Integrated Project Approach for Rail Projects

Agenda

LiDAR Survey, Mapping and Engineering Solution	**BIM for Station Redevelopment**	**Geospatial Solutions**

LiDAR Survey, Mapping and Engineering Solution

Type of LiDAR to be used

- Terrestrial LiDAR

  - Short range, medium range, Long Range upto 2000 m
  - Wide FOV (360° horizontal and 270° vertical),
  - Data scan rate is 50,000 points per second or more
  - Data accuracy can be achieved upto 1 to 6 mm
  - Interfaces (LAN, JSB 2.0)

- Mobile LiDAR

  - Comprises of Optical sensor, GNSS/INS positional navigation system (GPS + IMU), Laptop, and mobile platform
  - Scan at rate 50,000 and more with vehicle speed of 80 miles per hour with an accuracy of mm to cm
  - Provide acquisition of 360° horizontal and 100° vertical FO

TLS Vs MLS

TLS

- Railway platform structures and asset mapping & analysis
- Office 3D mapping and analysis
- As built inventory

MLS

- Rail track , railway asset and side inventory analysis
- Ballast profile determination
- Estimation of encroachment and erosion near tracks
- Corridor clearance, slope analysis, infrastructure planning, etc

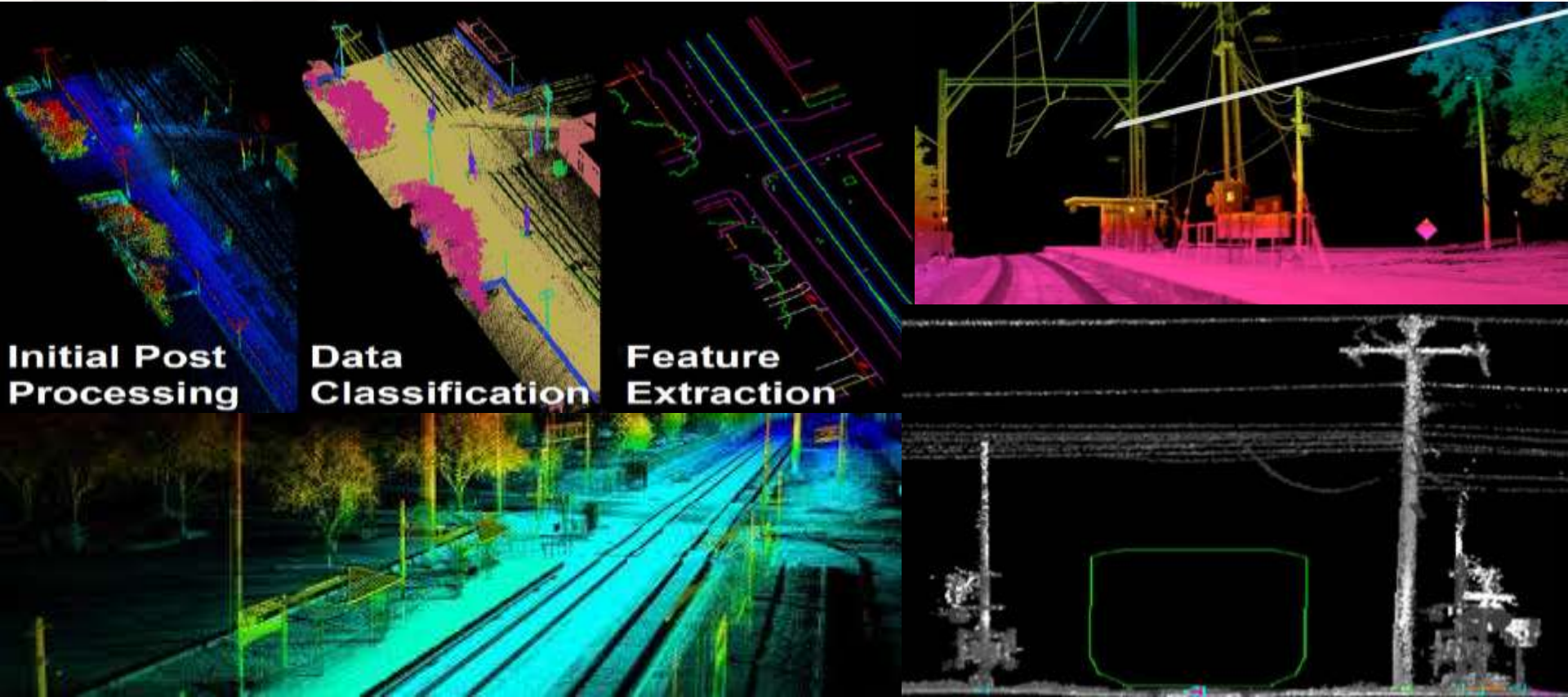
Advantage of using LiDAR in Railways

- Rapid and safe data capture with higher productivity
- Accuracy lies with mm and minimum gross errors
- Mobile scanner easy to mount on the rail car
- Do not miss feature, reliable data capture
- Analysis of as-built structure, tunnels, bridge, clearance analysis , Inventory analysis, etc

Cont……

- Mapping of terrain to determine alternate locations for new track routes
- Pre-construction surveys for spur line or double tracking studies
- Mapping of existing routes to support maintenance management
- Asset mapping providing property identification
- Flood plain evaluation of areas
- Vegetation mapping
- Detailed bridge inspections
- Derailment investigation support
- Data acquisition and analysis related to fires, rock/mud/snow slides
- Client specific support in acquisition, divesture and financial restructuring of operations

Asset Management



Mobile LiDAR Applications

Asset Management

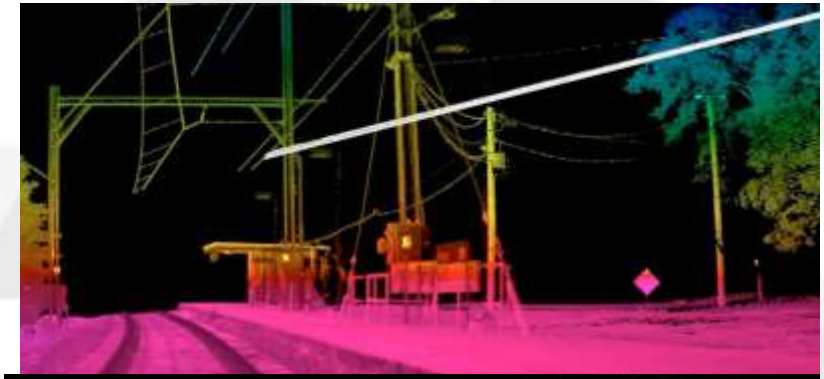
- Complete asset management
- Asset mapping of track inventories
- Bridge structure and overhead clearances
- Determine best way to serve existing & future travel demands

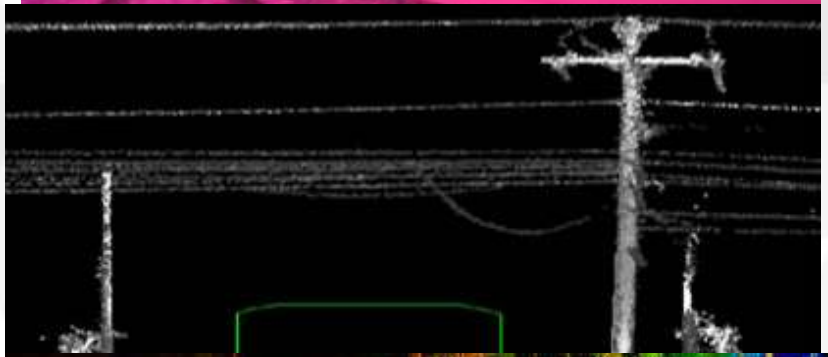
RailCorridor Development

- Pre and post construction surveys for corridor planning, maintenance and monitoring
- Traffic congestion/Parking Utilization at entry gates
- Determine land suitability, including resources and proximity to buildings

safety

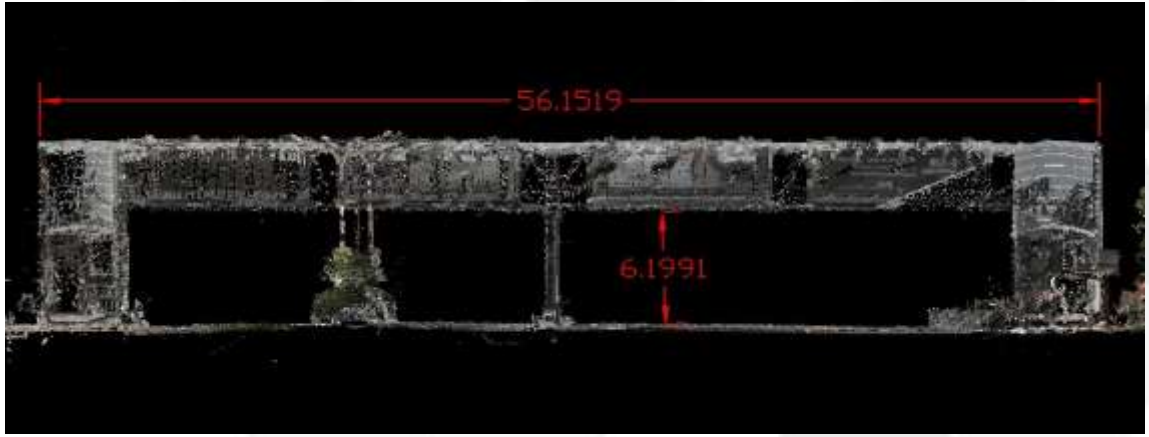
- Surveying of areas adjacent to existing highway corridors for erosion management and environmental impact
- Clash detection
- Deformation detection in tunnels





Roadside Inventory Analysis

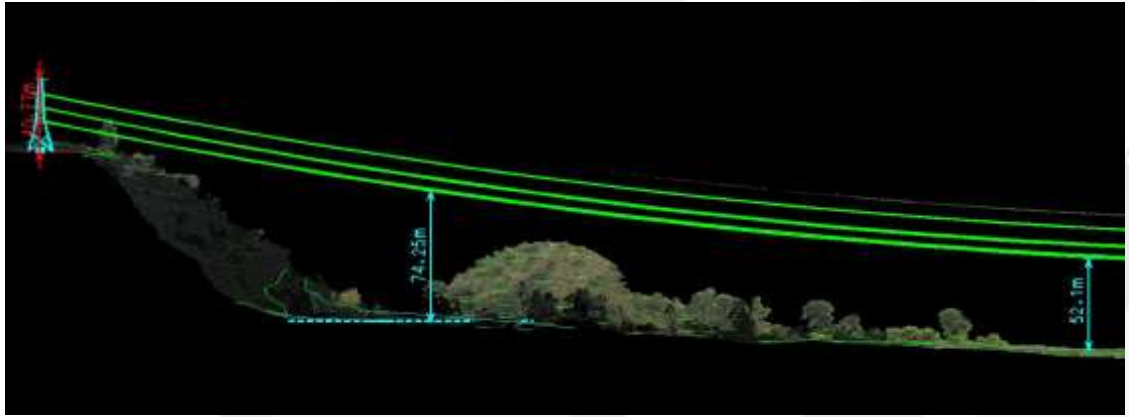
- Measurement of Over bridge height with LiDAR dataset



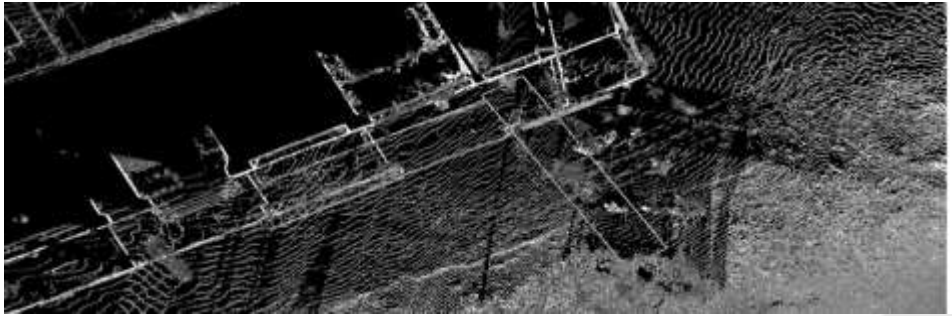
- Measurements of Metrorail overpass. Overpass pillar measurements are depicted in the figure

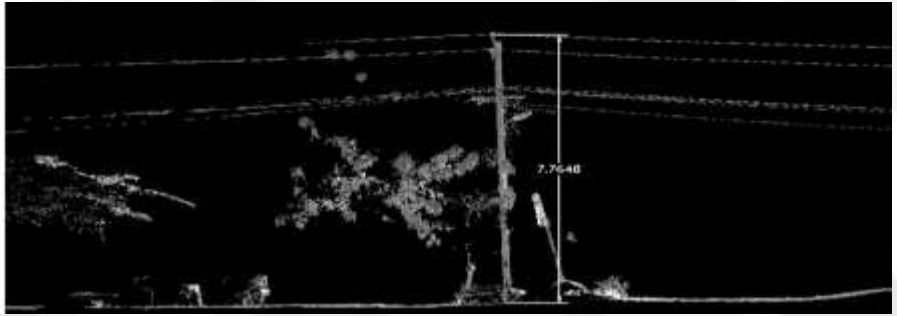
Roadside Inventory Analysis

- Transmission tower and line height measurements from the road



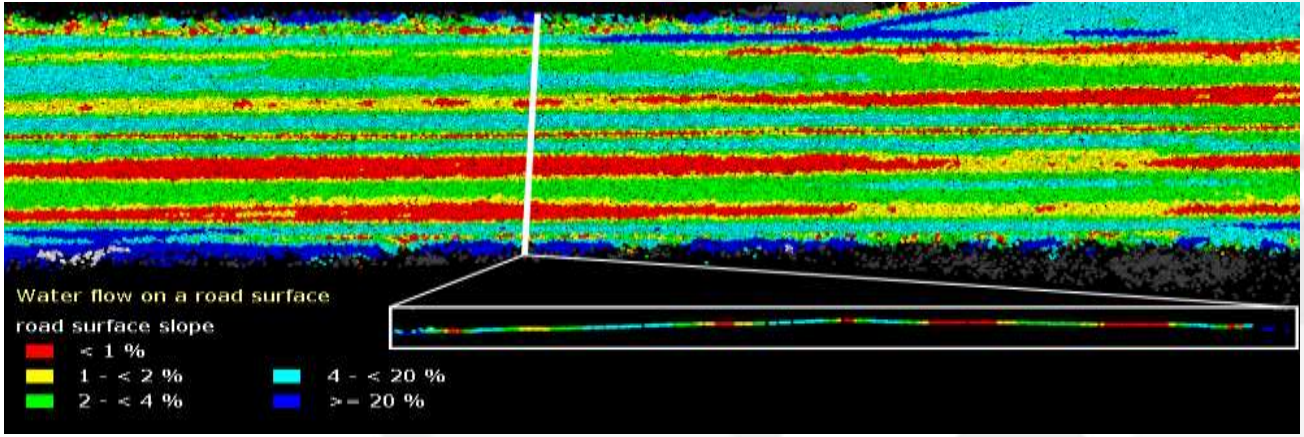
- Electric pole height calculations alongside Rail(Top view & side view)



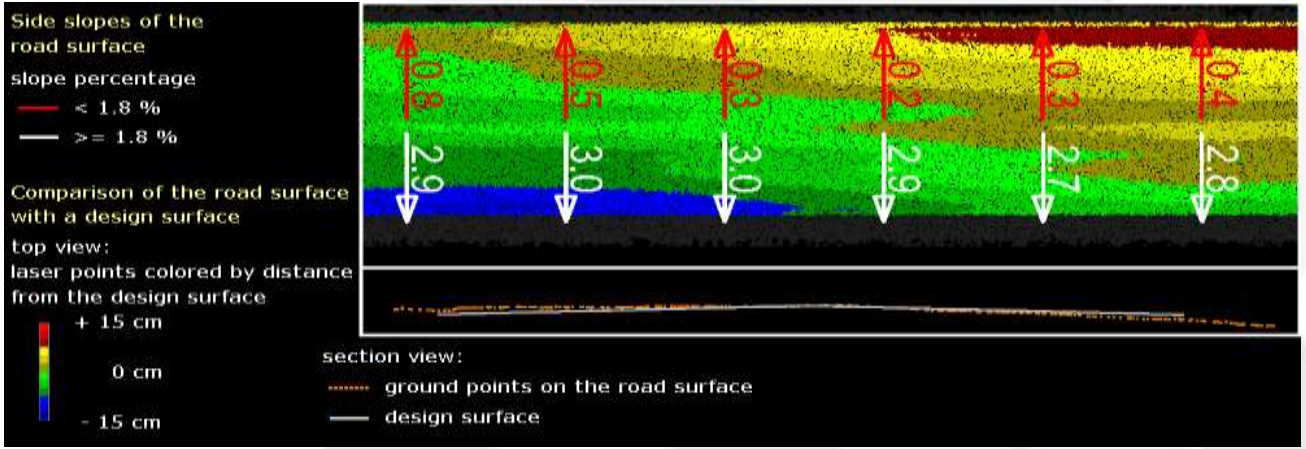


Rail Corridor Analysis

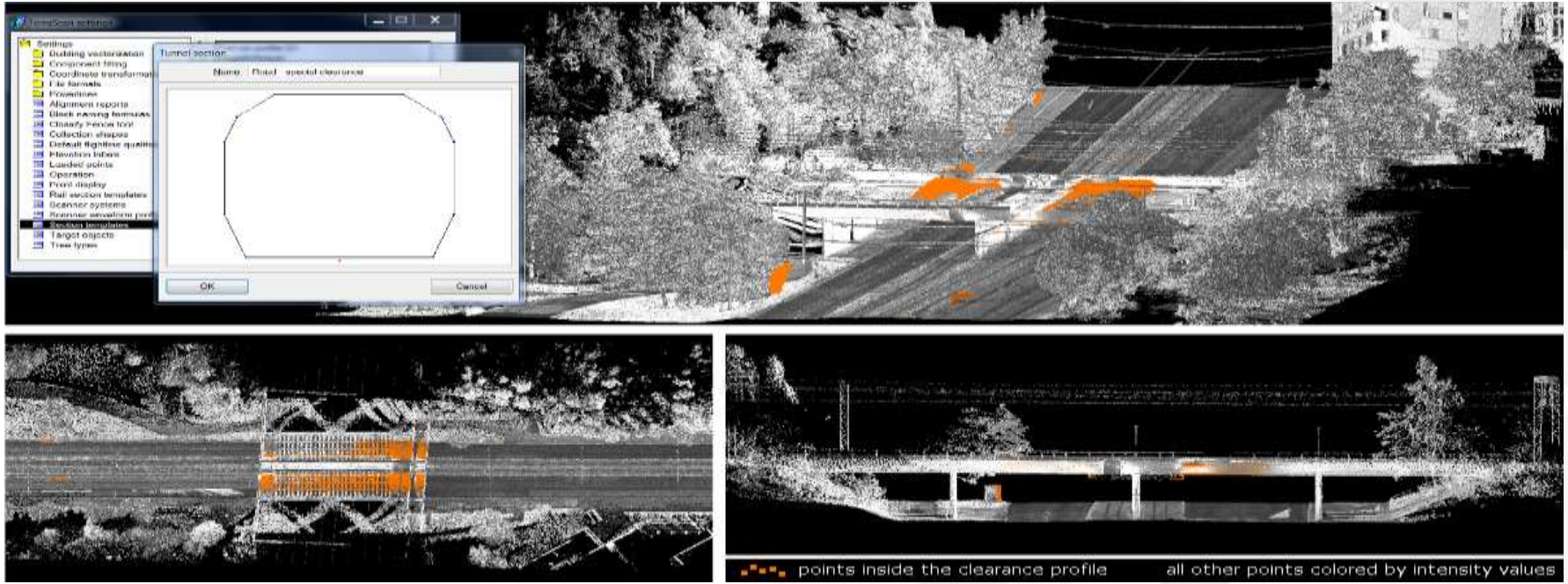
- Water flow analysis



- Railslope Analysis



Clearance Analysis



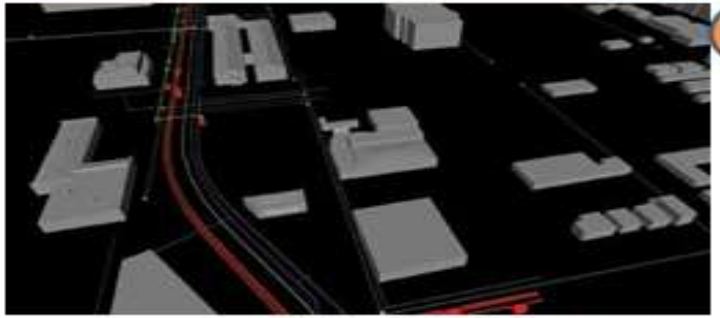
- Clearance analysis related to regulations for stopping and over passing distances
- Clearance areas under bridges, overhead wires, and in tunnels

Right of Way (ROW) Acquisition & Visualization

- ROW acquisition is a process that involves obtaining necessary property rights for a transportation project.

  - Planning
  - Appraisal
  - Acquisition
  - Relocation Process
  - Property Management

Integration of Surface & Subsurface Data

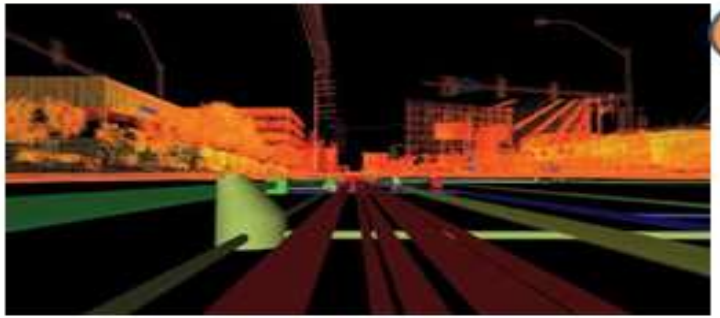


1

City buildings "in gray" are modeled with underground utilities.

2

RGB-colored point cloud helps locate existing utilities



4

Street view shows geo-located above- and below-ground utilities

3

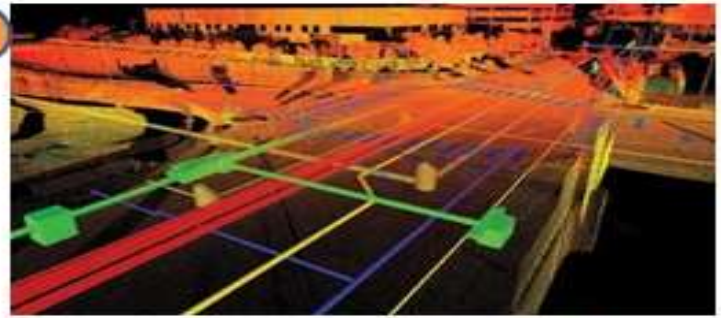
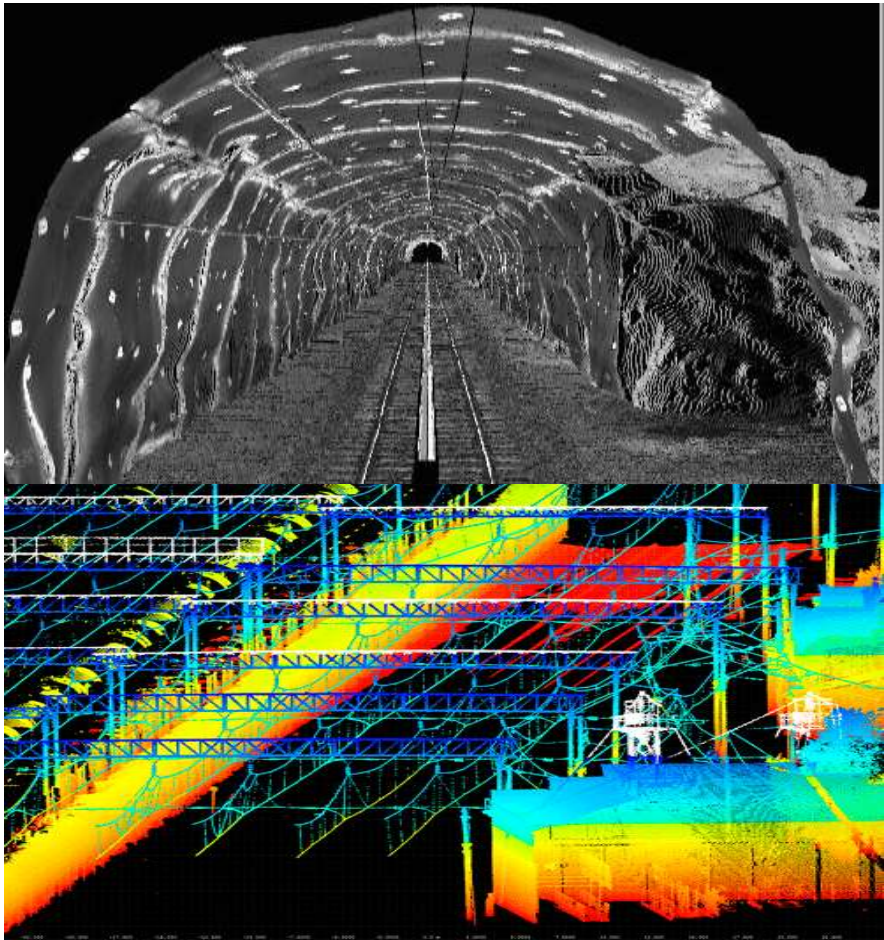


Image incorporates main street data point cloud and as-built plan sets

As-Built Mapping

- Asset Tracking (like sleepers, switches, signs, poles, towers, noise protection walls, etc) and creating track profile
- Real state management
- Facility management (Track, power, communication & signals, ware house, etc)
- Capacity planning
- Supply Chain management(ballast and gauge information)
- Danger object detection along railway

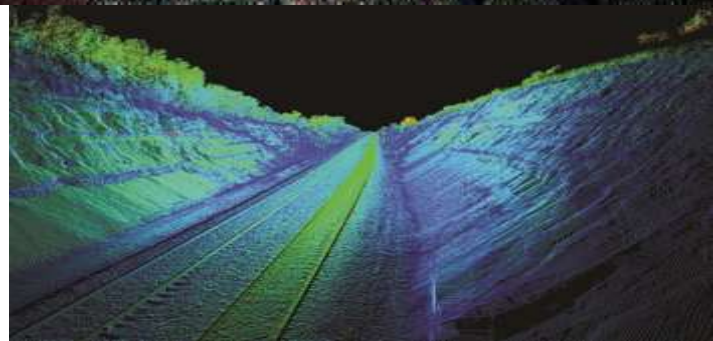


Infrastructure Planning

- New route/network planning
- Modifying as-built structure, new tracks, and facility
- DEM analysis
- New infrastructure planning like warehouses, substation, etc
- Safety and emergency services

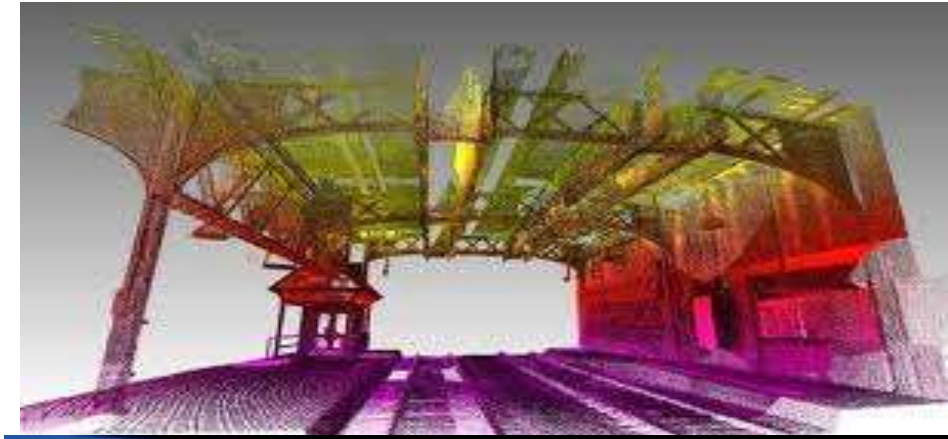
Corridor mapping

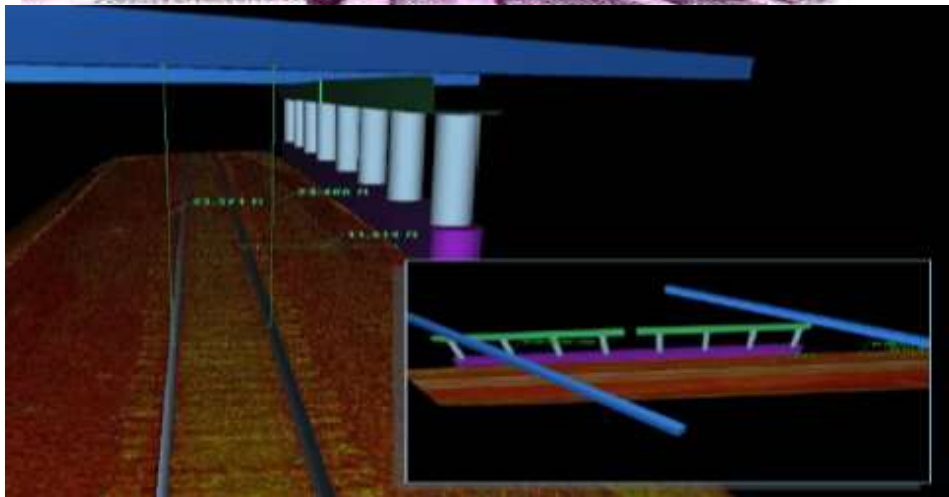
- Over head analysis (including power line, tunnel, vegetation, etc)
- Vegetation mapping
- Mapping all asset along track
- Mapping and measuring geometry of track & track bed
- Cliff and slope analysis along track
- Encroachment analysis, railway boundary, etc



Engineering and Design Services

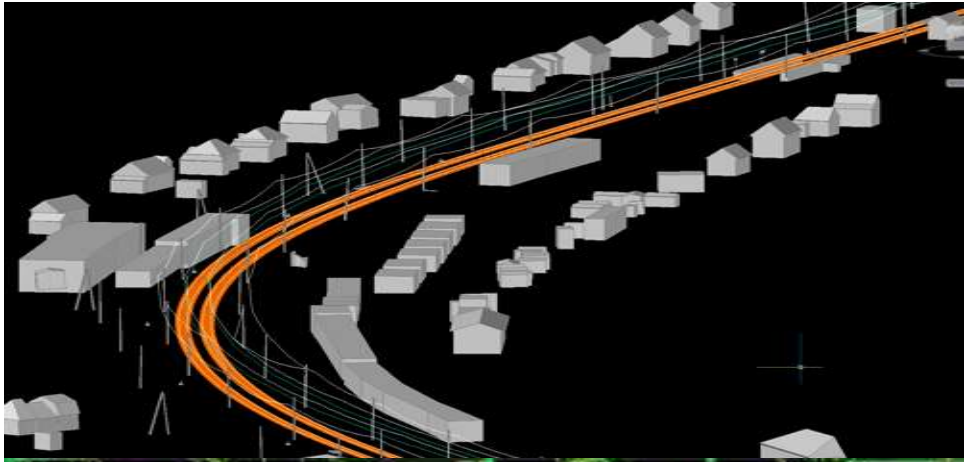
- Geometry analysis of railway structure (like platform, track)
- Building information management
- Stairs, Over bridge, and subway analysis
- Track alignments, clearance profiling, etc
- Structure analysis, etc

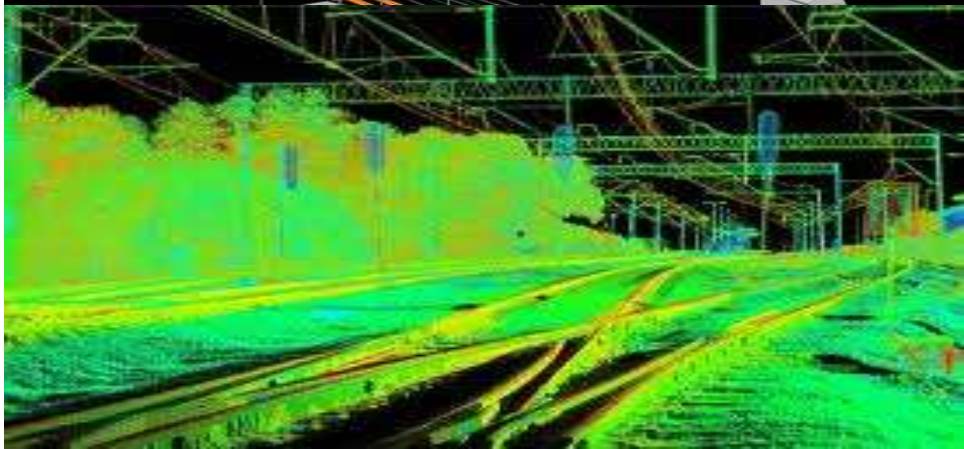




Track Side Inventory Management

- Mapping and managing asset along track (unused tracks, ballast, signals, crossing, etc)
- Encroachment analysis along track
- Railway dockyard management
- Rail inventory preparation

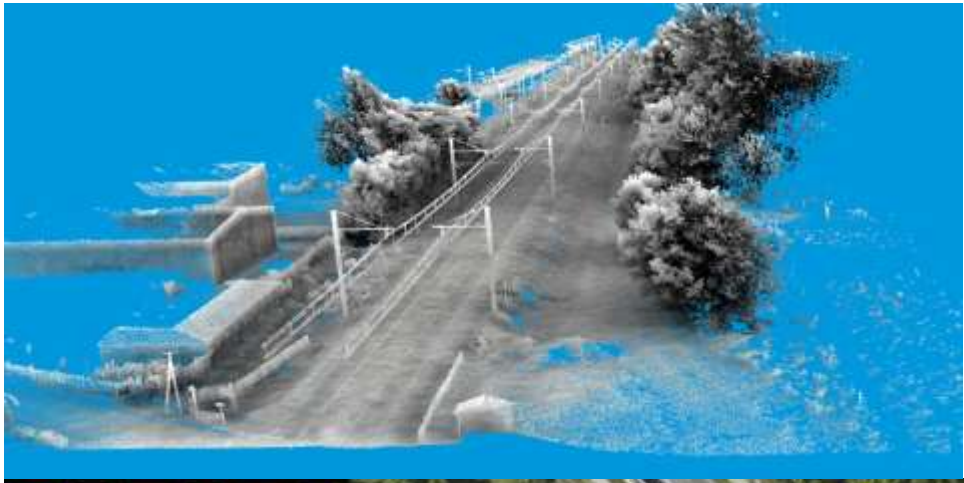


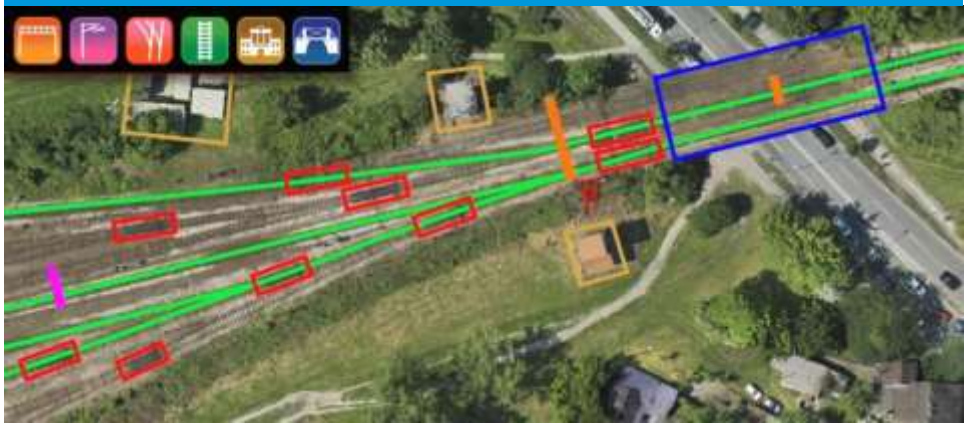


New Corridor Planning

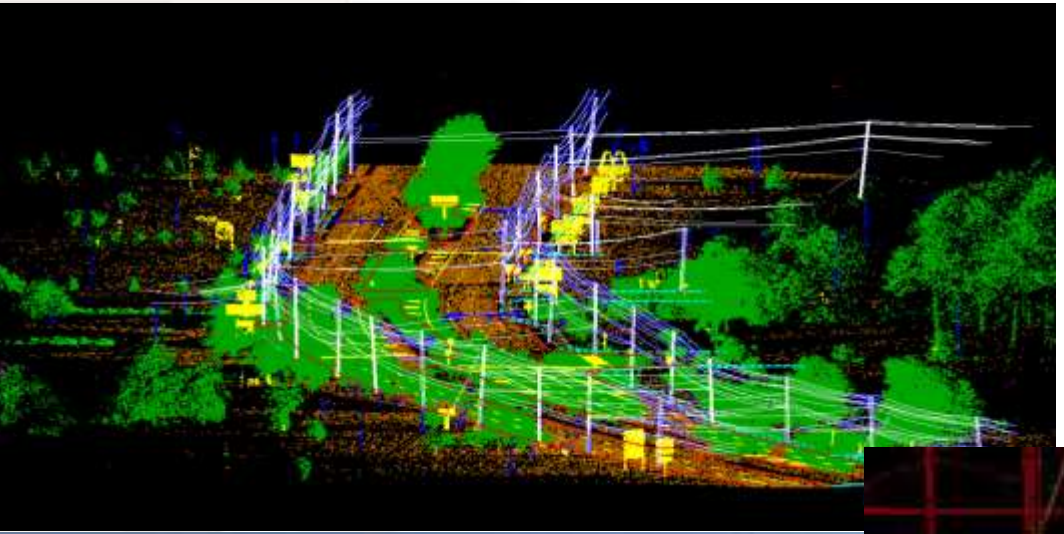
- Capture all asset along 50 m line of sight
- Create terrain model
- Mark all natural and man made feature along the existing track for planning of new track.
- Overhead analysis, terrain analysis, clearance profiling, etc.
- Fast and accurate way of planning new line.

Note: UAV Mapping will be required for the Green Field mapping where existing tracks are not available. It will provide the terrain information and imagery on high spatial resolution.

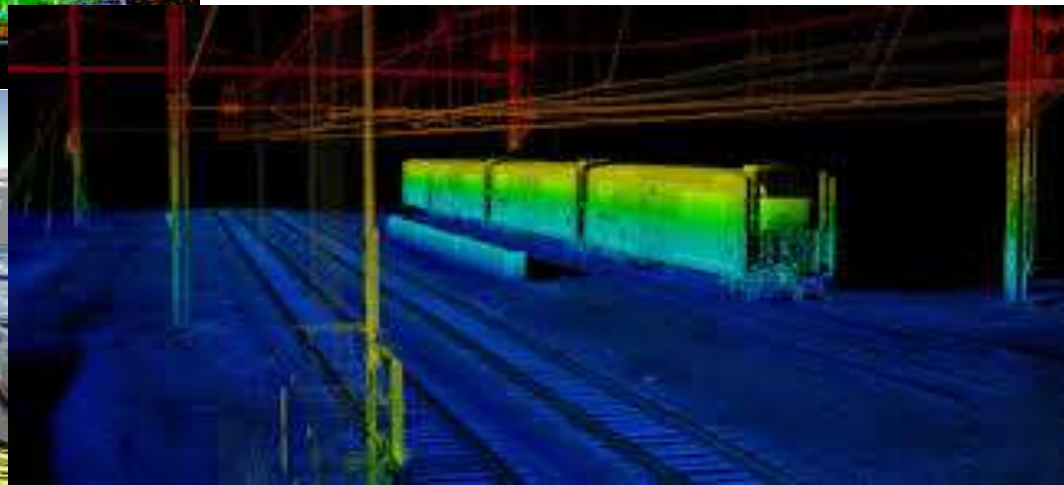




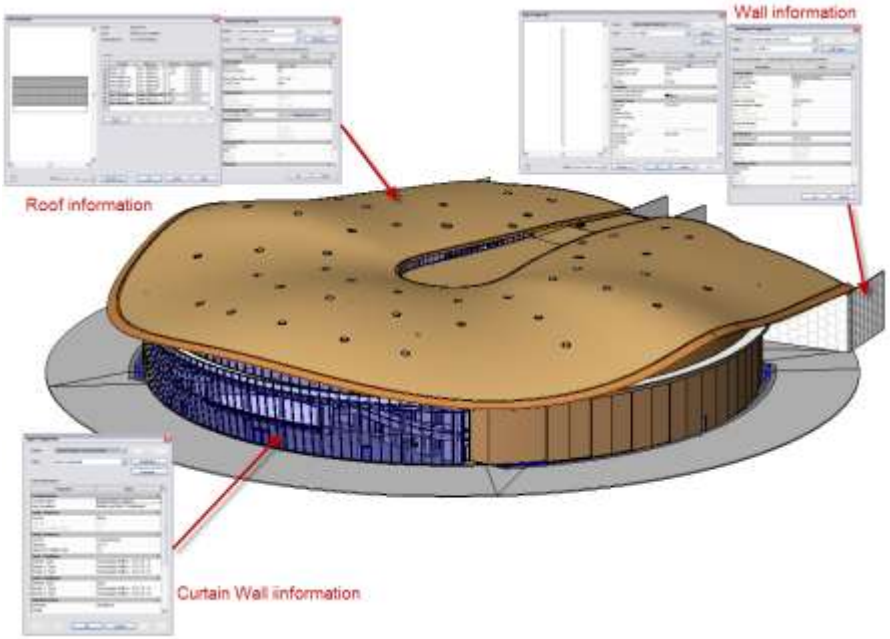
3D Modeling



- 3D walkthrough
- DEM analysis
- Bare Earth modeling



BIM for Station Redevelopment



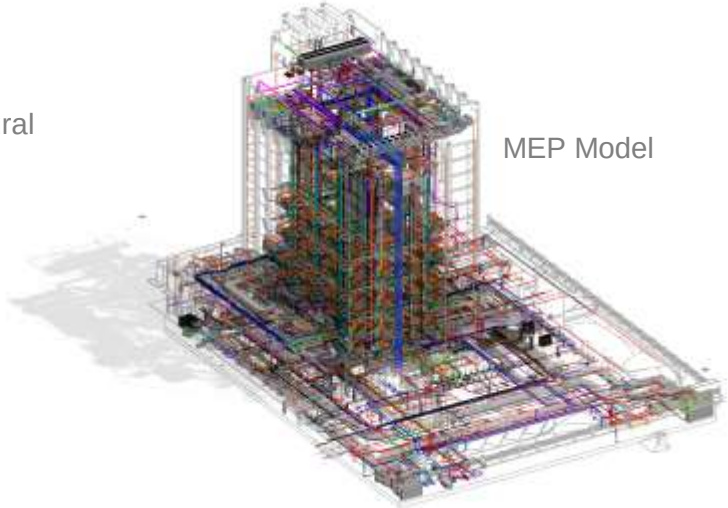
OBJECTIVES of Station Redevelopment

- Upgrade the existing Station and its surroundings or build a new Station into a world class passenger terminal in a manner which ensures:
- Superior services to passengers for the design passenger volume.
- Superior train operations (including allied services e.g., parcel, posts etc.) and maintenance facilities affording greater flexibility and enhanced operational efficiency for IR
- Smoother and safer Railtraffic flow to and from the station, superior Rail
- connectivity with the city and adequate parking within the station premises;

What is BIM?

"Building Information Modelling (BIM) refers to an intelligent, model- based process that provides insight for creating and managing building and infrastructure projects faster, more economically, and with lesser environmental impact".

Architectural & Structural Model



MEP Model

Construction Process - Traditional

Design

Architect

Struc Engg

MEP Designers

Plumbing
HVAC
Electrical
Fire F

Interiors

Data Inconsistency

Build

Contractors

Control

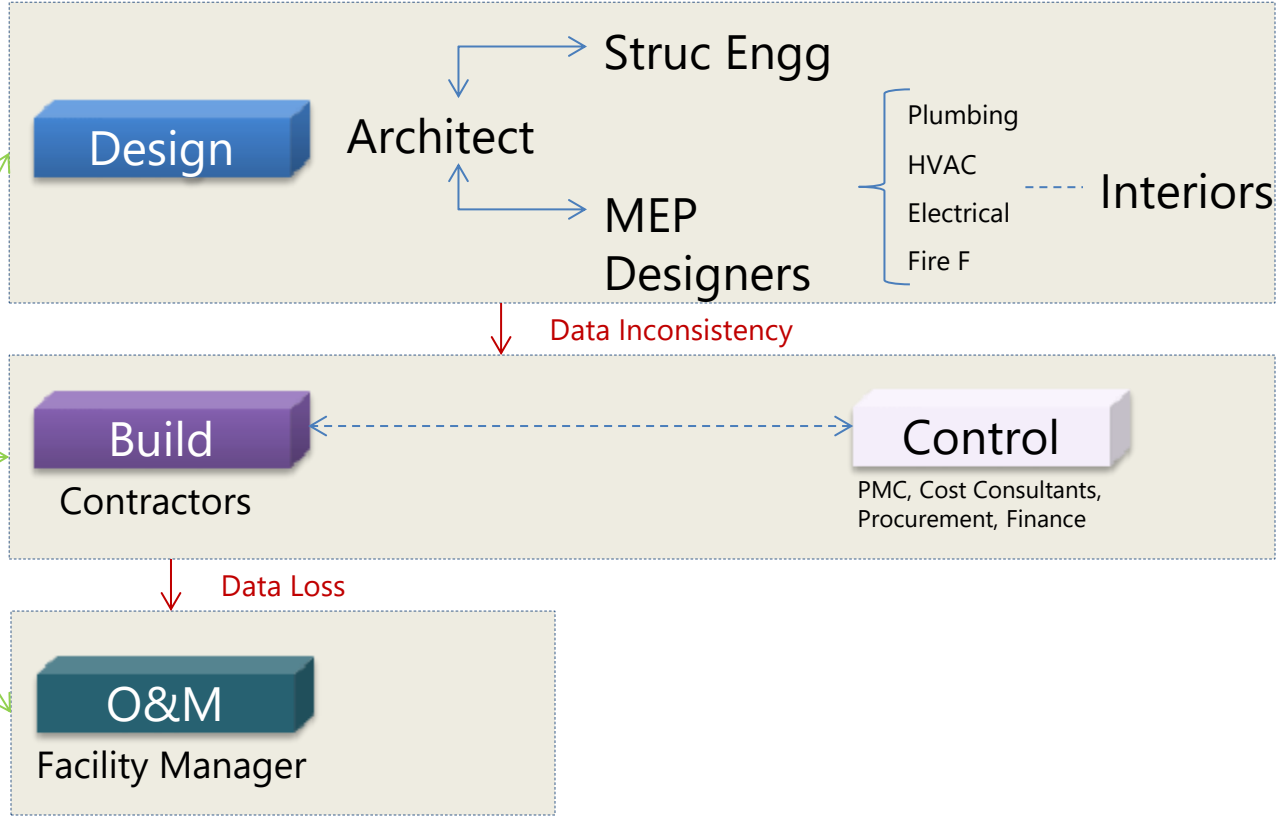
PMC, Cost Consultants, Procurement, Finance

Data Loss

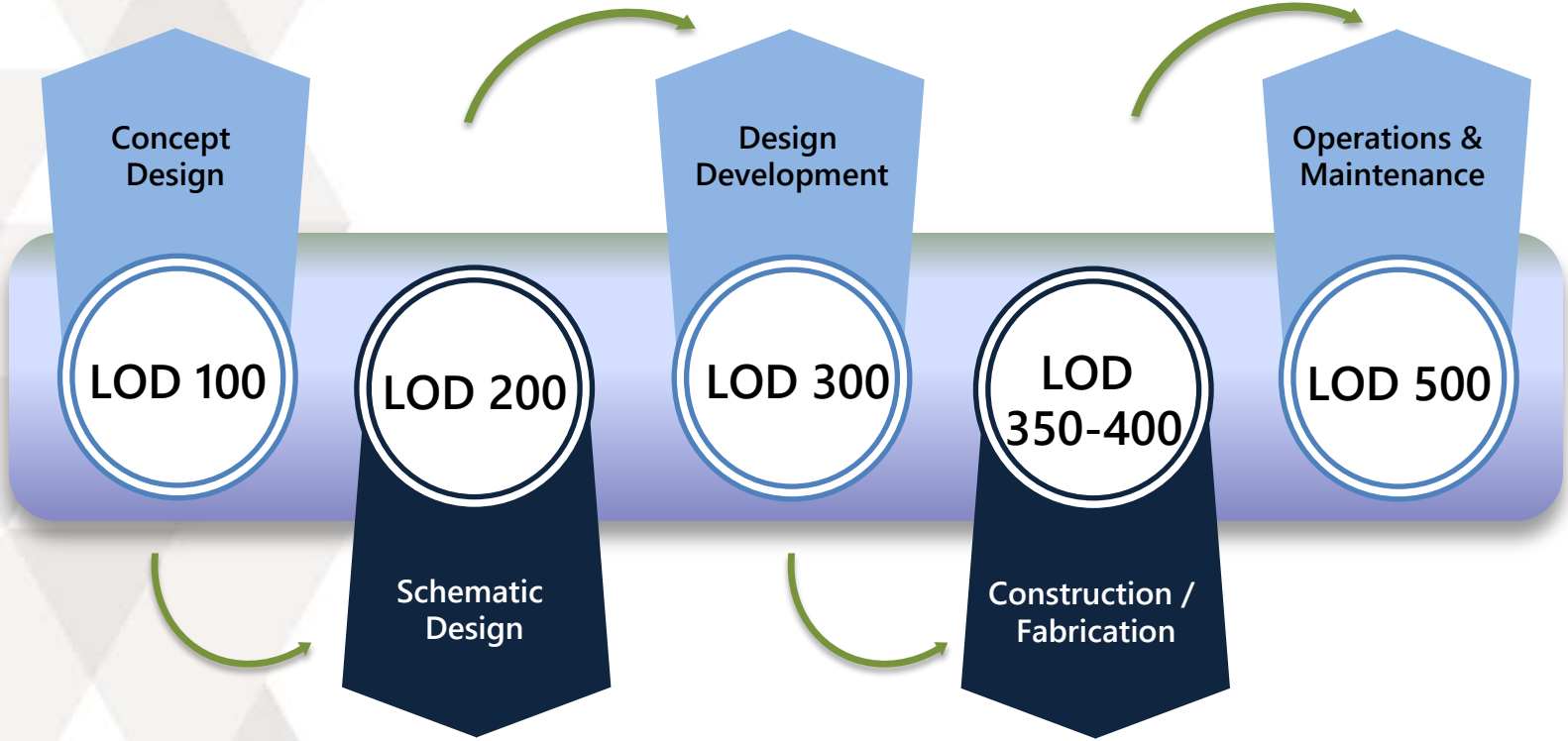
O&M

Facility Manager

Construction Process – using BIM



BIM Concepts - LOD



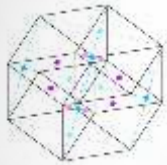
BIM Concepts - Dimensions

Simple to understand – X,Y,Z

3D

Time usually referred to as 4D – in BIM context used for Construction Simulation

4D



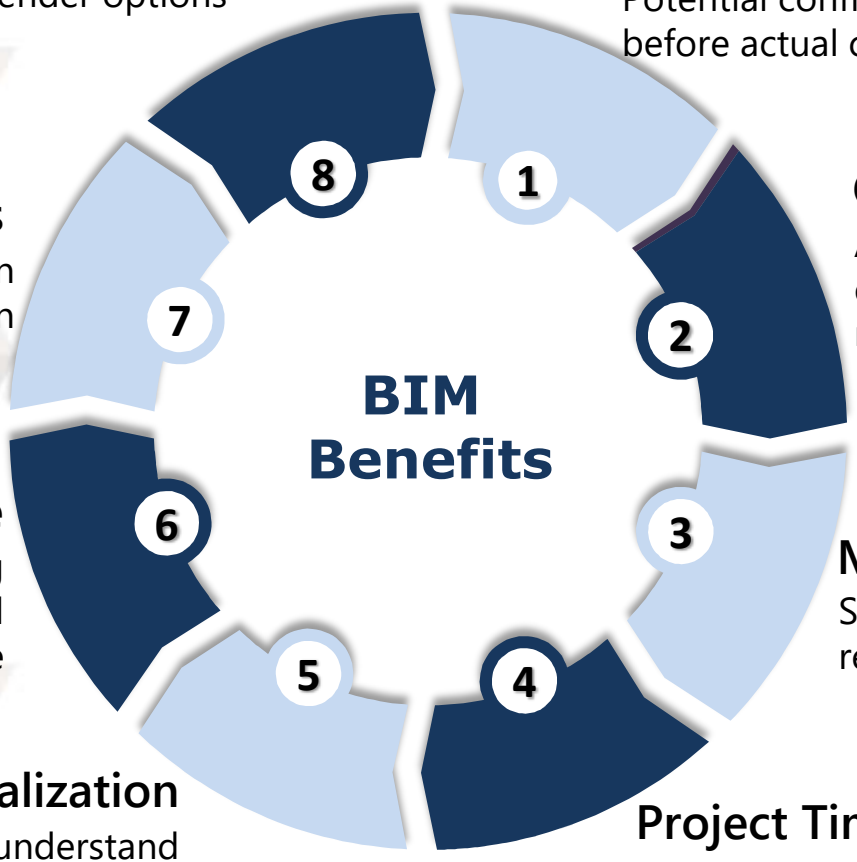
Facility Management Application

6D

5D

Cost Calculations (BoQs)

BIM Benefits



1 Clash Resolution
Potential conflicts are addressed before actual construction.

2 Quantity Estimates
Accurate quantity estimates enables better fund management

3 Material saving
Site errors minimized thereby reducing material wastage

4 Project Time Reduced
As a result of lesser issues on site

5 Project Visualization
All stakeholders can understand the project better in 3D

6 O & M phase
Coordinated data during handover can be used throughout lifecycle

7 Design Focus
More focus on design rather than documentation

8 Rendering
Quick render options

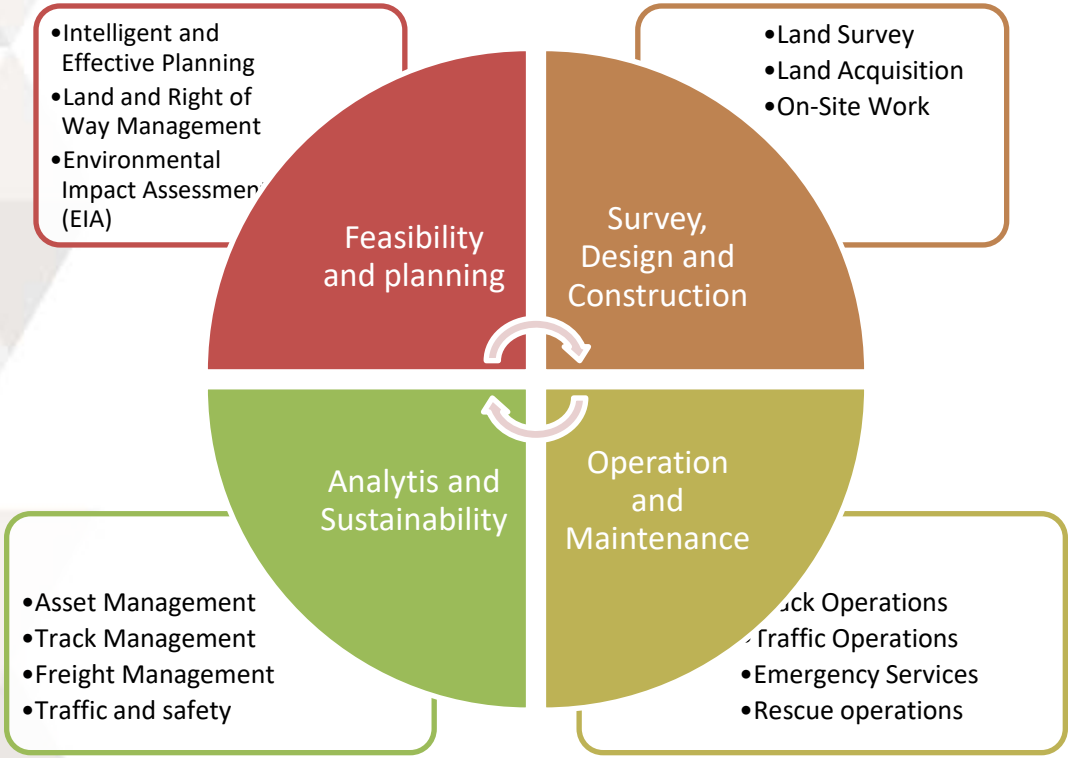
Geospatial Solution

Geospatial Technology?

- Geospatial technologies offer powerful tools for collection, storage, management, display and dissemination of spatial information. These technologies provide powerful spatial analytics tools and act as the core of robust decision support systems. These encompass a wide range of technologies for:
  - Spatial Data Acquisition
  - Data Processing and Creation of GIS Ready datasets
  - Integration, Dissemination and Applications
  - Update and Maintenance

Application using Geospatial Technology

Conceptual Framework



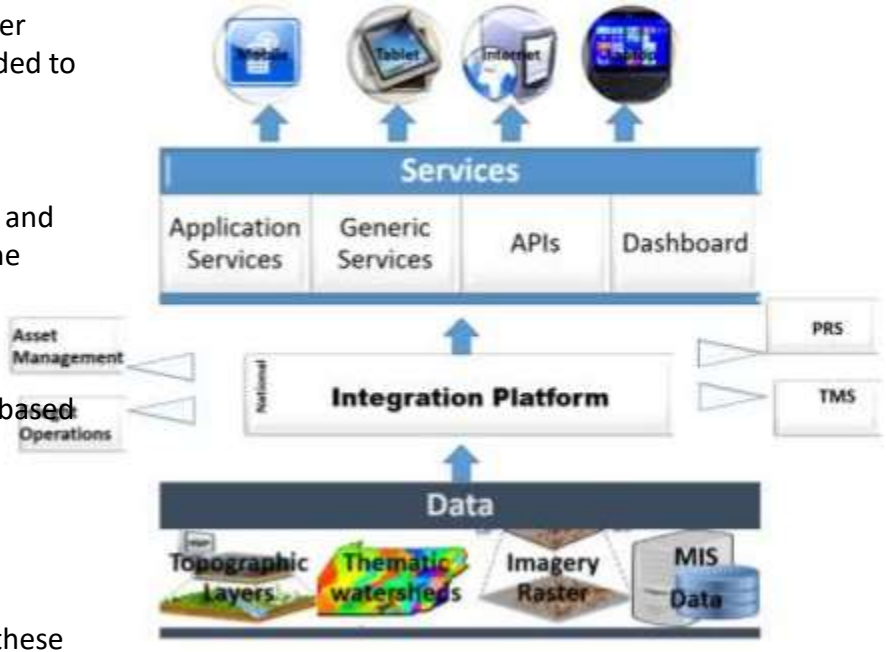
Enterprise GIS

Server and Data Infrastructure Tier—the server and data infrastructure tier provides management of and access to GIS and other data resources needed to perform the departmental business functions.

Business Logic Tier —the business logic tier consists of the business rules and programming logic for using GIS and other software capabilities to fulfil the step-by-step requirements of each business function.

Service Components Tier—the service components tier contains the GIS-based services used by Web-based applications. It also provides service-based capabilities for desktop and mobile applications.

User Access Tier — the user access tier contains the end user application interfaces as determined by the underlying technology platform. Each of these interfaces is an entry point for department staff and, where appropriate, the public to gain access to GIS application functionality and data resources.



THANK YOU

ADCC Infocad Limited
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