

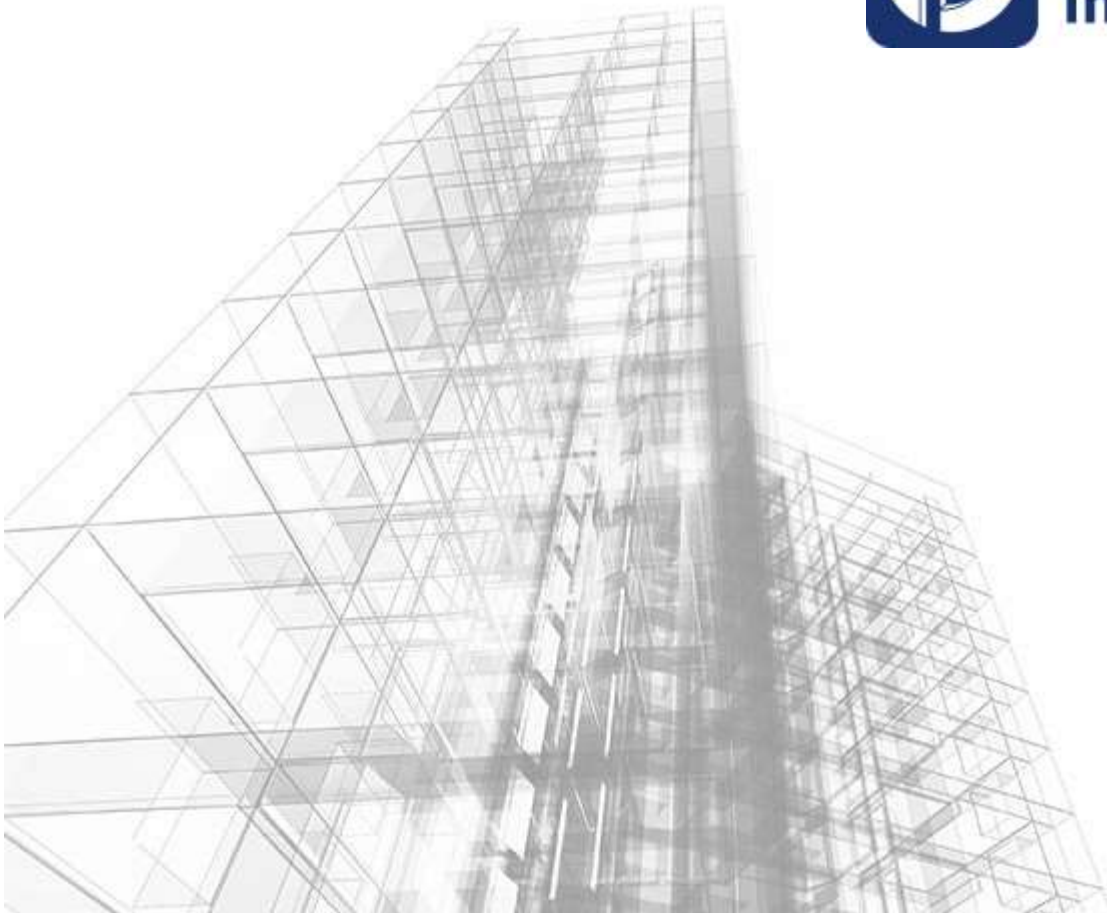


**Pinnacle
Infotech**

Construct
Certainty, with
Technology

Infrastructure Digital Twin Decoded

Pinnacle Infotech Solutions





Key Challenges



No Centralized System



Operational Inefficiencies



No Tools To Predict The Health Of Assets



Reactive Maintenance



Limited Real-Time Visibility



Location referencing issues



Fragmented Asset Tracking



Sustainability monitoring



Scalability Challenges





About the Project- Integration of Roads/Bridges in a single Digital Twin platform

- Demonstrate capability of incorporating OpenRoads, OpenBridge, Civil3D, Trimble, Revit, IFC drawings into iTwin Digital platform to power a hyper-connected, self-monitoring environment.
- This is central to resilient infrastructure, which can self-monitor, adapt and respond to unexpected events.

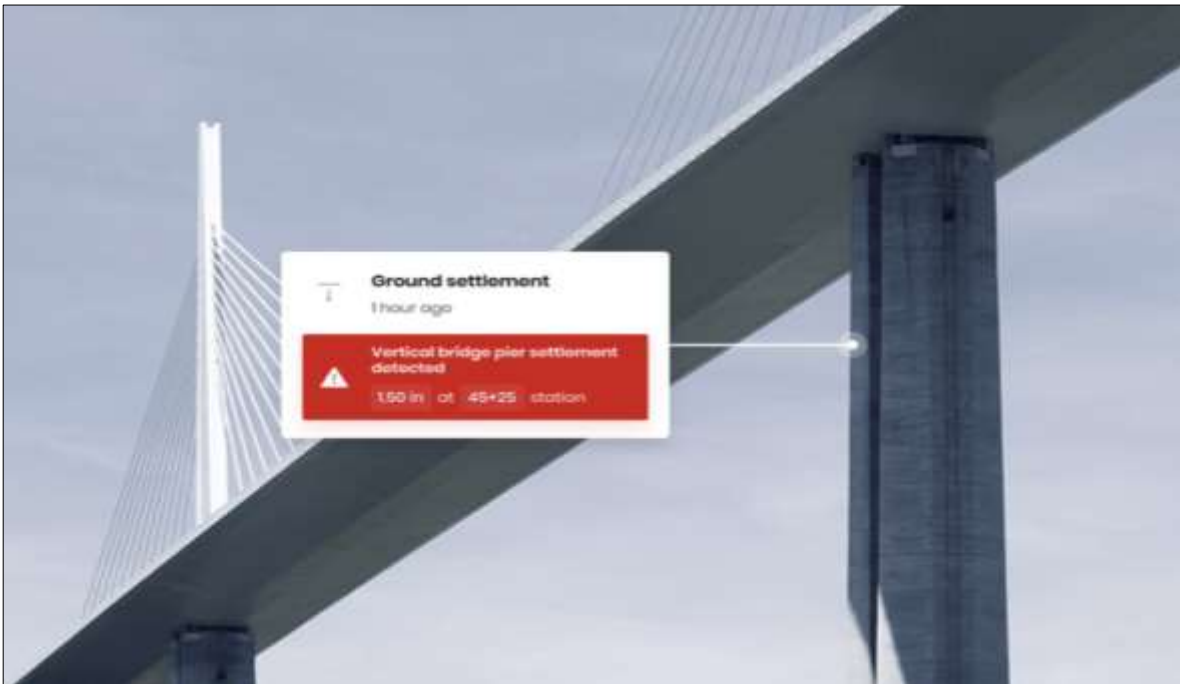


About the Project- CMMS integrated

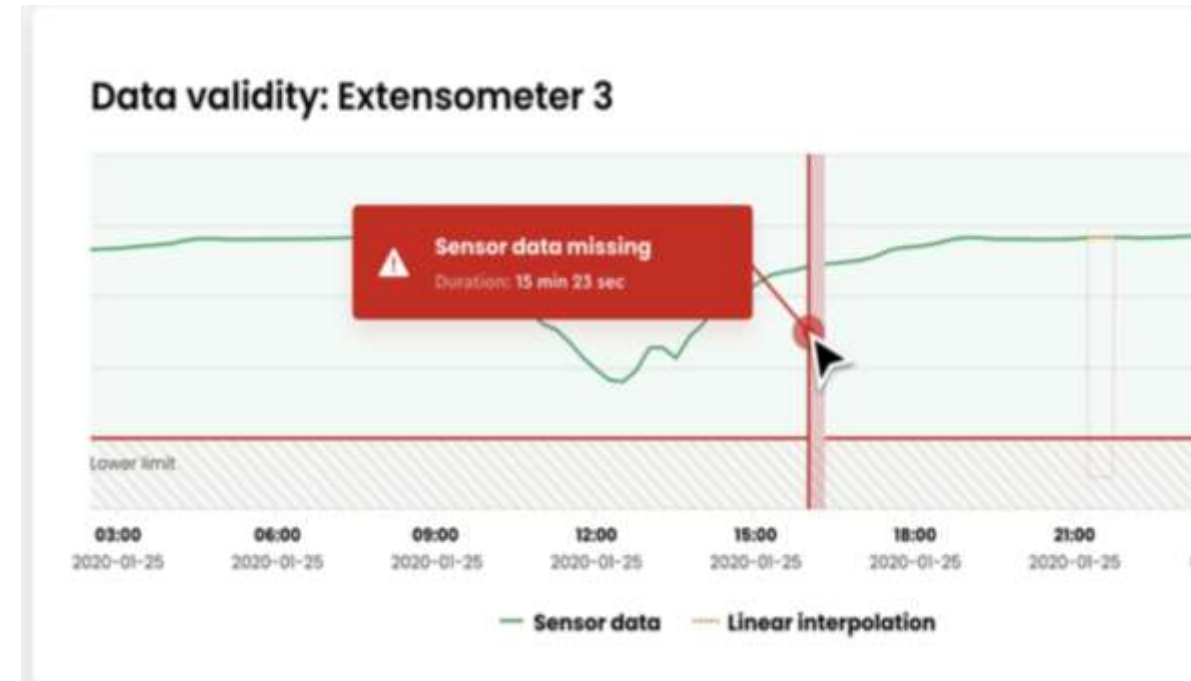
- From structural health monitoring of Bridges to real-time surface monitoring and visual analytics of Roads, Bridges and Pavements , set a benchmark for sensor-integrated infrastructure maintenance
- Empower multi-million dollar assets with dynamic validation of performance, usage, and sustainability.



Step 2— Data Acquisition



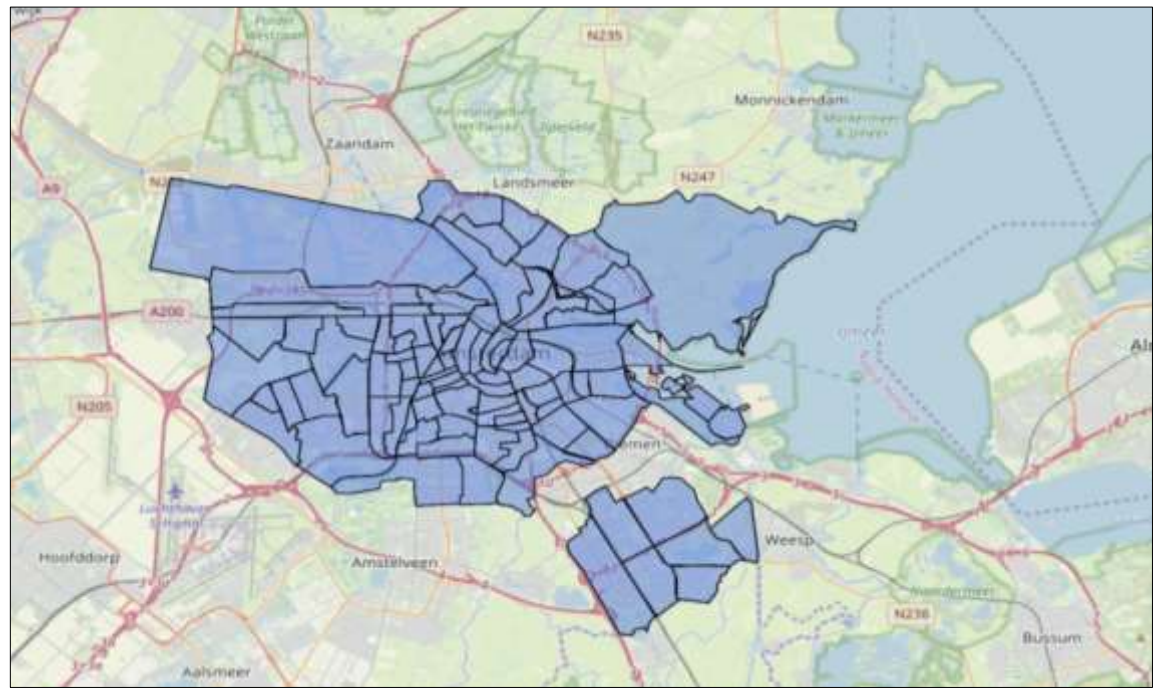
Gather data which is not possible by
Manual inspection



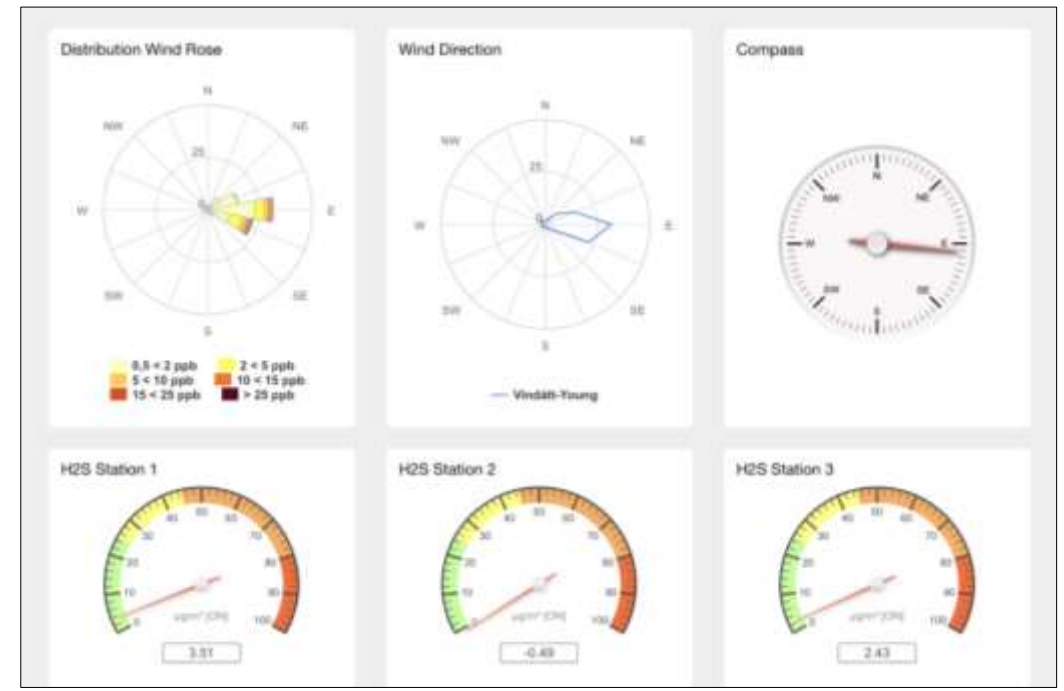
Monitor data quality



Step 3 — Visualization and analysis



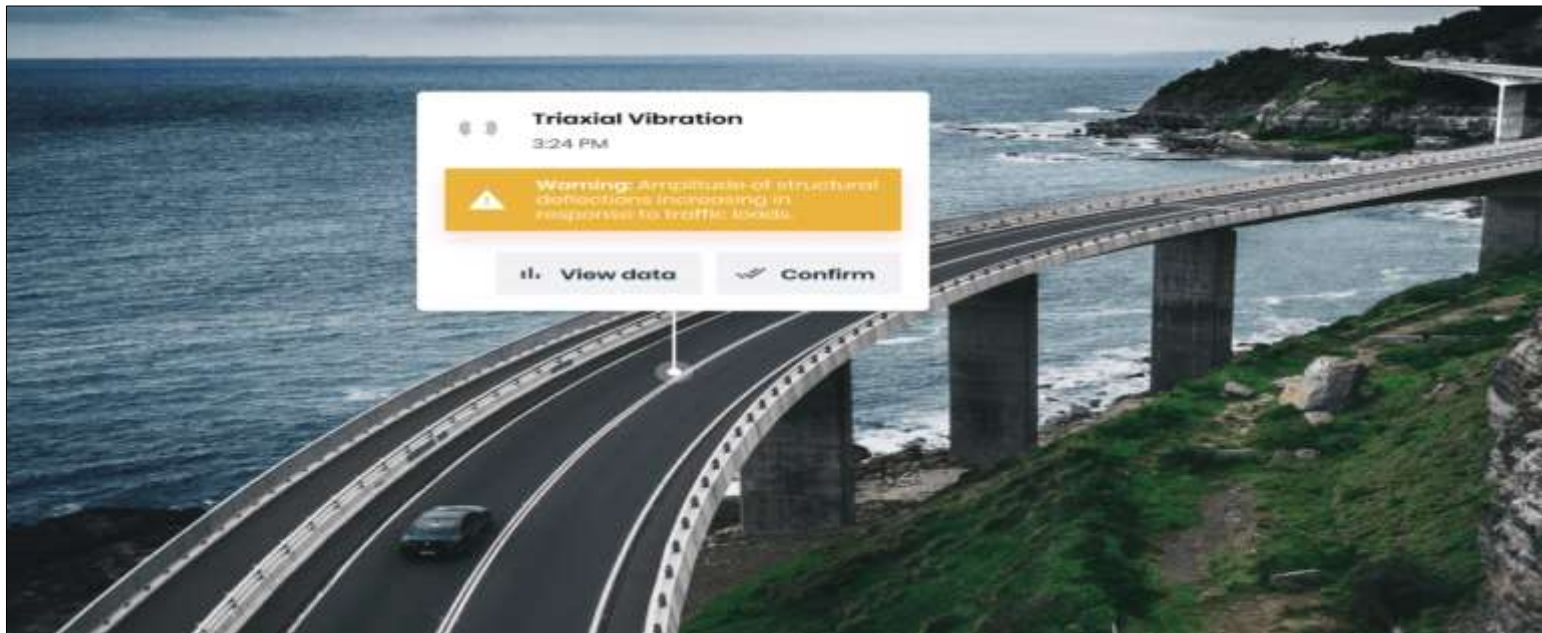
Show data in context



Visualizations and analysis



Step 4 — Alarms and Reporting



Alarms



Reports



Project Digital Twin- CMMS integration





Learnings



Benefits and Importance of Digital Twin integration for Bridges and Road



Key Points:

- ❑ **Structural Health Monitoring (SHM):** Real-time updates on load, tension, stress, and corrosion.
- ❑ **Preventive Maintenance:** Detects micro-cracks or fatigue before failure.
- ❑ **Asset Lifecycle Management:** Through intelligent data collection and comprehensive analysis of safety quality, noise, dust, and deformation monitoring.
- ❑ **Safety Assurance:** Prevents sudden collapses and ensures public confidence. DTs detect and notify stakeholders of safety risks, issue real-time warnings, and support early emergency detection
- ❑ **Disaster Preparedness:** Sensors can collect data on construction equipment, building materials, and environmental factors like temperature, humidity, and vibration, transmitting that data in real time to the DT platform. Simulates responses to earthquakes, floods, or heavy traffic surges.
- ❑ **Reduced Inspection Costs:** Drone/sensor data reduces manual inspection frequency.



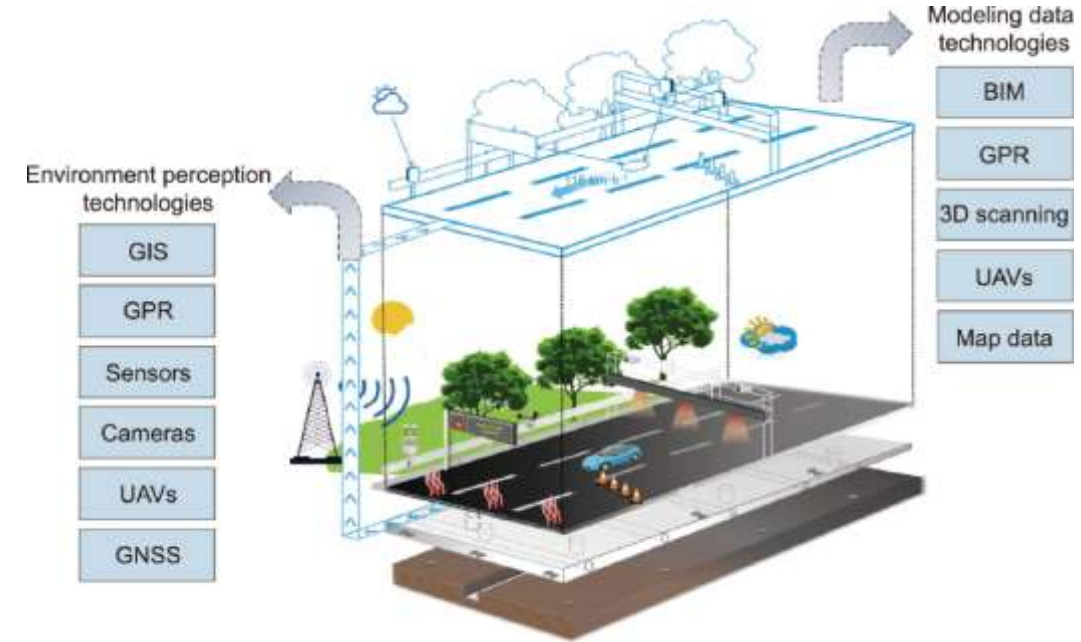


Implementation Challenges for Roads



Key Points:

- ❑ **Data Integration Complexity:** Inconsistent data from sensors, vehicles, weather stations.
- ❑ **Infrastructure Upgrades:** Need to retrofit existing roads with IoT sensors and smart systems.
- ❑ **High Initial Cost:** Deployment of sensors, connectivity, and analytics platforms.
- ❑ **Data Privacy & Security:** Real-time user and vehicle tracking requires robust cybersecurity.
- ❑ **Interagency Coordination:** Municipalities, traffic departments, and IT vendors must collaborate.
- ❑ **Connectivity Gaps:** DT technology leverages virtual–physical mapping to facilitate the real-time monitoring and dynamic simulation of transportation infrastructure.





Implementation Challenges for Bridges



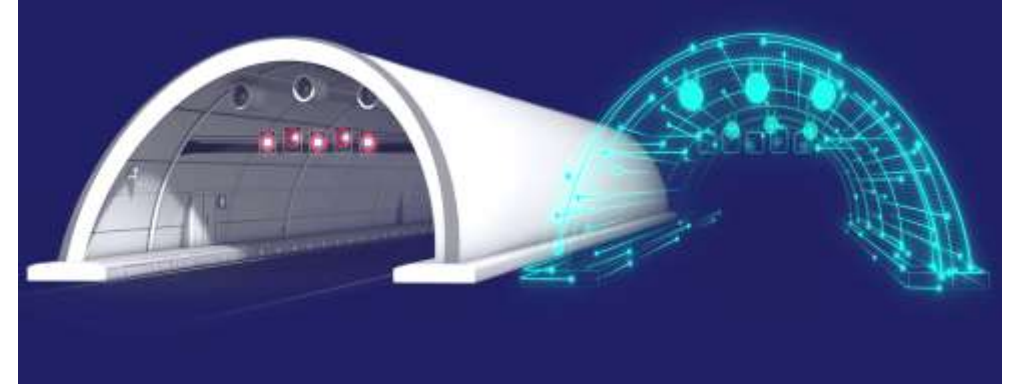
Key Points:

- ❑ **Retrofitting Legacy Structures:** Hard to install sensors on aging or inaccessible parts.
- ❑ **Data Volume & Processing:** Continuous structural data creates big-data challenges.
- ❑ **High Sensor Maintenance:** Sensors in harsh environments need regular calibration.
- ❑ **Cost of Implementation:** Especially high for long-span or iconic bridges.
- ❑ **Standardization Issues:** Lack of global norms for digital twin data models in infrastructure.
- ❑ **Legal & Compliance:** Ownership of data and regulatory approval processes.





Benefits and Importance of Digital Twin for Tunnels



Key Points:

- ❑ **Environmental Monitoring:** Real-time tracking of air quality, gases, humidity, and temperature.
- ❑ **Enhanced Safety:** Rapid detection of fires, gas leaks, structural faults.
- ❑ **Predictive Maintenance:** Avoids sudden breakdowns by simulating asset degradation.
- ❑ **Operational Efficiency:** Helps manage lighting, ventilation, drainage based on usage and weather.
- ❑ **Emergency Management:** Simulates evacuation during accidents or disasters.
- ❑ **Remote Supervision:** Minimizes human intervention in hazardous conditions.



Implementation Challenges for Tunnels



Key Points:

- ❑ **Hostile Environment for Sensors:** High humidity, limited airflow affect sensor performance.
- ❑ **Connectivity Limitations:** Underground settings cause signal and data transfer issues.
- ❑ **Energy Supply for Devices:** Powering IoT devices over long tunnel spans is a challenge.
- ❑ **High Installation Costs:** Due to complexity and safety requirements.
- ❑ **Data Overload:** Continuous monitoring generates large volumes of unstructured data.
- ❑ **Integration with Emergency Systems:** Needs to sync with fire, ventilation, and rescue protocols





Thank You



Countries Served



Website: www.pinnacleinfotech.com

India Office Locations

Durgapur - HQ

Pinnacle Infotech Solutions
Bidhannagar, Durgapur, WB 713212
Phone: +91 343 6602222
Fax: +91 343 6602230
Email: info@pinnacleinfotech.com

Madurai

Pinnacle Infotech Solutions
Elcot IT Park, Plot No - 5,6,&7, Vadapalanji,
Madurai, Tamil Nadu, India - 625021
Phone: +91 70100 97363

Jaipur

Pinnacle Infotech Solutions
Mahindra Sez, Jaipur, RJ 302037
Phone: +91 141 722444

Kolkata

Pinnacle Infotech Solutions
Ecospace Business Park, Kolkata 700156
Phone: +91 33 2324 5900

International Office Locations

USA - Houston

Pinnacle Infotech Inc.
50 Sugar Creek Blvd,
Sugar Land, TX 77478
Mr. Biswanath Todi
Phone: +1 713 780 2135
Email: btodi@pinnacleinfotech.com

USA - Atlanta

Pinnacle Infotech Inc.
6065 Roswell Rd NE #625,
Atlanta, GA 30328
Mr. Mickey Cantrell
Phone: +1 270 223 6319
Email: mcantrell@pinnacleinfotech.com

USA - San Jose

Pinnacle Infotech Inc.
25, N 14th Street, Suite #670
San Jose, CA 95112
Mr. Jash Hirani
Phone: +1 832 874 2798
Email: jhirani@pinnacleinfotech.com

Canada

Pinnacle VDC Inc.
3250 Bloor Street West, East Tower,
Suite 600, Toronto, ON M8X2X9, Canada
Mr. Cory Houle
Phone: +1 613 290 7477
Email: choule@pinnacleinfotech.com

UK

Pinnacle Infotech Limited
The Barley Mow Centre,
London, W4 4PH
Mr. Pat Saha
Phone: +44 79600 26070
Email: psaha@pinnacleinfotech.com

Germany

Pinnacle BIM Technology GmbH
Lilienthalstrasse 27, 85399 Hallbergmoos,
Munich, Germany
Mr. Arijit Sen
Phone: +49 162 5111 463
Email: arijits@pinnacleinfotech.com

UAE

Pinnacle Infotech Technologies FZ-LLC
Office No - 307, 3rd Floor, Building No. 7
Dubai Outsource Zone, Dubai, UAE
Mr. Yash Goyal
Phone: +971 52 769 7465
Email: dubai@pinnacleinfotech.com

Singapore

Pinnacle BIM Technology PTE. LTD.
BCA Braddell Campus, 200 Braddell Road,
#13-63, Singapore 579700
Mr. Kuntal Chakraborty
Phone: +65 69508205
Email: kchakraborty@pinnacleinfotech.com

Japan

Pinnacle BIM Technology K.K.
#403 7-1-5, Minamiaoyama, Minato-ku,
Tokyo, Japan, 107-0062
Mr. So Adachi
Phone: +81 80 3008 9453
Email: sadachi@pinnacleinfotech.com