

 ADVANCED ENGINEERING COURSE

Advanced Building Information Modeling Technology

A Master Course on Digital Pre-Construction, ISO 19650 Standards, 4D/5D Dimensions &
Digital Twins

MODULE 01

Standards & Digital Frameworks

Establishing robust data architecture and open BIM standards

CAD vs. Object-Oriented BIM

Legacy 2D/3D CAD Systems

Traditional Computer-Aided Design relies on geometric lines, arcs, and vectors without embedded parametric data.

Changes require manual updating across separate floor plans, elevations, and sections, leading to high error rates and coordination gaps during construction.

Object-Oriented BIM Architecture

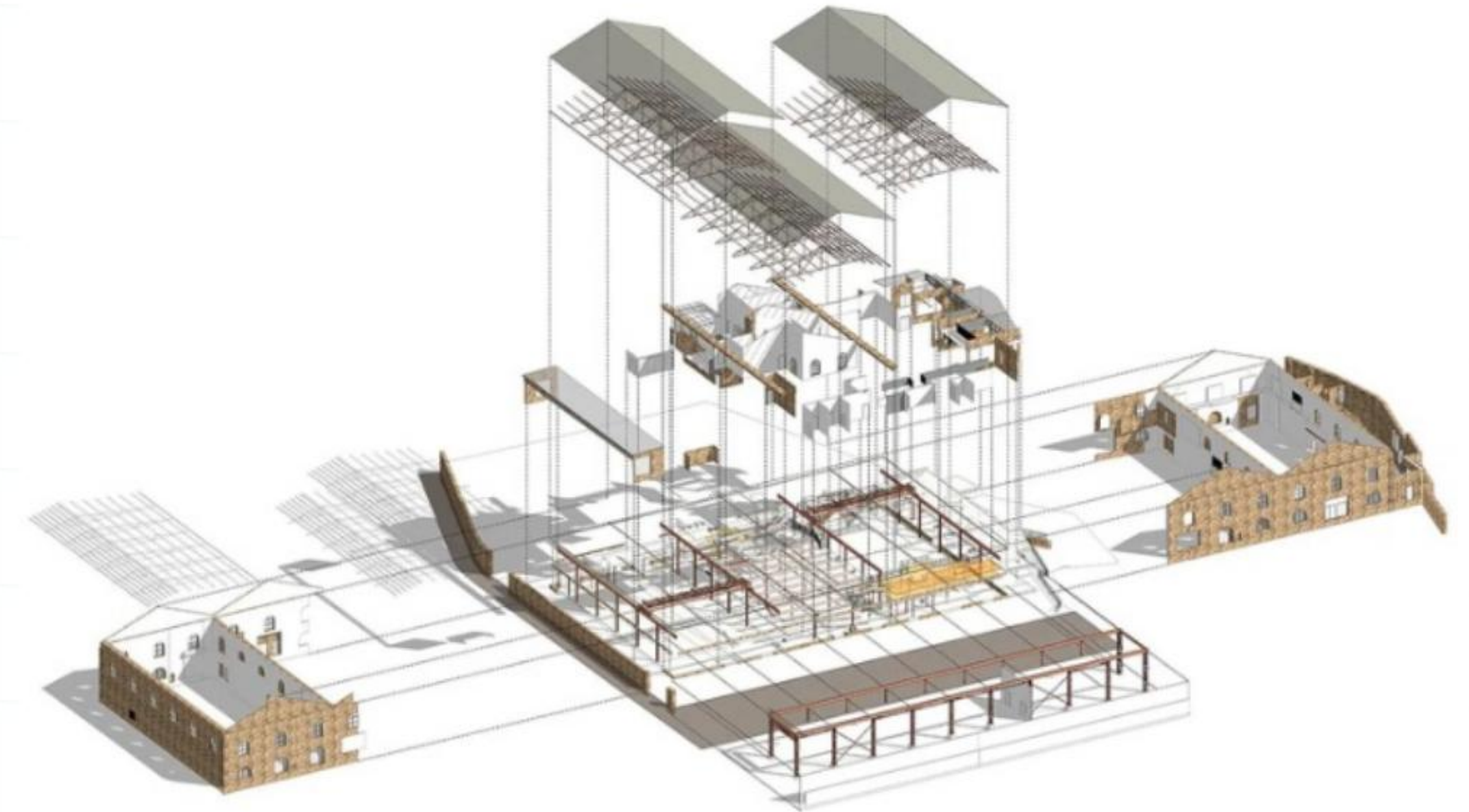
Advanced BIM utilizes intelligent, parametric families with dynamic data attributes (materials, thermal, cost).

Modifications dynamically recalculate all linked schedules, spatial views, and structural analyses in real time across the entire project lifecycle.

Level of Development Framework

Progressive LOD Specifications

- **LOD 100 - 200:** Conceptual massing, generic spatial requirements, and preliminary structural footprints.
- **LOD 300 - 350:** Precise geometry, structural assembly interfaces, and multi-trade system clearances.
- **LOD 400:** Fabrication-ready assemblies with exact detailing for MEP and precast elements.
- **LOD 500:** Field-verified as-built models for post-occupancy operations.



ISO 19650 Data Environment



1. Work In Progress

Unapproved design information developed by specific task teams. Access is strictly restricted to primary authors prior to official validation.



2. Shared State

Verified information shared between multidisciplinary teams (Architectural, Structural, MEP) for collaborative clash detection and review.



3. Published & Archive

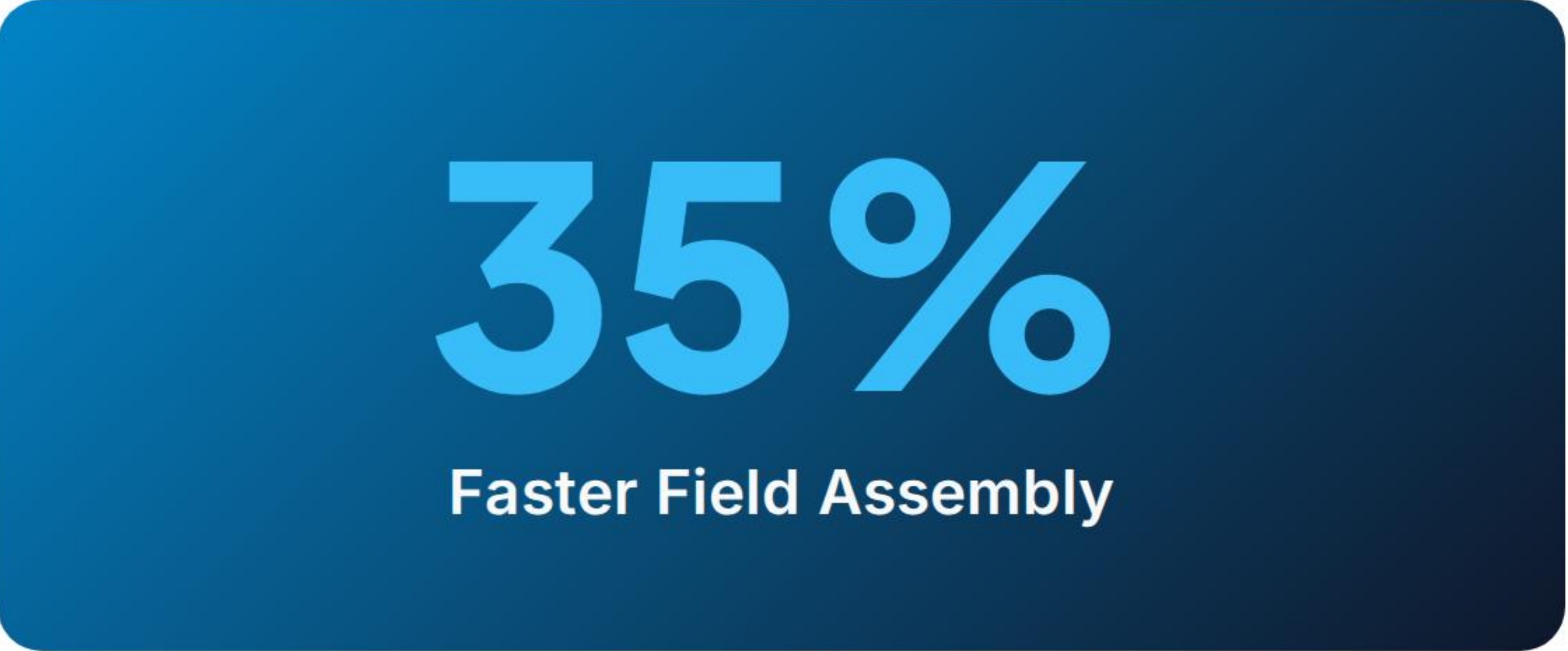
Fully authorized asset data designated for construction procurement or facility management, permanently locked for audit compliance.

MODULE 02

Multi-Dimensional Integration

Leveraging 4D Scheduling and 5D Cost Control Workflows

4D BIM Schedule Optimization



35%

Faster Field Assembly

Visual Time-Lapse Simulation

By linking 3D BIM parametric objects directly to CPM construction schedules (Gantt charts), project managers can visually simulate sequence timelines prior to breaking ground.

4D simulation identifies site congestion, crane radius overlaps, and staging conflicts early, drastically reducing on-site downtime and worker hazards.

5D Cost Estimation

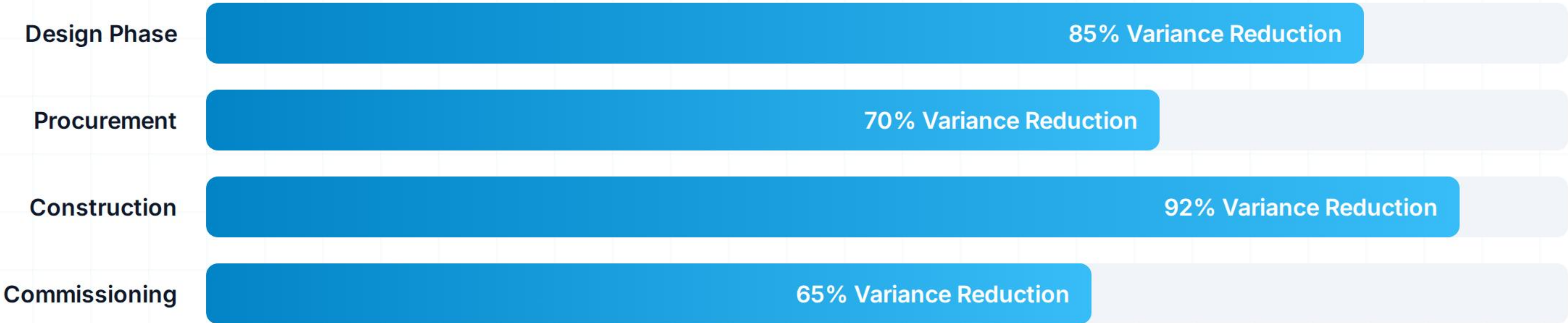
Real-Time Quantity Take-Off

5D BIM links model geometry directly to cost databases. As structural specs change, material volumes and budget impacts recalculate instantaneously.

This automated feedback loop eliminates manual quantity survey errors and enables rapid target-value design engineering.



Cost Variance Mitigation



Implementation of 5D BIM demonstrates drastic reductions in budget variance and unapproved change orders across all delivery phases.

MODULE 03

Advanced Field Tech & AI

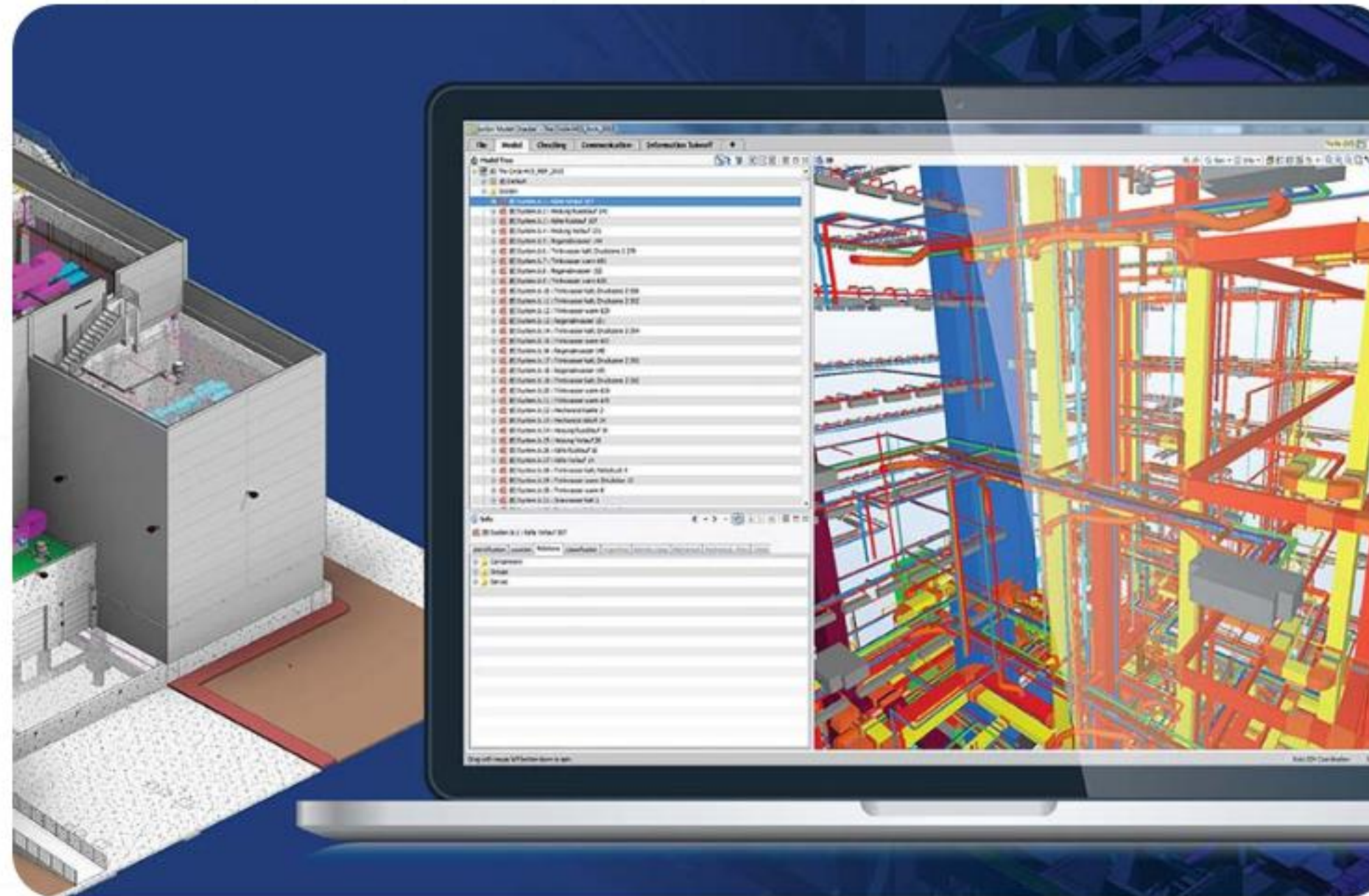
Scan-to-BIM, AR site coordination, and digital twin technology

Next-Gen Field Integration

 AR Field Inspection

Augmented Reality

Overlaying 3D BIM overlay models directly onto physical job sites using AR tablets and smart helmets.



Automated Clash Check

AI algorithms detecting hard and clearance clashes across complex MEP ductwork and structural beams.

 Laser Point Cloud Scan

LiDAR Scan-to-BIM

Converting high-precision terrestrial point cloud laser scans into intelligent, editable BIM geometry.

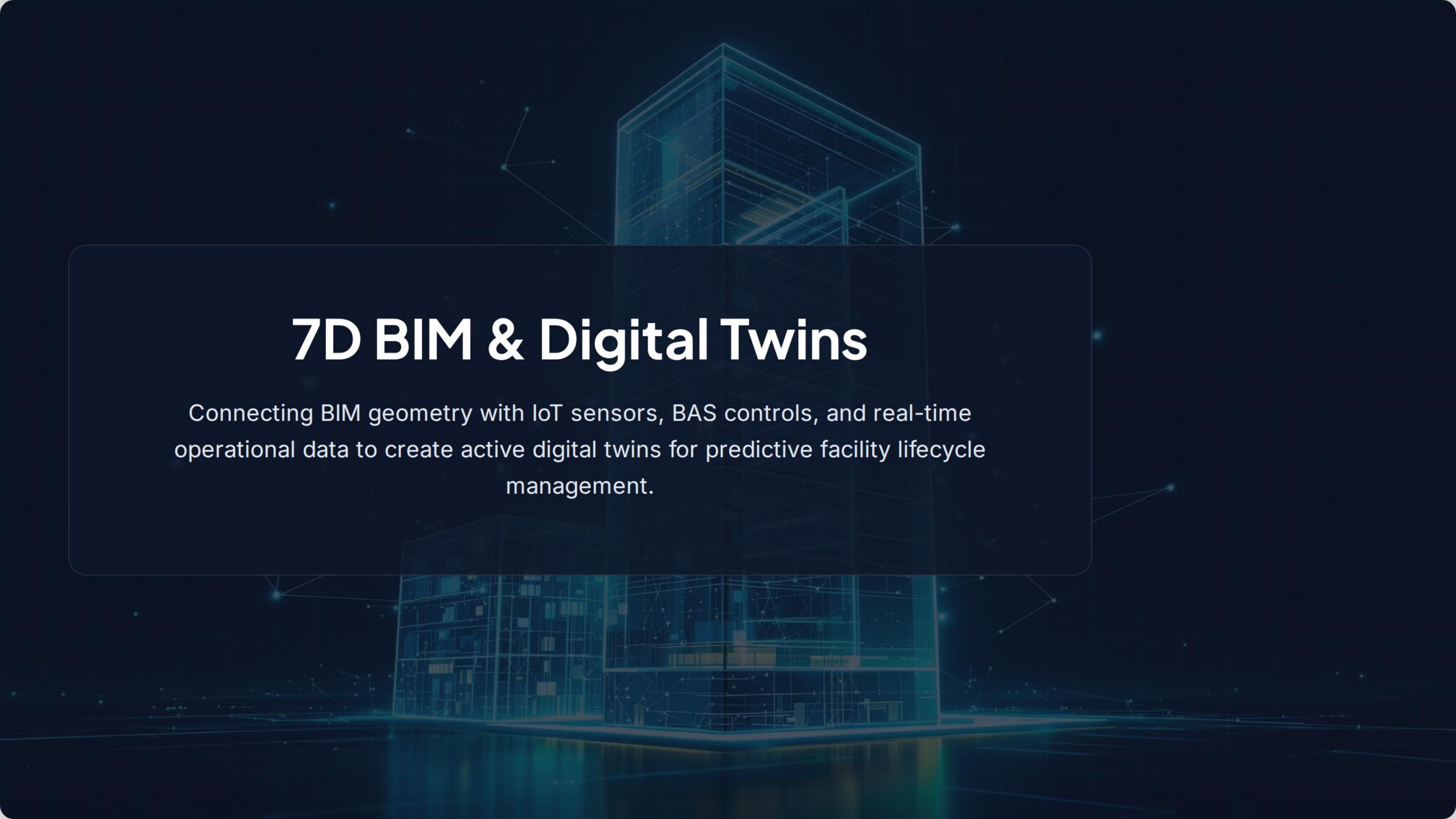
BIM Delivery Procurement

Delivery Model	BIM Collaboration Level	Risk Distribution	Efficiency Index
Design-Bid-Build (DBB)	Low (Isolated 2D/3D silos)	Owner holds full conflict risk	Baseline (High rework)
Design-Build (DB)	Medium (Design-construction sync)	Shared DB entity risk	+25% Speed gain
Integrated Delivery (IPD)	High (OpenBIM Federated CDE)	Shared risk & reward pool	+45% Overall ROI

Organizational ROI Over Time



Enterprise BIM adoption yields exponential compound returns through operational standardization, automated workflows, and reduced re-work.



7D BIM & Digital Twins

Connecting BIM geometry with IoT sensors, BAS controls, and real-time operational data to create active digital twins for predictive facility lifecycle management.