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Reality Capture Standards
for Digital Twin Enablement

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Veris – a fully integrated digital and spatial data advisory and consulting firm
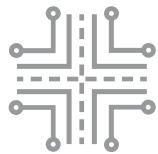
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Company Profile

500+ People

15 Offices across Australia

Sectors

Transport

Mining & Resources

Defence

Property & Buildings

Energy & Utilities

Government

Our Services

DIGITAL & SPATIAL
Digital solutions, 3D scanning, data capture, storage, management, modelling, visualisation and analysis.

ENGINEERING SURVEY
Civil construction and engineering survey solutions for major infrastructure.
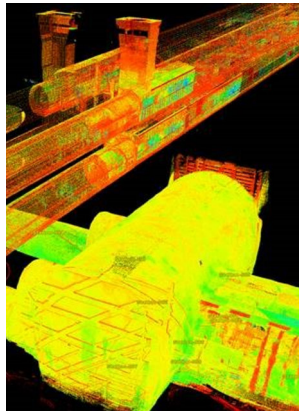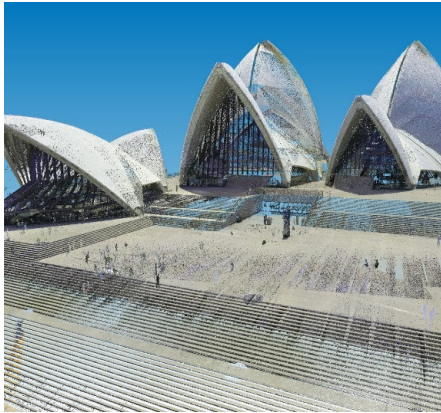
PROPERTY SURVEY
Land surveying, cadastral and consulting solutions.

CONSULTING & ADVISORY
Due diligence, strategic planning, master planning, place-making and planning approvals, environmental services.

Digital & Spatial Capabilities

Veris has the largest capability in Australia to capture and combine quality data from a large range of sensors and platforms.

Digital & Spatial Services

- Terrestrial laser scanning
- Mobile laser scanning
- UAV photogrammetry and LiDAR
- Hydrography
- 3D modelling and BIM
- Subsurface utilities and 3D Radar
- Monitoring and IoT
- GIS and spatial analytics
- 3D web visualisation
- Machine learning and AI
- Digital twins

Context is Key

How the data is intended to be used, by whom and for what ongoing purpose is fundamental to creating a sustainable solution.
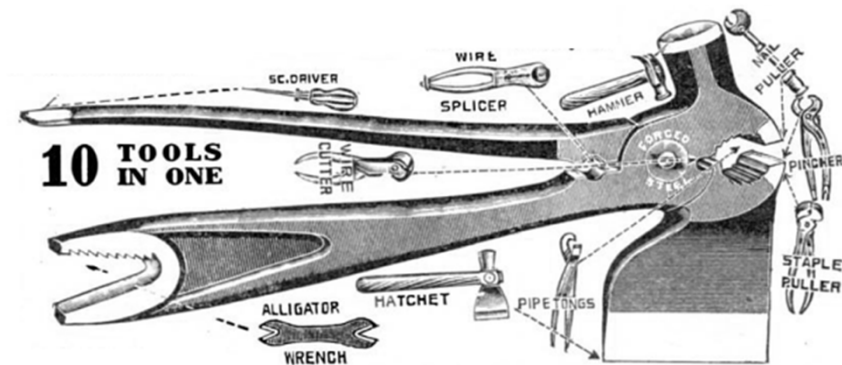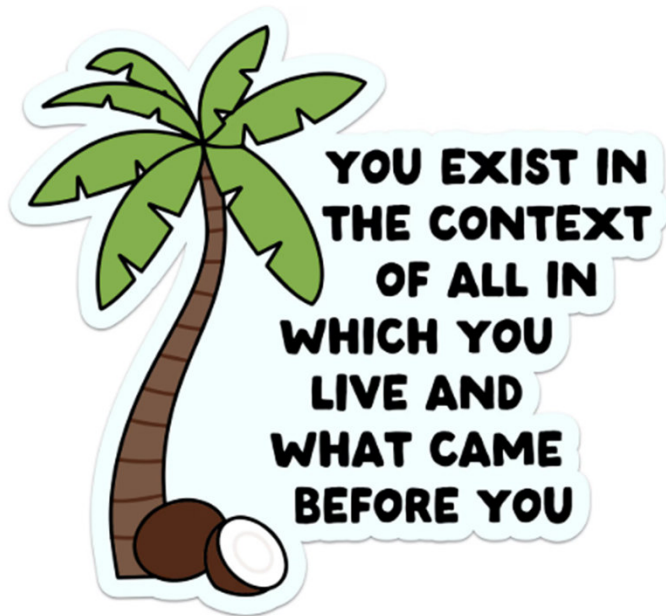

Fig 1: One tool to rule them all

Three Broad Use Cases of Examples

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Asset Identification
- Discrete Descriptive Images
- Sequential Images with Point Clouds

Site Context and Integration
- Discrete Overview Images
- Discrete Panoramic Images
- Discrete Imagery with Concurrent Point Clouds
- Point Clouds
- Sequential Panoramic Images
- Sequential Non-Panoramic Images

Defect Extraction and Temporal Reviews
- Sequential Imagery with Concurrent Point Clouds
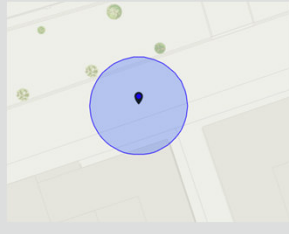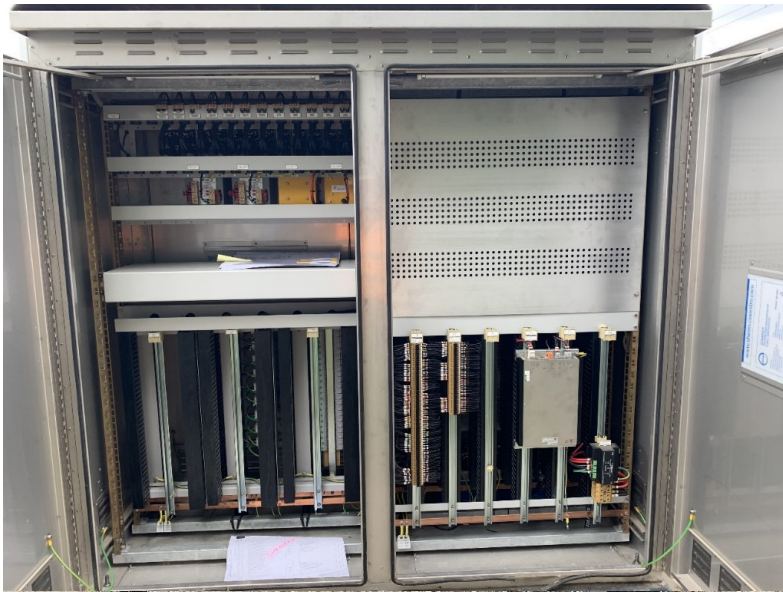- Asset Management System Integration

Use Case 1: Asset Identification

Asset Identification
- Discrete Descriptive Images
- Sequential Images with Point Clouds

"As a contractor I want to show all the assets at handover so I can demonstrate fulfillment of our contracted duties."

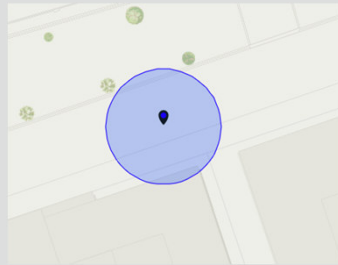| Spatial Accuracy:	5-10m (from location of captured asset in image)	Recommended Capture Equipment:	Smart Phone DSLR Camera (with GPS enablement)
Recommended Data Format:	JPEG with embedded metadata CSV file with Image Name and Asset ID of the captured asset	Recommended Coordinate System:	Not Applicable

Use Case 1: Asset Identification

Asset Identification
- Discrete Descriptive Images
- Sequential Images with Point Clouds

"As a contractor I want to show all the assets at handover so I can demonstrate fulfillment of our contracted duties."

Spatial Accuracy:	5-10m	Recommended Capture Equipment:	Ladybug6, Ladybug5+ Mozaic X, Mozaic 51 Leica Pegasus Insta360 Titan GoPro MAX 360 Custom Camera System (6x20MP) Riegl VUX-160 LiDAR Leica RTC360 NavVis BLK360 Leica P30, P40 Trimble X7/X9/X12 Riegl VZ range Faro range Emesent Hovermap
Data Resolution:	Imagery: Minimum 5 megapixel per camera Pt Cloud: Data collected inside defined scope area done so to achieve target resolution of around 4000 pts per square metre in area	Imagery Capture Orientation:	Mounted High, Focus on Forward Direction, ~30° Left Direction
Capture Intervals:	Imagery: Minimum 10m Pt Cloud: Operating speed at 200+RPS @ 1mil pts/sec per scanner	Capture Specifications:	Stationary: 360° FOV, HDR imagery enabled, point spacing to be better than 6mm at 10m, checkerboard targets to be used Mobile: Single and Dual Head MLS configurations

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Example
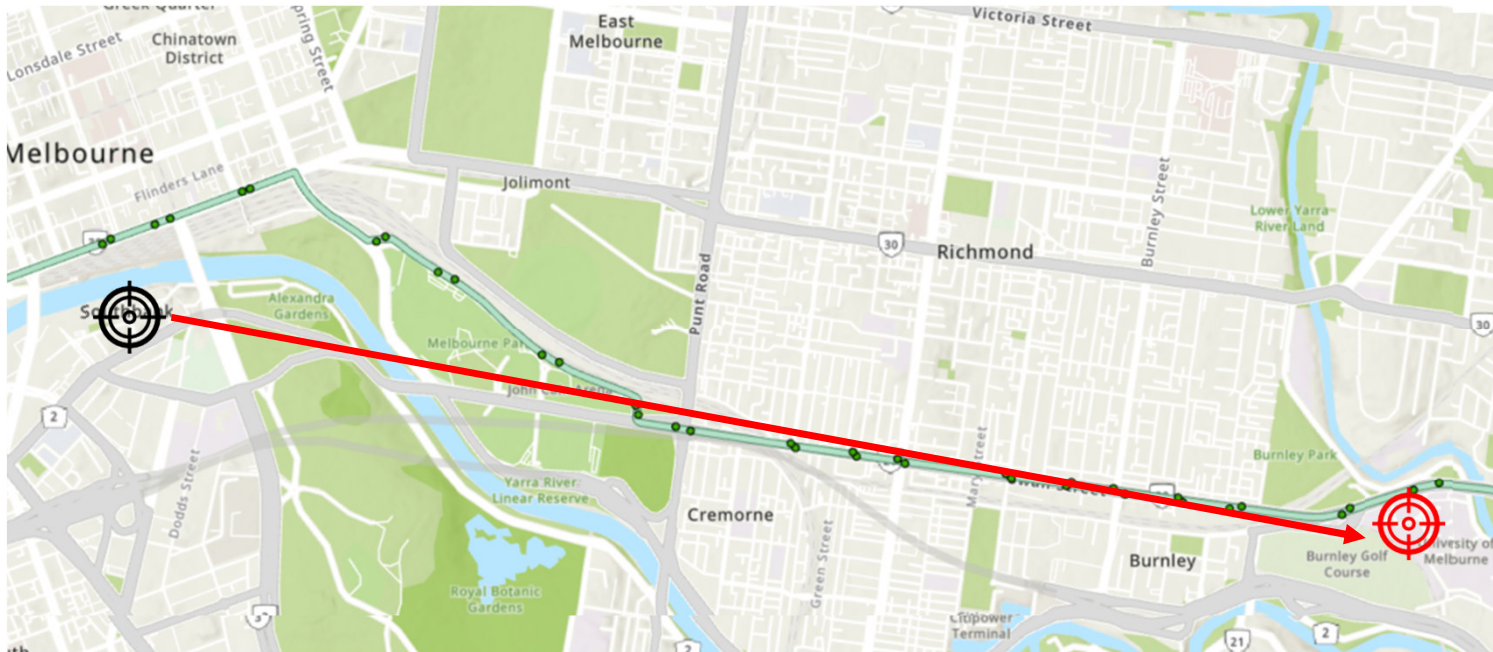
Asset-based discrete non-panoramic imagery capture of the tram stops: $

Discrete images with point clouds: $$$$$$$$$$

Sequential images with point clouds for entire environment: $$$$$$

36 tram stops

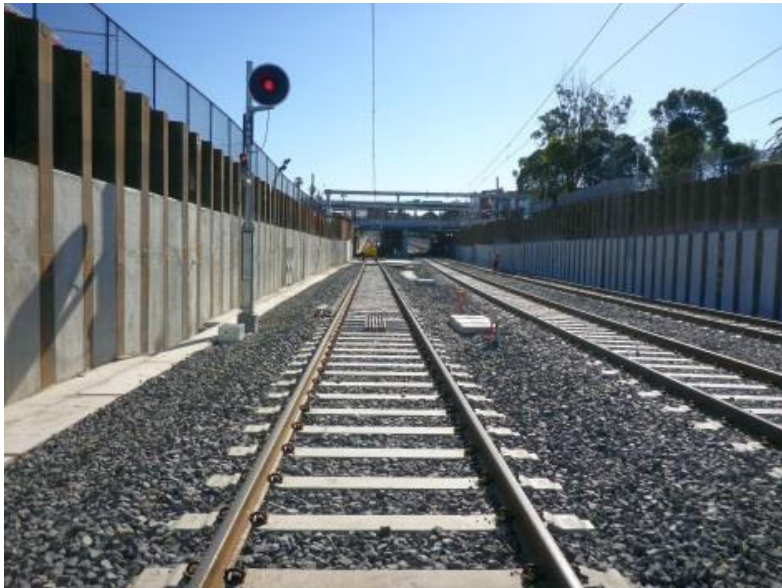5,325m

Use Case 2: Site Context and Integration

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Site Context and Integration
- Discrete Overview Images
- Discrete Panoramic Images
- Discrete Imagery with Concurrent Point Clouds
- Point Clouds
- Sequential Panoramic Images
- Sequential Non-Panoramic Images

"As a team member I want to undertake a desktop inspection on a location with supplementary data to understand the constraints."

Spatial Accuracy:	+/-0.5 metres	**Recommended Capture Equipment:**	Non-Panoramic: Smart Phone, DSLR Camera (with GPS enablement) Panormaic: Ladybug6, Ladybug5+ Mozaic X, Mozaic 51 Leica Pegasus Insta360 Titan GoPro MAX 360 iStar Camera Leica RTC360 Custom Camera System (6x20MP)
Recommended Data Format:	JPEG with attached CSV Import JPEG with embedded GPS information .oif, .bmp, .png	**Recommended Coordinate System:**	Projected Cartesian
Other Relevant Metadata:	Pose Information (pitch, roll, pan if captured) Date Captured, GPS Accuracy, Capture Hardware		

Use Case 2: Site Context and Integration
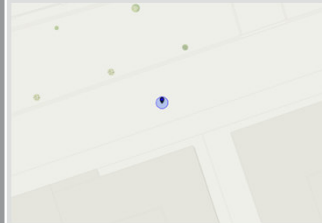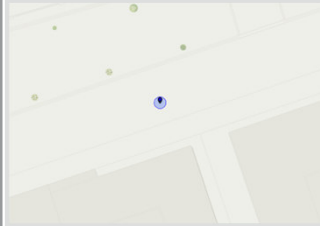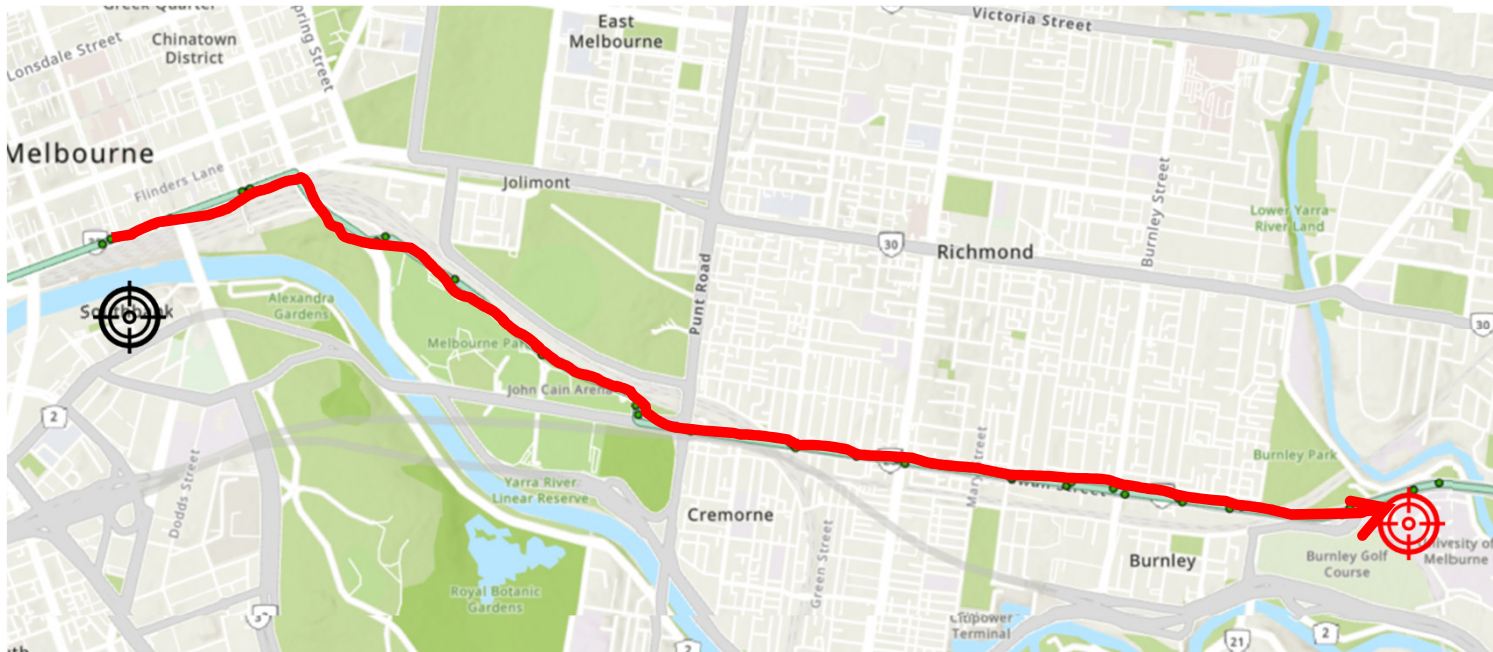
Site Context and Integration
- Discrete Overview Images
- Discrete Panoramic Images
- Discrete Imagery with Concurrent Point Clouds
- Point Clouds
- Sequential Panoramic Images
- Sequential Non-Panoramic Images

"As a team member I want to undertake a desktop inspection on a location with supplementary data to understand the constraints."

Spatial Accuracy:	+/-0.025 metres	**Recommended Capture Equipment:**	Leica Pegasus Riegl VUX-160 LiDAR Leica RTC360 NavVis BLK360 Leica P30, P40 Trimble X7/X9/X12 Riegl VZ range Faro range
Recommended Data Format:	LAZ & LAS (Version 1.4) E57	**Recommended Coordinate System:**	Projected Cartesian
Other Relevant Metadata:	Date Captured, Accuracy Sigmas, Capture Hardware, Scan Angle, Classification and RGB values (if camera used) present in point cloud data	**Data Resolution:**	Data collected inside defined scope area done so to achieve target resolution of around 4000 pts per square metre in area
Capture Intervals:	Operating speed at 200+RPS @ 1mil pts/sec per scanner		

Example

General discrete overview images of the alignment:
$$$$

Sequential images with point clouds of the alignment:
$$$$$$$$$

Sequential images with point clouds of the alignment in a tunnel:
$$$$$$$$$$$$$$$$$$$$$
$$$$$$$$$$

36 tram stops   5,325m

Let's Compare the Pair…

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Asset Identification

Site Context and Integration

Constraints

Constraints

Asset-based discrete non-panoramic imagery capture of the tram stops: $

General discrete overview images of the alignment: $$$$

Discrete images with point clouds: $$$$$$$$$$

Sequential images with point clouds: $$$$$$$$$$$$

Sequential images with point clouds for entire environment: $$$$$$

Sequential images with point clouds of the entire environment: $$$$$$$$$

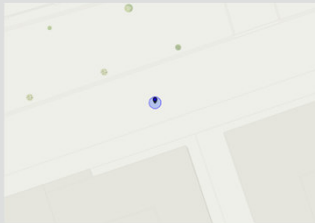Low spatial accuracy   Challenging integration   Potentially obstructed view   Time heavy   Costly

Use Case 3: Defect Extraction and Temporal Reviews

Defect Extraction and Temporal Reviews
- Sequential Imagery with Concurrent Point Clouds
- Asset Management System Integration

"As a road manager I want to understand the quantity and quality of defects on a roadway to understand the costs for my works program."

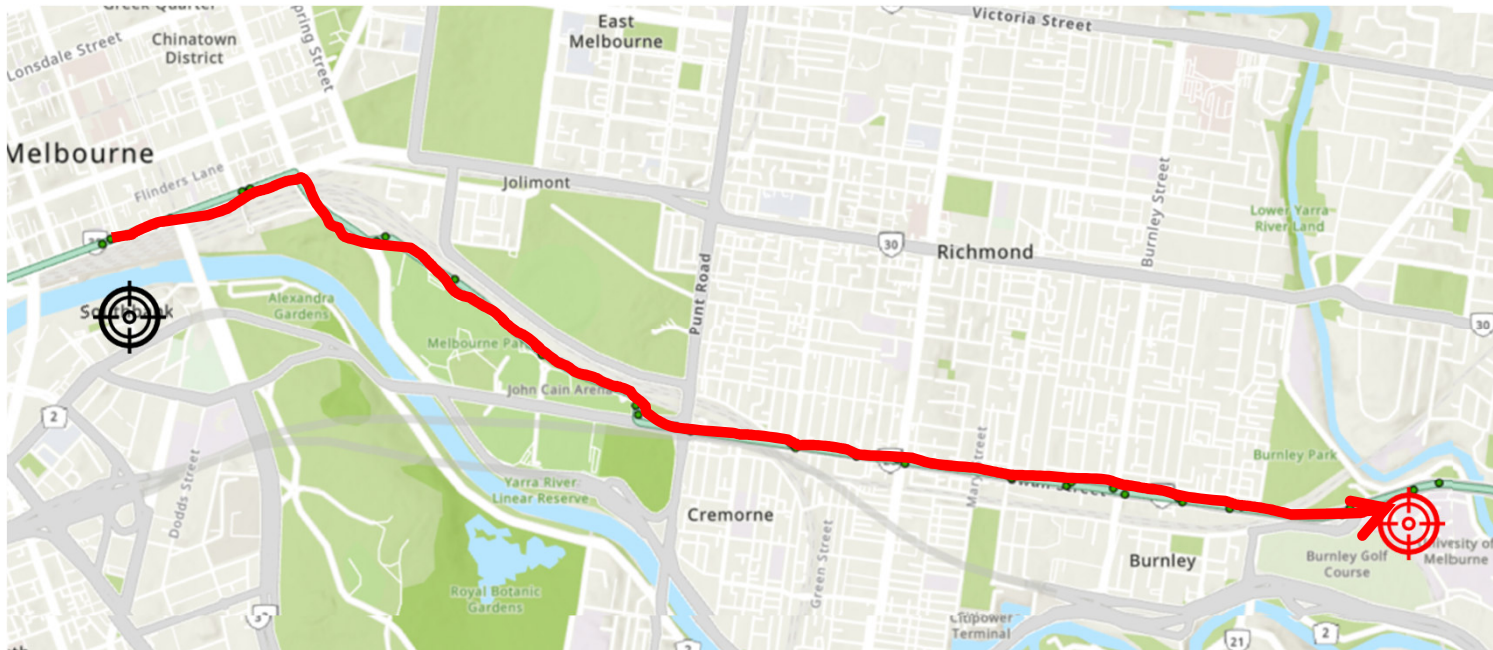| Spatial Accuracy:	+/-0.025 metres	Recommended Capture Equipment:	Ladybug6, Ladybug5+ Mozaic X, Mozaic 51 Leica Pegasus Custom Camera System (6x20MP)
Recommended Data Format:	JPEG with attached CSV Import JPEG with embedded GPS information LAZ & LAS (Version 1.4) E57	Recommended Coordinate System:	Projected Cartesian
Other Relevant Metadata:	Pose Information (pitch, roll, pan if captured) Date Captured, GPS Accuracy, Capture Hardware		

Use Case 3: Defect Extraction and Temporal Reviews

Defect Extraction and Temporal Reviews
- Sequential Imagery with Concurrent Point Clouds
- Asset Management System Integration

"As a road manager I want to understand the quantity and quality of defects on a roadway to understand the costs for my works program."

Point Cloud & Imagery → **Reality Mesh** → **Feature Tagging** → **GIS** → **Asset Management System**

Example

Sequential images with point clouds of the alignment with feature tagging:
$$$$$$$$$$$$$$

Sequential images with point clouds of the alignment:
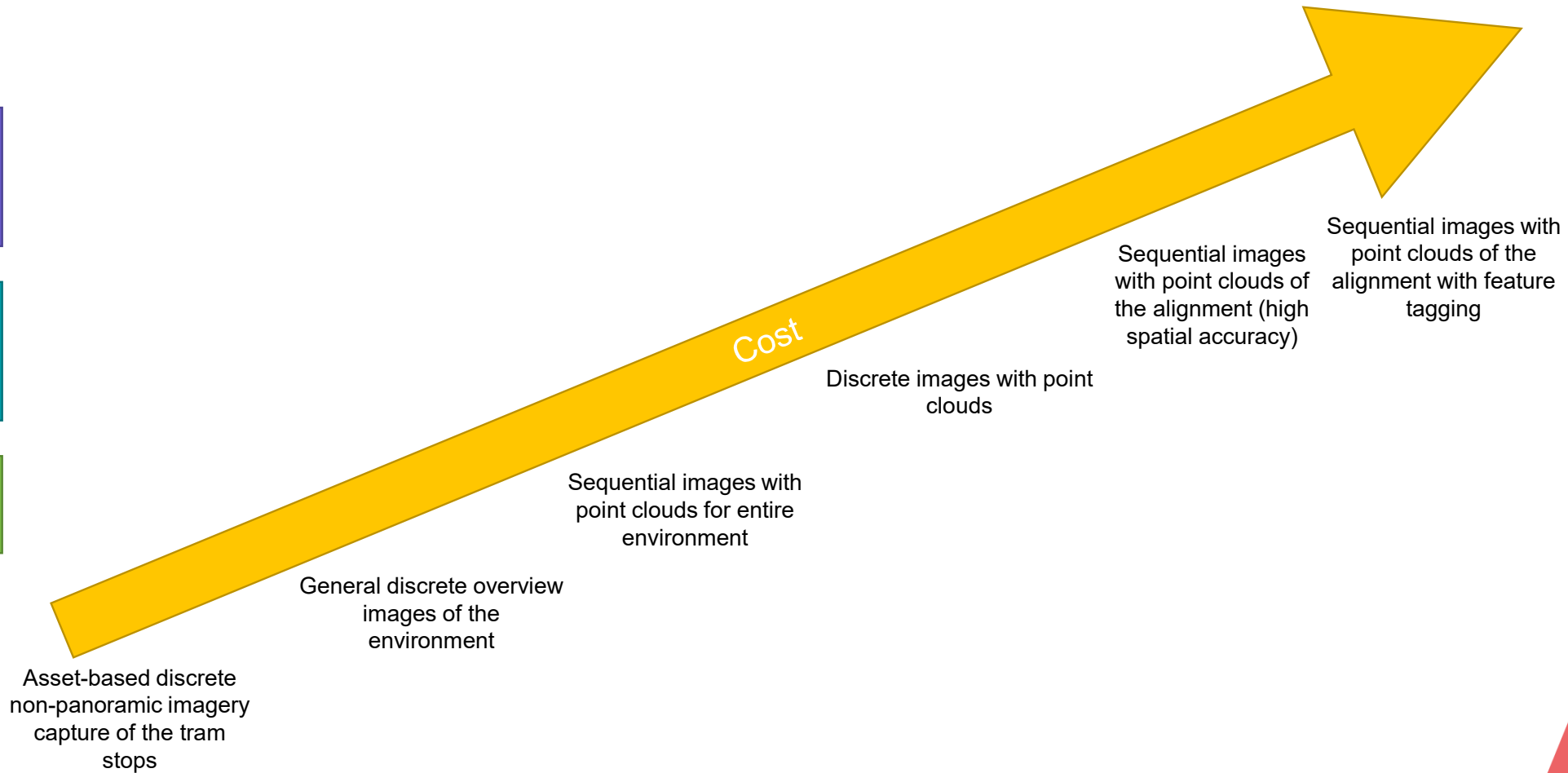$$$$$$$$$$

36 tram stops   5,325m

Context for Capture and Fit for Purpose

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Defects and Temporal Review

Site Context and Integration

Asset Identification

Cost

Sequential images with point clouds of the alignment with feature tagging

Sequential images with point clouds of the alignment (high spatial accuracy)

Discrete images with point clouds

Sequential images with point clouds for entire environment

General discrete overview images of the environment

Asset-based discrete non-panoramic imagery capture of the tram stops

Thank you

Mina Jahanshahi

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Data Insights and Solutions