Pinnacle Infotech

Driving Digital Excellence in Marine & Port Infrastructure

Leveraging BIM, Automation & Digital Solutions for Optimized Marine & Port Construction

Resilient Infrastructure through Digitalization
Enabling Viksit Bharat
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Presenter

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Marine Construction Industry Contexts Expansion Opportunities & General Complexities:

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Global Trade Growth:

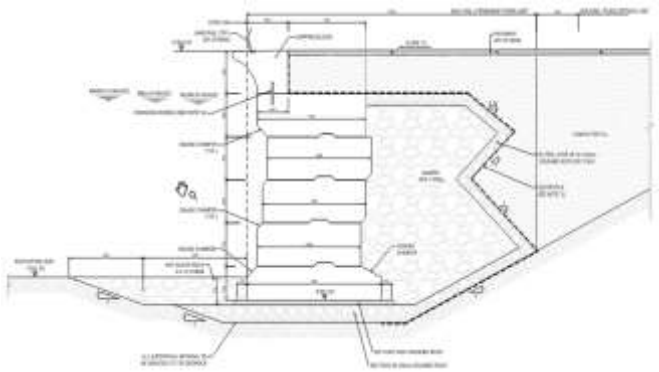
- Seaborne trade projected to handle >80% of world cargo
- Rising demand for new ports, terminals, and coastal defenses

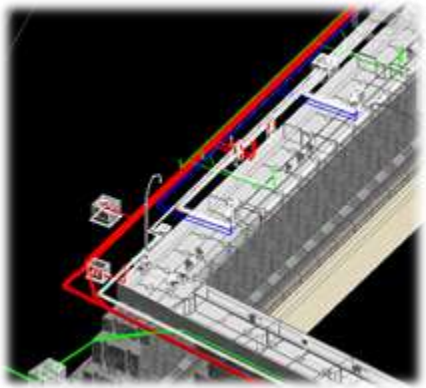
Complex Marine Environments:

- Tidal variations & access windows limit construction schedules
- High-risk underwater works: dredging, piling, seabed instability

Cost & Risk Factors:

- Marine works = high CAPEX, long payback, environmental sensitivity
- Rework & delays amplify costs in large-scale reclamation or quay wall projects





Fragmented Traditional Workflows:

- 2D drawings are inadequate for underwater/coastal complexity
- Siloed design → increased clashes, safety risks, delays

Need for Digital Transformation:

- BIM, IoT, and automation mitigate risks
- Enable accurate planning, sequencing, and compliance with global maritime standards

Pinnacle’s BIM Vision for Marine Construction

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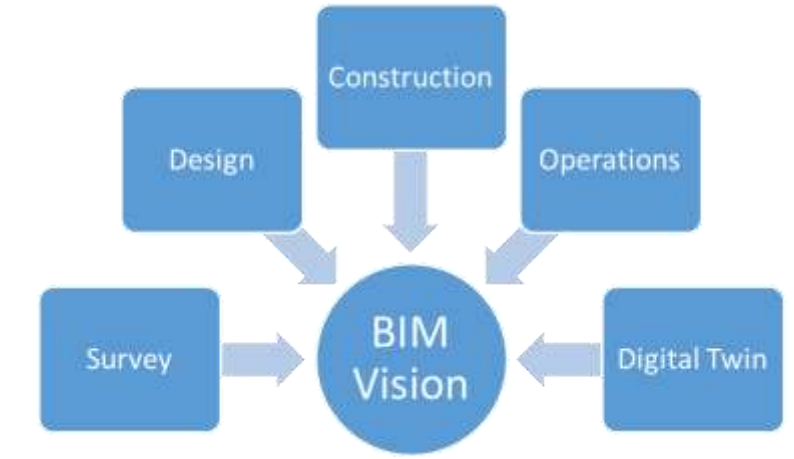
BIM as the Digital Backbone
Centralized environment connecting design, construction & operations
Reduces risk and increases constructability in complex marine works

Integration Across Disciplines
Combines Structural, Geotech, Mechanical & Electrical design data, aligned with hydrodynamic predictions
Enables clash-free planning for submerged, Offshore & coastal assets

Construction Considerations
During dredging, reclamation, or poldering, the exact prediction of soil/sediment use
Helps plan safe working windows in tidal zones through construction process simulations.

Digital Twin Readiness through IDD
BIM models simulate constructability for offshore and onshore works powered by automation through PiVDC, Dynamo, and Grasshopper scripting, IoT-enabled asset intelligence, and digital twin readiness for lifecycle optimization.

Survey, Bathymetry & GIS Integration
BIM integrates sonar, LIDAR, drone, and GPS survey data to generate accurate DTM.
GIS-enabled georeferencing aligns with tidal benchmarks, navigation charts, and national datums for spatial precision



Pinnacle's BIM Service Mitigating Industry Challenges

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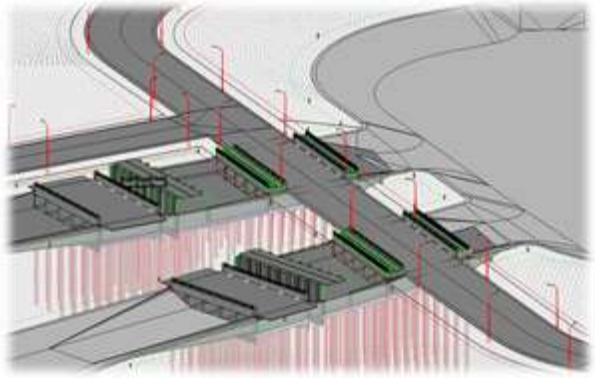
Industry Challenges	Pinnacle Infotech's BIM Solutions
Tidal Constraints and Marine Access Windows	4D simulation in **Synchro/Navisworks** to align construction with tidal cycles and weather forecasts
Uncertain Sub-Sea Terrain & Bathymetry	Integration of **bathymetric surveys, sonar data, and DTMs** into the BIM environment
Clashes Between Submerged Utilities and Structures	Multidisciplinary **clash detection and coordination** using **Navisworks & Civil 3D**
Corrosion and Marine-Induced Structural Degradation	BIM-based **material tracking and durability analysis** tied to maintenance cycles
Inaccurate Dredging & Reclamation Volumes	High-precision **cut/fill modeling and quantity take-off (5D BIM)** tools
Disruption to Port Operations During Expansion	**Phased construction sequencing** and visualization of operational interfaces
Complexity in Integrating Marine MEP Systems	**LOD 400–500 modeling** of utilities (fuel, firewater, drainage) across submerged and dock areas
Environmental Impact & Regulatory Pressures	BIM-enabled simulation of **silt dispersion, spoil zones**, and EIA compliance visualization
Lack of Interdisciplinary Collaboration	Centralized BIM collaboration using **BIM 360 / iTwin / Common Data Environments**
Lack of Lifecycle Visibility of Marine Assets	Deployment of **Digital Twins** for quay walls, berths, and jetties for ongoing O&M monitoring



Benefits of Digital Modeling

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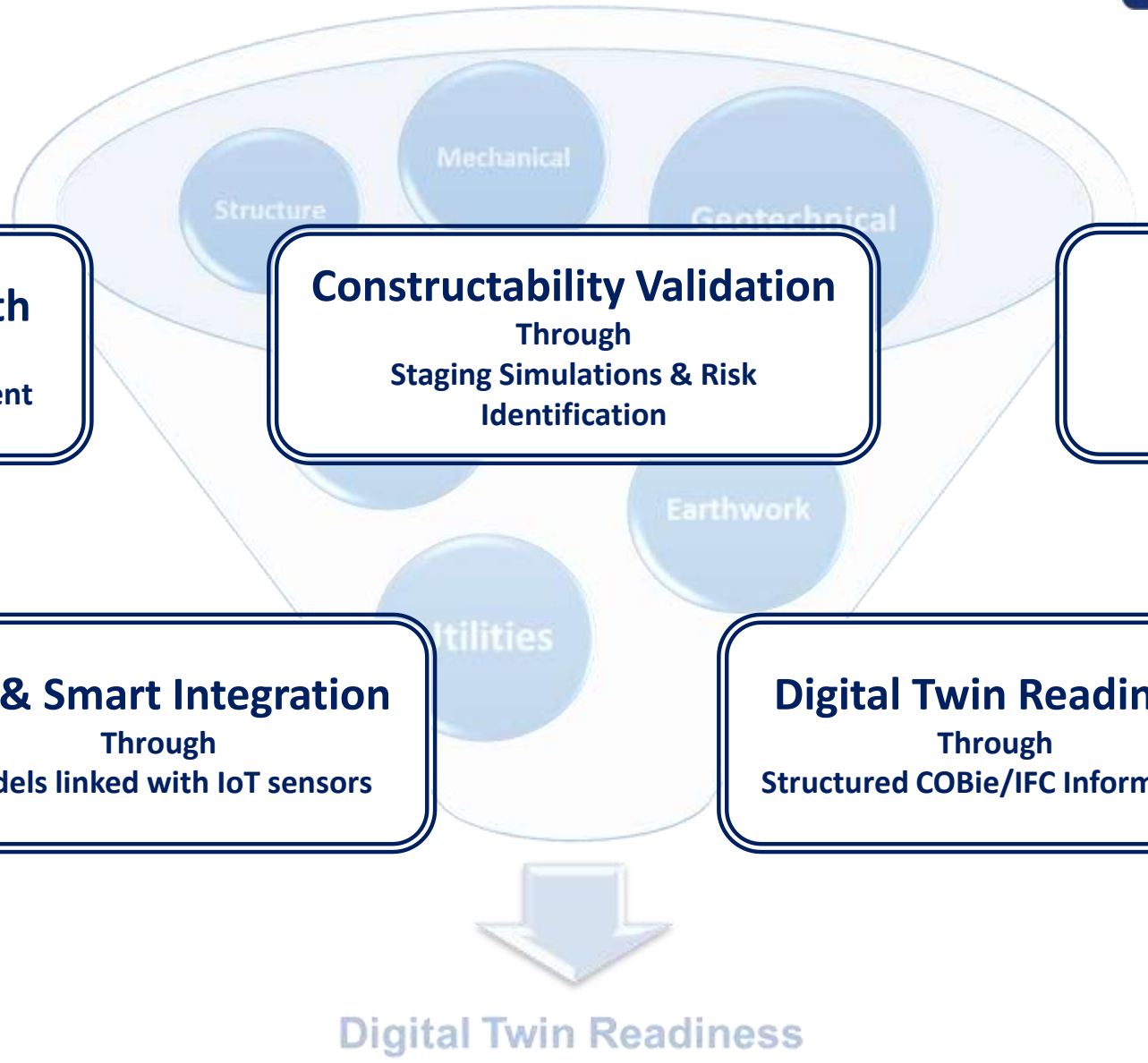

Single Source of Truth
Through
Federated 3D BIM environment

Constructability Validation
Through
Staging Simulations & Risk Identification

Automation & Computation
Through
Streamlining Repetitive Tasks

IoT & Smart Integration
Through
Models linked with IoT sensors

Digital Twin Readiness
Through
Structured COBie/IFC Information

Progress Monitoring Through BIM

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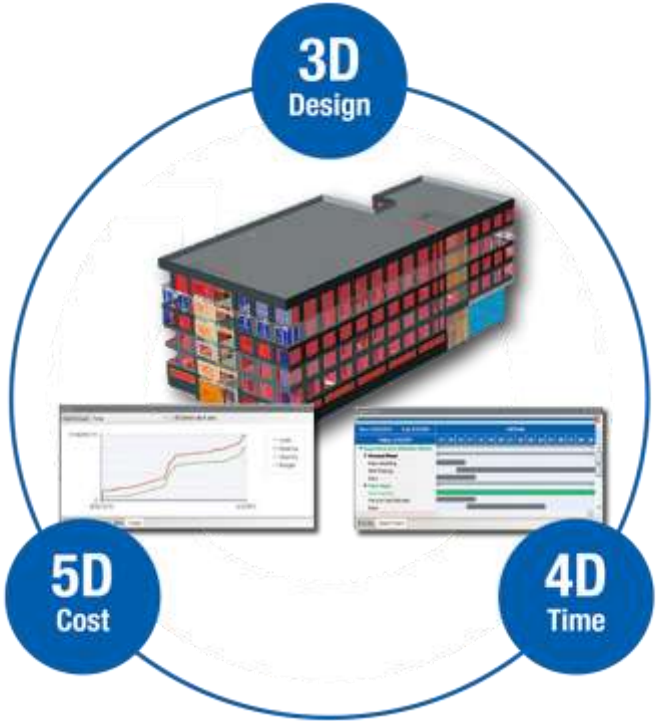
4D BIM Application :

- Identify problems that may not be visible via normal schedules
- Study how the execution process will appear at different project stages
- Run scenarios to assess feasibility of execution and find the best solutions
- Optimize your budget by accurate scheduling
- Risk mitigation due to improved team coordination and communication



5D BIM Application :

- Real-time cost visualization with notification on changes in costs.
- Automatic count for components/system/equipment associated with a project
- Simplified cost analysis and budgetary analysis with predicted and actual spending over time
- Minimization of budgetary offshoot due to regular cost reporting and budgeting

Survey, Bathymetry & GIS Integration

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High-Precision Data Capture

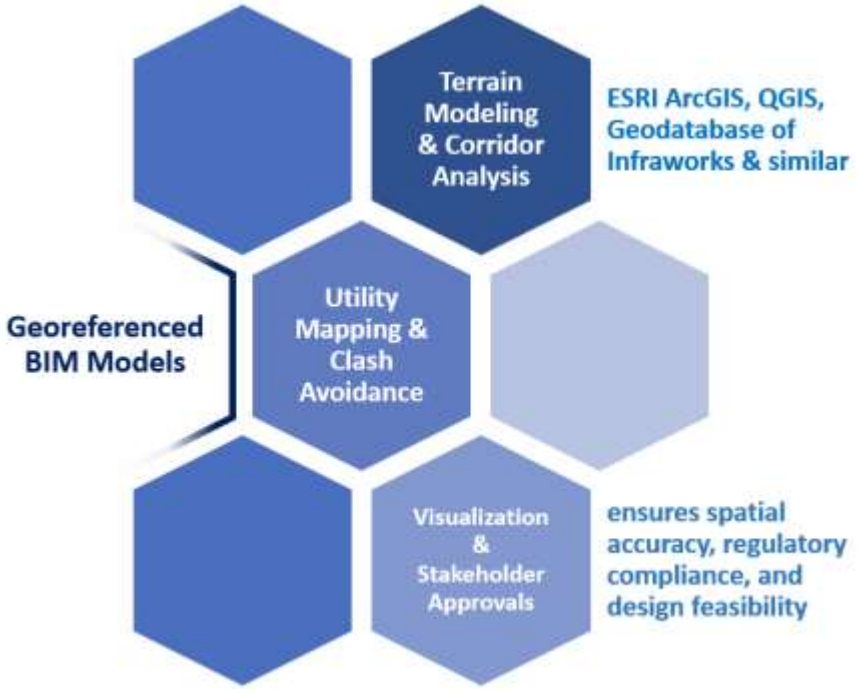
- BIM integrates sonar, LIDAR, drone, and GPS survey data to create accurate terrain and seabed models for dredging, reclamation, and Offshore & Onshore works.

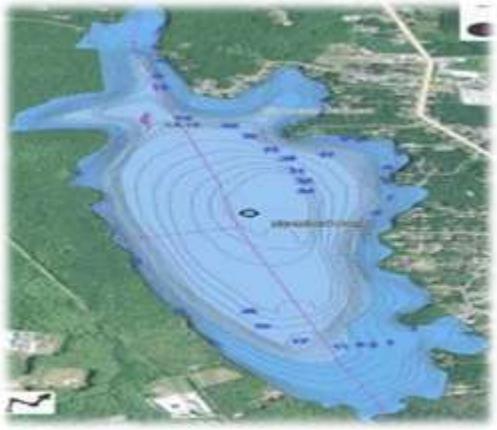
GIS-Enabled Georeferencing

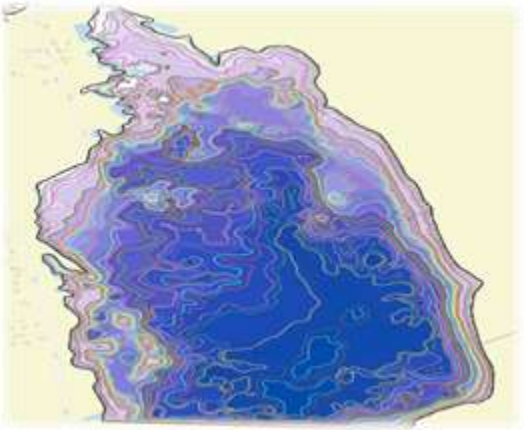
- Aligns BIM models with tidal benchmarks, navigation charts, and national datums.
- Ensures spatial precision, regulatory compliance, and environment-friendly execution.

Seamless Design Integration

- Survey & GIS datasets feed directly into federated BIM models, ensuring constructible and location-accurate design outputs.







Automation in BIM for Marine Construction

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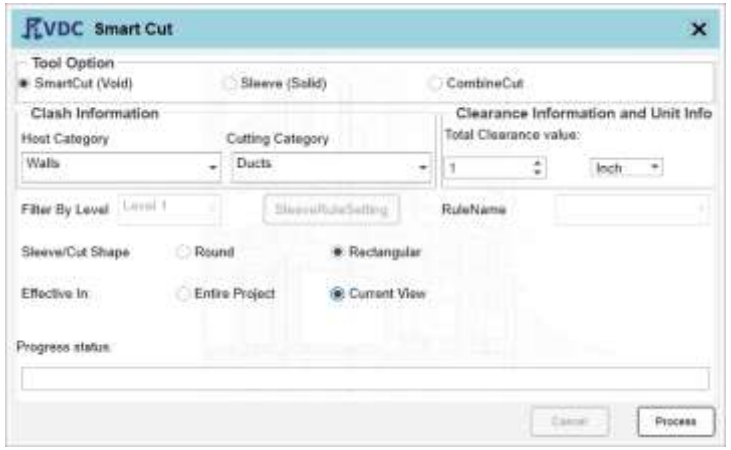
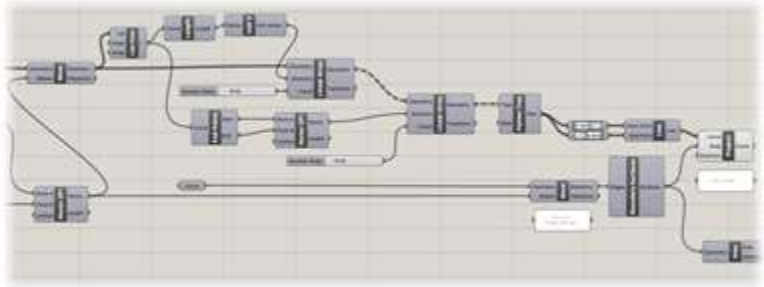
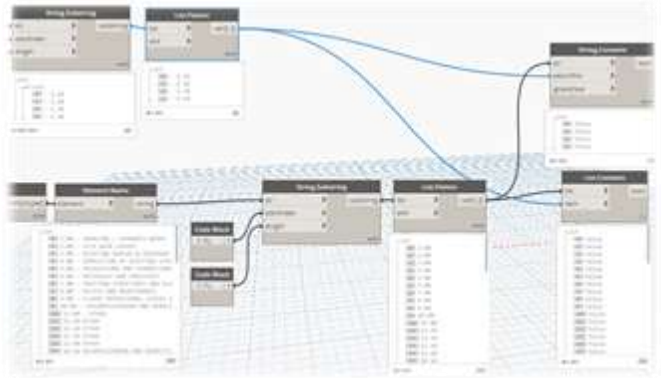
Rule-Based Modeling	Dynamic placement of Marine components & Coastal furniture, Marine Utilities
Parametric Design Tools	Dynamo, Grasshopper, and PiVDC scripts enable rapid iteration of complex marine structures.
Efficiency in Large-Scale Projects	Reduces manual modeling time for breakwaters, dolphins, slipways, and dockyard facilities.
Standardization & Accuracy	Ensures consistency in repetitive elements like fenders, bollards, and utility corridors.
4D/5D Integration	Automated linking of models with schedule (4D) and cost (5D) data for real-time updates.
Scalable for Mega Projects	Supports automation across multiple terminals, docks, and reclamation packages.







Challenges in Marine BIM Implementation

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Legacy System Integration
Difficulty in connecting BIM with older CAD/GIS platforms and existing port authority systems.

Workforce Upskilling
Limited availability of BIM-trained marine engineers, surveyors, and site teams.

Data Complexity
Managing large datasets (bathymetry, geotechnical, structural, utilities) in a federated model.

Cybersecurity Risks
Mission-critical port and coastal data require strict protection against cyber threats.

Interdisciplinary Coordination
Aligning designers, contractors, and port authorities under a common BIM execution framework.

Cost & Time of Transition
Initial investment in training, hardware, and software before long-term ROI is realized.

How Pinnacle Addresses it

- Custom APIs with Efficient RnD Team
- CDE Workflow & IFC-GIS Interoperability
- Training Programs (Internal & External)
- BIM Workshops
- Advanced Model Management
- Effective Data Federation Strategy
- Secured CDE Management
- ISO 27000 Certified Process
- Developing & Implementing BEP
- ISO 9001 Certified QA/QC Process
- Most Recent Technologies & Tools
- Technical & Tool Experts to Implement Best Practices

Technology Ecosystem for Marine BIM

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BIM Authoring	Autodesk Civil 3D Autodesk Revit Autodesk AutoCAD Tekla Structures Bentley OpenRoads Bentley OpenBuildings Bentley MicroStation	Autodesk Navisworks Manage Bexel Manager Solibri Model Checker Revizto
Coordination + Clash Detection		
Automation + GIS + Collaboration	Rhinoceros + Grasshopper Dynamo ESRI ArcGIS QGIS Infraworks	Synchro Pro Bexel Manager iTwo CostX Assemble Autodesk Takeoff
Simulations + Construction Planning	iTwin Autodesk Tandem	Autodesk Construction Cloud BIM360 ProjectWise Trimble Connect Bluebeam Studio Procore Etc.
Visualization & Digital Twin	Bentley Infrastructure Cloud Twinmotion 3DSMAX	
Reality Capture	Recap Pro Bentley Descartes iTwin Reality Capture	Power BI Integration

BIM Services for Marine Construction Projects

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Bid

Pre-Bid Estimation

Marketing Presentation

4D / 5D Simulation

Preconstruction

3D Modelling & Clash Coordination

Constructability Review

Value Engineering

Quantity Takeoff

Construction Drawings & Detailing

Digital Prefabrication

Construction

BIM to Field Integration

Production & Cost Control

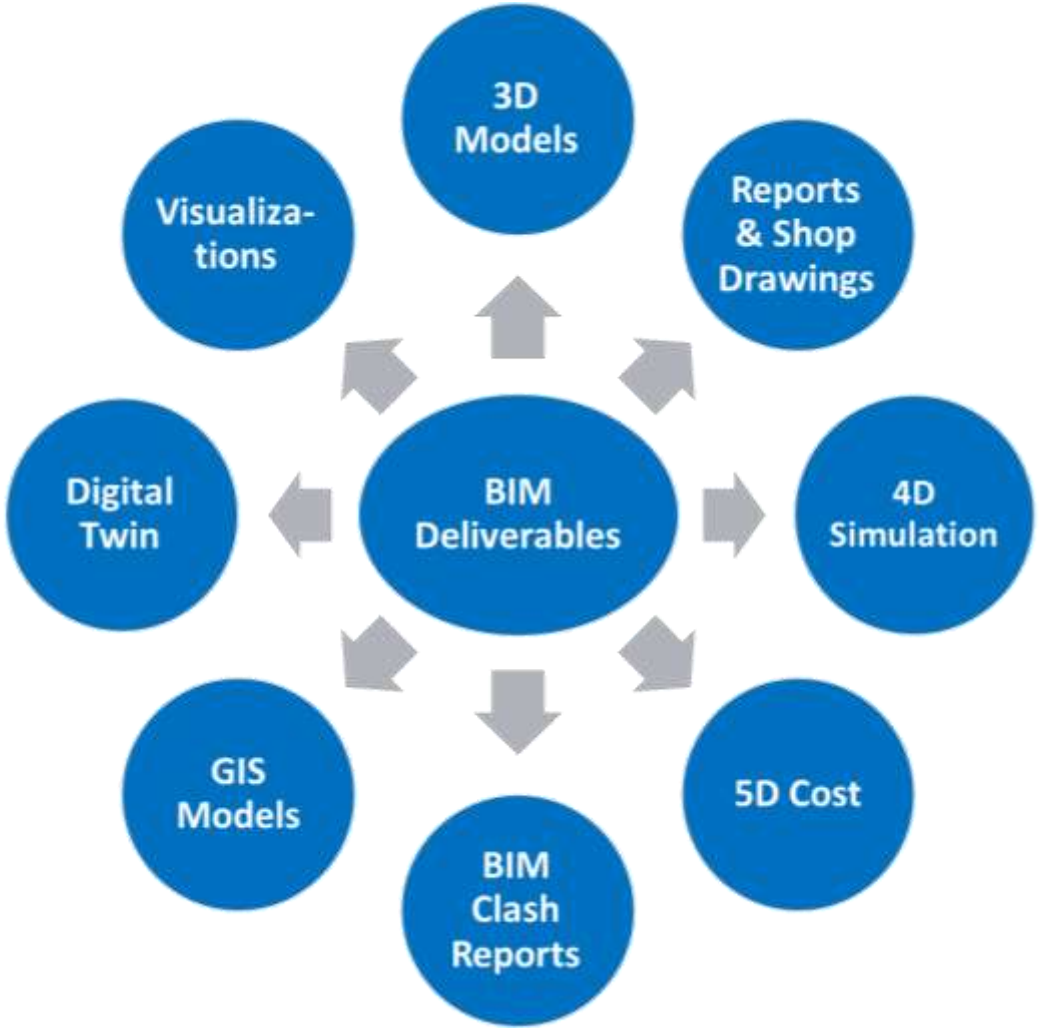
Progress Monitoring

Operations

As-Built Updates

Facilities Management

Digital Twin



Case Studies

Project: Oxagon Port – Dockyard & Terminal Development

Scope: BIM implementation across the Dockyard and terminal buildings.

Challenges:
- Design & Build Stage project resulting in Frequent Design Changes.
- Coordinating multiple contractors and global consultants.
- Tight timeline for BIM deliverables.

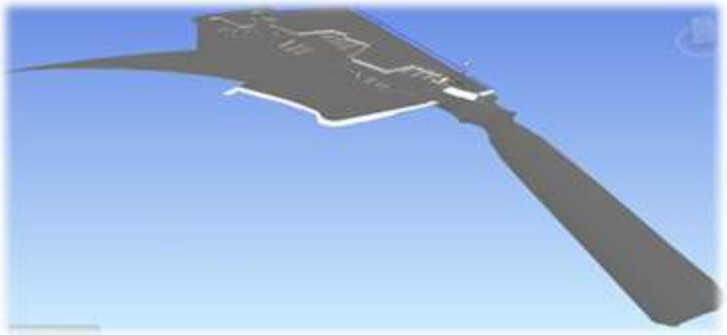
Pinnacle's BIM Role:
- Tracking Change Management using Smart Dashboard Reporting & CDE Management
- Developed a federated BIM model for marine structures.
- Used Dynamo & Grasshopper for automation in Model Authoring.
- Executed 4D simulations for the complete scope, starting from Baseline till Handover.
- Delivered GIS-integrated BIM for geospatial accuracy.

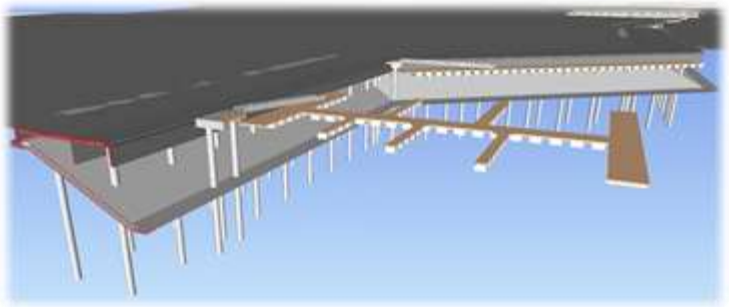
Outcome:
- Reduced rework by 35% through early clash detection.
- GIS Integrated BIM delivered.

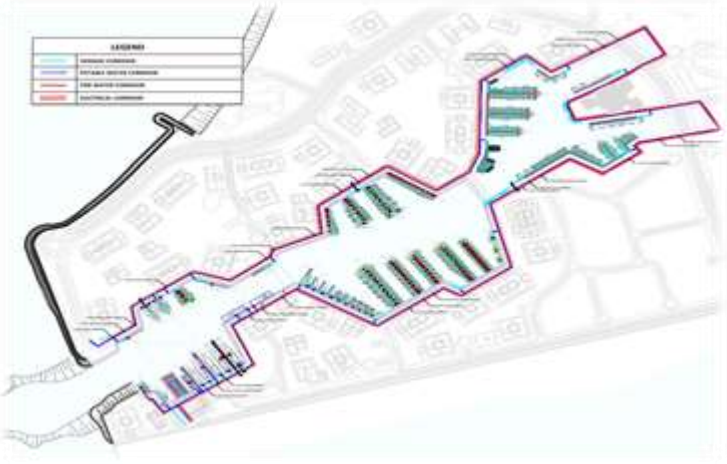
Case Studies

Project: Coast Marina, KSA

Scope: BIM for port expansions and waterfront industrial developments (breakwaters, jetties, pontoons, gangways, utilities, revetments).







Challenges:

- Multiple specialized marine assets requiring high-detail modeling.
- Coordinating submerged utilities with landside marine networks.
- Strict compliance with coastal geometry and safety standards.

Pinnacle's BIM Role:

- Delivered LOD 400 BIM models, shop drawings, and BOQ extraction.
- Modeled breakwaters, revetments, pontoons, gangways, and jetty bridges.
- Produced clash-free 3D models for planning and fabrication workflows.
- Used Revit, Civil 3D, Rhino, and Navisworks for phased delivery.
- Coordinated with contractors & consultants to ensure compliance with marine standards.
- Linked BIM deliverables to field execution for reduced errors.

Outcome:

- Achieved streamlined construction planning across multiple port zones.
- Reduced onsite rework through clash detection and phased coordination.

Case Studies

Project: Land Reclamation and Polder Construction at Pulau Tekong, Singapore

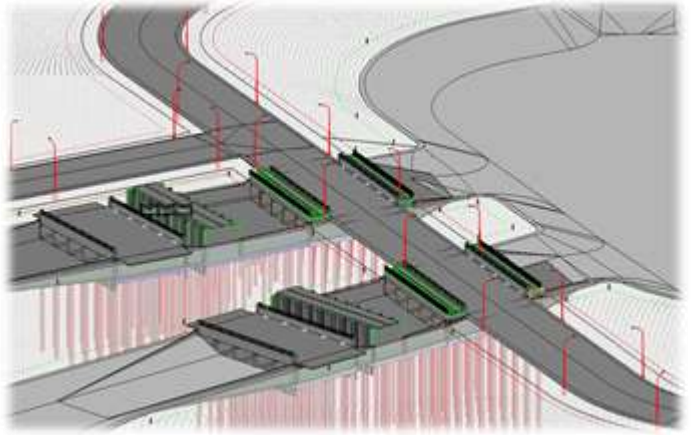
Scope: BIM services for sea dikes, drainage systems, service trenches, polder roads, and reclaimed zones.

Challenges:

- Coordinating large-scale grading and subsurface drainage in reclaimed low-lying sea areas.
- High-precision cut-fill analysis for 810 hectares of land reclamation.
- Ensuring compliance with Singapore's strict reclamation and infrastructure standards.

Pinnacle's BIM Role:

- Created 3D models of reclaimed land, sea dikes, drainage systems, and polder road networks.
- Performed model validation, clash detection, and grading coordination.
- Conducted cut-fill volumetric analysis and zone-based phasing for construction sequencing.
- Produced construction documentation and shop drawings for roads, trenches, and access paths.
- Enabled COBie data extraction and QR code integration for field-ready BIM elements.



Outcome:

- Delivered accurate BIM models for 810 hectares of reclaimed land.
- Streamlined interdisciplinary coordination with contractors and consultants.
- Improved construction accuracy, reduced rework, and ensured compliance with Singapore's reclamation policies.

Case Studies

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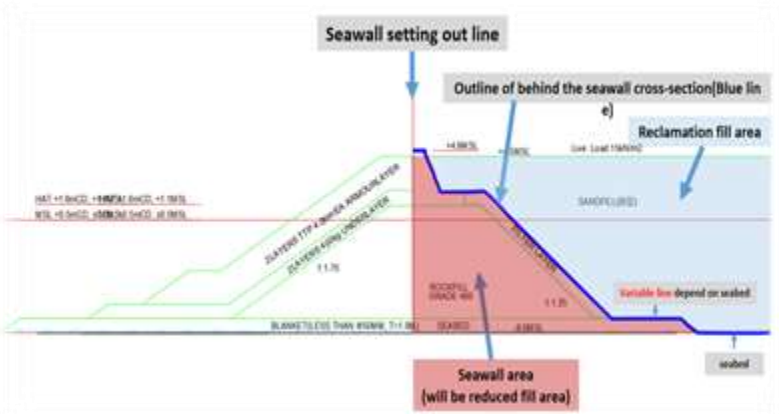
Projects	Description
Pulau Tekong Polder – Singapore	Delivered BIM for Singapore's largest land reclamation project using the **polder method**, including sea dikes, drainage canals, and service roads. Models supported cut-fill analysis and construction staging.
International Airport Reclamation – Sangley Point, Philippines	Developed BIM models for 810 hectares of coastal reclamation. Scope included **dike structures, pumping stations, road networks**, and utility corridors with COBie-ready asset data.
Oxagon Port & Dockyard – Saudi Arabia	Provided LOD 400 BIM for **quay walls, berths, dolphins, marine utilities, and dock infrastructure**. Integrated 4D sequencing, shop drawings, and COBie-ready asset handover aligned with NEOM's digital vision.
Coast Marina – Saudi Arabia	Executed BIM modeling for **floating pontoons, marina walkways, MEP services, and waterfront facilities**. Supported architectural coordination, marine utility layout, and phased construction deliverables.
Shura Marina – Saudi Arabia	Delivered high-detail BIM for **marina pontoons, floating walkways, access gangways, and submerged utility systems**. Supported MEP integration, mooring systems, and architectural coordination.
Mid Barataria Sedimentation Basin – USA	Supported BIM for a **coastal restoration project** by modeling levees, sediment channels, and hydraulic interfaces.



Glimpses of Successful BIM Implementations

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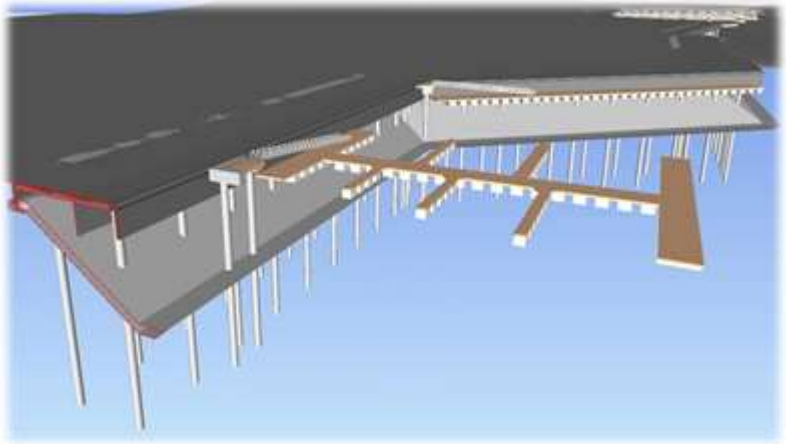
Project Location: **USA**



Project Location: **Saudi Arabia**

Project Location: **Saudi Arabia**

Project Location: **USA**

Project Location: **Singapore**

Project Location: **Saudi Arabia**

Partnering for the Future of Marine & Port construction

Pinnacle Infotech Construct Certainty, with Technology

30+ years

Proven Global Experience –

Successful delivery of marine projects in Singapore, KSA, Middle East, Europe, and USA.

End-to-End BIM Expertise –

From survey integration to digital twin handover.

Technology Leadership –

Automation, PiVDC, Dynamo, Grasshopper, IoT-enabled BIM.

Client-Centric Approach –

Phased adoption, tailored training, and ROI-driven delivery.

Future-Ready Commitment –

Aligning with Industry 4.0, national digitization policies, and sustainable marine infrastructure.

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Thank You

Countries Served

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