AEC FORUM

GEOSPATIAL + BIM + DIGITAL TWIN

RESILIENT INFRASTRUCTURE THROUGH DIGITALIZATION: ENABLING VIKSIT BHARAT

21 - 22 AUGUST 2025

Vivanta, Dwarka, New Delhi

Theme of the presentation:

BIM & 4IR for Streamlined and Coordinated Metro, Semi-speed, High-speed Project Planning

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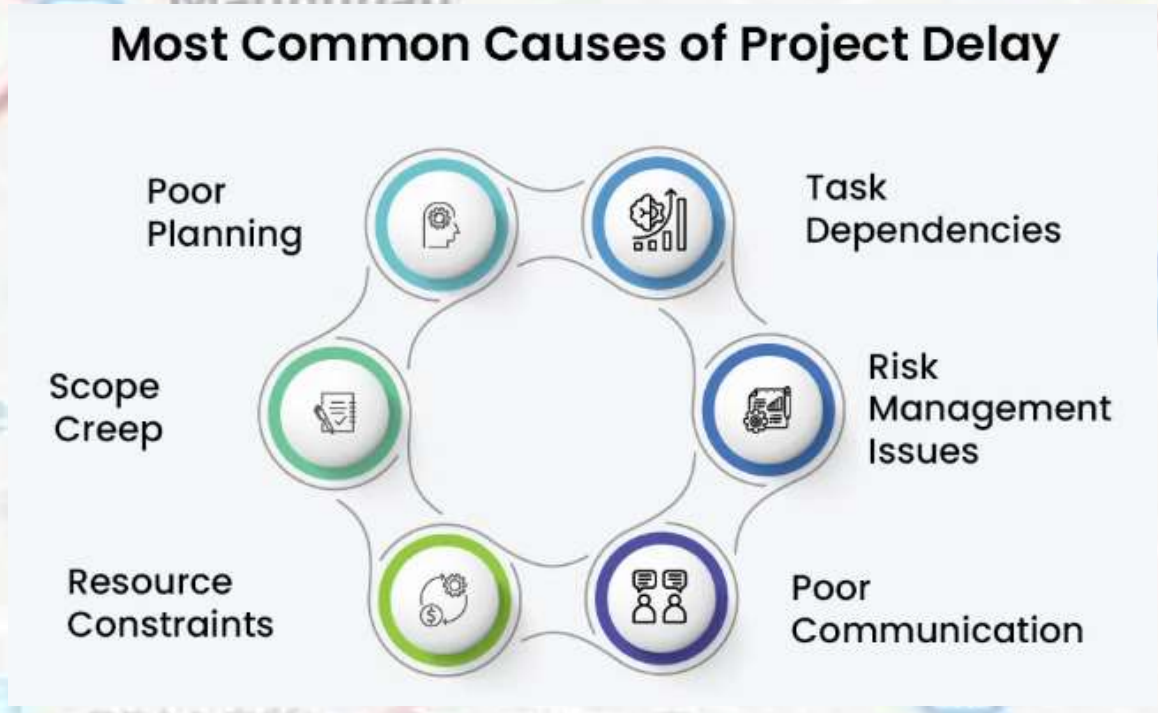
DATE: 22.08.25

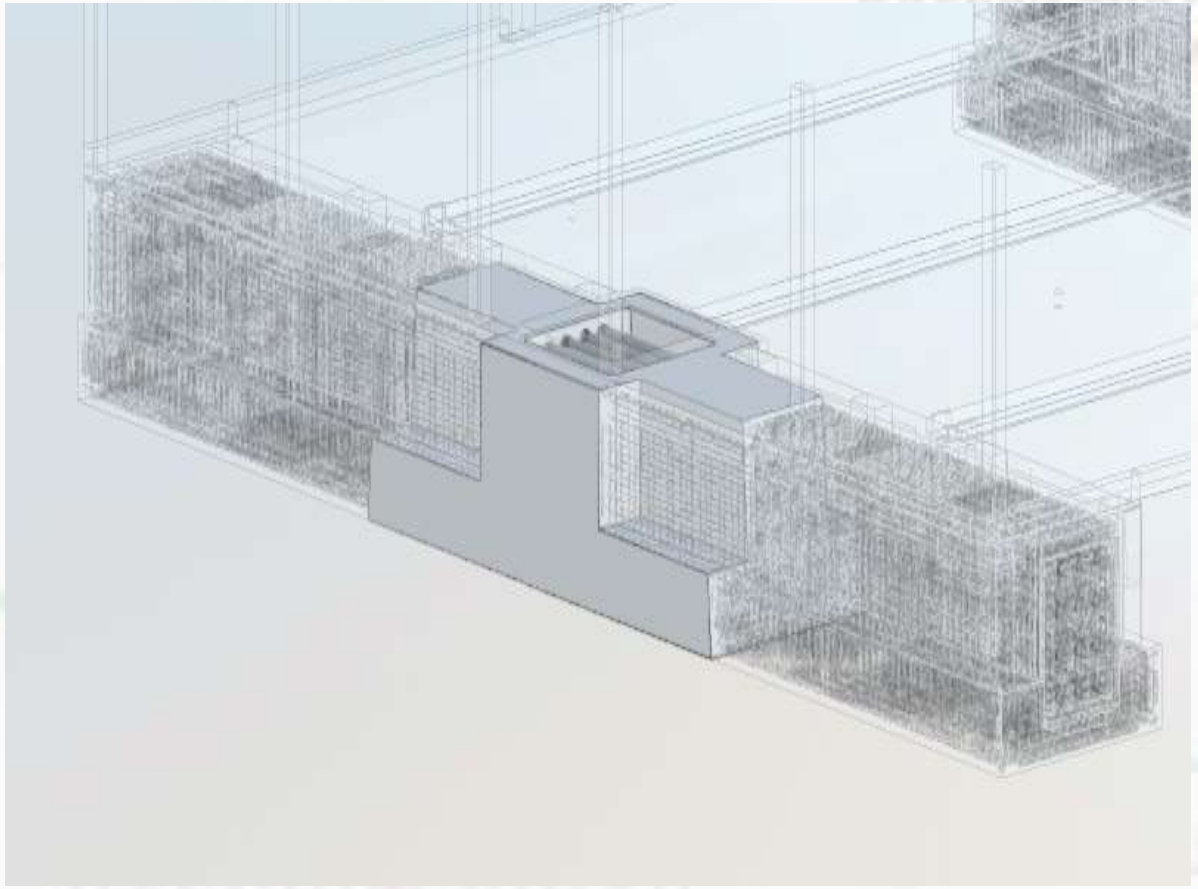
Causes of Construction Delays (Statistics)



- **As per KPMG, Only 25% of the Construction Projects are completed within 10% of the Original Deadlines**
- **25% of the Projects delays due to Planning, Design & Scheduling problems**
- **8% of the Projects delays due to Reworks at Site**

Courtesy: Various sources on Google

Using BIM for integrated design, construction sequencing, and stakeholder coordination across large-scale metro and high-speed projects.



Agenda points:

- Why BIM in Large-Scale Projects?
- Integrated Design (3D BIM)Overview of BIM
- Construction Sequencing (4D BIM)Challenges & Lesson Learned
- Stakeholder Coordination
- Extended BIM Benefits
- Conceptual Flowchart
- Conclusion

Why BIM in Large-Scale Projects?

- Complex, multi-disciplinary designs (Civil, MEP, Systems, Architecture)
- Urban constraints & sequencing challenges
- Multiple stakeholders → risk of misalignment
- Need for cost, time, and risk optimization

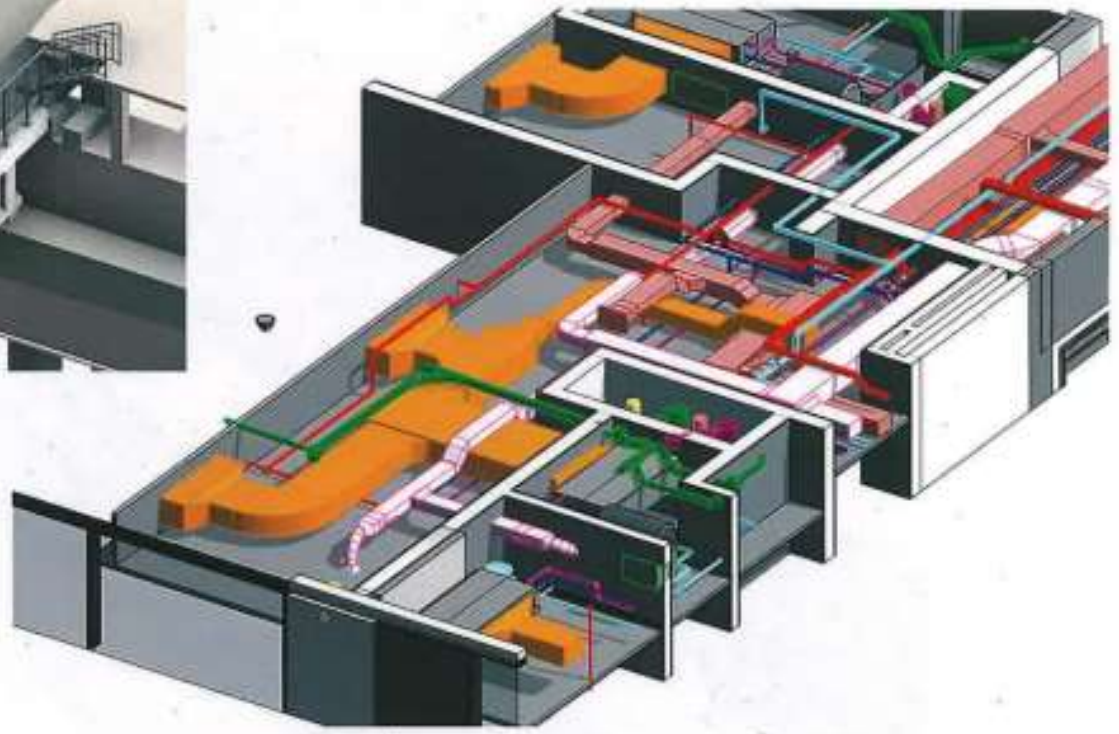
Integrated Design (3D BIM)

- Centralized digital model (Civil + MEP + Stations + Systems)
- Clash detection before construction
- Enhanced visualization for approvals
- Integration with GIS/topography
- Outcome → Reduced rework & faster approvals

BIM & 3D MESH (TOPOGRAPHY) INTEGRATION

Snapshots from Metro project (Coordinated Model)

MEPF Coordinated BIM Model

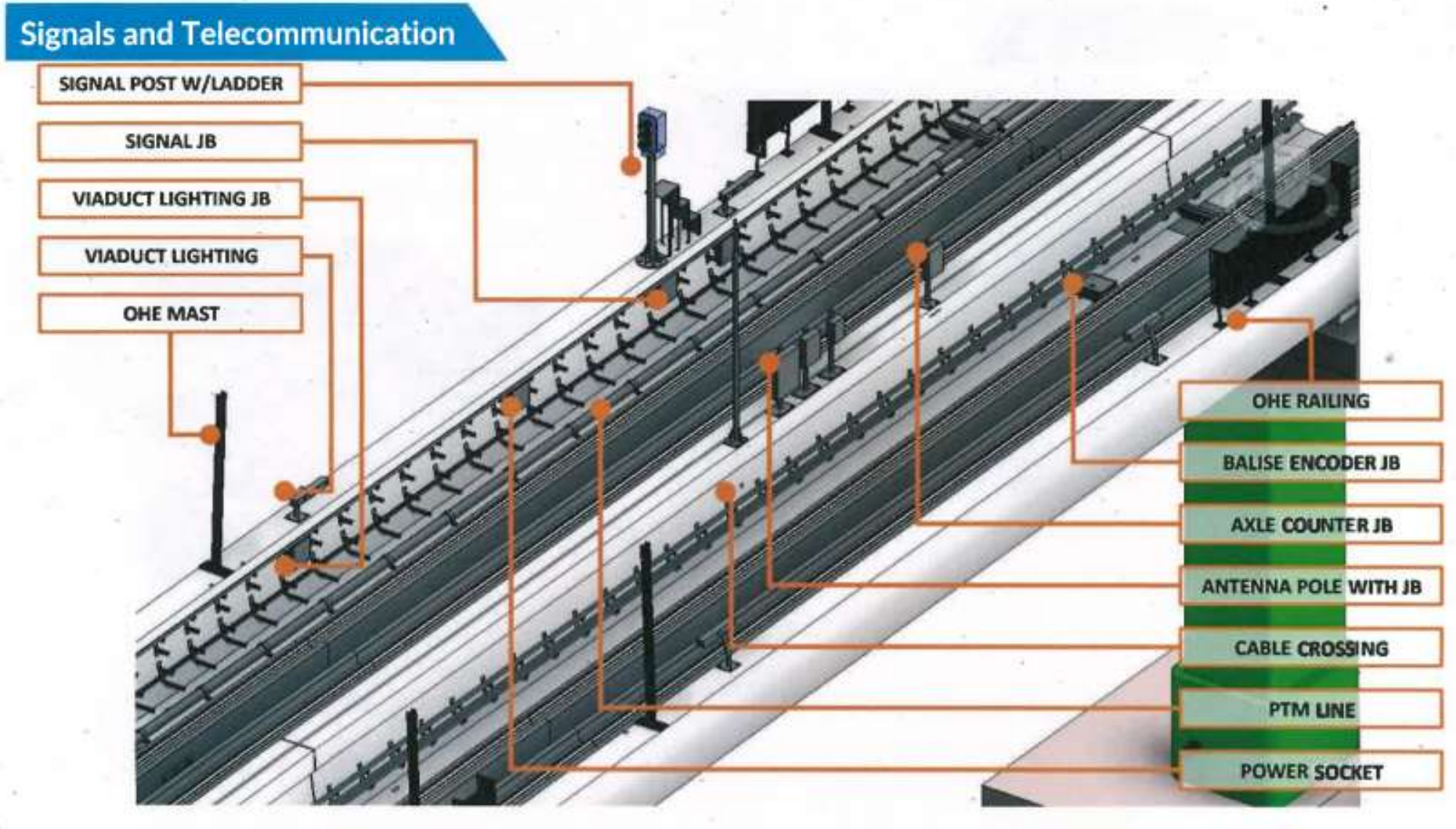


Snapshots from Metro projects (Federated Model)

Federated Model

Disclaimer: The PPT is prepared for presentation purpose only

Snapshots from Metro project (S & T detailing in Viaduct)



Construction Sequencing (4D BIM)

- Linking 3D model with schedule (Primavera/MSP)
- Visual simulation of tunneling, stations, viaducts
- “What-if” scenarios for delays/logistics
- Safety planning in congested areas
- Outcome → Optimized execution & risk mitigation

Stakeholder Coordination

- Common Data Environment (CDE) for collaboration
- Real-time updates & issue tracking
- Virtual model-based meetings
- Digital approvals & version control
- Outcome → Smooth communication & fewer disputes

4D Simulation (As per Detailed Work Plan)

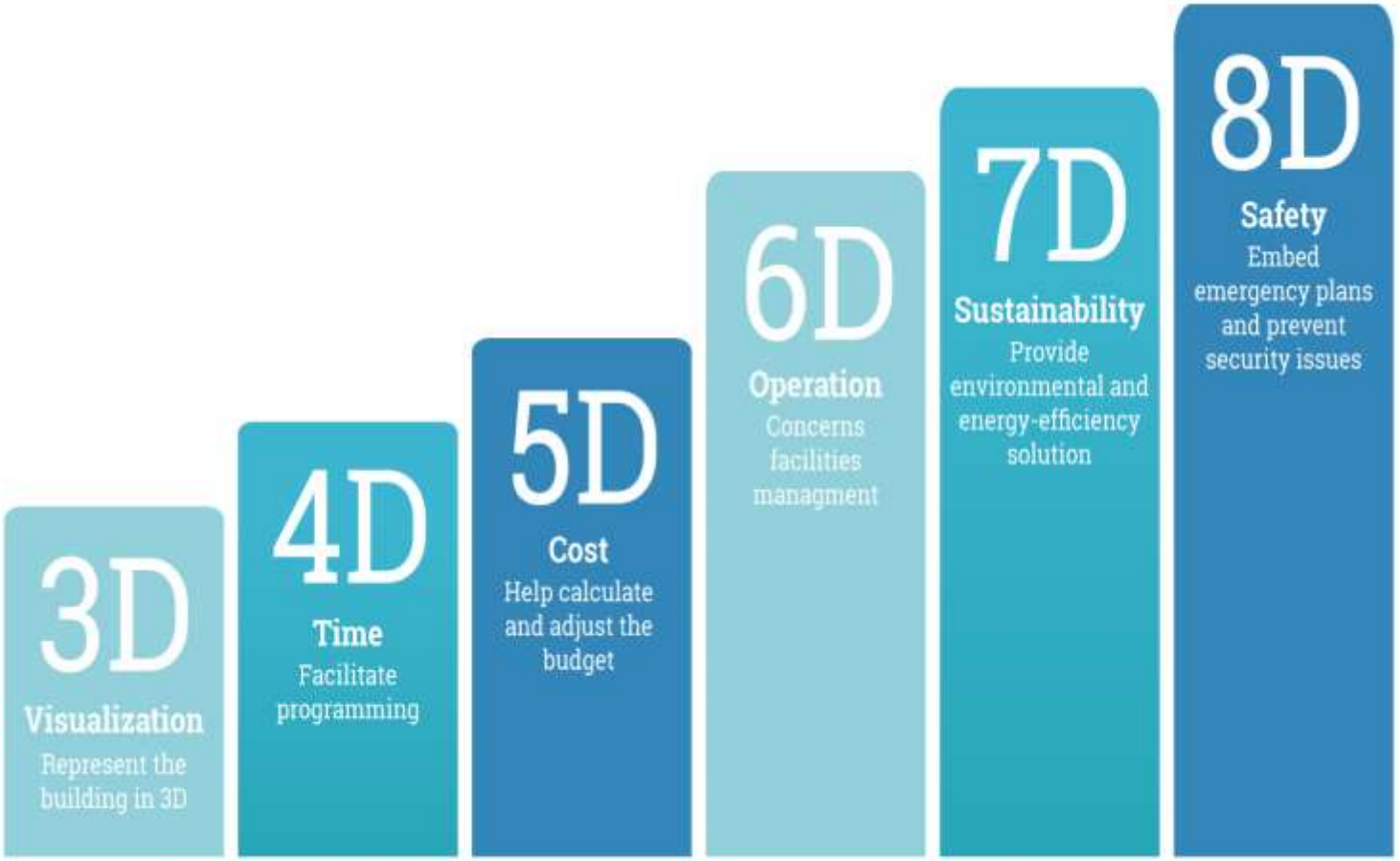
Extended BIM Benefits

- 5D BIM: Cost integration & quantity take-off
- 6D BIM: Energy & sustainability analysis
- 7D BIM: Facility management & digital twin

Conceptual Flowchart

- Design Models (3D)
- ↓ Clash Detection
- ↓ 4D Construction Sequencing
- ↓ Logistics & Risk Simulation
- ↓ Stakeholder Coordination (CDE)
- ↓ Optimized Construction → Handover → O&M (7D Digital Twin)

Various Dimensions in BIM

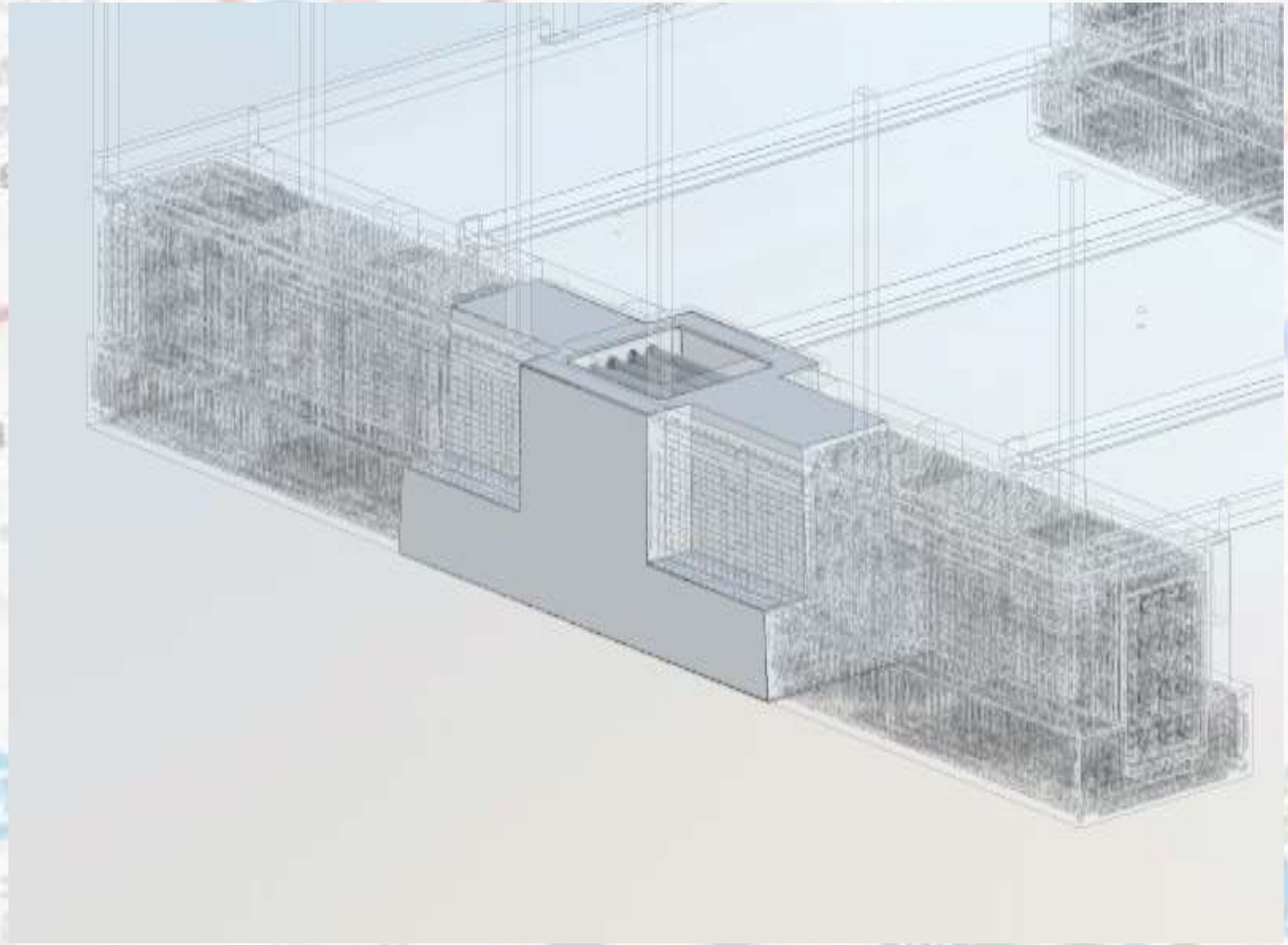


- **In Metro projects, 4D & 5D simulation is done to review the planned vs actual progress at site using *STAMP software (System for tracking & monitoring project).***
- **This simplified & digitized the review mechanism across the projects**
- **Various customized dashboards are being created to review site progress.**
- **Actual Site pics can be linked upon planned activity completion**
- **Contractors submitted the BIM models linked with DWP for progress update to be reviewed by the senior management review**

Conclusion

- **BIM ensures integration, transparency & efficiency**
- **Reduces risks, delays & cost overruns.**
- **Creates a digital foundation for long-term asset management**
- **Mitigate Construction delays.**

How the BIM is beneficial to the Construction Industry (Case Study)



Planning alignment with precision

- ✅ **New Alignment is planned adjacent to existing flyover with accurate precision, mitigating clashing with existing structures. BIM models helped in decision making.**

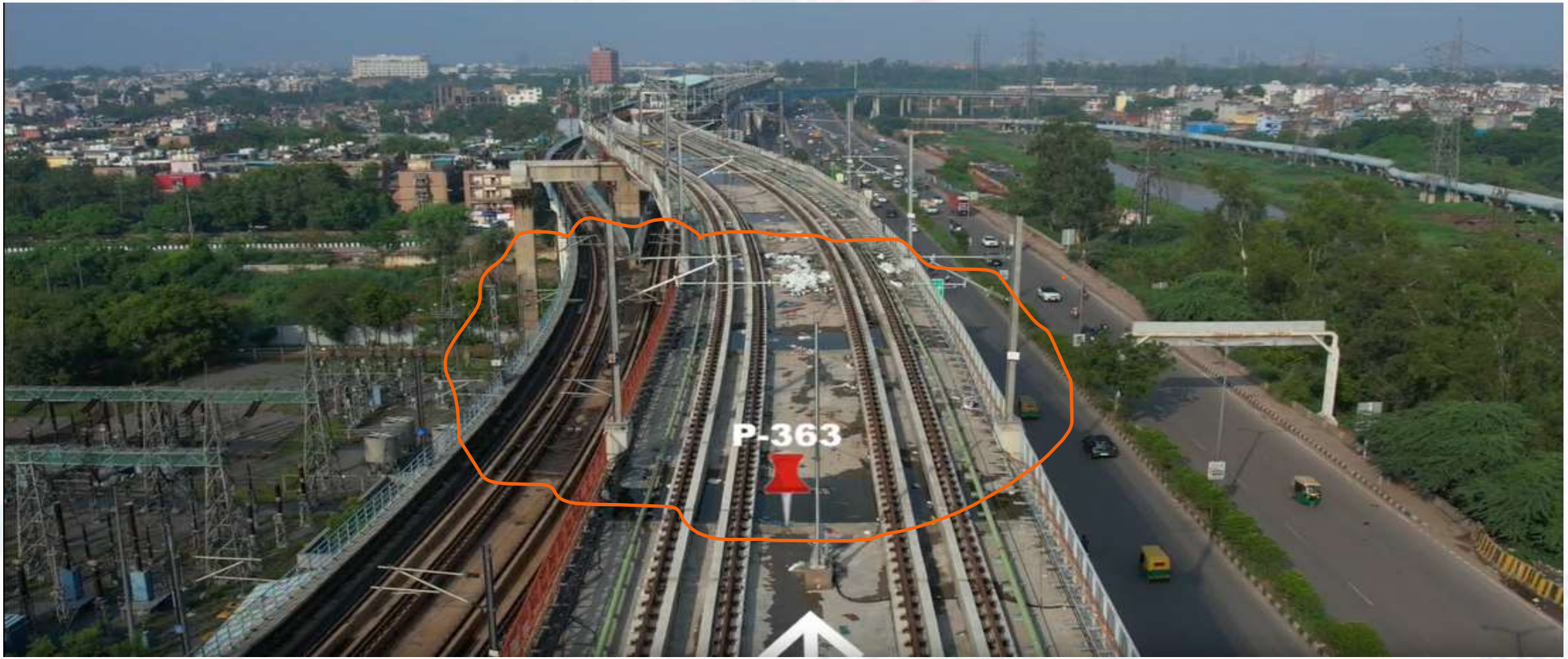
Assuring existing Buildings, FOB's, Temples etc are saved

- ☑ **While passing by existing structures, BIM Models helped to take precise decision to save them by either altering alignment or design**

Assuring required clearances are maintained

- ☑ **While crossing the existing "RED LINE", BIM Models helped to assure required clearances for CMRS Sanctions are achieved**

Assuring required clearances are maintained

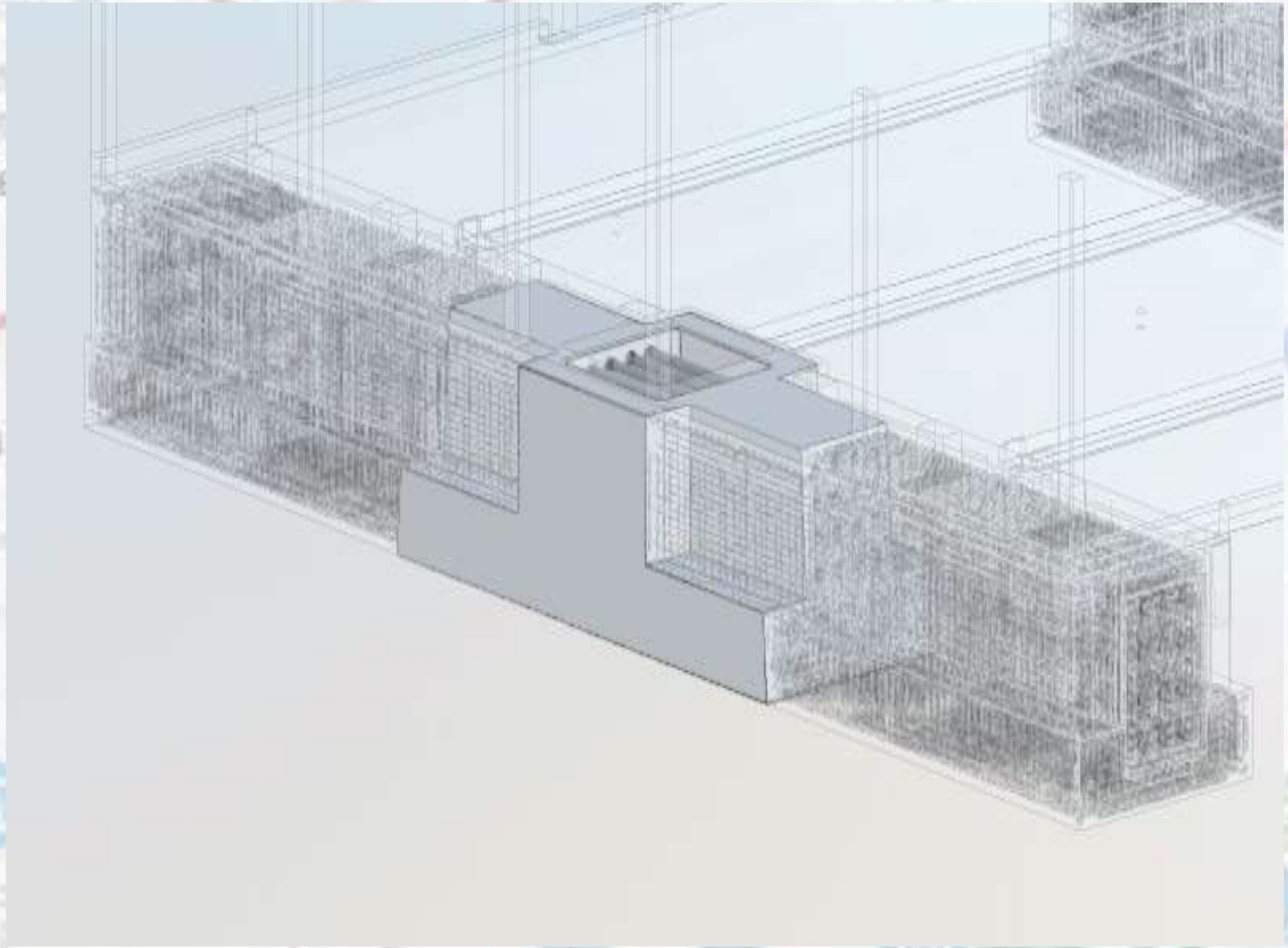


- ☑ **While crossing the existing "YELLOW LINE" & Indian Railway line at Haiderpur badli, BIM Models helped to assure required clearances for CRS Sanctions are achieved**

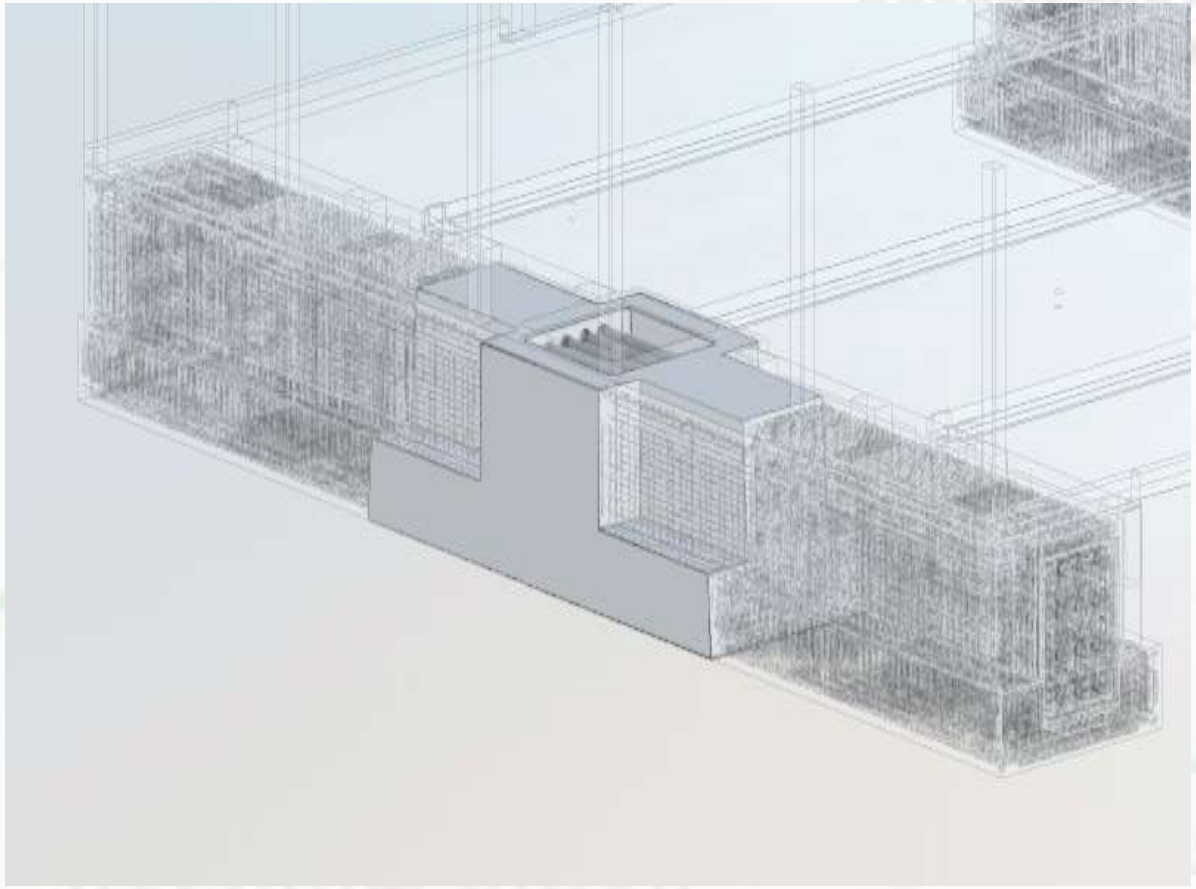
Assuring required clearances are maintained

- ☑ While crossing the existing “YELLOW LINE”, BIM Models helped to assure required clearances for CRS Sanctions are achieved

Challenges & Lesson learned



Tackling Challenges in Complex Rail Infrastructure Cross-Agency Coordination • Land Acquisition • Regulatory Clearances

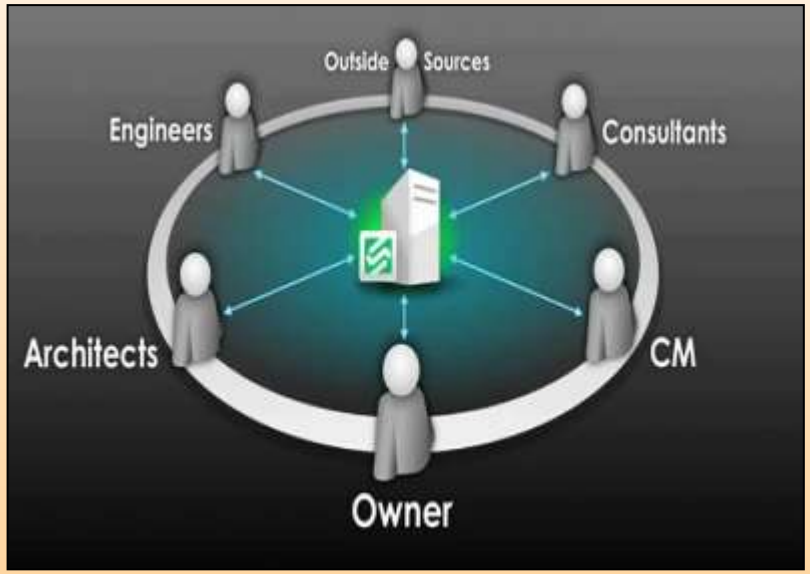


Agenda points:

- Cross-Agency Coordination
- Land Acquisition & Resettlement
- Regulatory Clearances
- Closing Message

Cross-Agency Coordination

- **Challenges:**
- **Multiple stakeholders (Railways, Urban Development, Environment, Utilities, Contractors)**
- **Conflicting priorities and fragmented communication**
- **Delays in approvals and design integration**
- **Solutions:**
- **Centralized BIM Platform for real-time updates**
- **PMIS Dashboards for tracking deliverables & risks**
- **Weekly coordination forums with escalation protocols**
- **Dedicated Interface Managers bridging design–construction–authority gaps**



Land Acquisition & Resettlement

- **Challenges:**
- **Delays from fragmented ownership, legal disputes, community resistance**
- **High compensation costs**
- **Relocation of residents, businesses, and utilities**
- **Solutions:**
- **GIS Mapping of land parcels & utilities before alignment finalization**
- **Transparent compensation via digitized land records**
- **Community engagement for trust-building**
- **Dedicated Land Acquisition Cells within authority for faster approvals**

Regulatory Clearances

- **Challenges:**
- **Multiple permits: environmental, forest, heritage, safety, utilities**
- **Sequential approval processes → delays**
- **Inconsistent interpretation of rules**
- **Solutions:**
- **Single-window clearance system (digital portal)**
- **Parallel approvals where possible instead of sequential**
- **Standardized checklists and guidelines**
- **Policy advocacy for fast-track reforms in strategic projects**
- **Dedicated Land Acquisition Cells within authority for faster approvals**

Closing Message

- ✅ **Tackling these challenges with digital integration (BIM, GIS, PMIS), structured governance, and active stakeholder engagement ensures timely, cost-effective, and socially responsible rail project delivery.**

Coordinated Solutions through BIM

S.No	Issues in Construction	Solution/ Benefit in BIM
1	Lack of Project coordination	• Enhanced collaboration with Inter disciplinary coordination
2	Complexity in scope quantification	• Accurate costing & budgeting through 4D/5D BIM.
3	Delay in approvals of Engineering deliverables.	• Fastrack approvals through BIM Workflow within stipulated time.
4	Monitoring of Review Mechanism was difficult	• Easy to monitor and submit compliance in a transparent manner.
5	Difficulty in taking informed decisions	• Faster decision from Clients through Graphical/ 3D representation.
6	Difficulty in accessing database. Disorganized & Decentralized	• Centralized project data due to cloud-based capabilities for future reference.
7	Difficulty in Visualization structure complexities, hence increased safety risks	• Better Visualization with rendering provisions, walkthroughs etc. • Reduced safety risks by greater predictability. It's a Digital Twin. • Fits first time, less rework
8	Difficulty in Design and Planning through traditional approach	• Optimized designs. Issue resolution through clash coordination • Greater predictability of project completion within targeted dates
9	Rework/ delays due mismatches in views, levels	• All views are coordinates. Faster execution
10	Time & cost over-runs	• Faster project delivery – Time & Cost savings, Better forecasting • Elimination or reduction of unforeseen/ unbudgeted changes

Challenges & Lesson learned

S.No	Challenges	Suggestions
1	Interoperability between the Software's **(Compatibility issues)**	Since Revit is not compatible with any of the design software like STAAD, MIDAS, OASYS etc, it leads to rework, as 2D drawings need to convert into 3D/BIM extracted drawings. **To make BIM faster & more sustainable for construction needs, Interoperability should be devised**
2	Issues with version change	Data loss, warning messages flash during version change. **Version change to be seamless process**
3	**BIM Implementation cost is much higher** than traditional (2D environment) approach	BIM Implementation cost should be account for during the estimation at the Tender Stage
4	**Insufficient time given for Detailed Design** & Model development during the execution stage	**Sufficient time should be given for Detailed Design** & Model development prior to construction phase in advance to fetch Site GFC needs
5	A mild change in approach (i.e **review on BIM Models by project stakeholders**) shall expedite execution & rework in Design & Execution stage	**Review can happen on 10%, 30%, 60%, 90% of design & model** development with Clients & Proof Consultants prior to execution stage. GFC's shall be coordinated & more accurate for execution
6	Revit files becomes very heavy with heavy geometry. **Sometimes files crashed due to heavy size leaving "No Backup" which leads to rework.**	**Backup to be created at shorter intervals to save time & efforts**

Working examples from the Metro projects

BIM vs Actual Images

Actual Site Image (Viaduct)

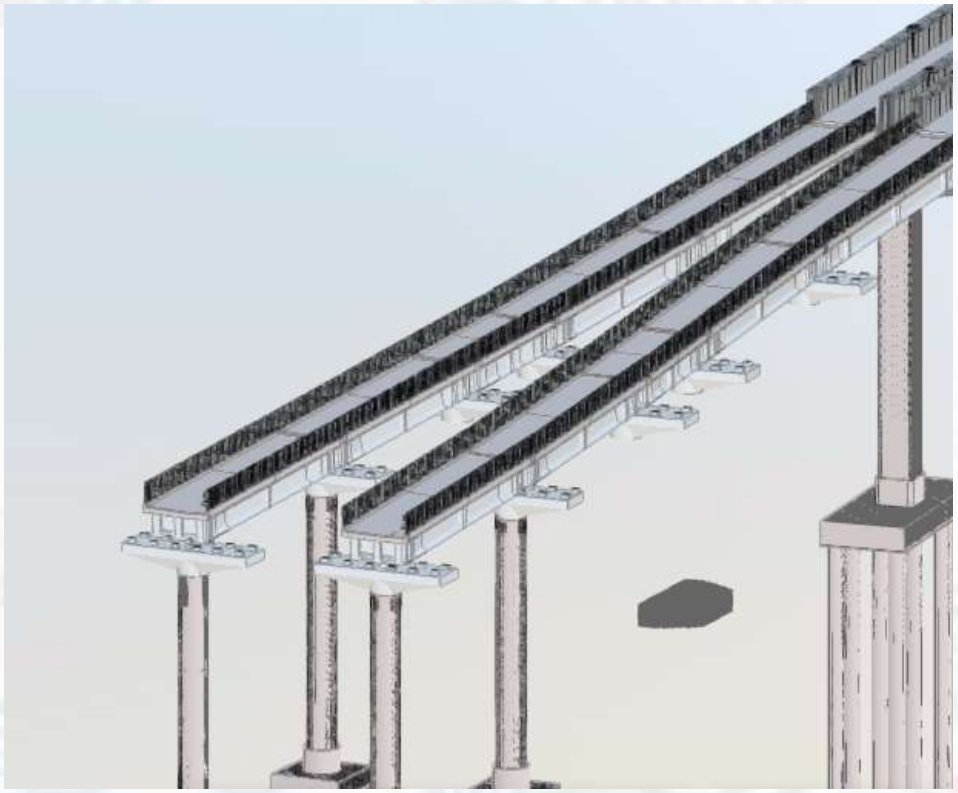
Image of BIM Model (Viaduct)

Disclaimer: The PPT is prepared for presentation purpose only

BIM vs Actual Images

Actual Site Image (Viaduct)

Image of BIM Model (Viaduct)



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BIM vs Actual Images

Actual Site Image (Viaduct)

Image of BIM Model (Viaduct)

BIM vs Actual Images

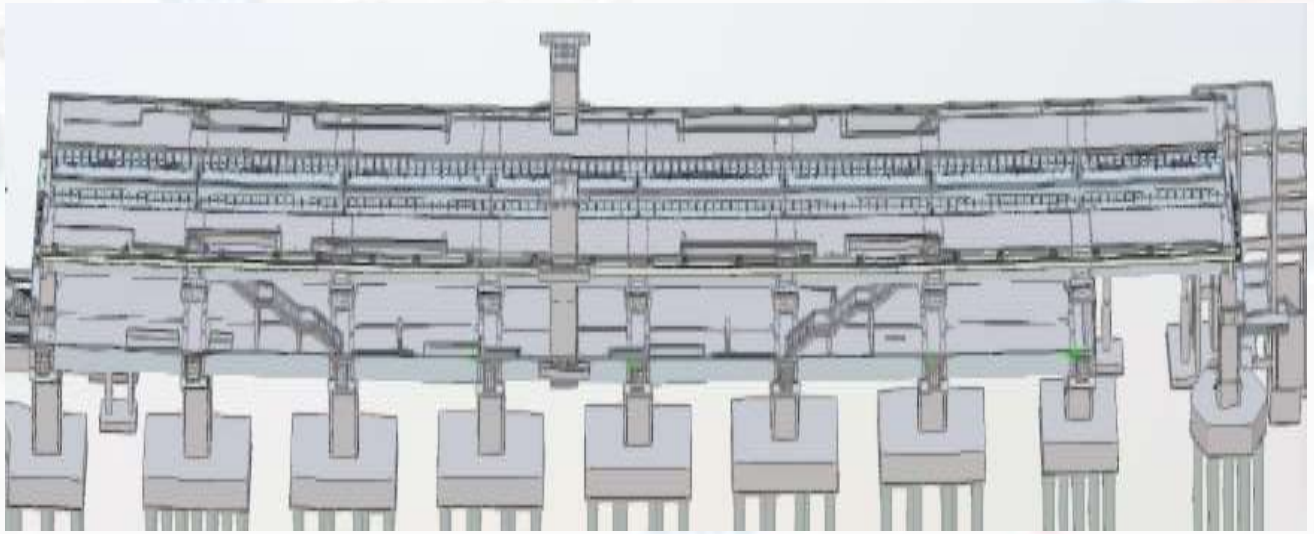
Actual Site Image (Viaduct)

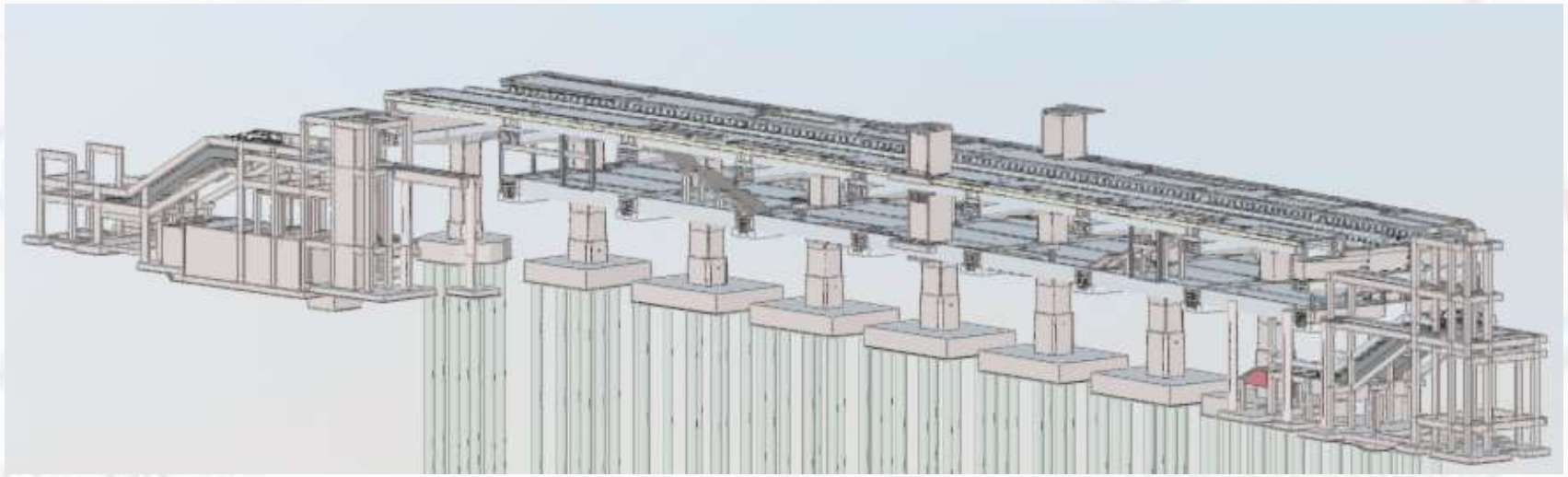
Image of BIM Model (Viaduct)

BIM vs Actual Images

Actual Site Image (Station)

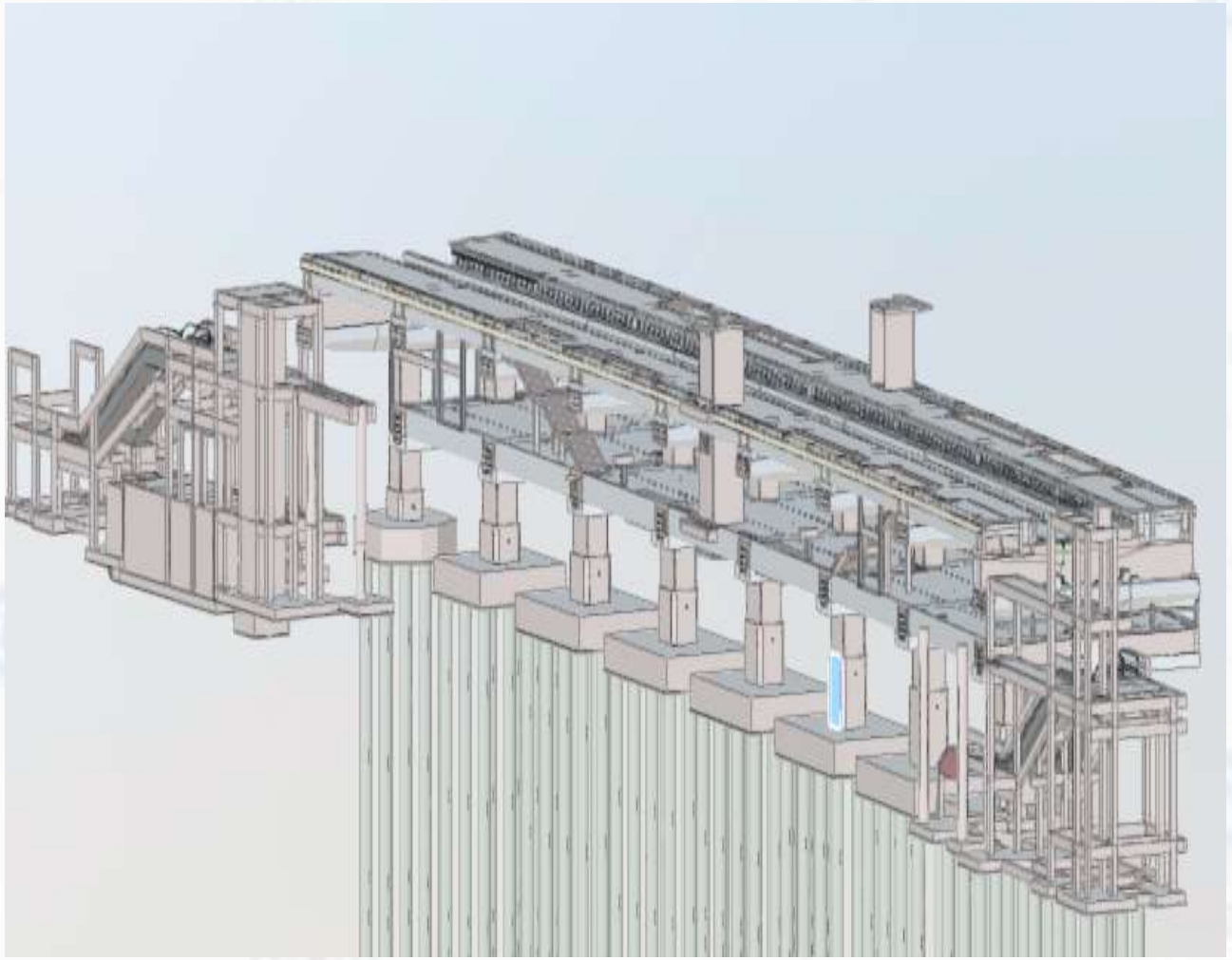
Image of BIM Model (Station)





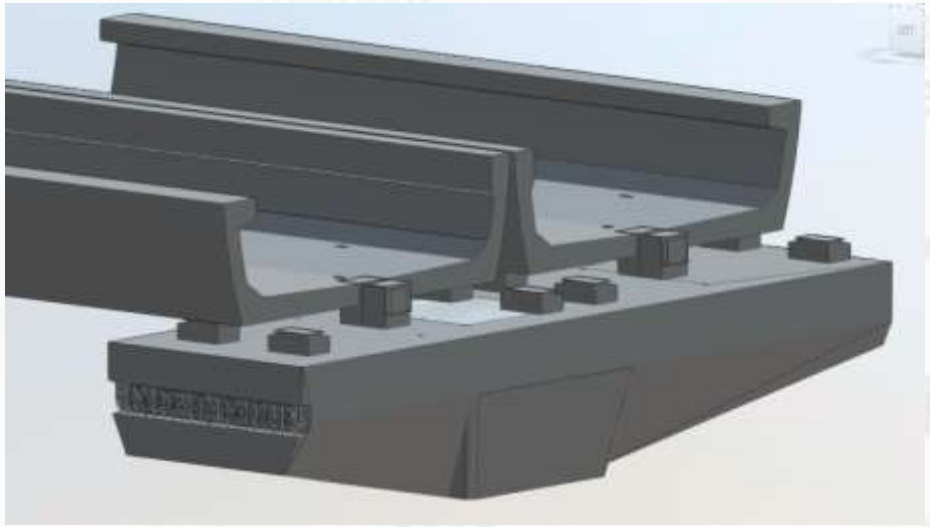
BIM vs Actual Images

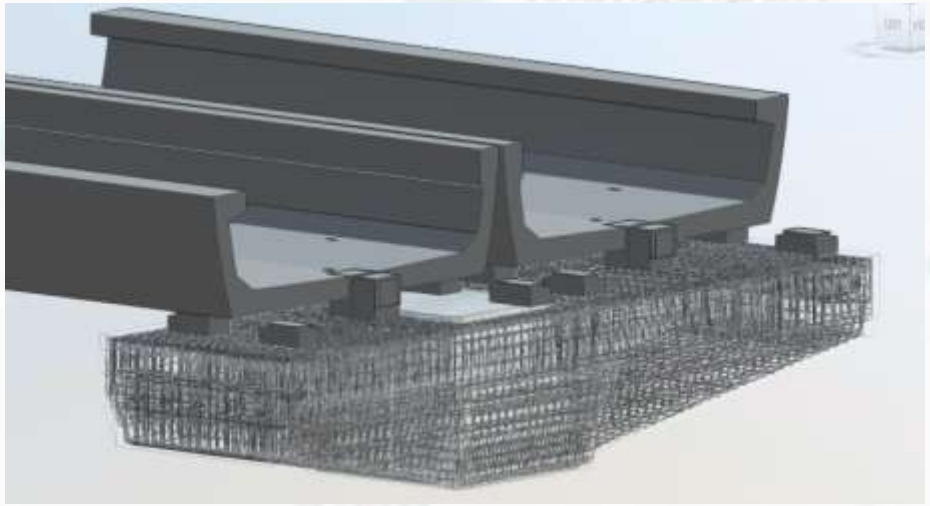
Image of BIM Model (Station)

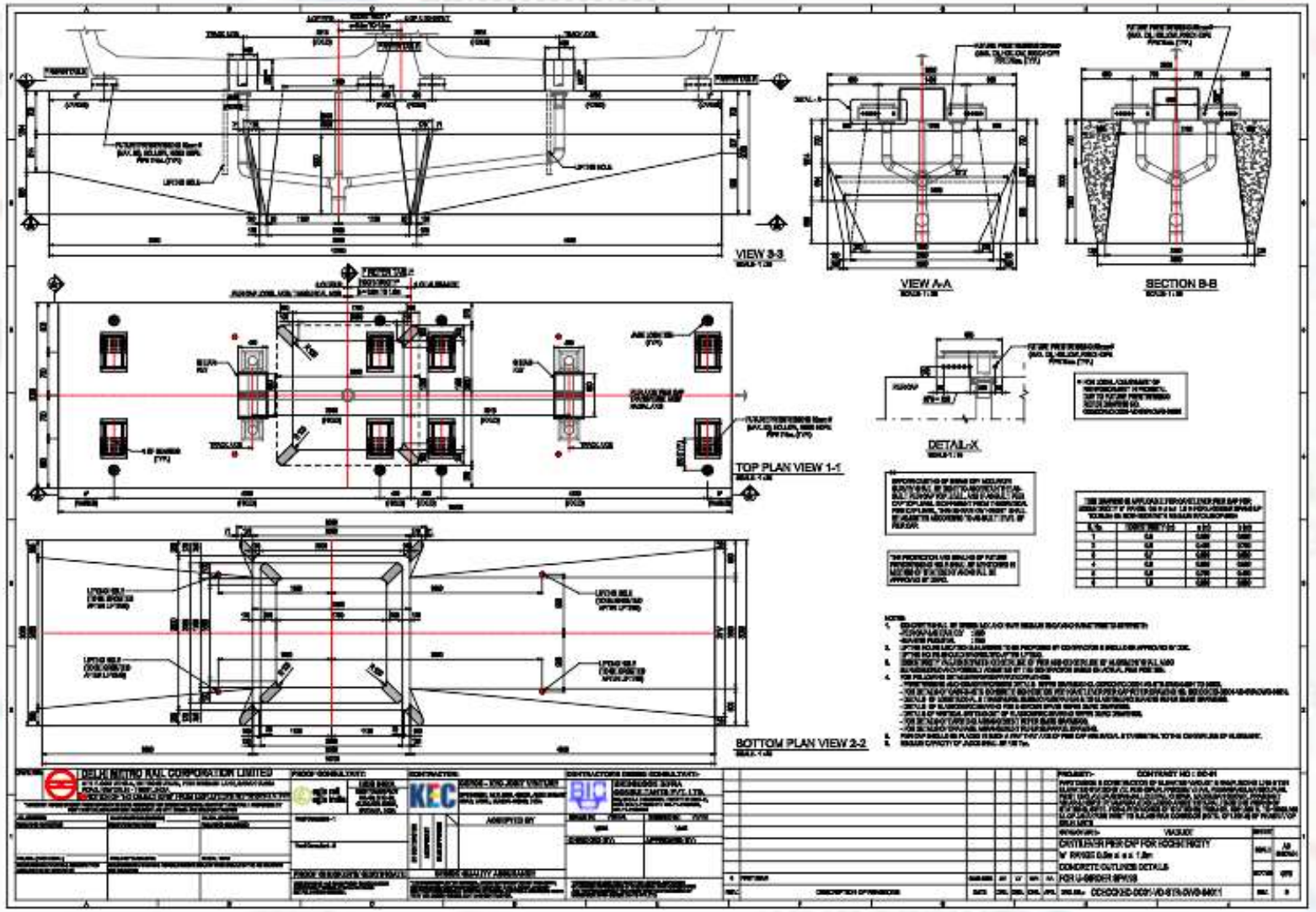


Actual Site Image (Station)

Snapshot from Metro project (Reinforcement detailing – Pier cap)







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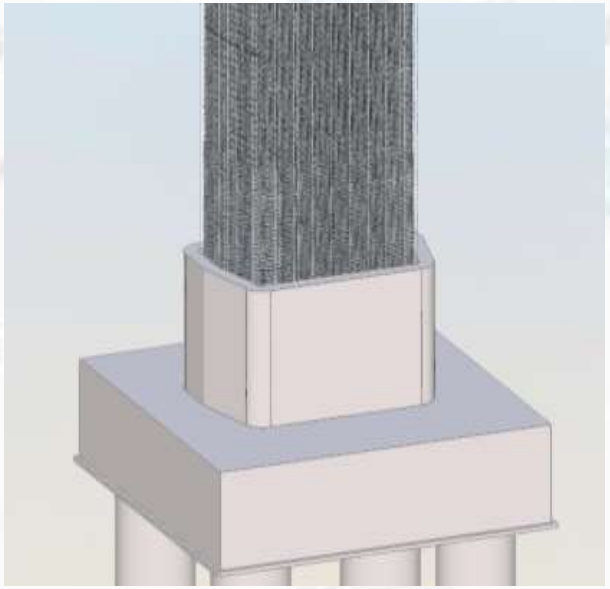
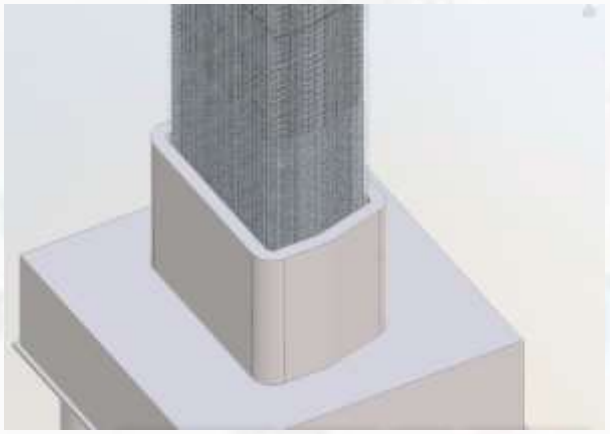
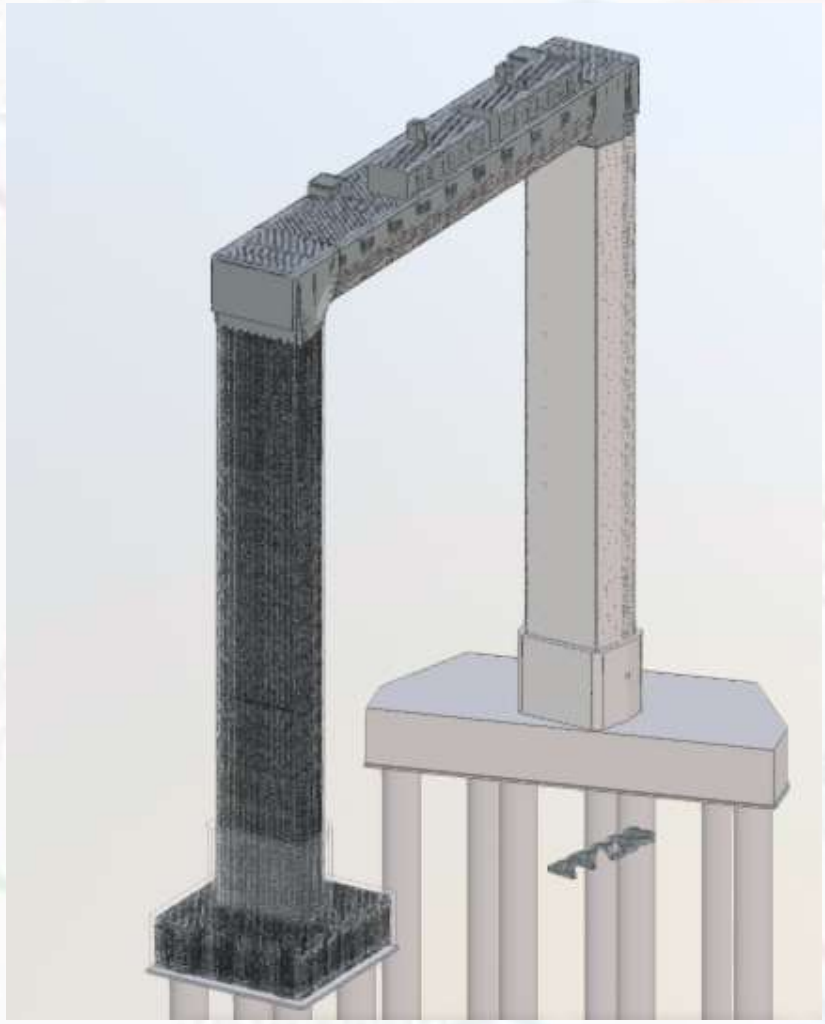
BIM vs Actual Images

Actual Site Image (Portal Pier)

Image of BIM Model (Viaduct)







Approach towards BIM Implementation

Approach in BIM Implementation

Phase-I	Phase-II
Design Phase	**Scale Up (Across Projects)**
• As-Is Assessment of existing Design Processes • Evaluation of Process Maturity, Benchmarking and Gap Identification (In terms of Hardware/ Software/ Skilled Manpower etc) • **Design of - To Be Processes for phased implementation**	• Review and Refresh Design Processes, Fine tuning of your earlier developed to be processes for overall implementation • Organization Capability Development (Trainings, Hiring) • Overview by Internal Change Management. Look ahead if any hesitancy & resistance in process implementation • Involvement of leadership to de-bottlenecking actions • **Implementation across projects**
Implementation (for Pilot Projects)	
• Selection of Technology Partner for Hardware / Software requirements (Investment, Features) • Roadmap/ Blueprinting for phased implementation • **Identification of 2-3 Pilot Projects & it's implementation**	




Thank you

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