Theme Paper

Presented by

Construction Industry Development Council (CIDC), INDIA

28th AsiaConstruct Conference
September 24 -26, 2025, Seoul, Korea

Theme : Promoting Smart Construction for Sustainable Development

Preamble :

India is honoured to contribute to the deliberations at the 28th AsiaConstruct Conference and applauds the collective commitment of member nations toward advancing innovation, resilience, and sustainability in the construction sector.

The theme, **"Promoting Smart Construction for Sustainable Development,"** reflects a shared regional aspiration—to leverage technology and policy innovation to build infrastructure that is not only efficient and high-quality but also inclusive, environmentally responsible, and future-ready.

As an apex body established by the Planning Commission Govt of India (Now **NITI Aayog)**, the **Construction Industry Development Council (CIDC)** serves as a national platform for driving systemic reforms and capacity development in the construction and infrastructure ecosystem.

India's Perspective on Smart Construction :

Promoting smart construction is a crucial strategy for sustainable development in the Indian construction industry. By leveraging cutting-edge technologies, the industry can reduce its environmental impact, improve efficiency, and enhance sustainability. Here are some key smart technologies being adopted in India:

India views **smart construction** as an integrated approach that combines:

1**. Digital Technologies**

- Building Information Modelling (BIM): A digital representation of the physical and functional characteristics of a building, enabling better collaboration, reduced errors, and improved project outcomes.
- Artificial Intelligence (AI): AI can be used to analyze data, predict outcomes, and optimize construction processes, improving efficiency and reducing costs.
- Internet of Things (IoT): IoT sensors and devices can be used to monitor and track construction progress, improving site management and reducing waste.
- 3D Printing: Reduces construction time, labour costs, and waste, promoting eco-friendly construction.
- Modular Construction: Reduces project timelines, material waste, and environmental impact.
- Robotics and Automation: Improves efficiency, safety, and precision in construction tasks.

2. Sustainable Building Practices :

- Green Building: Designing and constructing buildings that minimize environmental impact, reduce energy consumption, and promote occupant health and well-being.
- Climate Resilience: Building structures that can withstand and adapt to the impacts of climate change, such as extreme weather events and rising sea levels.
- Sustainable Materials : Using materials that are environmentally friendly, sustainable, and recyclable, reducing waste and minimizing environmental impact.
    - Green Building Materials: Sustainable materials like recycled materials, low-VOC options, and sustainable wood reduce environmental impact.

- Smart Glass: Energy-efficient and aesthetically pleasing, smart glass can switch properties based on external factors.
- Solar Energy: Harnesses renewable energy, reducing reliance on non-renewable sources.
- Advanced HVAC Systems: Energy-efficient systems like Variable Refrigerant Flow (VRF) and geothermal heating and cooling.

3. **Skill Development and Human Capital :**

- Workforce Development: Investing in training and development programs to upskill and reskill construction workers, improving productivity and efficiency.
- Future-Ready Workforce: Preparing the workforce for emerging technologies and trends, such as BIM, AI, and IoT, to ensure they remain relevant and competitive.
- Diversity and Inclusion: Promoting diversity and inclusion in the construction industry, attracting talent from diverse backgrounds and perspectives.

4. Collaborative Frameworks :

- Public-Private Partnerships (PPPs): Collaborating with private sector partners to deliver construction projects, leveraging their expertise, resources, and financing capabilities.
- Research and Development: Collaborating with research institutions and industry partners to develop new technologies, materials, and construction methods.
- Financing and Implementation: Developing innovative financing models and implementation strategies to support construction projects, reducing costs and improving outcomes.

Current Challenges in the Construction Industry :

The Indian construction industry is facing numerous challenges which are delaying the hinder its growth and sustainability. Some of the current challenges include :

Labor Challenges :

- Skilled Labor Shortage: The industry is struggling with a significant shortage of skilled labour, which affects project timelines and efficiency.
- Training and Development: There's a need for vocational training institutes to bridge the gap between industry requirements and available skills.

Technological Challenges :

- Slow Technological Adoption: The industry is slow to adopt new technologies, which can improve efficiency, productivity, and sustainability.
- Technology Fragmentation: Disconnected software tools create inefficiencies and gaps in communication.

Sustainability Challenges :

- Environmental Pressures: The industry faces mounting pressure to reduce its environmental impact, with 32% of global energy consumption and 34% of total CO2 emissions attributed to construction.
- Sustainable Practices: There's a need to adopt sustainable practices, such as green building certifications, eco-friendly materials, and renewable energy solutions.

Financial Challenges :

- Cash Flow Issues: Construction companies often face cash flow problems, which can lead to project delays and increased costs.
- Razor-Thin Profit Margins: The industry operates on thin profit margins, making it challenging to invest in new technologies and sustainable practices.

Regulatory Challenges :

- Bureaucratic Delays: Regulatory approvals and compliance issues can cause project delays and increased costs.
- Policy Frameworks: Fragmented policy frameworks and inadequate stakeholder engagement can hinder progress in the industry.

Supply Chain Challenges :

- Supply Chain Disruptions: Disruptions to supply chains can cause material shortages, increased costs, and project delays.
- Local Material Sourcing: There's a need to explore local material sourcing options to reduce reliance on external suppliers.

Addressing these challenges will be crucial to promoting smart technologies as a strategy for sustainable development in the Indian construction industry. By adopting new technologies, investing in workforce development, and promoting sustainable practices, the industry can overcome these challenges and achieve sustainable growth.

Government Initiatives :

1. Smart Cities Mission :

Launched by the Ministry of Housing and Urban Affairs (MoHUA) in June 2015. It aims to transform 100 cities into smart cities with core infrastructure, clean environment and decent quality of life and focuses on area-based development, retrofitting, and greenfield projects and implemented through Special Purpose Vehicles (SPVs) at the city level .

Key achievements:

- Smart Infrastructure: 12,300 km of smart roads, 2,500 km of cycle tracks, and Intelligent Transport Management Systems
- Public Safety: 76,000+ CCTV cameras installed
- Sustainable Development: 50 lakh+ solar/LED streetlights, and 89,000 km of underground electricity cabling

2. Pradhan Mantri Awas Yojana (PMAY) :

Launched by MoHUA in June 2015 to provide affordable housing for all, promoting sustainable construction practices and aims to build 2 crore affordable houses. It has four verticals :

- In-situ Slum Redevelopment: Rehabilitation of existing slum dwellers using land as a resource.
- Affordable Housing in Partnership: Providing low-cost housing through public-private partnerships
- Beneficiary-Led Individual House Construction/Enhancement: Financial assistance for individuals to construct or enhance their houses
- Credit Linked Subsidy: Interest subsidy on home loans for eligible beneficiaries

Key statistics:

- 114 lakh houses grounded for construction, with 84 lakh houses completed and delivered to beneficiaries
- 25.04 lakh beneficiaries have received interest subsidy

3. Real Estate (Regulation and Development) Act, 2016 (RERA) :

Enacted to regulate the real estate sector and protect homebuyers interests and bring transparency and accountability to the sector .

Key features :

- Registration of real estate projects: Mandatory registration of projects with RERA
- Disclosure of project details: Developers must disclose project details, including timelines and finances
- Accountability: Developers are held accountable for delays and defects
- Protection for homebuyers: RERA provides a platform for homebuyers to file complaints and seek redressal

India's promotion of smart construction as a strategy is a step towards achieving sustainable development and creating efficient, livable cities. We aim to drive economic growth, improve quality of life, and enhance sustainability through area-based development and technology integration. Key aspects of this strategy include :

- Area-Based Development: Focus on retrofitting, redevelopment, and greenfield projects to create replicable models for other cities.
- Technology Integration: Leverage digital technologies, such as Building Information Modelling (BIM), Artificial Intelligence (AI), and Internet of Things (IoT), to enhance infrastructure development and citizen services.
- Sustainable Practices: Emphasize green building practices, energy-efficient designs, and renewable energy solutions to reduce environmental impact.
- Citizen Engagement: Encourage citizen participation in governance and decision-making processes through e-governance and digital platforms.

Benefits:

- Improved Quality of Life: Enhanced infrastructure, services, and amenities contribute to a better living experience for citizens.
- Economic Growth: Smart cities attract investments, create jobs, and stimulate local economies.
- Environmental Sustainability: Reduced energy consumption, waste management, and green spaces promote eco-friendly urban development.

Challenges:

- Implementation Delays: Regulatory approvals, funding issues, and coordination among stakeholders can hinder project timelines.
- Infrastructure Deficits: Existing infrastructure gaps need to be addressed to support smart city development.
- Capacity Building: Training and capacity building for urban local bodies and stakeholders are essential for successful implementation.

Way Forward:

- Learning from Global Best Practices: Adopting successful strategies from cities like Singapore and Barcelona can enhance India's smart city development.
- Innovative Financing Solutions: Exploring municipal green bonds and other financing options can support sustainable urban development.
- Data-Driven Decision Making: Leveraging data analytics and AI can inform policy decisions and optimize urban planning .

Strategic Initiatives by CIDC and India :

1. Technology Integration and Smart Practices

- Promoting adoption of **Building Information Modelling (BIM)**, **MIVAN shuttering**, 3D printing, and **precast construction** for speed, transparency, and quality.
- Supporting technology start-ups and MSMEs to create scalable smart construction solutions.

2. Sustainability and Green Innovation

- Launch of a **Green Steel Rating Framework**, aligned with the Ministry of Steel and international frameworks such as CBAM, to promote low-emission materials.
- Advocacy for **circular economy practices** in construction through material recycling and sustainable procurement standards.

3. Workforce Transformation and Safety

- Training and certifying construction professionals under national and international safety and quality frameworks.
- Strategic collaboration with global partners like **BCSP (USA)** to institutionalize **health, safety, and environmental best practices**.

4. Regional Equity and Smart Growth

- Focusing on India's **North Eastern Region** as a pilot for smart and climate-resilient infrastructure, with support from bilateral and multilateral partners including the **Republic of Korea**.
- Developing integrated townships, logistics hubs, and connectivity corridors under the **PM-DevINE initiative**.

Call for Regional Cooperation

CIDC proposes that AsiaConstruct evolve as a dynamic platform for actionable cooperation by:

- Creating a **shared knowledge repository** of smart construction pilots, policies, and toolkits.
- Launching an **AsiaConstruct Innovation Forum** to promote joint R&D, startups, and skill mobility programs.
- Facilitating **triangular cooperation models** (e.g., Korea–India–ASEAN or India–Japan–Africa) for implementing best practices in emerging and developing economies.

Conclusion

India reiterates its commitment to smart, inclusive, and sustainable infrastructure development. Through platforms like AsiaConstruct, we can collectively harness the strength of our diversity, share our innovations, and co-create resilient solutions for the region and beyond.

CIDC remains ready to support and participate in joint efforts to realise the shared vision of **"Smart Construction for Sustainable Development."**

IN Case Study: BIM Implementation in the Mumbai Coastal Road Project (MCRP)

Project Overview:

- **Project Name:** Mumbai Coastal Road Project (South Package)
- **Executing Agency:** Brihanmumbai Municipal Corporation (BMC)
- **Total Length:** Approx. 10.6 km
- **Estimated Cost:** ₹12,721 crore
- **Technology Used:** Building Information Modelling (BIM), GIS, Digital Twin, and Drone Mapping

Why BIM Was Chosen:

Given the project's complexity—constructing an 8-lane coastal freeway on reclaimed land with tunnels, interchanges, and sea walls in a high-density urban area—BMC opted to use **BIM** to:

- Enable **accurate planning** of utilities and alignments.
- Minimize **environmental and community disruption**.
- Ensure **coordination** among multiple consultants and contractors.
- Facilitate **real-time monitoring** of progress and quality.

Key Benefits Achieved:

✅ **Clash Detection & Design Optimization**

- BIM helped in detecting over **500+ potential clashes** in MEP, structure, and road alignments.
- Early resolution led to cost savings and reduced time delays.

✅ **Integrated Project Delivery**

- Seamless collaboration among **designers, engineers, contractors**, and **urban planners** through a **Common Data Environment (CDE)**.

✅ **Sustainability & Environmental Safeguards**

- BIM-supported environmental simulations enabled better marine structure alignment, minimizing ecological disruption and optimizing **wave deflection design**.

✅ **Digital Twin for O&M**

- A **digital twin** is being developed for post-completion asset management and preventive maintenance, ensuring long-term **cost efficiency** and **urban resilience**.

Lessons for AsiaConstruct Community:

- Large-scale urban infrastructure projects in coastal or congested zones benefit significantly from BIM-driven coordination.
- Embedding BIM in **public sector procurement frameworks** (like BMC did) can mainstream smart construction.
- Investing in BIM capability also supports **climate resilience**, better **risk management**, and **informed decision-making**.

Mumbai Coastal Road Project Progress Full Project Details.mp4

https://youtu.be/q2jrba6m0BA

Case Study: IoT Implementation in the Atal Mission for Rejuvenation and Urban Transformation (AMRUT) – Smart Water Management, Pune

Project Overview

- **Project:** IoT-based Smart Water Supply System
- **Location:** Pune, Maharashtra
- **Executing Authority:** Pune Municipal Corporation (PMC)
- **Program:** Under AMRUT and Smart Cities Mission
- **Technology Partner:** L&T Smart World & Communications

Objective

To create a **real-time, efficient, and equitable urban water distribution system** by deploying an **IoT-based network** to monitor flow, pressure, consumption, and leakages — thereby reducing water loss and improving transparency.

Key IoT Deployments

1. **Smart Flow Meters** with integrated IoT sensors across bulk supply points and distribution zones.
2. **Pressure Monitoring Sensors** installed in critical pipelines to detect abnormal fluctuations or bursts.
3. **Remote Monitoring via SCADA** systems and cloud-based dashboards.
4. **Smart Consumer Meters** for real-time consumption tracking and leak detection.
5. **Mobile App Integration** for field teams and citizens to report and track issues.

Impact & Results

✅ **Operational Efficiency:**

- Detected and reduced **Non-Revenue Water (NRW)** by 20% in Phase 1.
- Enabled **predictive maintenance** and reduced emergency shutdowns.

✅ **Data-Driven Decision Making:**

- IoT data helped in **demand forecasting** and **equitable distribution** across wards, particularly during summer stress.

✅ **Citizen Satisfaction:**

- Billing transparency improved.
- Complaints related to leakages and overuse reduced significantly.

✅ **Sustainability:**

- Lowered energy consumption by optimizing pump operations based on real-time demand.
- Minimized water wastage — aligning with UN SDG 6: Clean Water and Sanitation.

Relevance to Smart Construction

This case highlights the role of **IoT in infrastructure lifecycle management** — demonstrating how **digital technologies enhance construction utility, sustainability, and governance**. Lessons from this model are now being replicated in solid waste management, street lighting, and smart traffic control across India.

Conclusion

Pune's smart water initiative illustrates the power of **IoT as a key enabler of sustainable infrastructure**. It showcases how public agencies can leverage construction technologies to build **resilient, efficient, and citizen-centric urban systems** — a model worth scaling across the AsiaConstruct community.

Amrit Smart Water Supply Measurement and Quality Monitoring System.mp4

https://youtu.be/hnMvZENoohA

Case Study: AI-Based Quality Monitoring in Delhi Metro Rail Corporation (DMRC) Projects

Project Overview

- **Organization:** Delhi Metro Rail Corporation (DMRC)
- **Scope:** Phase III and IV Metro Network Construction
- **Technology Partner:** Tata Consultancy Services (TCS) & internal DMRC engineering teams
- **Focus Area:** AI-based defect detection, project monitoring, and predictive maintenance

Objective

To improve **quality assurance**, reduce manual inspection efforts, and detect **early-stage construction defects** using **AI-powered computer vision** and predictive analytics.

AI Applications Implemented

1. **Computer Vision for Surface Quality Checks**
    - Cameras mounted on mobile devices and drones captured thousands of site images.
    - An AI model trained on historical defect data automatically identified cracks, surface inconsistencies, honeycombing, and reinforcement issues.
2. **Predictive Maintenance Analytics**
    - AI tools analyzed historical sensor data (vibration, temperature, stress) from tunnel boring machines (TBMs) and elevated structures.
    - Preventive actions were initiated based on failure trend forecasts.
3. **Progress Monitoring using AI-enabled Drones**
    - Periodic drone surveys were analyzed by AI algorithms to map actual progress vs. planned schedules, identifying lagging areas.
4. **Natural Language Processing (NLP) Tools**
    - AI models extracted insights from thousands of contractor reports, detecting recurring issues and prioritizing safety risks.

Key Outcomes

✅ **Improved Quality Control**

- Reduced **manual errors by over 70%** in defect identification.
- Significantly faster detection and correction of issues — **saving nearly 15% in rework costs**.

✅ **Enhanced Safety**

- Real-time insights helped prevent potential failures, especially in underground sections and elevated viaducts.

✅ **Efficiency and Cost Savings**

- Time required for manual site inspections reduced by **up to 50%**.
- Improved contractor accountability and compliance through automated logs.

✅ **Sustainability**

- Lowered material wastage through precise defect tracking.
- AI-assisted scheduling reduced energy use from idle equipment and rework.

Relevance to AsiaConstruct Goals

- Demonstrates a **scalable model for AI adoption** in large infrastructure projects.
- Encourages **digitally augmented supervision and quality assurance**, especially in urban megaprojects.
- Validates how **AI-driven construction management** can support the dual goals of **smartness and sustainability**.

LT Realty Case Study Leveraging Ciscos EndtoEnd Portfolio for Indias Smartest Building.mp4

Conclusion : The DMRC case presents a strong Indian example of **AI as a transformative tool** in smart infrastructure development. It underlines the potential of public agencies to **mainstream AI into routine construction practices**, ensuring better quality, safety, and cost-effectiveness.