From Infrastructure to Intelligent Mobility

- *International Workshop on Intelligent Transport Systems and Urban Mobility Management for Metropolitan Areas*

May 2026

New Development Bank

CONTENTS

SUMMARY

Photo: Delegation Visit to NDB Headquarters

Upon request of the Government of India the New Development Bank (**NDB**) has been working on Hyderabad Elevated Corridor Project aimed at addressing increasing congestion, improving urban mobility, and strengthening metropolitan connectivity across the Hyderabad Metropolitan Region (**HMR**). As part of this work, NDB organized an international knowledge-sharing workshop on Intelligent Transport Systems (**ITS**) and Urban Mobility Management for Metropolitan Areas in Shanghai, China.

The workshop was designed to support the Government of Telangana and the Hyderabad Metropolitan Development Authority (**HMDA**) in identifying innovative and scalable technological solutions applicable to both the proposed Hyderabad Elevated Corridor Project and the broader Hyderabad 2050 Mobility Plan. Given Hyderabad's status as one of India's leading information technology hubs, the workshop emphasized practical applications of advanced technologies—including artificial intelligence (**AI**), digital twins, intelligent traffic management systems, predictive analytics, and integrated mobility platforms—to support the transition toward a smarter, more efficient, and sustainable metropolitan transport system.

The workshop brought together representatives from Department of Economic Affairs, Ministry of Finance India, HMDA, sector specialists, and NDB staff through technical exchanges, site visits, and seminars with leading transport system operators, engineering institutions, research organizations, and technology providers in Shanghai. The program focused on city-level intelligent traffic operations, congestion management, smart infrastructure lifecycle systems, mobility-as-a-service ecosystems, and emerging technologies for metropolitan transport governance.

A major component of the workshop involved a technical engagement with Shanghai Electric Intelligent System Co., Ltd. (**SEISYS**), one of China's leading ITS solution providers and long-term operators of Shanghai's integrated traffic management ecosystem. Participants were introduced to Shanghai's Traffic Comprehensive Information Platform (**TCIP**), a city-scale digital backbone that integrates real-time traffic monitoring, incident management, adaptive signal control, and multimodal coordination into a unified governance framework. Discussions highlighted how Shanghai's transition from reactive traffic management toward proactive, AI-enabled congestion mitigation has contributed to measurable reductions in travel delays, improved traffic operations, and more efficient use of road infrastructure.

The workshop also explored the growing role of AI-powered congestion analytics, dynamic signal optimization systems, and predictive traffic modeling in metropolitan transport management. Further sessions focused on digital ecosystems for urban mobility, including integrated platforms for smart parking, multimodal coordination, transportation hub management, and climate-responsive transport systems.

The workshop also provided insights into Building Information Modeling (**BIM**)-enabled infrastructure planning, digital twin technologies, and full lifecycle asset management systems for large-scale transport infrastructure. Shanghai's experience demonstrated how digital twins and real-time infrastructure monitoring can improve construction supervision, optimize maintenance planning, enhance operational safety, and reduce lifecycle costs of transport assets such as expressways, bridges, tunnels, and elevated structures. Academic perspectives from NYU Shanghai further enriched discussions on AI-driven urban mobility.

Overall, the workshop successfully created a platform for international knowledge exchange and technical learning, contributing directly to the refinement of intelligent transport strategies for Hyderabad. The insights generated through the workshop support a key objective under NDB's General Strategy 2022–2026, which emphasizes the Bank's role as a catalyst for innovation, knowledge sharing, and sustainable infrastructure development among its member countries.

This report consolidates the key lessons, operational experiences, and preliminary technical recommendations emerging from the workshop, with the objective of informing the design and implementation of smart mobility interventions under both the Hyderabad Elevated Corridor Project and the Hyderabad 2050 Mobility Plan.

01.

LEVERAGING INTERNATIONAL EXPERIENCE FOR HYDERABAD'S SMART MOBILITY TRANSFORMATION

Hyderabad's Metropolitan Mobility Challenge

Hyderabad has emerged as one of India's fastest-growing metropolitan regions and a major center for information technology, pharmaceuticals, advanced manufacturing, and logistics. Sustained economic growth, rapid urban expansion, and rising motorization have substantially increased travel demand across the metropolitan region, particularly along high-growth economic corridors linking residential, industrial, and commercial centers.

While this transformation has strengthened Hyderabad's position as a leading economic hub, it has simultaneously intensified mobility challenges associated with congestion, travel delays, road safety, emissions, and reduced transport efficiency. Increasing traffic volumes, mixed traffic conditions, limited right-of-way availability, and operational bottlenecks at key intersections continue to affect corridor performance across major parts of the city. Peak-hour congestion has progressively reduced travel speeds and increased travel uncertainty, affecting commuter productivity and economic competitiveness.

To address these challenges, the Government of Telangana has advanced a long-term metropolitan mobility vision under the Hyderabad 2050 Mobility Plan, emphasizing integrated transport systems, multimodal connectivity, sustainable infrastructure, and intelligent mobility solutions. Within this broader framework, the proposed Hyderabad Elevated Corridor Project seeks to improve mobility efficiency, strengthen metropolitan connectivity, reduce travel times, and alleviate congestion across strategically important urban corridors.

However, international experience increasingly demonstrates that physical infrastructure expansion alone is often insufficient to sustainably address urban congestion. While elevated roads and corridor expansions can improve mobility in the short to medium term, their long-term effectiveness depends significantly on how efficiently traffic is managed and integrated across the broader transport network.

Consequently, many metropolitan regions are transitioning toward ITS, AI-enabled traffic management, integrated operational platforms, and predictive mobility systems that combine physical infrastructure with real-time operational intelligence.

NDB's Knowledge Exchange Initiative

Recognizing the growing importance of smart mobility systems, the NDB organized the *International Workshop on Intelligent Transport Systems and Urban Mobility Management for Metropolitan Areas* in Shanghai, China, to support technical learning relevant to the proposed Hyderabad Elevated Corridor Project and the broader Hyderabad 2050 Mobility Plan.

The program combined technical presentations, knowledge-sharing sessions, and site-based discussions covering key themes relevant to Hyderabad's future mobility system, including: intelligent traffic management systems and integrated operations platforms; AI-enabled congestion prediction and adaptive traffic management; smart expressway and elevated corridor operations; digital twins and BIM-enabled infrastructure lifecycle management; mobility data systems and digital governance; and emerging technologies for sustainable metropolitan mobility.

Why Shanghai's Experience Matters for Hyderabad

Shanghai offers valuable lessons for Hyderabad due to several comparable metropolitan characteristics, including rapid economic growth, increasing motorization, large-scale infrastructure expansion, and rising mobility pressures.

Over several decades, Shanghai has progressively transitioned from conventional traffic management approaches toward a highly integrated urban mobility system supported by city-wide intelligent transport systems, AI-enabled traffic operations, predictive congestion management, and coordinated institutional governance. Rather than relying exclusively on continuous road expansion, Shanghai increasingly emphasizes intelligent operational strategies that optimize infrastructure utilization, improve travel efficiency, reduce delays, and strengthen emergency response capability through integrated digital systems.

For Hyderabad, these lessons are particularly relevant as the city advances the Elevated Corridor Project while simultaneously pursuing a long-term metropolitan mobility strategy under the Hyderabad 2050 Mobility Plan.

The workshop therefore provided an important opportunity to examine how international experience in intelligent mobility systems may inform the future design, operation, and management of transport infrastructure in Hyderabad.

02.
INTELLIGENT TRANSPORT SYSTEMS AND METROPOLITAN TRAFFIC MANAGEMENT

2.1 Integrated Traffic Operations and the Traffic Comprehensive Information Platform (TCIP)

One of the workshop's key technical sessions focused on Shanghai's TCIP, which functions as the city's central digital backbone for mobility management. Developed and supported by SEISYS, the platform integrates information from multiple transport systems into a unified operational environment capable of supporting metropolitan-scale traffic monitoring, congestion management, incident response, and corridor optimization.

TCIP consolidates information from diverse sources, including traffic cameras and video surveillance systems; roadside sensors and traffic detectors; GPS-based mobility information; traffic incident reporting systems; weather and environmental monitoring platforms; and infrastructure systems associated with bridges, tunnels, and expressways.

Photo: Delegation visit to SEISYS

The workshop highlighted how integrated traffic platforms can significantly improve mobility governance by enabling real-time traffic monitoring; faster incident detection and response; improved coordination among agencies; dynamic traffic operations; corridor-level performance analysis; and better planning based on operational data.

Participants observed that such integrated systems may be particularly relevant for Hyderabad, where elevated corridors will need to operate within a broader metropolitan transport ecosystem rather than as standalone infrastructure assets.

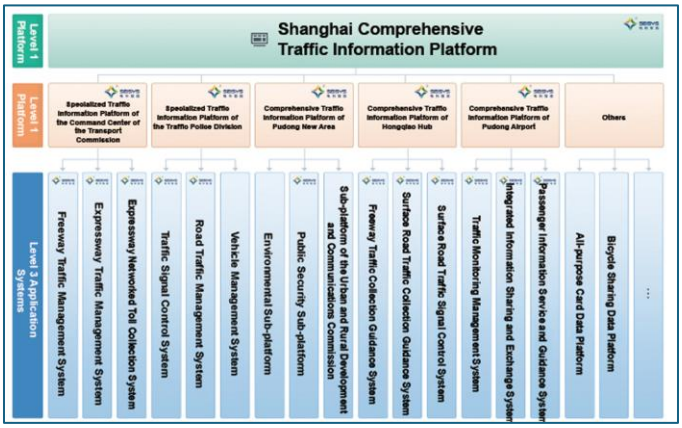

Photo: TCIP Model

2.2 AI-Enabled Congestion Management and Predictive Mobility

A major theme throughout the workshop concerned Shanghai's growing use of AI and predictive analytics to improve congestion management. Traditional traffic management systems typically rely on reactive approaches, whereby interventions are implemented only after congestion or operational disruptions become severe. In contrast, Shanghai increasingly applies predictive traffic management, using AI systems capable of identifying emerging congestion risks before traffic conditions deteriorate.

The workshop introduced an operational framework based on:

"Precision Perception – Intelligent Prediction – Proactive Intervention – Closed-Loop Optimization."

Under this model, traffic management systems continuously analyze large volumes of mobility data to identify abnormal traffic behavior; detect congestion hotspots; predict queue spillovers and bottlenecks; assess corridor saturation levels; forecast downstream disruptions; and recommend operational interventions.

These systems support more dynamic mobility management through adaptive traffic operations, where traffic signals, corridor controls, and operational responses are continuously adjusted based on real-time conditions rather than fixed traffic assumptions.

Photo: Intelligent connected vehicle traffic management application

2.3 Smart Elevated Corridor and Expressway Operations

Another important component of the workshop focused on the management of smart expressways, bridges, tunnels, and elevated transport infrastructure. Discussions emphasized that elevated roads increasingly require intelligent operational systems to manage traffic complexity, ensure safety, and maintain long-term reliability.

Shanghai's experience demonstrated that smart corridor systems can support real-time corridor monitoring; dynamic traffic management; automatic incident detection; emergency response coordination; traveler information systems; and infrastructure performance monitoring.

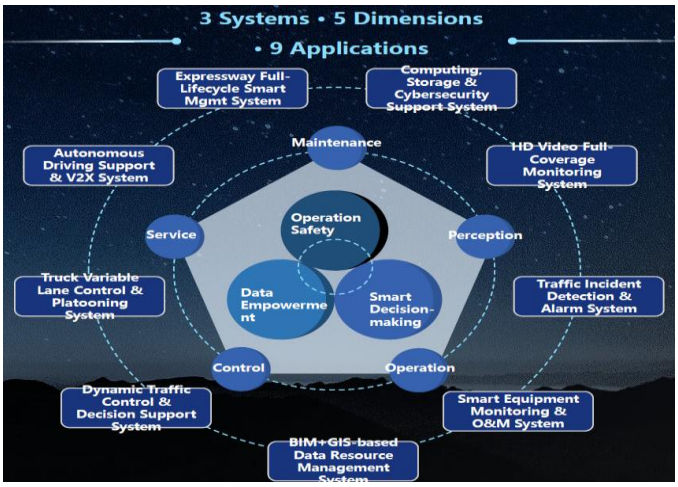

Photo: Integrated Smart Highway Management Framework

Technical sessions highlighted the example of Shanghai's S32 Smart Expressway, where integrated sensing systems, monitoring technologies, and predictive analytics are utilized to improve corridor efficiency and operational resilience. Rather than functioning as isolated transport assets, elevated roads in Shanghai are increasingly integrated into broader metropolitan traffic systems capable of coordinating operations between expressways, surface roads, signals, and emergency response services.

2.4 Key Implications for Hyderabad

Several important lessons emerged from Shanghai's experience that may inform Hyderabad's future mobility strategy.

First, intelligent transport systems should be integrated into the planning and design of transport infrastructure from the early stages, rather than introduced after construction.

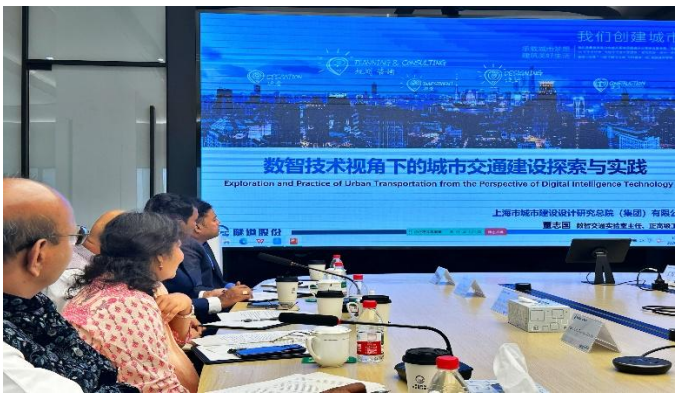

Photo: Delegation visit to Shanghai Urban Construction Design & Research Institute

Second, elevated corridors should function as components of a larger metropolitan mobility ecosystem linked to traffic signals, public transport systems, and city-level traffic management platforms.

Third, Hyderabad may benefit from establishing an integrated metropolitan traffic management framework capable of combining real-time monitoring, predictive congestion management, and coordinated corridor operations.

Finally, intelligent mobility systems should be viewed not only as traffic management tools but also as mechanisms for improving sustainability, infrastructure efficiency, resilience, and long-term mobility performance.

The workshop demonstrated that the future effectiveness of urban transport investments will increasingly depend not only on the scale of infrastructure developed but also on the ability of cities to manage mobility intelligently through integrated systems, predictive analytics, and coordinated governance.

Photo: Smart expressway command center application

03.
DIGITAL ECOSYSTEM, DATA GOVERNANCE, AND MOBILITY INTELLIGENCE

BUILDING AN INTEGRATED DIGITAL FOUNDATION FOR FUTURE MOBILITY

As metropolitan mobility systems become increasingly complex, effective transport management requires more than physical infrastructure and conventional traffic engineering. Cities are increasingly adopting integrated digital ecosystems that connect infrastructure, operational systems, institutional actors, and data platforms to support coordinated and evidence-based mobility governance.

During the workshop, participants engaged with experts from a top-tier technology enterprise to explore how advances in AI, cloud computing, semantic search technologies, federated data systems, and digital collaboration platforms can support decision-making in large and complex urban systems. Although discussions extended beyond transport into broader applications related to climate governance and digital public infrastructure, several important lessons emerged for metropolitan mobility planning in Hyderabad.

Photo: Delegation visit to a prominent provider of AI-powered urban mobility solutions.

3.1 From Fragmented Systems to Integrated Mobility Intelligence

A recurring challenge highlighted during the workshop concerns the persistence of "data silos", whereby transport-related information remains fragmented across multiple agencies and operational systems with limited interoperability. In many metropolitan areas, data relating to traffic management; public transport operations; infrastructure systems; land use planning; parking management; environmental monitoring; and emergency response services are maintained independently, limiting opportunities for coordinated decision-making.

The workshop emphasized that effective metropolitan mobility increasingly requires a transition from fragmented databases toward integrated mobility intelligence systems, where information from different sectors can be analyzed collectively to support planning and operations.

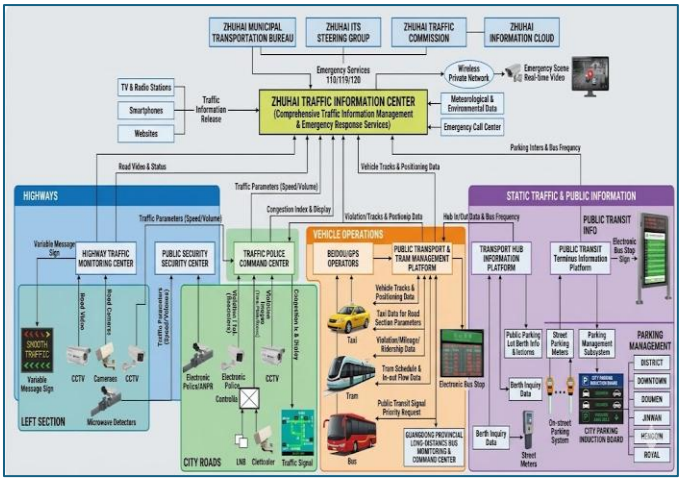

Photo: Zhuhai ITS Planning Architecture

The technology firm demonstrated how digital ecosystems can help consolidate complex information environments through interoperable platforms capable of supporting cross-sector coordination, real-time analytics, and AI-enabled decision support. Discussions highlighted how such approaches may strengthen urban governance by improving institutional coordination and reducing informational fragmentation.

For Hyderabad, this lesson is particularly relevant given the involvement of multiple agencies in mobility management, including road authorities, traffic police, metro systems, municipal agencies, planning institutions, and environmental authorities.

3.2 AI-Enabled Knowledge Systems and Decision Support

An important area explored during the engagement concerned the application of AI-enabled knowledge systems to support institutional learning, information retrieval, and technical decision-making.

The workshop demonstrated how large volumes of technical reports, datasets, operational information, and policy materials can be transformed into searchable and interactive knowledge systems using semantic search technologies and

natural language interfaces. Rather than relying on conventional document repositories, these systems enable users to rapidly identify relevant information and synthesize evidence across large information ecosystems.

Photo: Delegation visit to the AI center of a leading Chinese technology company

Participants observed that similar approaches may offer substantial benefits for metropolitan mobility planning and infrastructure management. For example, Hyderabad could potentially establish a Mobility Knowledge and Decision Support Platform capable of consolidating traffic and corridor studies; infrastructure designs and engineering records; congestion analyses; environmental and emissions information; maintenance records; and mobility demand forecasts.

Photo: Delegation visit to Shanghai Urban Construction Design & Research Institute

The workshop also highlighted the growing role of AI-assisted scenario analysis, enabling city managers to simulate and evaluate operational interventions before implementation for evidence-based planning. Potential applications may include predicting traffic impacts of new elevated corridors; evaluating congestion spillovers; testing signal optimization strategies; assessing incident response scenarios; and supporting long-term transport investment planning.

3.3 Institutional Coordination and Metropolitan Governance

The workshop reinforced the understanding that technological systems alone cannot ensure successful mobility outcomes without effective institutional coordination and governance frameworks.

International experience suggests that intelligent mobility systems perform best when supported by clear coordination mechanisms among agencies responsible for transport planning, traffic operations, public transport, infrastructure management, and environmental oversight.

An important concept discussed during the sessions was the idea of federated information systems, whereby institutions maintain ownership of their respective data while enabling secure interoperability across organizations. This approach can improve information sharing without requiring full institutional consolidation of systems.

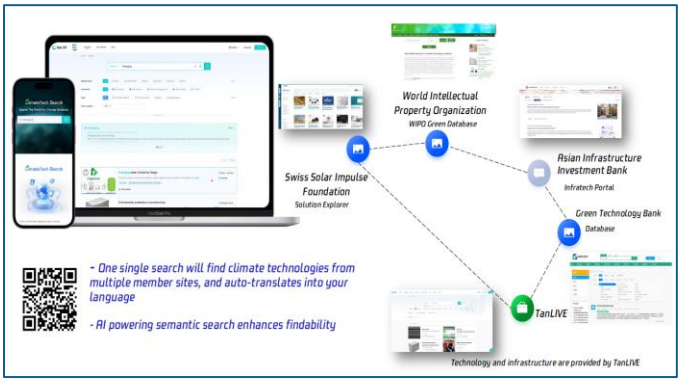

Photo: Digital Infrastructure for Global Climate Innovation

For Hyderabad, such an approach may offer a practical pathway toward strengthening metropolitan mobility coordination while respecting institutional mandates across agencies.

The workshop demonstrated that metropolitan mobility governance increasingly requires institutions to move beyond sector-specific operations toward integrated and collaborative management systems capable of responding to increasingly dynamic urban mobility challenges.

The discussions further reinforced the broader lesson that future mobility competitiveness will increasingly depend on a city's ability to combine technology, institutional coordination, and data-driven decision-making into a coherent metropolitan transport governance framework.

04.
SMART INFRASTRUCTURE LIFECYCLE MANAGEMENT

A major component of the workshop focused on how digital technologies are transforming the planning, construction, operation, and maintenance of metropolitan transport infrastructure. Technical discussions with the Shanghai Municipal Engineering Design Institute (**SMEDI**) highlighted the growing role of BIM, digital twins, IoT-enabled monitoring systems, and predictive maintenance technologies in improving infrastructure performance and lifecycle management.

Photo: Delegation visit to SMEDI

The discussions highlighted an important transition in infrastructure management: moving from conventional approaches centered primarily on project delivery toward full lifecycle asset management, where infrastructure performance is continuously monitored and optimized throughout its operational life.

4.1 BIM and Integrated Infrastructure Management

SMEDI demonstrated how BIM is increasingly being used to support integrated planning, design coordination, construction management, and operational monitoring for major transport assets including urban expressways, bridges, tunnels, and multimodal transport facilities.

Rather than functioning solely as a three-dimensional design tool, BIM was presented as a comprehensive digital framework capable of integrating engineering, operational, maintenance, and asset information throughout the infrastructure lifecycle.

The workshop highlighted how BIM systems may improve design coordination across engineering disciplines; construction sequence and supervision; project quality management; asset inventory systems; and long-term maintenance planning.

For large and technically complex infrastructure such as elevated corridors, BIM can help maintain continuity of engineering information between planning, construction, and operational stages, reducing inefficiencies and improving lifecycle performance.

4.2 Digital Twins and Real-Time Infrastructure Monitoring

The workshop also explored the growing application of digital twins in transport infrastructure management.

A digital twin refers to a dynamic digital representation of physical infrastructure, continuously updated using real-time operational and monitoring data. By integrating sensor information, engineering specifications, traffic operations, and infrastructure performance indicators, digital twins allow operators to better understand infrastructure conditions and anticipate operational risks.

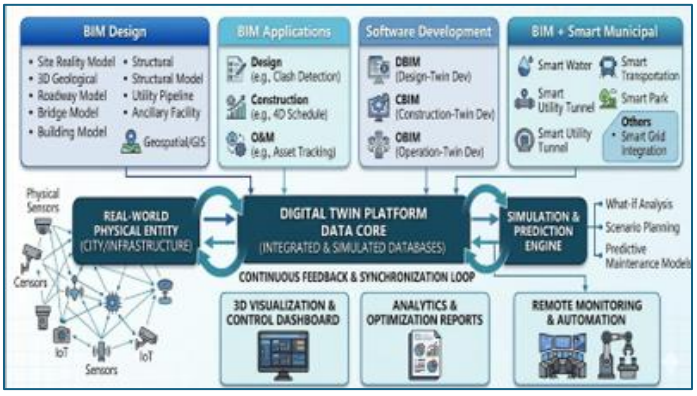

Photo: BIM driven Digital Twin Architecture

Participants were introduced to examples where digital twin systems support such as structural health monitoring; real-time infrastructure performance tracking; traffic and corridor management; emergency preparedness; predictive maintenance; and infrastructure resilience assessments.

Rather than relying solely on periodic inspections or reactive maintenance, digital twins enable infrastructure operators to identify emerging issues before failures occur. These capabilities are particularly relevant for elevated corridor systems, where structures, ramps, lighting systems, drainage, surveillance equipment, and traffic management devices require continuous operational monitoring.

Photo: Delegation visit to SMEDI IT Centre

Academic sessions at NYU Shanghai focused on the role of AI, data systems, and sustainable mobility planning. Presentations explored how advances in machine learning, mobile-phone mobility datasets, and spatial analytics are increasingly enabling cities to better understand travel behaviour, predict mobility demand, and support evidence-based transport planning.

Discussions also highlighted emerging research on low-carbon urban mobility, equity in mobility systems, insights across the global south, low carbon travels, and climate-responsive transport governance, reinforcing the importance of integrating sustainability, data governance, and technological innovation into future metropolitan mobility systems.

Photo: Delegation visit to NYU Shanghai

4.3 Predictive Maintenance and Infrastructure Resilience

One of the lessons from the workshop was the growing importance of predictive maintenance systems, which utilize sensors, monitoring systems, and AI-enabled analytics to anticipate maintenance needs before infrastructure deterioration becomes severe.

Traditional maintenance systems often depend on fixed inspection schedules or reactive interventions following equipment failure. In contrast, predictive systems enable infrastructure managers to prioritize interventions based on real-time conditions and operational risk.

SMEDI highlighted how intelligent infrastructure systems increasingly incorporate structural monitoring sensors; automated diagnostics; environmental monitoring systems; equipment performance analytics; and AI-supported maintenance prioritization. Such systems may improve infrastructure reliability, reduce operational disruptions, and lower long-term lifecycle costs.

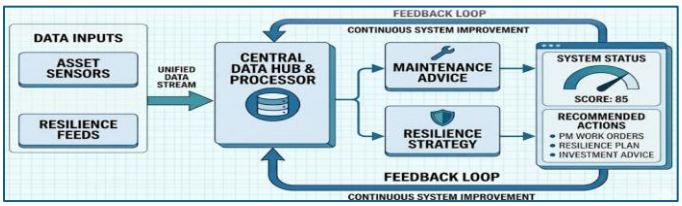

Photo: Predictive Maintenance Flow diagram

For Hyderabad, participants observed that integrating BIM, digital twins, and predictive maintenance approaches during the planning and design stages may improve long-term operational performance while strengthening resilience and safety outcomes.

4.4 Infrastructure Projects in Shanghai

The workshop highlighted SMEDI's work on Shanghai's Beiheng Passage pilot project, where a digital lifecycle platform supports long-term tunnel and expressway maintenance through the integration of engineering information, traffic operations, infrastructure condition monitoring, and maintenance planning.

The workshop also included discussions on the Shanghai Hongqiao Comprehensive Transportation Hub. SMEDI demonstrated how digital planning tools, integrated transport design, and coordinated mobility systems were utilized to support seamless passenger movement and operational efficiency across multiple transport modes.

4.5 Key Implications for Hyderabad

Several lessons emerging from the workshop may be relevant for Hyderabad's future infrastructure systems.

First, digital engineering systems such as BIM should be integrated from the early stages of project development to improve implementation efficiency and lifecycle continuity.

Second, elevated corridors should increasingly be treated as intelligent infrastructure systems requiring real-time monitoring and operational intelligence.

Third, digital twins and predictive maintenance systems may significantly improve asset reliability and reduce lifecycle costs.

The workshop demonstrated that future transport infrastructure effectiveness will increasingly depend not only on construction quality but also on the ability to manage assets intelligently throughout their lifecycle.

05.

CONCLUSION

TOWARD AN INTELLIGENT, INTEGRATED, AND FUTURE-READY MOBILITY SYSTEM FOR HYDERABAD

The International Workshop on Intelligent Transport Systems and Urban Mobility Management for Metropolitan Areas provided an important platform for technical exchange and institutional learning relevant to Hyderabad's future mobility transformation. Through engagements with leading institutions in Shanghai, the workshop generated practical insights into how metropolitan regions are increasingly leveraging ITS, AI, digital ecosystems, predictive analytics, BIM-enabled lifecycle management systems, and integrated governance frameworks to address rapidly evolving mobility challenges.

A central lesson emerging from the workshop is that future metropolitan mobility systems can no longer rely exclusively on physical infrastructure expansion to address congestion and travel inefficiencies. While investments in elevated corridors, roads, and transport infrastructure remain essential, international experience increasingly demonstrates that infrastructure effectiveness depends significantly on the ability of cities to manage mobility intelligently through real-time operations, integrated systems, and predictive decision-making.

Shanghai's experience highlighted how metropolitan mobility governance has progressively evolved from fragmented and reactive traffic management toward integrated, data-driven, and predictive operational systems. The deployment of city-wide traffic management platforms, AI-enabled congestion analytics, adaptive signal systems, smart corridor management tools, and coordinated emergency response mechanisms demonstrated how technology can improve infrastructure utilization, reduce travel delays, and strengthen operational resilience.

The workshop further emphasized the growing importance of integrated digital ecosystems and mobility intelligence systems capable of linking traffic management, infrastructure operations, public transport systems, environmental monitoring, and urban planning within a unified decision-making framework. The ability to integrate and interpret large volumes of mobility-related information increasingly represents a critical capability for metropolitan governance.

Similarly, discussions on digital twins, BIM, and predictive maintenance systems highlighted how future infrastructure management is increasingly transitioning toward lifecycle-oriented approaches, where infrastructure assets are continuously monitored and optimized throughout their operational life. For long-life infrastructure systems such as elevated corridors, these technologies may contribute to improved reliability, lower maintenance costs, stronger resilience, and enhanced safety outcomes.

For Hyderabad, the workshop generated particularly relevant insights given the city's dual objectives of implementing the Hyderabad Elevated Corridor Project while advancing the broader vision articulated under the Hyderabad 2050 Mobility Plan. The discussions reinforced the importance of ensuring that future mobility investments are planned not as isolated infrastructure assets, but as components of an integrated metropolitan mobility ecosystem capable of dynamically managing traffic demand, improving accessibility, and supporting sustainable urban growth.

The workshop also underscored Hyderabad's significant potential to emerge as a leader in intelligent urban mobility given its strong technology ecosystem and capabilities in software development, artificial intelligence, digital systems, and innovation. These strengths create opportunities to foster partnerships among government institutions, research organizations, universities, and technology providers to develop mobility solutions tailored to Hyderabad's specific urban context.

Importantly, the lessons emerging from the workshop extend beyond short-term congestion management and provide strategic direction for long-term metropolitan mobility governance. Future urban competitiveness will increasingly depend on the ability of cities to develop transport systems that are efficient, resilient, adaptive, sustainable, and technologically responsive.

In this regard, the workshop successfully fulfilled its objective of strengthening technical understanding and facilitating international knowledge exchange while generating practical lessons that may support future planning, project preparation, and institutional strengthening efforts in Hyderabad. Consistent with the objectives of NDB's General Strategy 2022–2026, the initiative further reinforced the role of the NDB not only as an infrastructure financier, but also as a facilitator of innovation, knowledge partnerships, and sustainable urban development among member countries.