas at the time of the geotechnical investigation including
 1. field work,
 2. data analysis,
 3. soil modelling and software validation,
 4. soil structure interaction
 5. finalisation of the type of foundation.
- Allowing sufficient time and budget for the geotechnical investigation is critical to the success of any project. He stressed that it was folly to try and reduce costs and time for geotechnical work because the stakes are very high and making a mistake could be financially fatal to the development. He illustrated his point through case studies.
- N values from cone penetration tests require expert guidance during the field measurement stages as well as at the time of interpretation. Mr Vora give some examples of how N values can be misinterpreted or improperly measured.
- On data analysis he stated that Indian codes do not have guidelines for data analysis and selection of characteristic design parameters. It is therefore necessary for geotechnical engineers to use European codes.
- Care needs to be taken at the time of data analysis particularly during the analysis of fieldwork results because experienced interpretation is required to establish the correct values and therefore the safe bearing capacity.
- On soil modelling and software validation the factor of safety adopted is very important further software analysis should be selectively validated where necessary through hand calculations which should never be abandoned.



- He went on to discuss 2D and 3D analysis using current software packages.
- He emphasized the need to adopt safe design by considering the worst-case scenario particularly with regard to the water table level.
- Finally, he emphasized the need for sufficient interaction between structural and geotechnical engineers. For example, load takedown should be made available to geo-technical engineers at the outset.

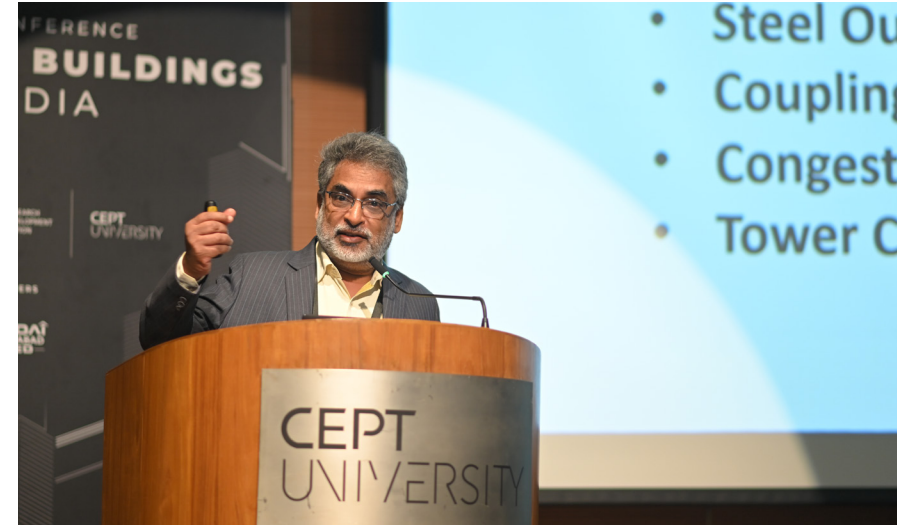




Mr. Girish Dravid and **Mr. Utsav Shah** went on to discuss the design challenges of tall buildings. **Mr. Utsav Shah** elucidated the analytical, design and codal aspects affecting the structural design of tall buildings in considerable detail. **Mr. Girish Dravid** covered the interface between design and construction for tall buildings giving examples from his personal experience.

Mr. Utsav Shah showed the varied floor plate layout of a number of projects that he had designed. He then went on to illustrate the following points...

- Check the plan aspect ratio and the height aspect ratio to define the potential structural system that can be developed. The aspect ratio should be < 5 . He also discussed the concept of “seismic gap”.
- The importance of wind tunnel testing, as mandated by the code.
- Discussion topics included coupling beams, shear walls
- Differential settlement between tower and non-tower buildings having a contiguous foundation can lead to cracking. He suggested mitigatory measures.
- The use of higher concrete grades and also using various concrete mix designs such as dual or triple blends.
- Vulnerability of staircases and measures that can be adopted to mitigate failure.



Mr Girish Dravid covered the following points..

- Advancing the core and techniques associated with this.
- Climbing formwork
- Slab induced floor sags
- Axial Shortening of columns
- Settlement profile of foundation raft and differential settlements between tower and podium
- Shoring systems for basements and basement construction
- Outrigger Construction
- Coupling Beams – Shear Failure – Reinforcement v/s Steel plates
- Congestion in shear walls and columns
- Tower Crane reactions
- Different types of concretes in a high-rise project, performance based specifications of concrete
- Excessive Accelerations – measurements during construction
- Multi-level propping of floors successively to avoid cast in floor sagging
- Verticality tolerances – lift shafts
- Deflections induced in services and finishes/facades

Mr Sooraj Nair spoke about the design and construction aspects of electrical, HVAC, plumbing and firefighting services.

He made a general point that the services are the “life-blood” of a building and specific themes discussed included...

High rise buildings are best suited for residences, offices or hotels. Each type of usage has a specific need which he called “the core design value” and the MEP services design needed to be aligned to this.

- Residential high rises need to be low on Common Area Maintenance (CAM) charges considering that the developers provide a warm shell design and the interiors are completed by the flat owners. 24x7 Occupancy.
- Commercial A grade offices need to be highly energy efficient. A core design issue is the elevating strategy in addition to the fire and life safety compliance. The buildings operates 10 to 12 hours/daily with usually almost zero occupancy at night.
- Hotel high rises are an extension to residential units, but need to be completely finished in all respects including interiors and furniture before occupancy. Fire safety becomes extremely important. Operates 24x7.

The checkpoints for high rise services design include...

- Compliance to codes and standards
- Identifying and mitigating challenges to MEP Design / Installation
- Alignment to Real Estate Value
- Alignment to CAM charges (Common Area Maintenance)
- Alignment to operations strategy
- He outlined challenges faced during the design of electrical, plumbing and firefighting systems





Mr S.Dutta and Mr Jairam Panch then addressed matters from a contractor's view point.

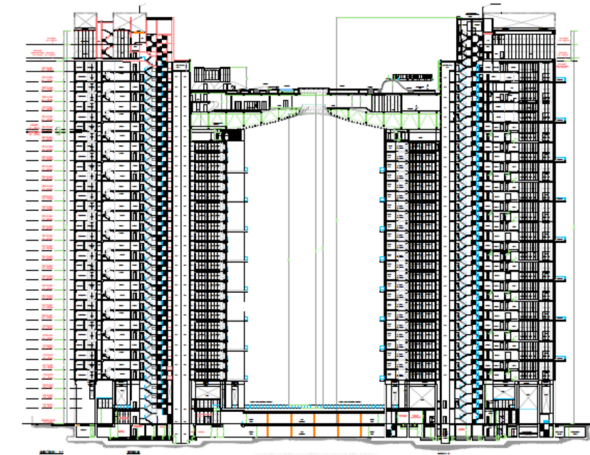
Mr S. Dutta showcased a case study for a sophisticated building in Kolkata called Atmosphere.

- Atmosphere is a 39 storey twin tower project with a connecting Skybridge. The construction challenges were very significant. The construction period was 26 months.
- The installation of Eradiquake earthquake isolation bearing system
- Reduced wall thicknesses and accommodation of heavy reinforcement in less space
- Very challenging architectural design with 18m cantilevers for each duplex flat, Kum Kang aluminium shuttering
- An distinctive feature of the development is a Skybridge connecting the two towers at levels 32,33 and 34. Designed as composite structure
- Piled raft foundation with an excavation depth of 6-7m
- Wall thickness reduced from 600mm to 450mm. Congestion of rebars was a challenge.
- Pre-assembled rebar cages used for 70% of the walls
- International standard fire protection measures including intumescent paint utilised on the steelwork.
- Complex temporary works design including additional steel to take the erection loads and a detailed support plans for the Tower Cranes.

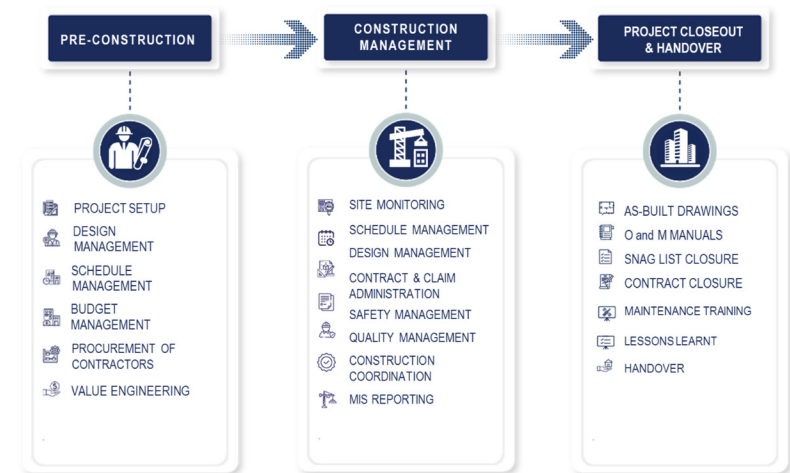
Mr. Jairam Panch focussed on the role of professional construction management in the context of tall buildings.

Mr. Panch outlined the typical scope for project management, this included 3 stages of Pre-construction, Construction and Project closeout and handover.

Mr. Panch presented case studies for the Statue of Unity, Phoenix Business Hub, Burj Khalifa and Merdeka PNB 118



PMC Typical Scope of Work



He discussed the importance of BIM adoption at the early stages and in the context of coordination of various disciplines and activities.

He ended by talking about new techniques including laser guided setting out, 3D laser scan and 3D printing.



The final talk was by a young engineer, **Ronak Shah** from Arup and aimed at students. Ronak has been involved in the design of tall buildings and has seven years' experience. He spoke about his journey following graduation and the differences between University and working on real world projects. He discussed the technical tools at his disposal and the training being provided to him.

Particularly, he stressed the importance of structured training to fresh graduates so that they can effectively contribute to organisations and also build their own careers.

This was a conversation between three experienced structural engineers namely, **Girish Dravid, Anal Shah and Utsav Shah.**



CONVERSATION ON THE CODES FOR TALL BUILDINGS



Indian codes are not comprehensive, especially for special structures. This makes it necessary to use international codes where required. Some of the buildings in Mumbai go beyond the scope of the current code IS 16700 and the code needs to catch up.

The current process requires an Expert Review Panel (ERP) for code exceeding tall buildings which has been constituted for Mumbai and now Haryana. This is required for other locations including for Ahmedabad. New Delhi is close to creating an ERP.

Buildings in Gujarat exceed 155m (at present) and building heights will continue to increase. The challenge for structural consultants, developers, and project engineers lie with the ambitious timelines. Structures need to be flexible and should be quick to construct in order to meet market demands.

We are likely to see an increase in the number of steel structures since India is facing labour shortages. Innovative technologies such as dampers, viscous dampers, friction dampers need to be explored further.

IMPORTANT ISSUES COVERED DURING THE INTERIM AND FINAL Q&A SESSION



Modern tall buildings have now been around for over 120 years. Very little is now left to learn in terms of structural engineering and the focus should now be on sustainable materials and social aspects of living in tall buildings.

- Professional project management during construction is very important for tall and ultra-tall buildings
- The use of natural ventilation is difficult in India bearing in mind the inhospitable climate and pollution levels in our major cities.
- The value of civil and structural engineers in society need to improve and the civil engineering committee needs to do more for itself in this respect.
- Discussion around improving the education of engineers was discussed. Topics included, expanding engineering curricula to include arts and aesthetics, reducing closed book examinations, learning about AI and coding, history of structural engineering, site visits and interaction with industry.

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