A GeoVerra Perspective on Mobile Mapping Innovation

Leveraging Wearable Mobile Mapping Systems: Innovative Solutions for Transportation Infrastructure

Canada's Land Surveying & Geomatics Experts

GeoVerra

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Introduction

About Me

Mohamed Attia

Vice President Geospatial & Advanced Technology

- B.Sc. & M.Sc. In Civil Engineering, Egypt
- PhD, Geomatics Engineering, University of Calgary
- Registered Professional Engineer in Alberta, Geomatics Engineering
- Working with GV since 2014 delivering geospatial and advanced technologies solutions to various industries: Oil & Gas, Transportation, Infrastructure, Industrial, Land Development, and Pipelines

www.geoverra.com

Mohamed's LinkedIn

GeoVerra / Our Roots & Team

Hughs & Taylor
Waberski Darrow Survey Group
George Munro & Associates
Usher Canada Ltd.
Maltais Geomatics
Crape Geomatics
EZRA Consulting
Condon Survey Group
Focus Corporation
J.W. Sharpe & Associates
Fulton & Associates
Sunbow Consulting
All West Surveys
Peters Survey
Wright-Focus
Opus Stewart Weir
GPEC
Lennon Trilogy
Cadastral Group
WSP
Altus Group
MMM Group

GeoVerra

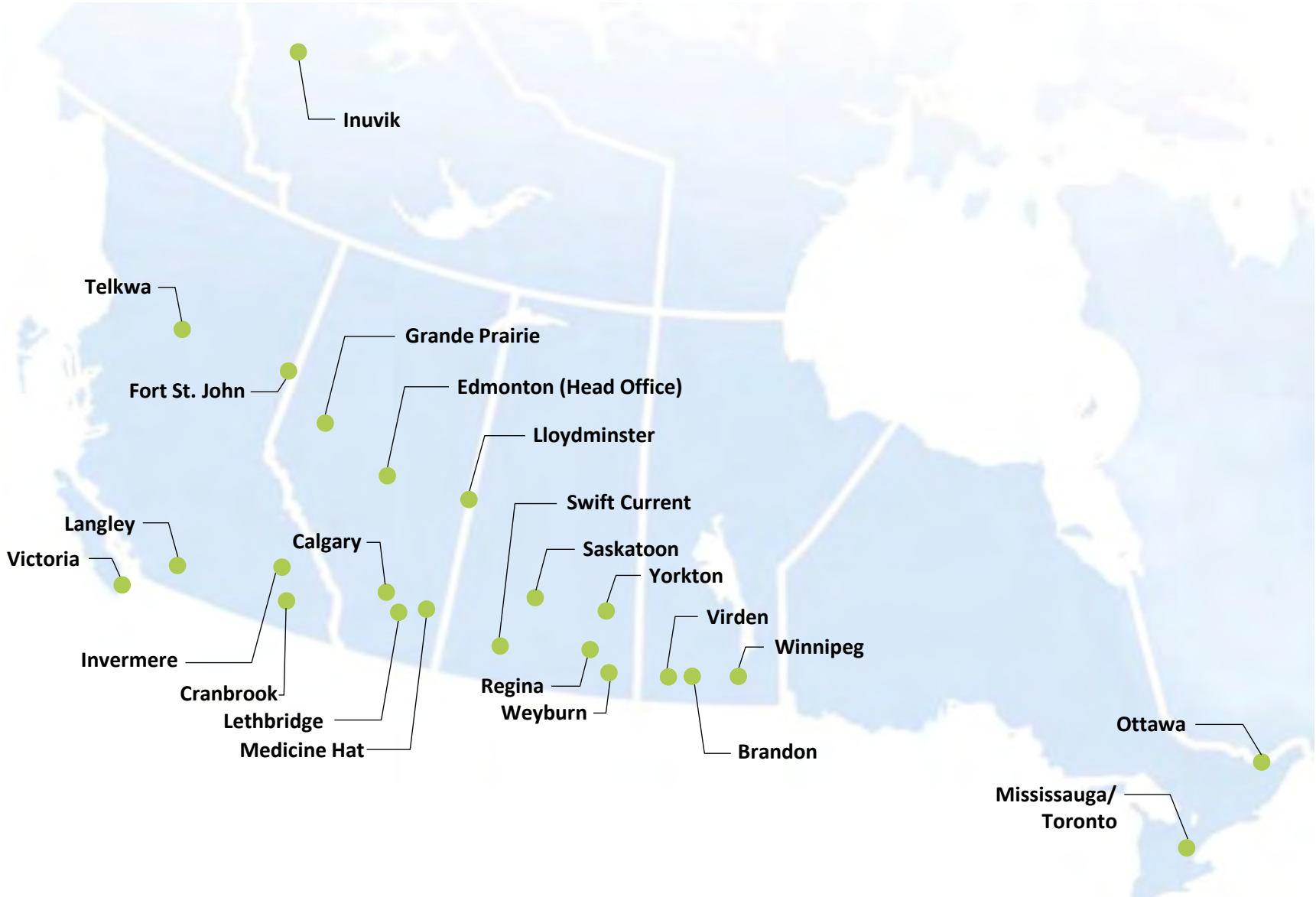
600+ **Team Members**

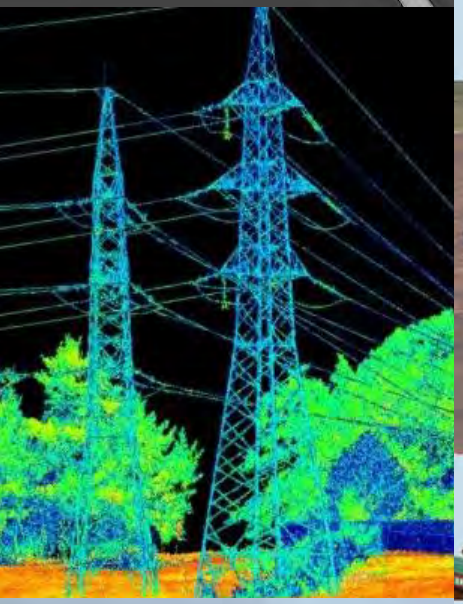
160 **Field Crews**

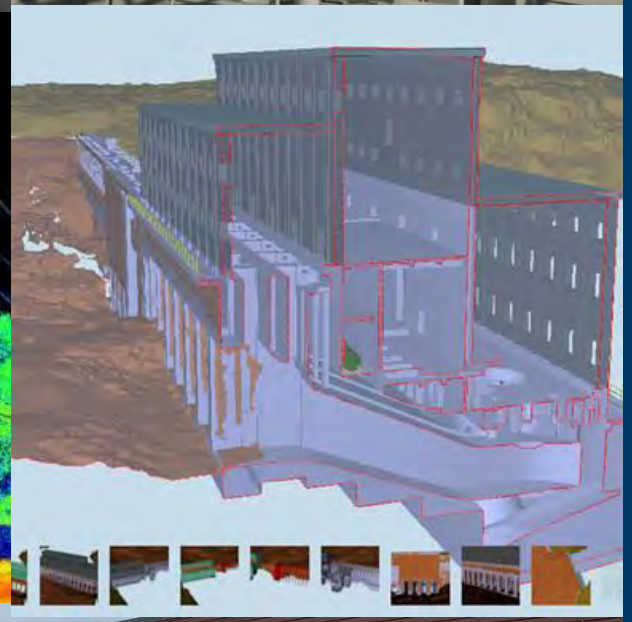
23 **Locations**

100+ Years of Expirience

Offices / 23 Locations Across Canada







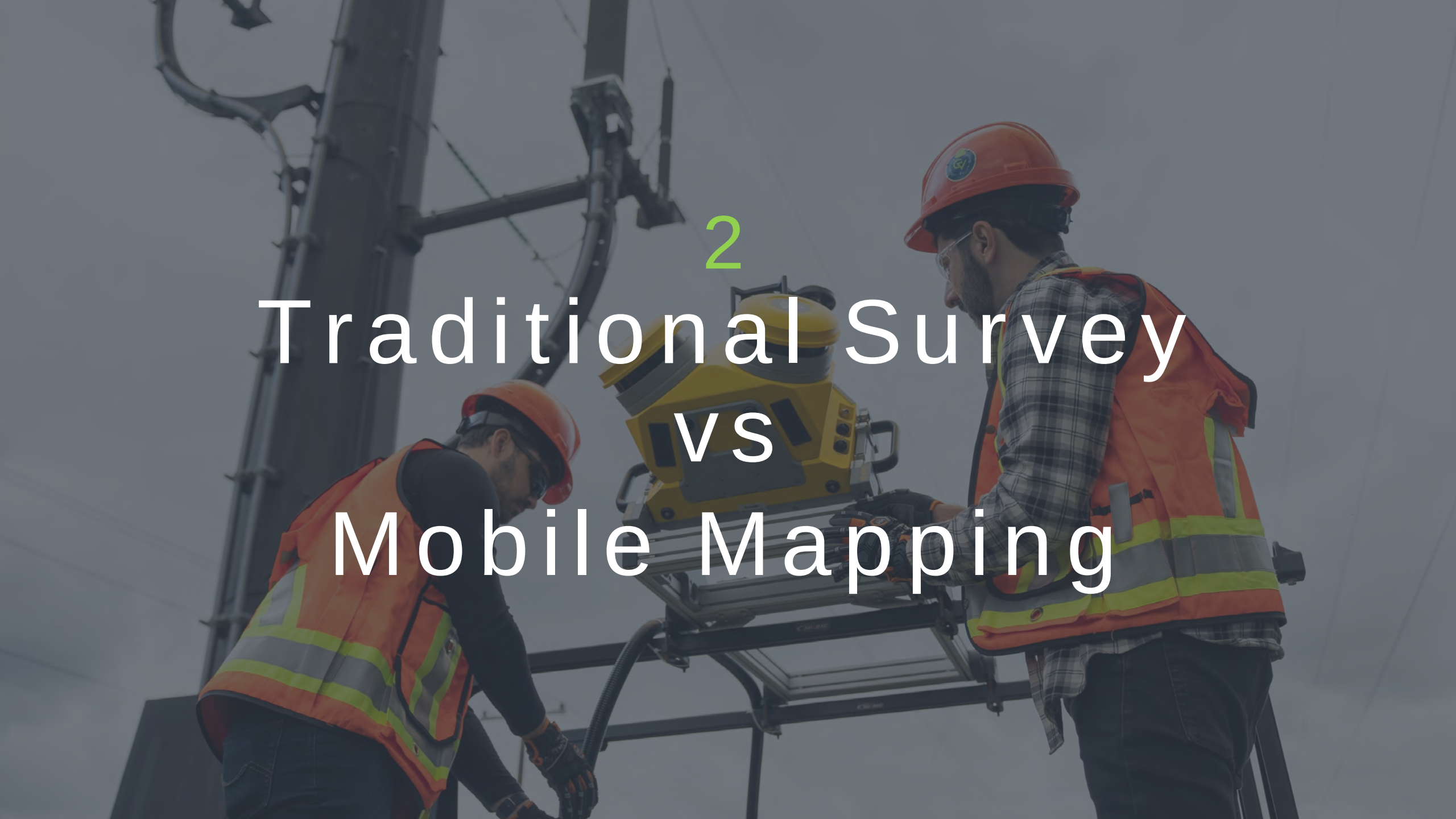
GeoVerra

Innovation & Technology

As a well-established company with a new name and culture, we're geared towards continuous improvement and integrating new systems with existing processes that work.

We aren't investing in just any technology. We're focused on the things that create efficiencies to better serve our clients:

- Updated fleet
- New surveying and geospatial equipment
- Geospatial team, focused on new technology
- Customized web-portals
- Up-and-coming talent with efficiencies-driven mindset



2

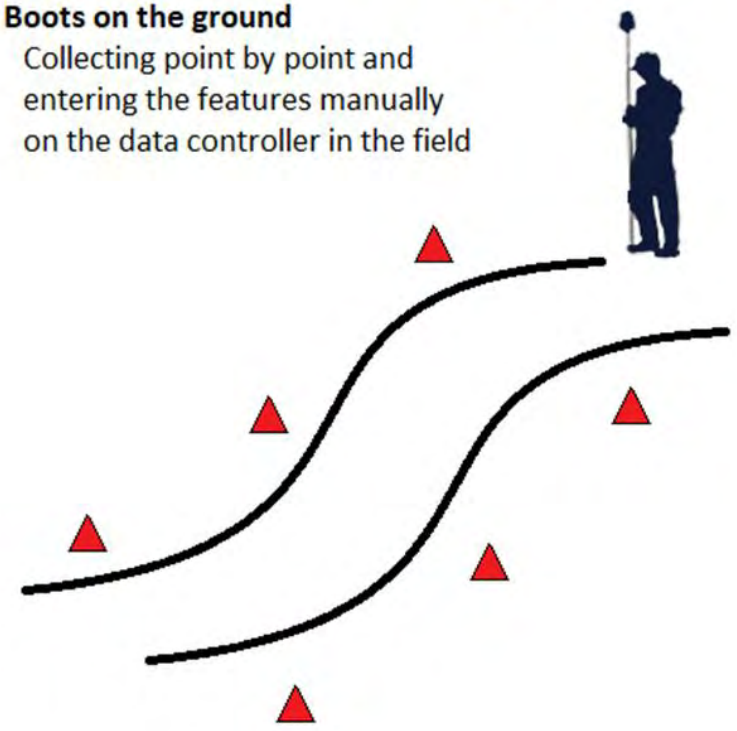
Traditional Survey vs Mobile Mapping

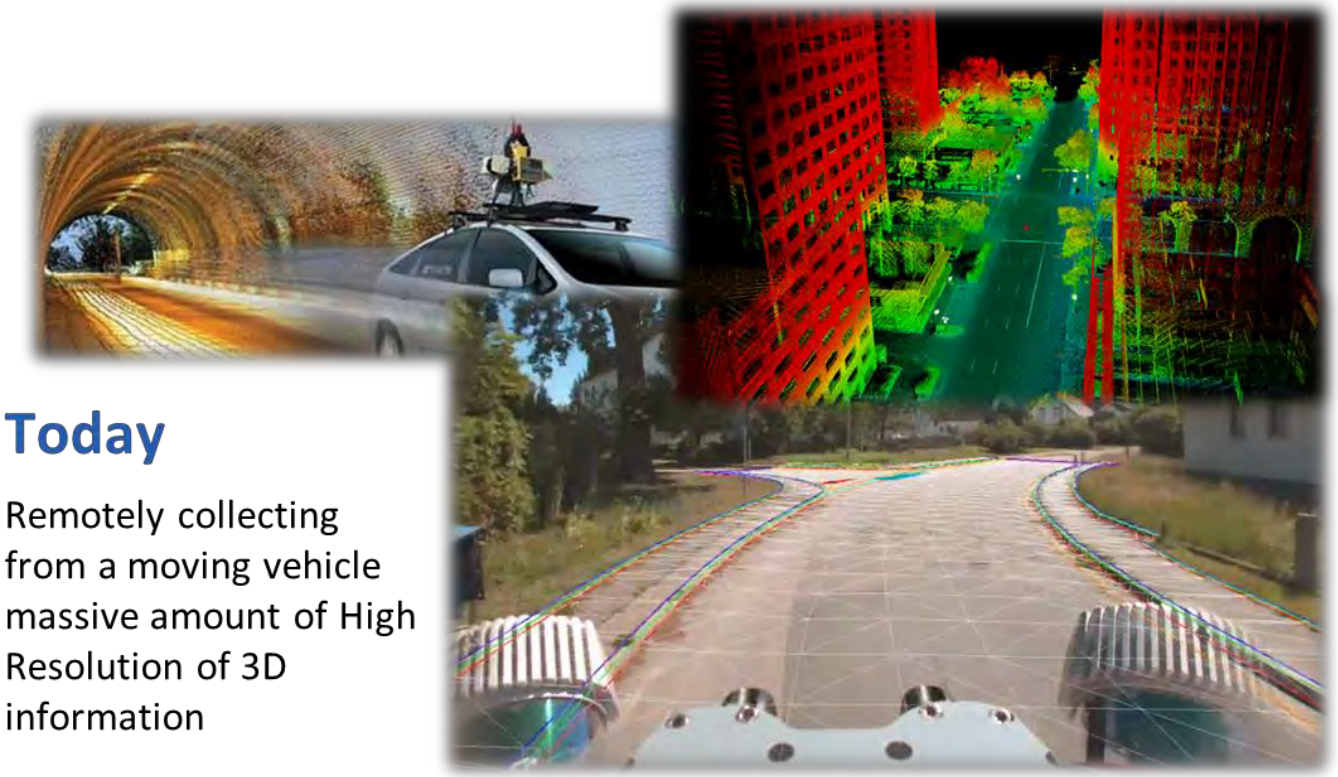
Traditional Survey vs Mobile Mapping

Traditional Technologies

Boots on the ground

Collecting point by point and entering the features manually on the data controller in the field





Today

Remotely collecting from a moving vehicle massive amount of High Resolution of 3D information

Traditional Survey vs Mobile Mapping

CHALLENGES OF THE TRADITIONAL SURVEY METHOD

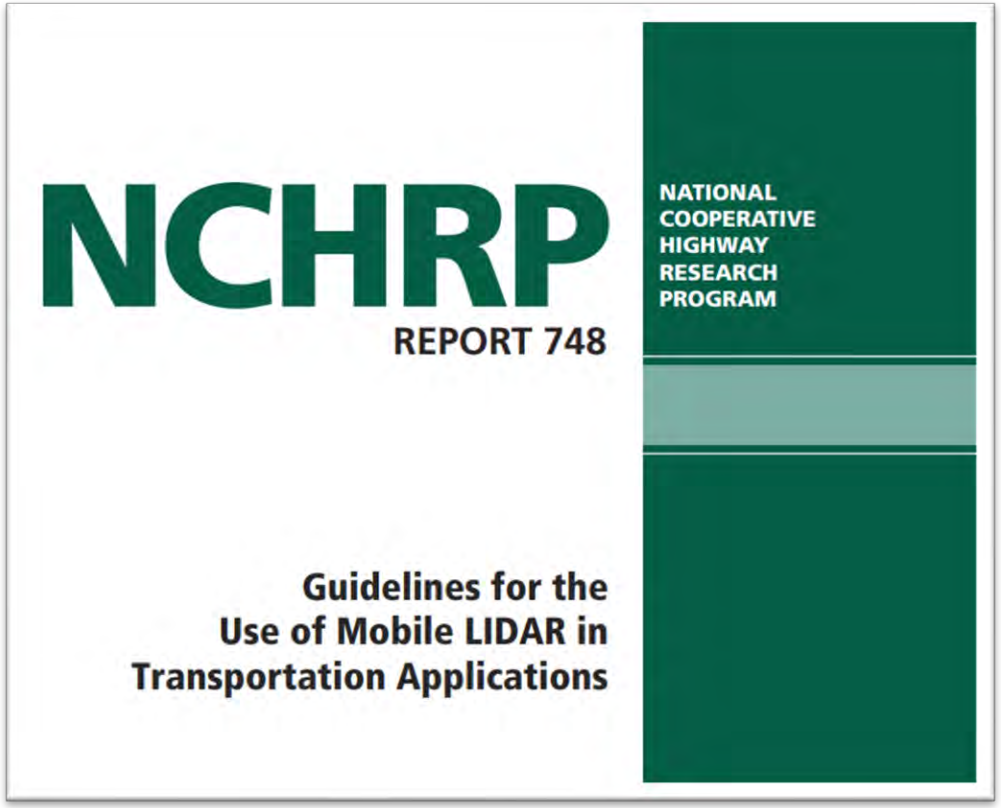
1. Obstructed line of sight
2. Slow process
3. Small feature
4. Room for error
5. Cumbersome linework

Traditional Survey vs Mobile Mapping

TRANSPORTATION RESEARCH BOARD 2013 EXECUTIVE COMMITTEE

The guidelines document aims to:

- Encourage effective use of mobile LIDAR in transportation.
- Support agencies in adopting mobile LIDAR cost-effectively, minimizing risks.
- Facilitate communication between data providers and users within agencies.
- Create a clear management process with guidance on quality and deliverables.
- Ensure data providers supply sufficient metadata and documentation for reproducibility.
- Offer recommendations for data management and long-term dataset viability.



Traditional Survey vs Mobile Mapping

Visual	Type of Equipment	Best Fit For	Strengths/Industries
	**Vehicle Mounted Mobile** Mapping System Images and LiDAR	**Large Areas**	• Corridor Mapping • Highways • Roads • Railroad • Airport
	**Stationary** Terrestrial Laser Scanners Images and LiDAR	**Small Areas**	• Intersections • Small Road Blocks • Buildings Outdoors/Indoors • Tunnels • Complex Areas

Traditional Survey vs Mobile Mapping

Visual	Type of Equipment	Best Fit For	Strengths/Industries
	**Vehicle Mounted Mobile** Mapping System Images and LiDAR	**Large Areas**	• Corridor Mapping • Highways • Roads • Railroad • Airport
	**Walkable Backpack Mobile** Mapping System Images and LiDAR	**Small Areas**	• Intersections • Small Road Blocks • Buildings Outdoors/Indoors • Tunnels • Complex Areas

3

The NavVis VLX 3 Wearable Mobile Mapping System

The NavVis VLX 3 Walkable Mobile Mapping System

LiDAR Sensors

Utilise two 32-layer lidar sensors alongside innovative SLAM software to achieve exceptional point cloud quality in a wearable device.

Imagery Sensors

The device features four cameras that capture high-resolution images from all angles, providing a full 360º view without including the operator.

The NavVis VLX 3 Walkable Mobile Mapping System

GeoVerra

Laser Scanners

Number of laser scanners	2 × 32-layer
Laser class	1, eye-safe per IEC 60825-1:2007 & 2014
Wavelength	903 nm
Range	Up to 300 m
Points per second	2 × 1,280,000

Cameras

Number of cameras	4
Image resolution	4 × 20 megapixel
Focus	Fixed
Lens	Fisheye, 3.3 mm, aperture f/2.4

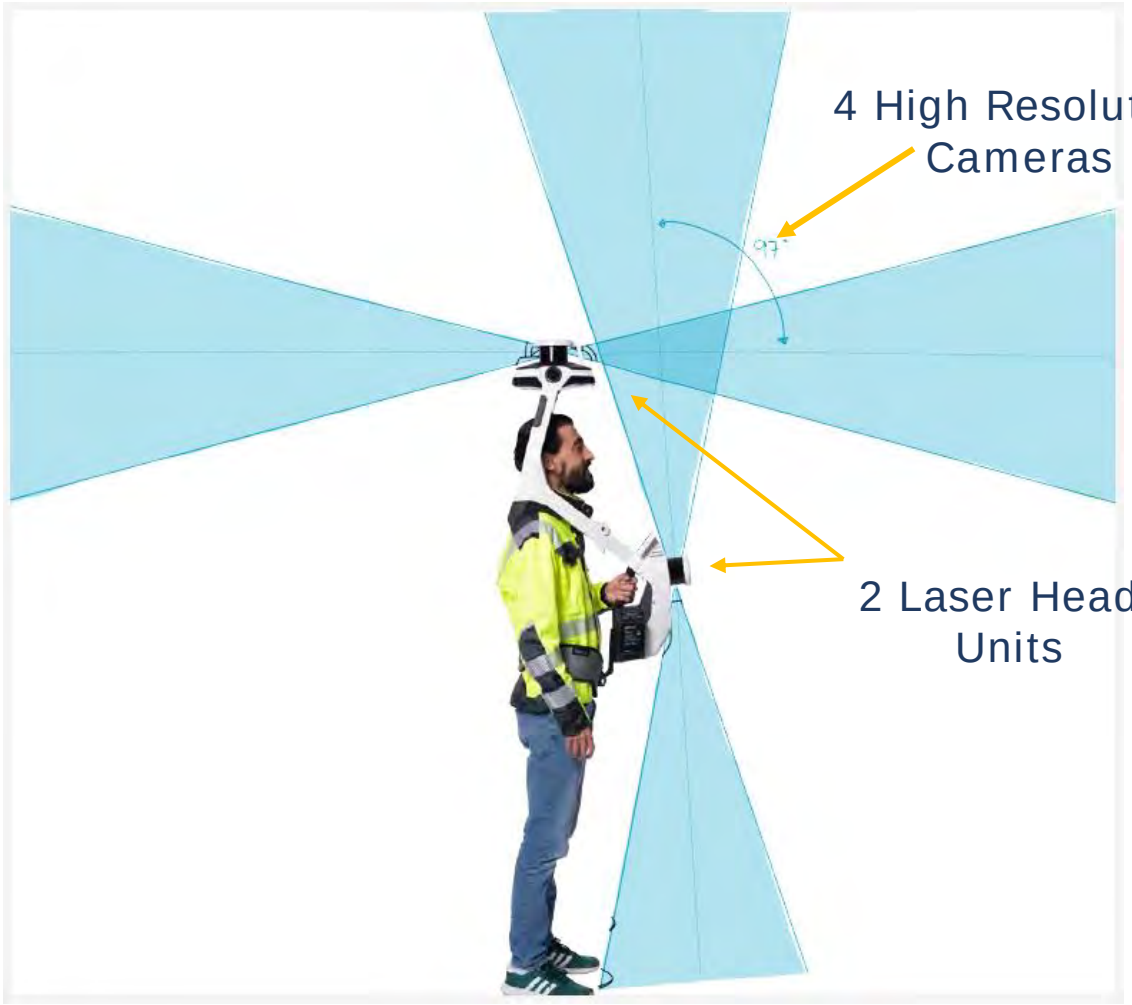
Accuracy

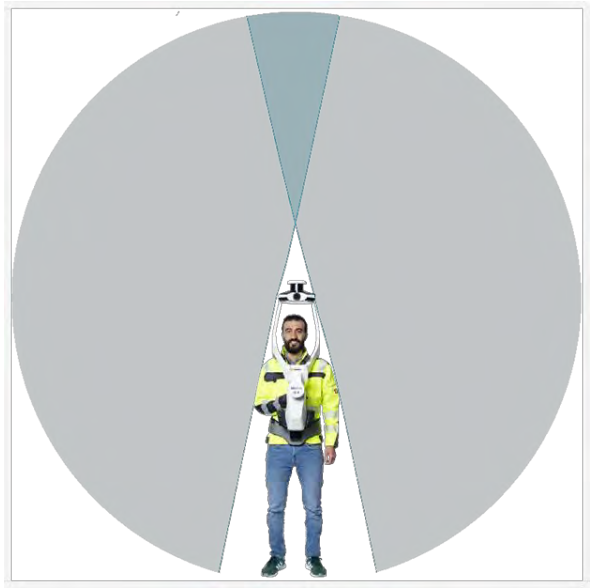
Accuracy of point cloud	5 mm in a dedicated test environment of 500 m^2 (1)
Control point support	Ground and wall

Output

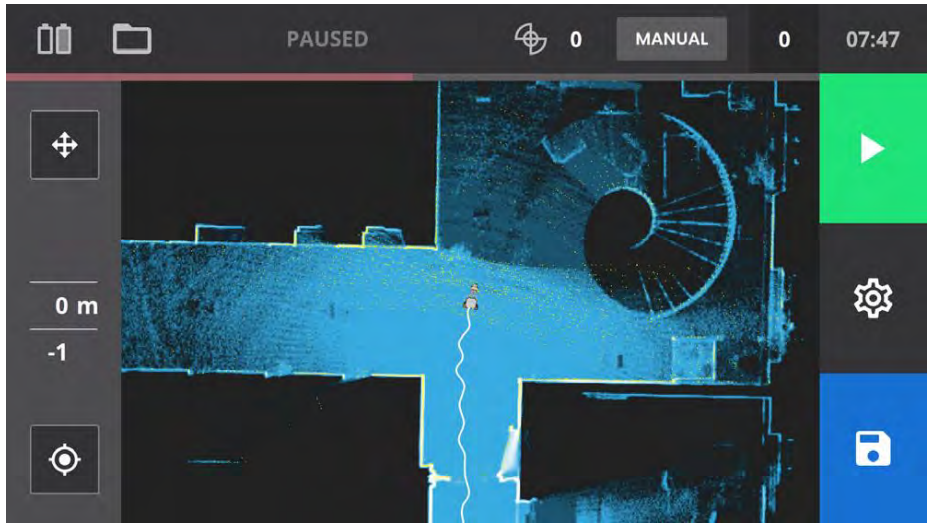
Images	JPEG
Point cloud	E57, LAS, PTS, XYZ, PLY

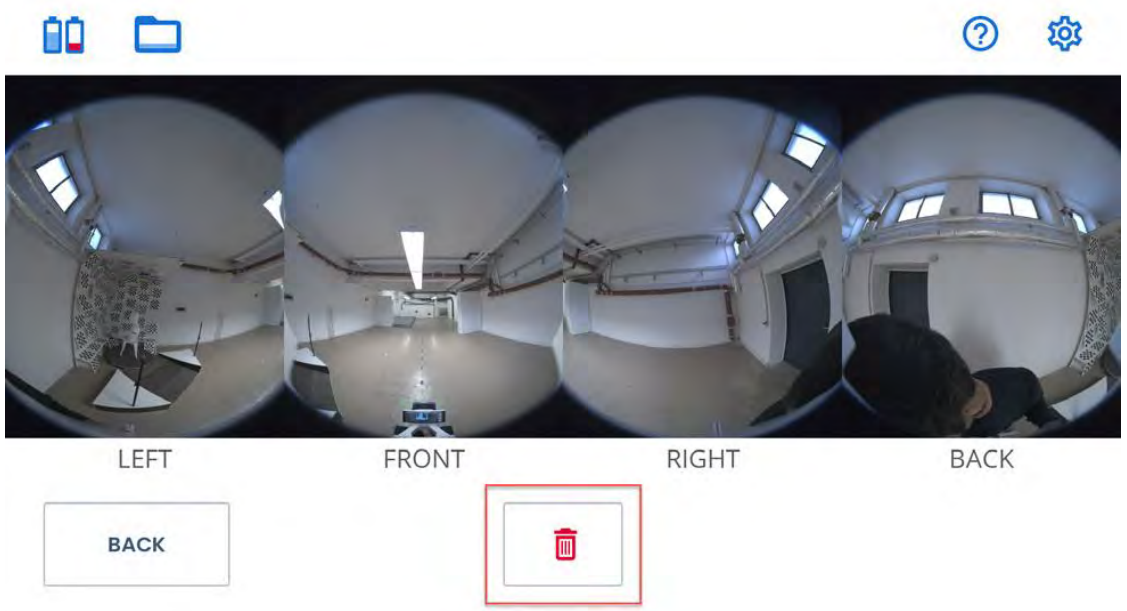
The NavVis VLX 3 Walkable Mobile Mapping System



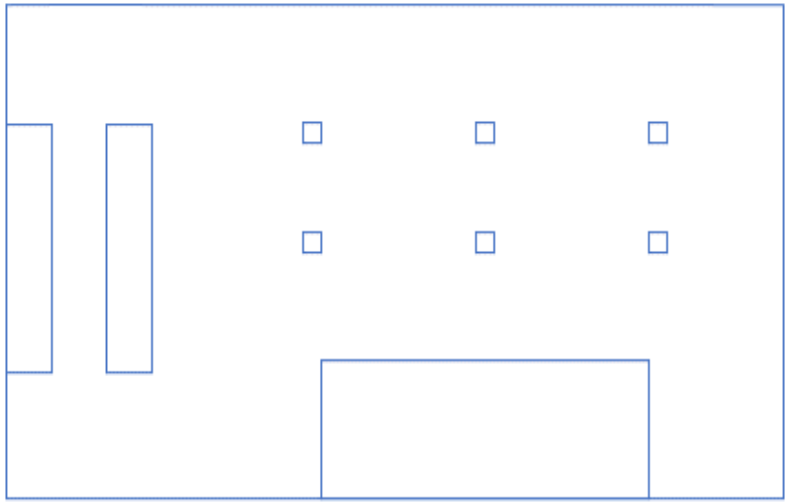


The NavVis VLX 3 Walkable Mobile Mapping System

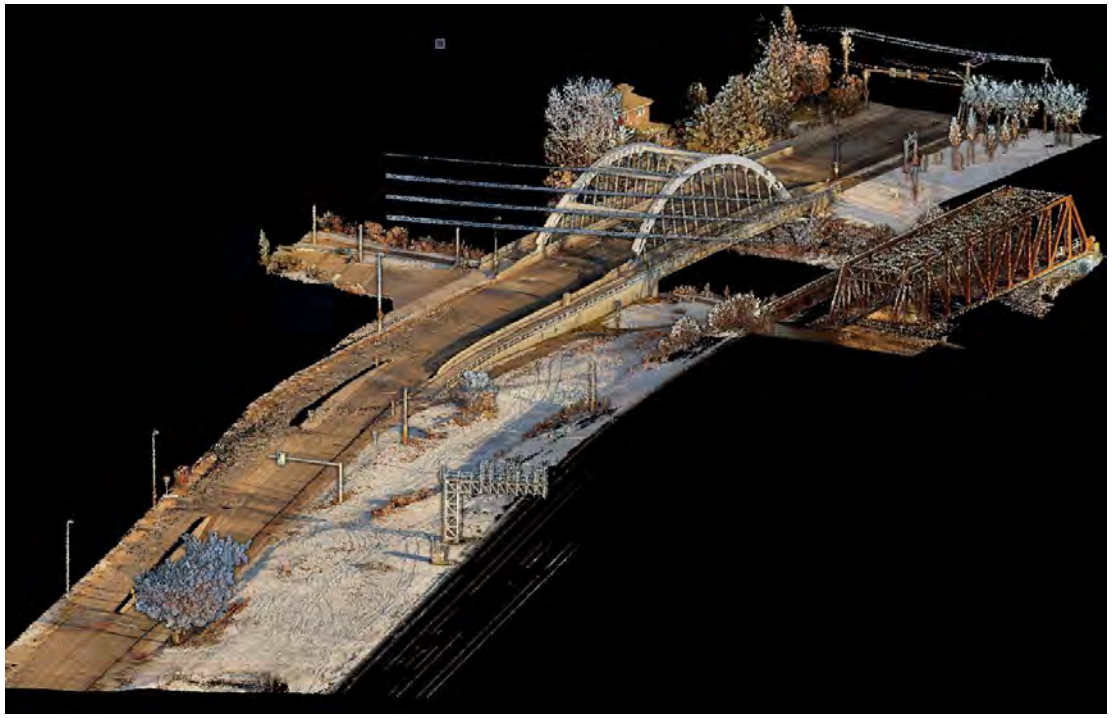




SLAM Technology and Mobile Mapping



The NavVis VLX 3 Walkable Mobile Mapping System



Quantified Results - Challenging Environment

NavVis VLX surveys a comparable area in just one-tenth the time of traditional equipment.

A survey control network was established in around three hours, and in under two hours (specifically 108 minutes), the area surveyed was:

With traditional equipment:
Approx. 3,800 square meters (40,900 square feet) (10% of the site)

With NavVis VLX:
Approx. 38,000 square meters (409,000 square feet) (100% of the site)

NavVis VLX achieved an accuracy of better than 6 mm

4

Benefits of Wearable Mobile Mapping

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Efficiency & Speed

Terrestrial Laser Scanners

- Requires multiple setups to capture a large area, with additional time spent planning and aligning scan stations.

NavVis VLX 3

- Designed for walkable mapping, it enables continuous data collection while moving.
- Covers large areas faster, reducing field time significantly (up to 50% less in many cases).
- Eliminates the need to reposition equipment multiple times.

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Flexibility in Accessing Complex Environments

Terrestrial Laser Scanners

- Bulky and stationary, making it less suited for tight or hard-to-reach areas.
- May struggle in areas where line-of-sight is restricted.

NavVis VLX 3

- Ideal for narrow, complex, or confined spaces such as train stations, tunnels, and urban environments.
- Can be easily carried and maneuvered, even in areas with obstacles or heavy pedestrian traffic.

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Real-Time Data Visualization

Terrestrial Laser Scanners

- Provides real-time feedback via its built-in screen, allowing users to monitor data collection and quality on the go.
- Reduces the need for re-surveys by ensuring complete coverage during the initial pass.

NavVis VLX 3

- Requires post-processing to verify coverage, which might reveal gaps after fieldwork is complete.

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Lower Disruption

Terrestrial Laser Scanners

- Typically requires more setup time and potentially disrupts site activities during scanning.

NavVis VLX 3

- Walkable mapping minimizes disruptions in public or operational spaces (e.g., train stations or roads).
- Quickly completes surveys in high-traffic environments without the need for cordoning off large areas.

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Positional Accuracy in GPS-Challenged Areas

Terrestrial Laser Scanners

- While highly accurate at individual setups, aligning multiple setups in GPS-restricted areas can be challenging and time-intensive.

NavVis VLX 3

- Equipped with advanced SLAM (Simultaneous Localization and Mapping) technology, ensuring high positional accuracy even in GPS-restricted areas such as indoors, tunnels, or dense urban canyons.

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Seamless Integration with Digital Workflows

Terrestrial Laser Scanners

- While precise, TLS data may require additional post-processing steps for alignment or stitching, increasing time before use.

NavVis VLX 3

- Generates highly accurate 3D point clouds and panoramic imagery that integrate directly with CAD/BIM software, streamlining design and analysis workflows.

Benefits of Wearable MMS

Stationary Terrestrial Laser Scanners

Wearable Backpack Mobile Mapping System

Cost-Effectiveness

Terrestrial Laser Scanners

- Longer setup and scan durations translate into higher labor costs, particularly for large or complex projects.

NavVis VLX 3

- Reduces overall project costs by minimizing field time and the need for revisits.
- Allows smaller teams to complete projects faster.

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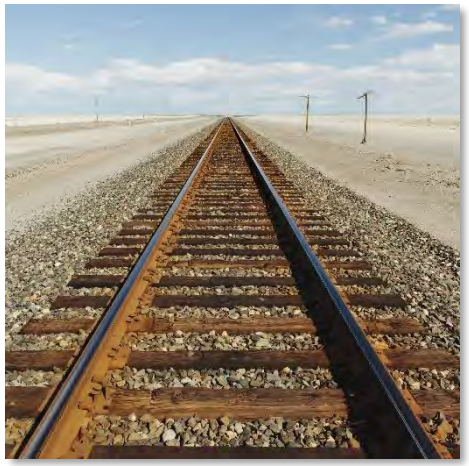
Applications in Transportation Projects

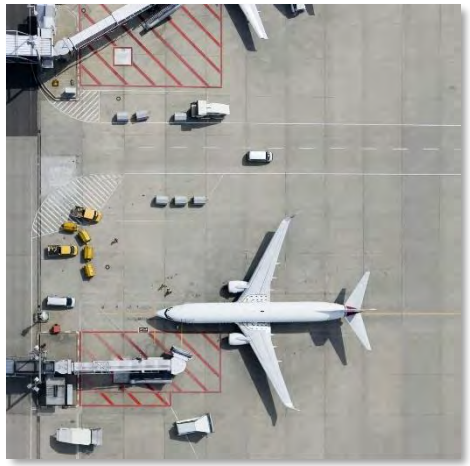
Applications in Transportation Projects

Highways & Urban roads



Rail & LRTs

Bridges & Tunnels



Airports

NavVis VLx3 can collect accurate and high-density geospatial remotely, avoiding unsafe areas and limits disruption of sites and work areas.

- Corridor Mapping
- As-built Surveys
- Asset Management
- Structural Inspection
- 3D Modeling – of transportation infrastructures
- BIM
- Road and Railway Mapping and Inspections
- Road and Sidewalk Condition Analysis

Applications in Transportation Projects / Highways & Roads

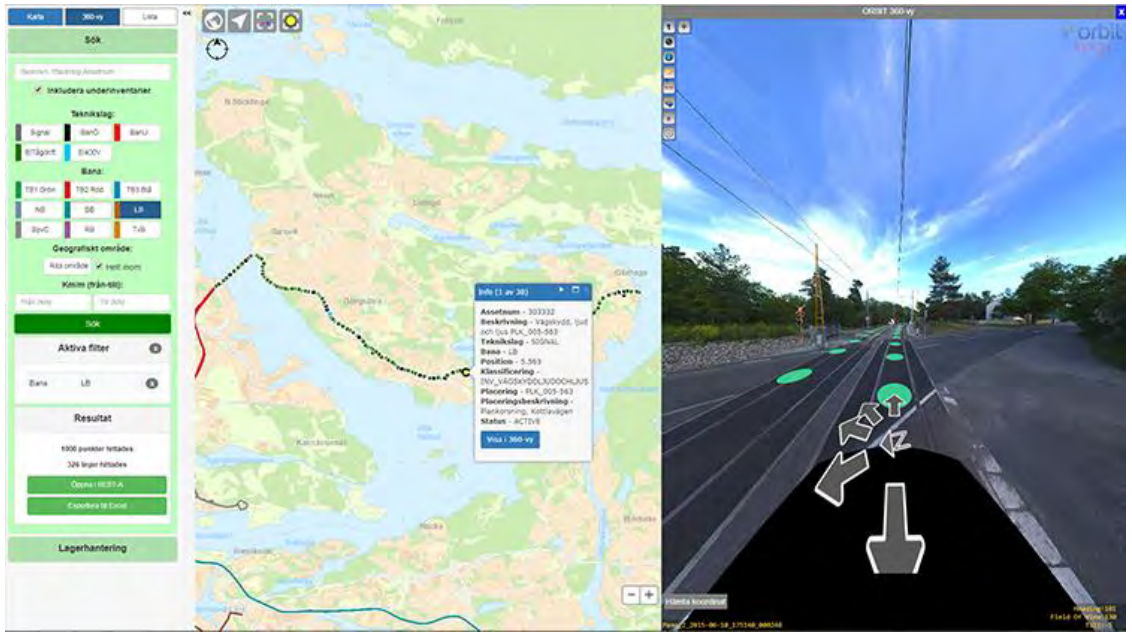
Survey Grade

- Topography Feature Extraction
- Structural Model Extraction
- Automated Analysis
- Surface Modeling

Engineering

- Higher accuracy is required
- The relevant information for the asset database is extracted from the gathered data (LiDAR only)
- Roadway survey for design
- As-built survey for quality control
- Vertical clearance (bridges, signs, wires, etc.)

Applications in Transportation Projects / Highways & Roads



Asset Grade

- Storm water, wastewater structures, culverts, drain inlets, etc.
- Manholes, hydrants, valves
- Signs, poles, structures/buildings
- Guard rails, paint lines
- Measure vertical/horizontal
- Attribute with greater detail
- Inspection (Roadways, signs, guardrails)

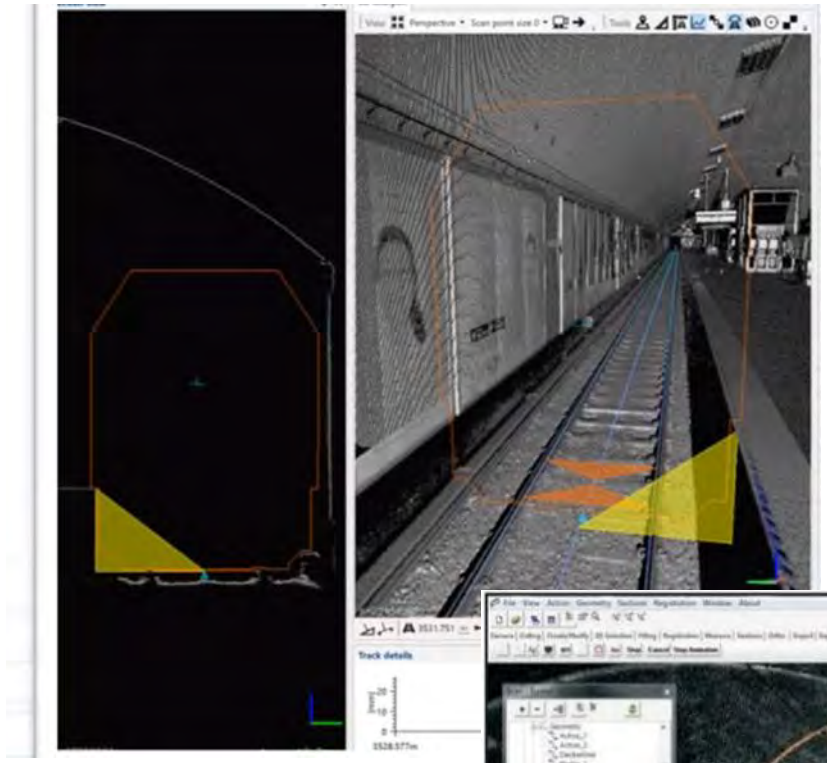
GIS Inventory

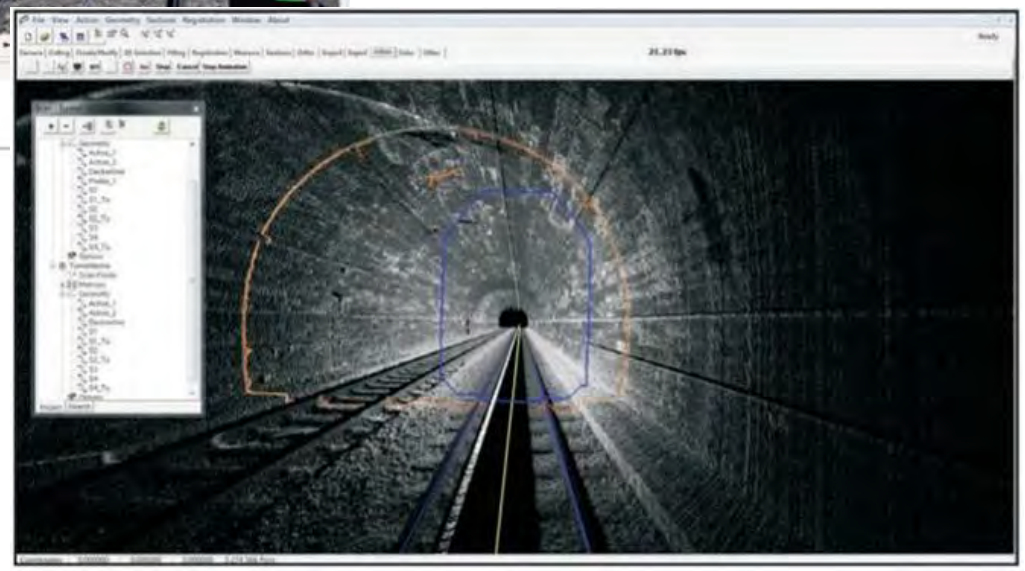
- Low Accuracy is required for GIS Inventories
- The relevant information for the asset database is extracted from the gathered data (LiDAR and Imagery).
- A great number of assets need to be identified, attributed and put in a database

Applications in Transportation Projects / Rail & LRT

Railways

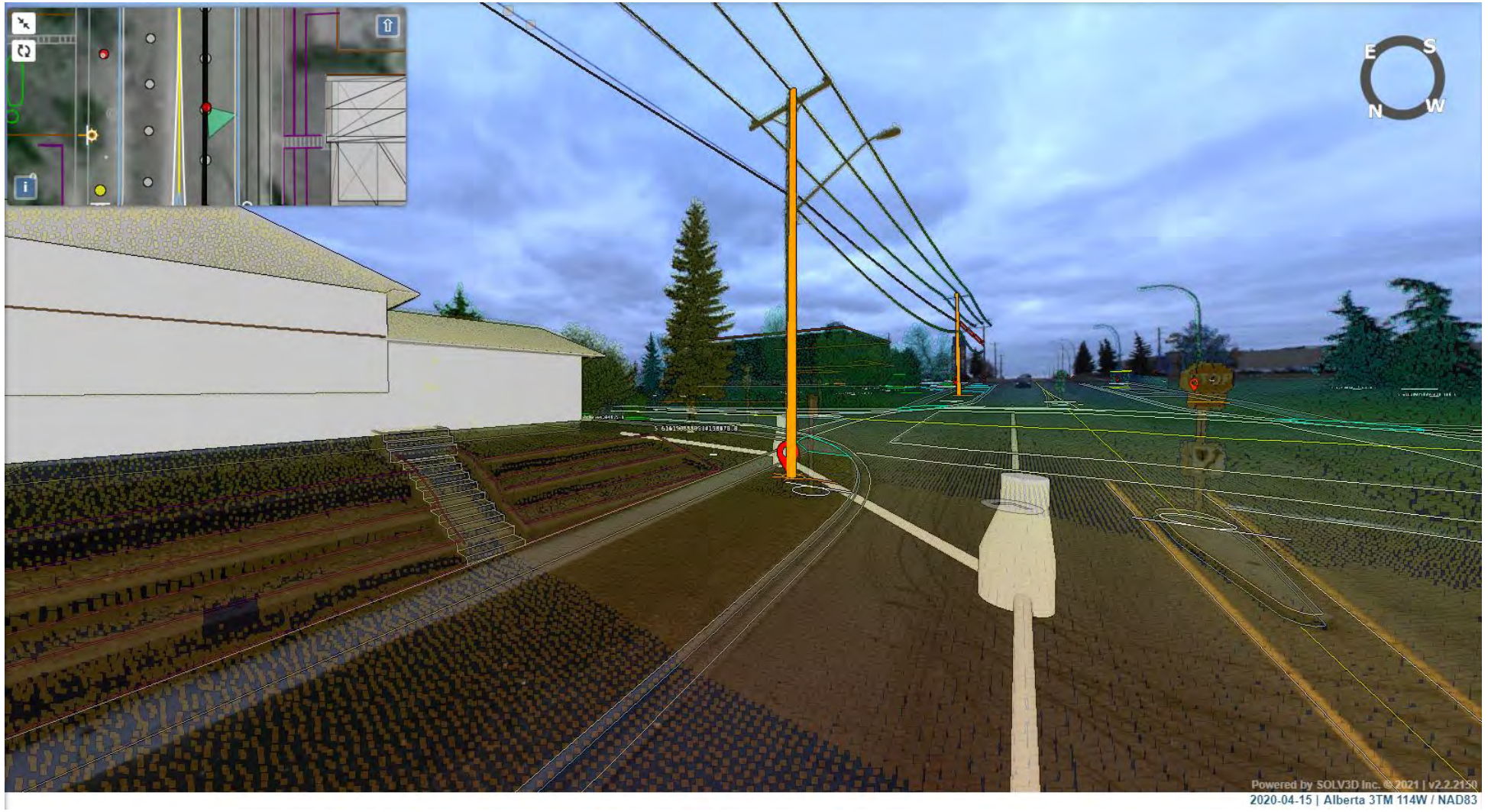
- Rail lines extraction
- Rail Assets (post, signals, wires)
- Rail Clearances Analysis
- 3D models of terrain
- Web-Portal for Asset Management
- Surface Modeling



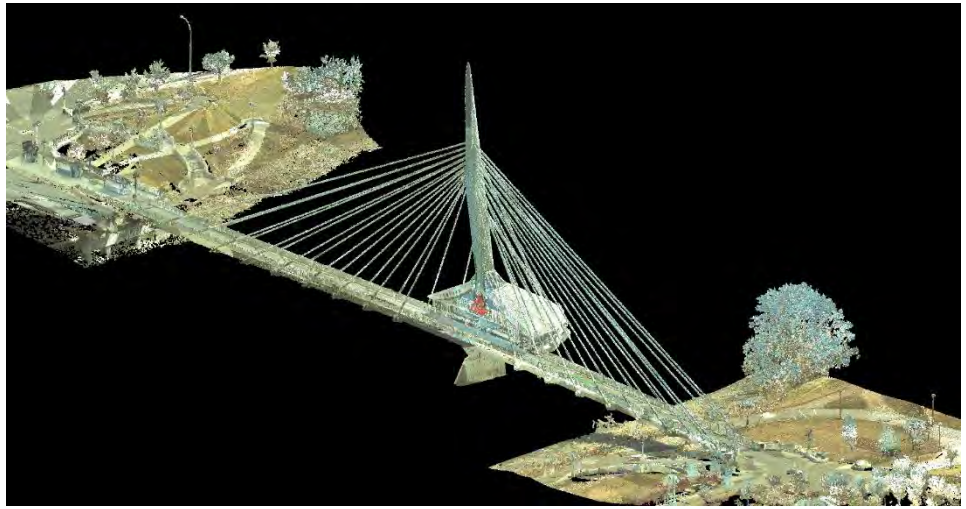


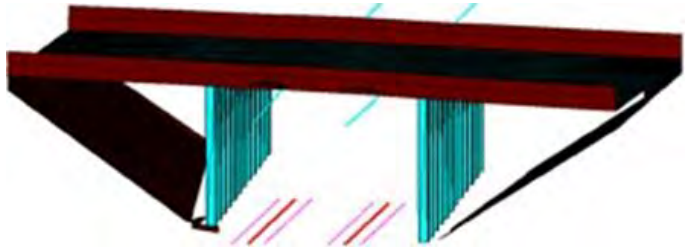
Applications in Transportation Projects

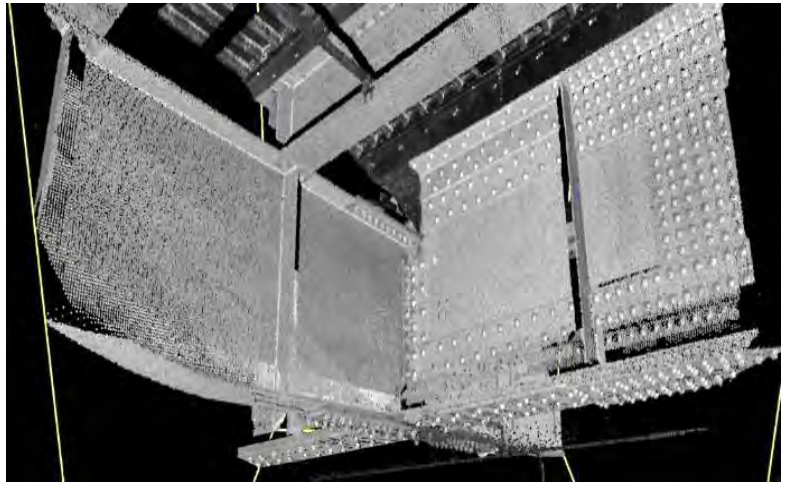
BIM

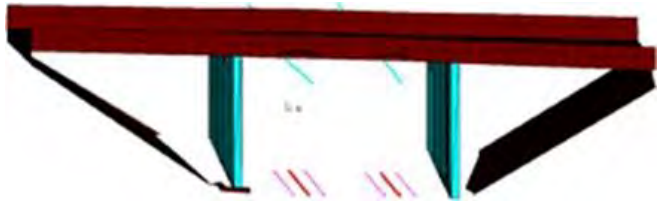


Applications in Transportation Projects / Bridges



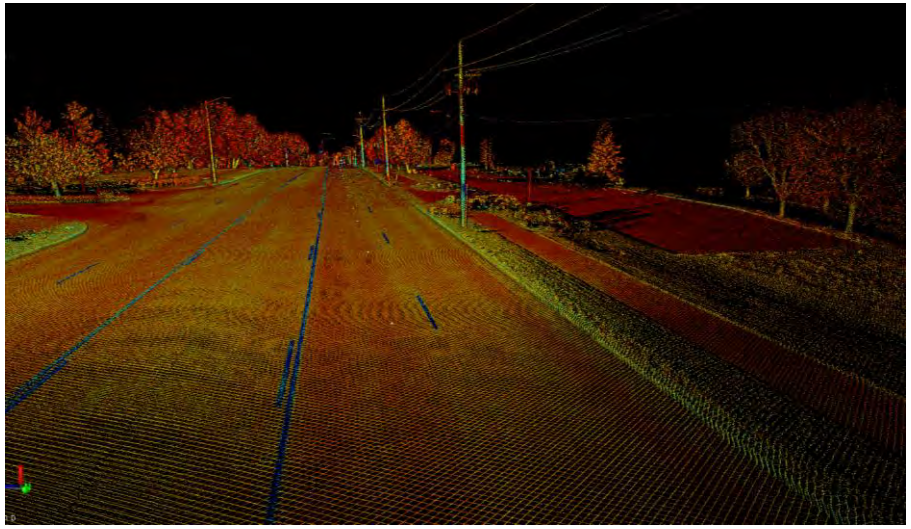




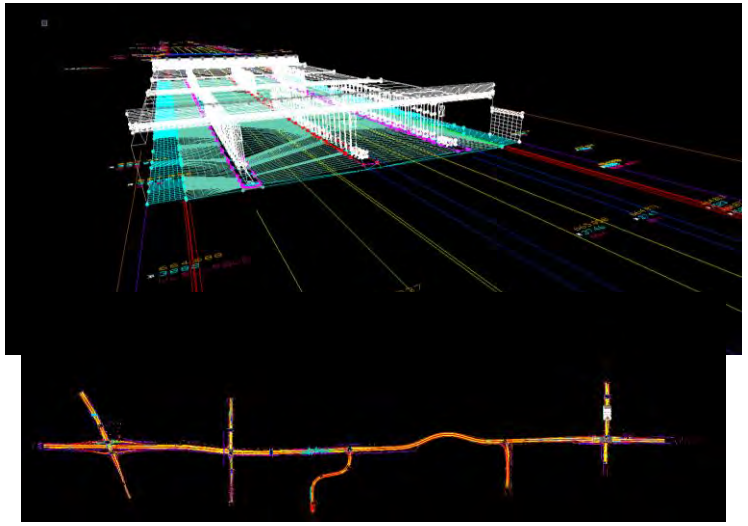


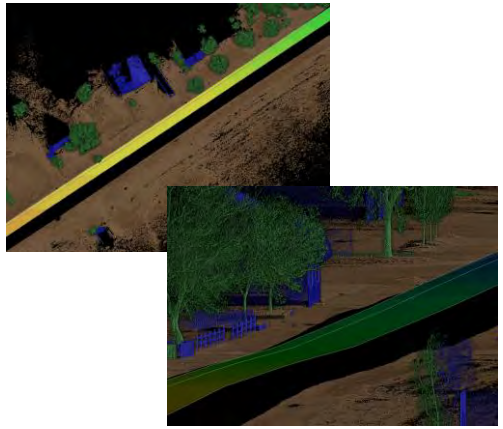
Applications in Transportation Projects

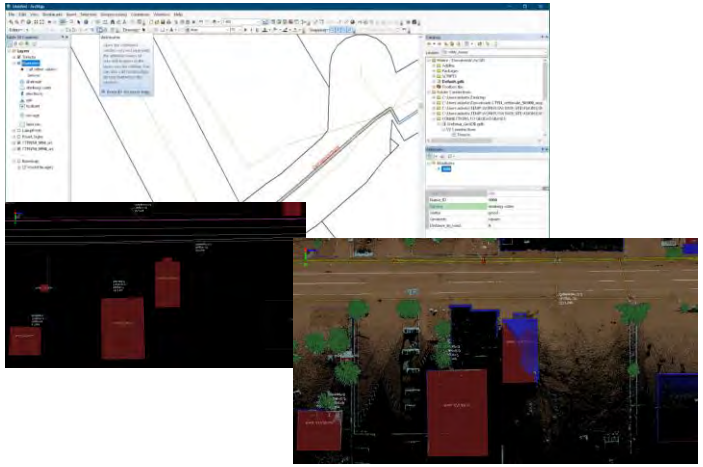
Imagery (Web-Portal)



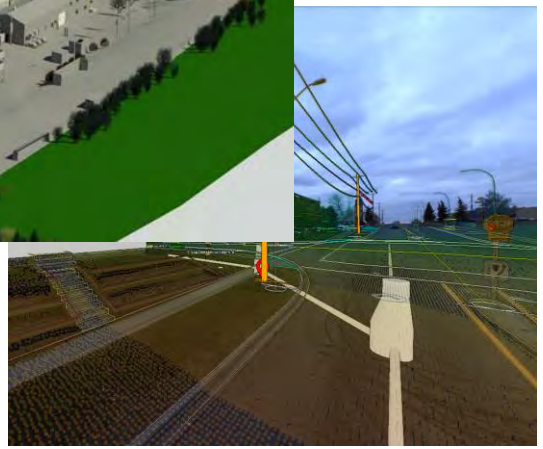
Point Cloud (Web-Portal)



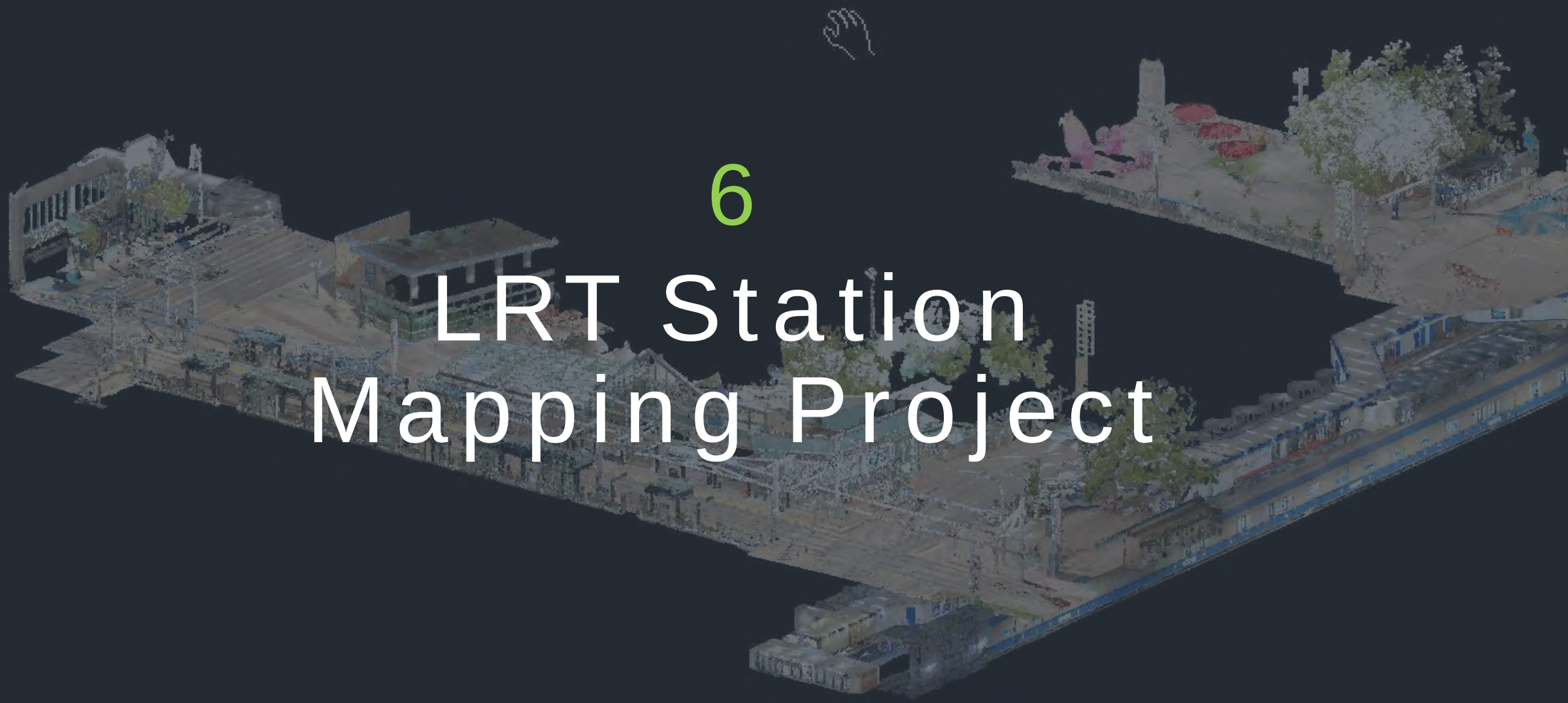




CAD Surface



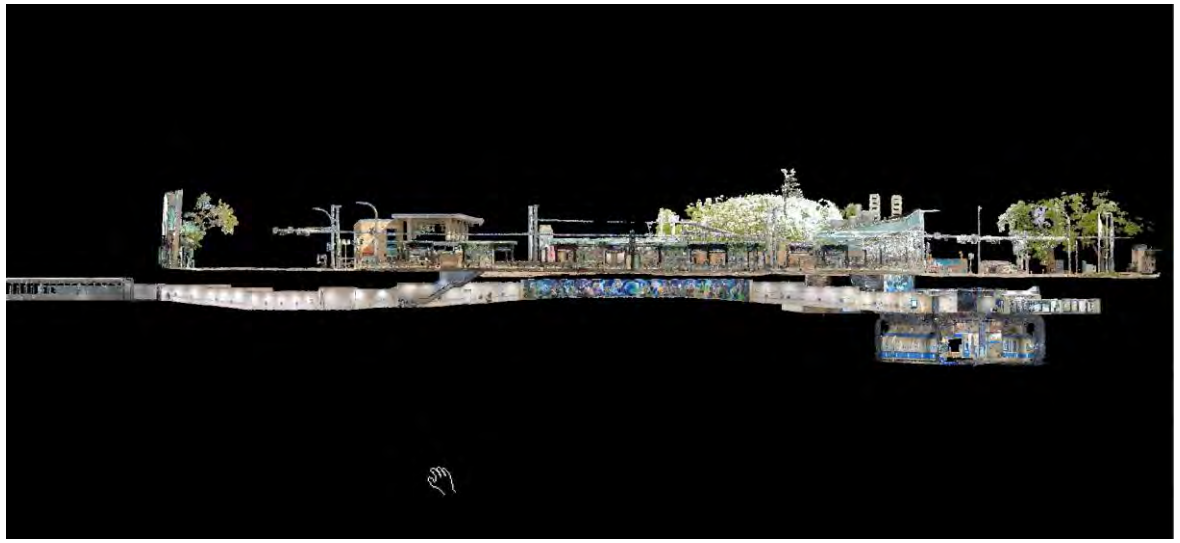
BIM Model
(Web-Portal)



6

LRT Station Mapping Project

GeoVerra's 3D Train Station Mapping Project



GeoVerra's 3D Train Station Mapping Project

Questions?

geoverra.com