INTELLIGENT TRANSPORT SYSTEM
ASSOCIATION OF MALAYSIA

Using
UAV photogrammetry & 3D laser scanning
for better road planning and management

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www.jpsurveys.com

ITS SEMINAR AND EXHIBITION 2017

DRIVING ITS TO A NEW NORMAL

ITS MALAYSIA

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Presentation outline

1. Introduction: What is UAV photogrammetry & 3D laser scanning ?
2. Application: pre-construction stage
3. Application: construction stage
4. Application: post-construction stage
5. Beyond road planning and management
6. Challenges

Using UAV photogrammetry and 3D laser scanning for better road planning and management

What is UAV/Drone Photogrammetry?

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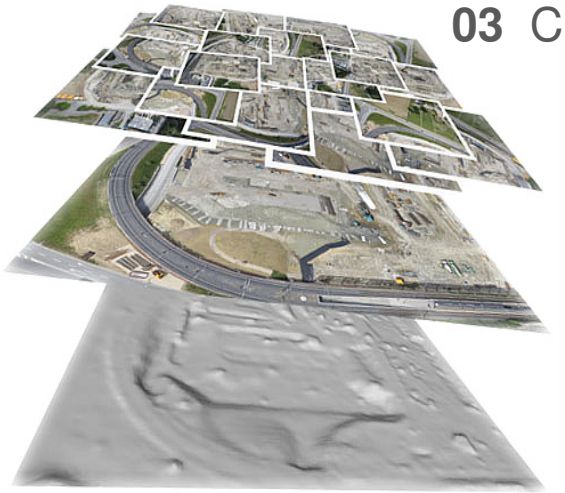
01 PREPARE

02 CONDUCT MISSION

03 CREATE MAPS AND MODELS



Classic Photogrammetry

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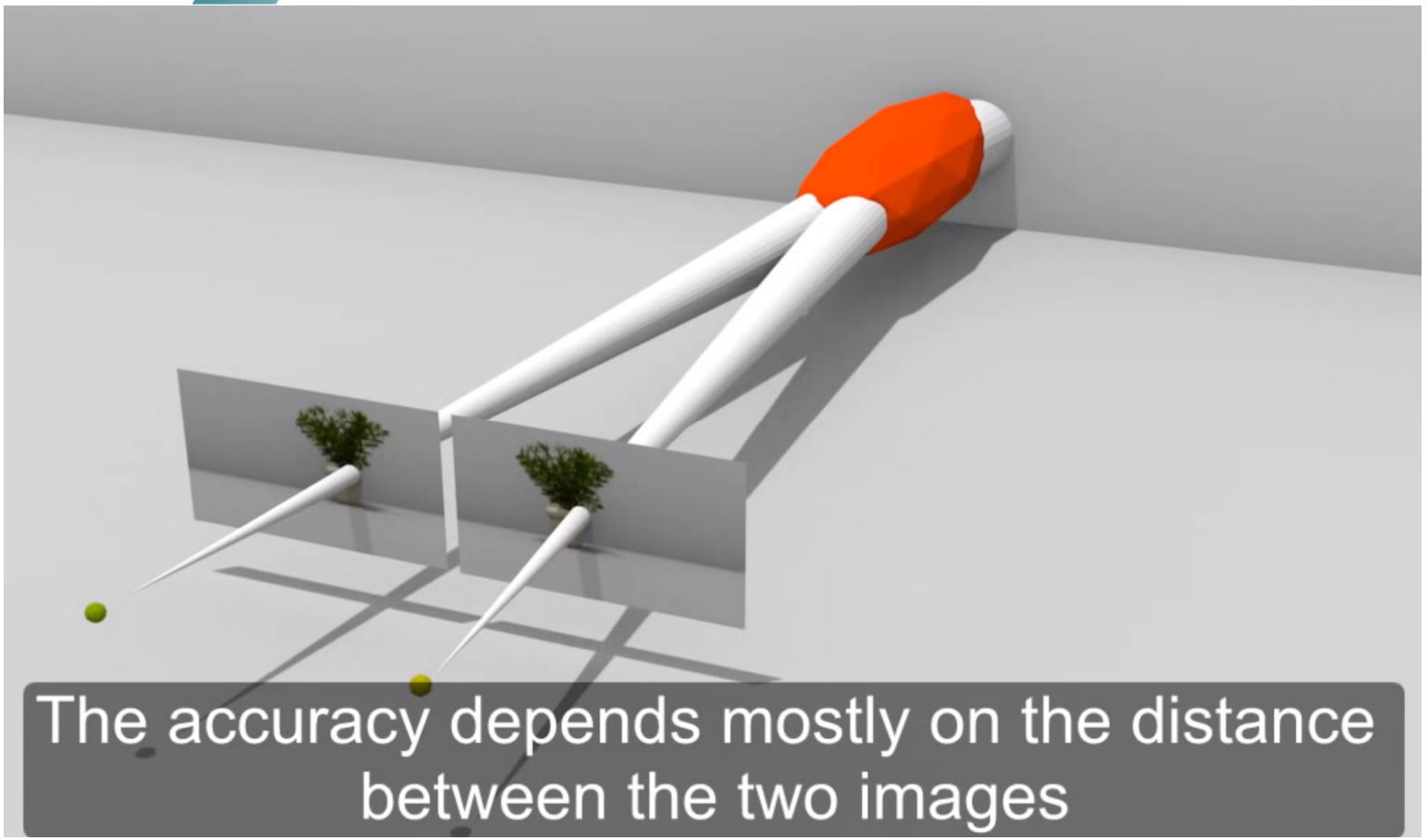

1. Introduction

Multi-ray Photogrammetry

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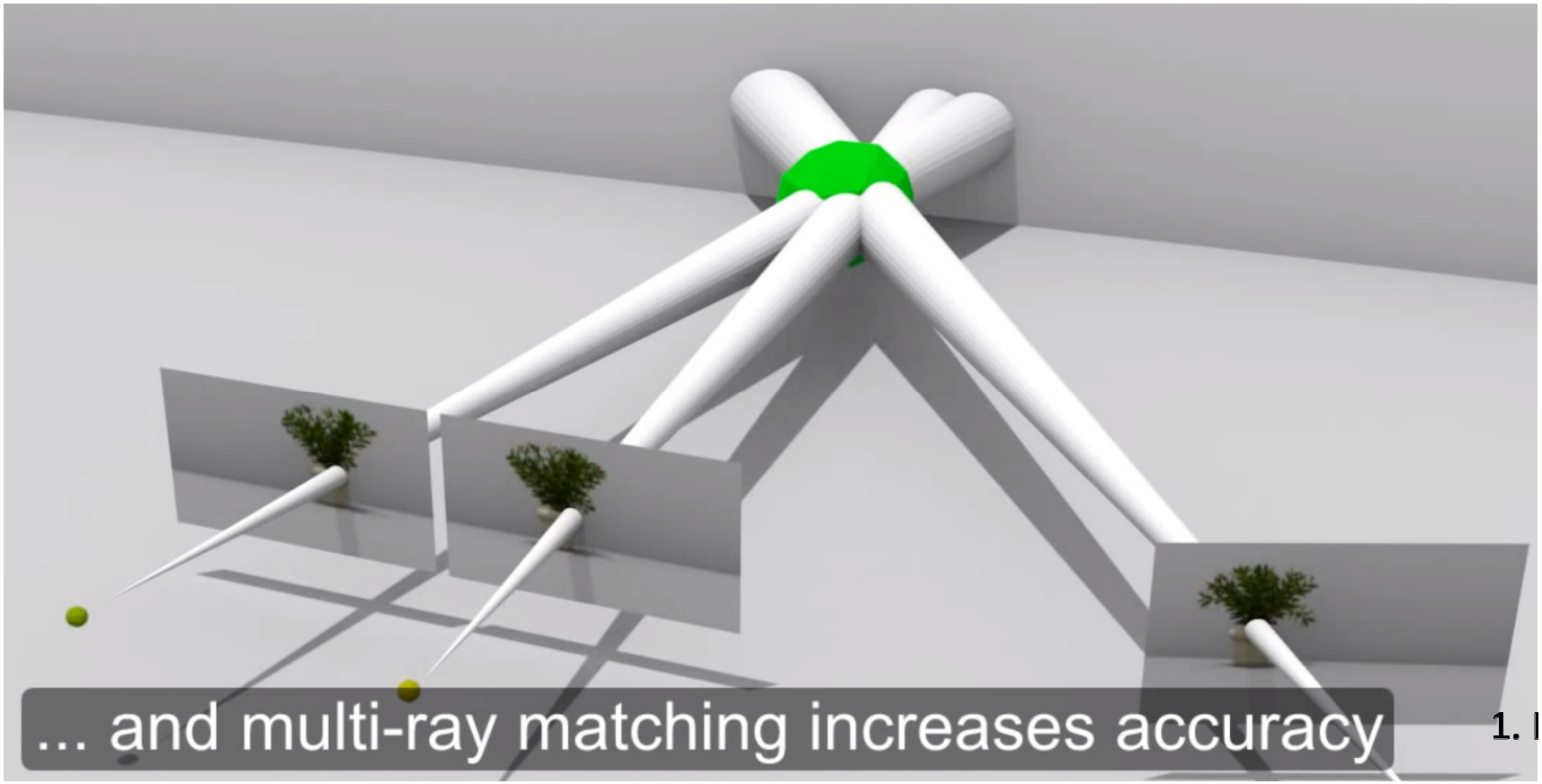

Multi-Ray Photogrammetry

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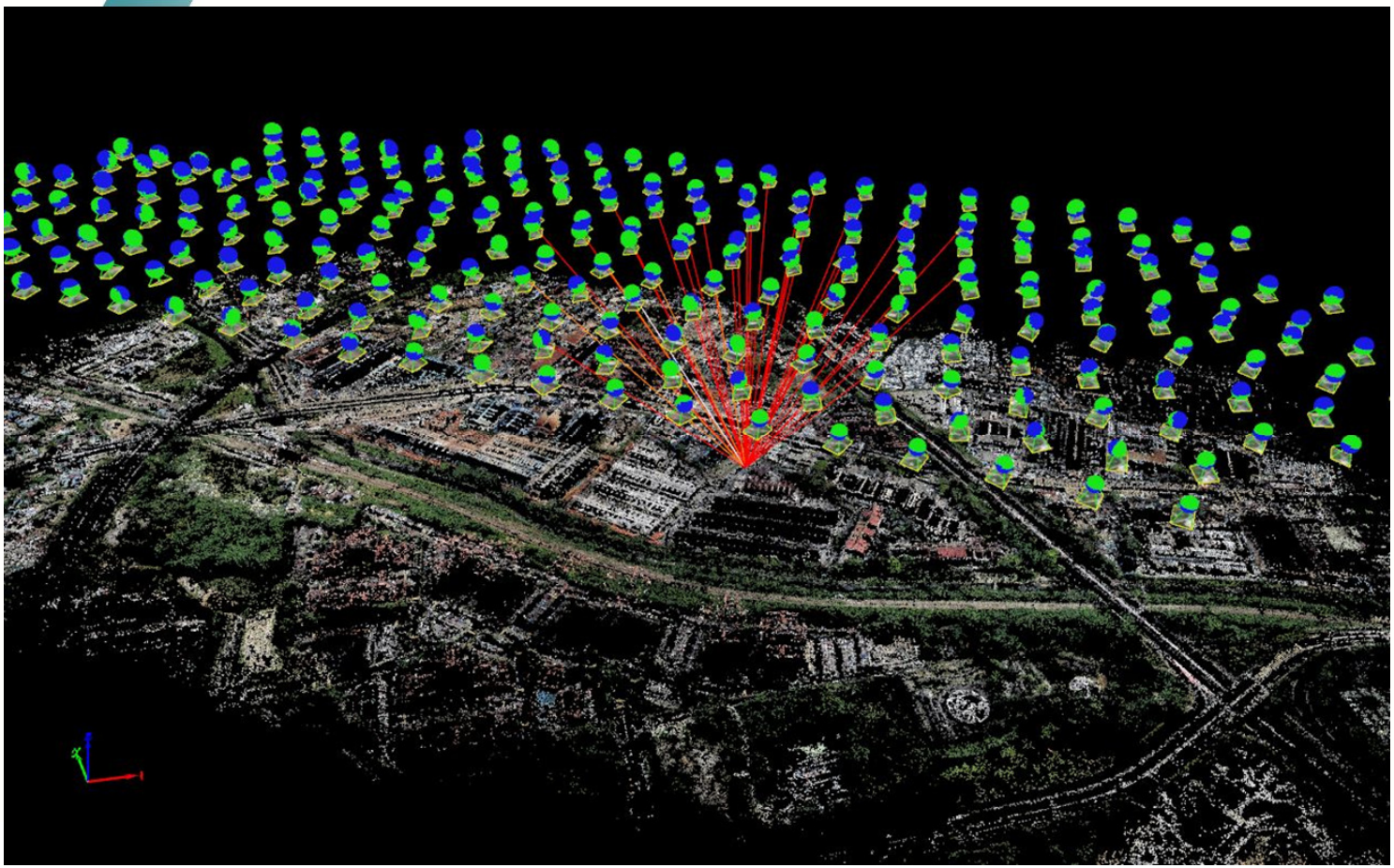

1. Introduction

3D color point cloud

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1. Introduction

What is 3D laser scanning aka TLS?

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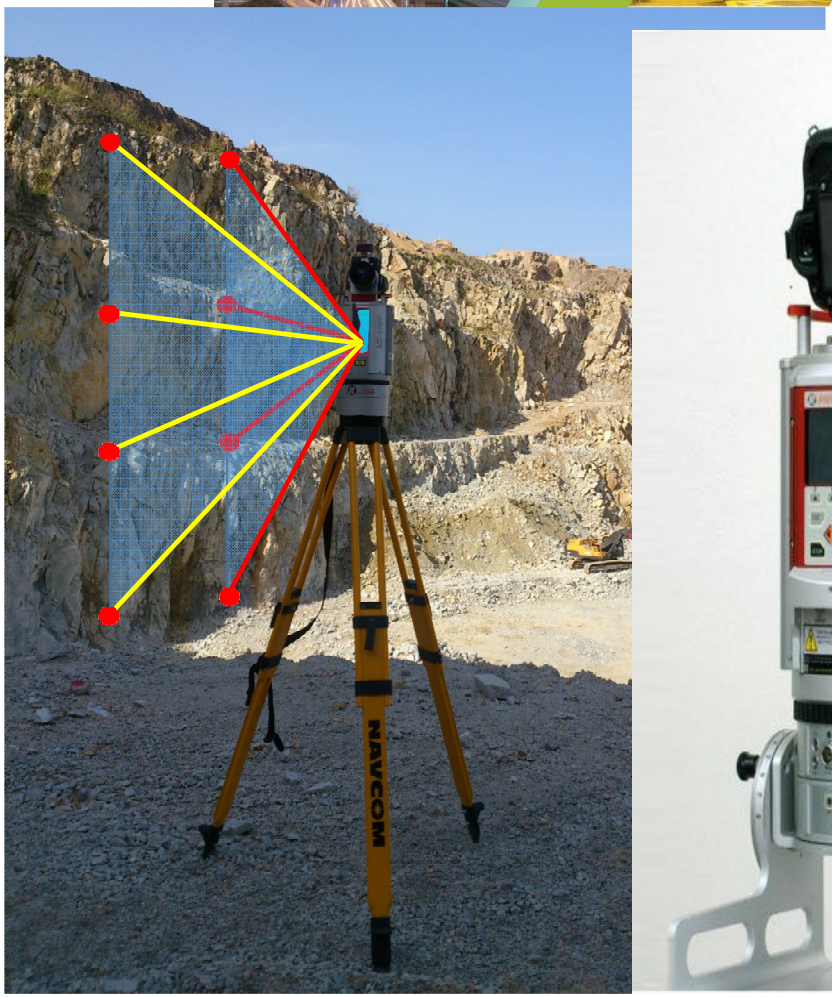

RIEGL VZ-1000 3D Scanner

Feature	
• Range	1,400 m
• Speed	120,000 pps
• Precision	5 mm
• Ranging Accuracy	8 mm (@100m)
• Sampling Accuracy	8 mm / 50m
• Camera DSLR	12 MPx

3D color point cloud

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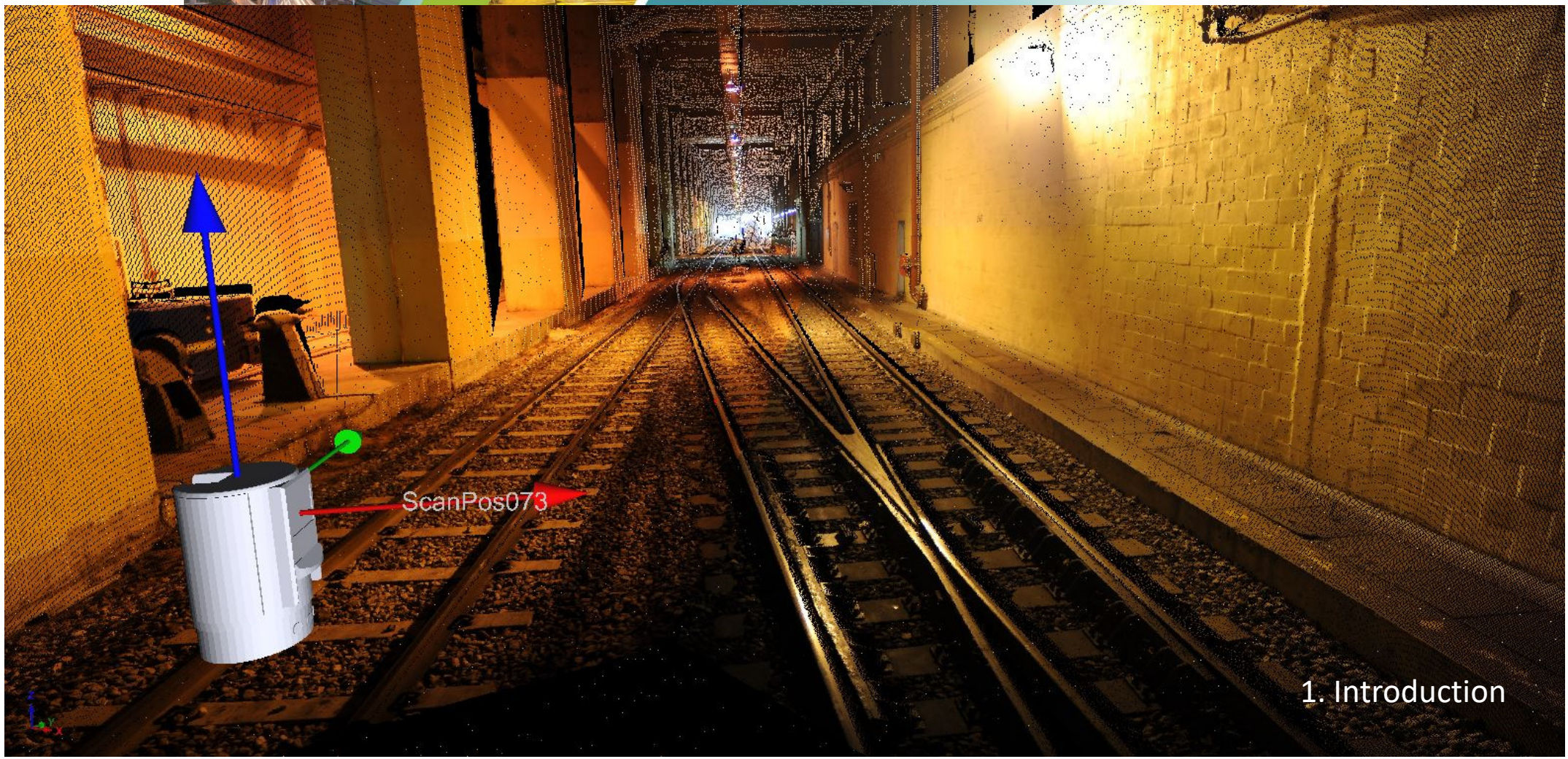

Characteristics of Point clouds

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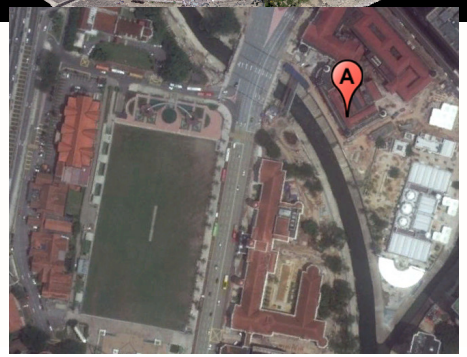
1. Accurate (xyz)
2. Faithful representation
3. Visual and impactful
4. Further Integration
5. Further Extraction



Further Extraction

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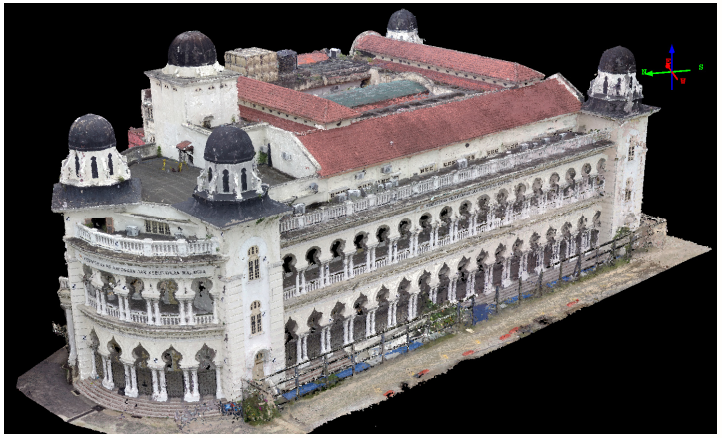

1. Orthophoto
2. 2D map/plan
3. 3D map/model
4. Sectional /elevation plan
5. DTM/DEM , contour, slope..
6. Volumetric
7. Temporal changes/crash detection & ...

YW1

2. Pre-construction

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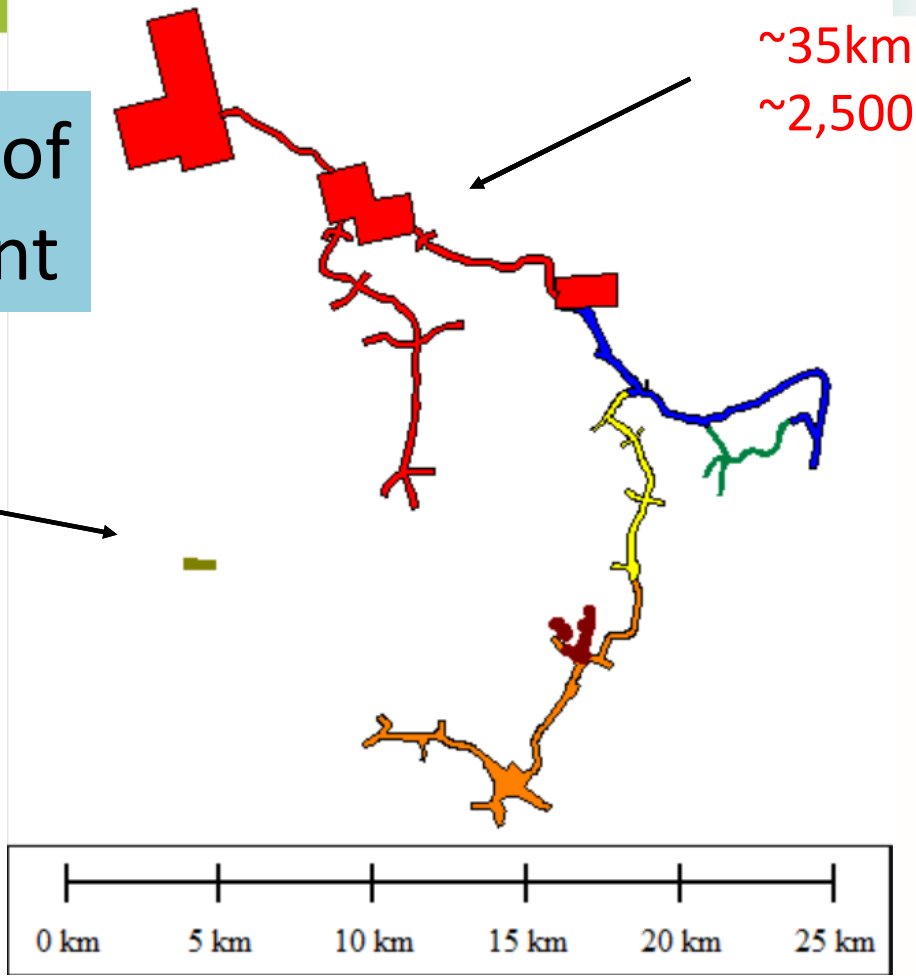
Optimization of road alignment

~35km
~2,500ha

~1km
~35ha



5 urban highways/roads

Each took about 2 weeks to 3 months

Slide 12

YW1 YS Wong, 1/24/2017

Orthophoto

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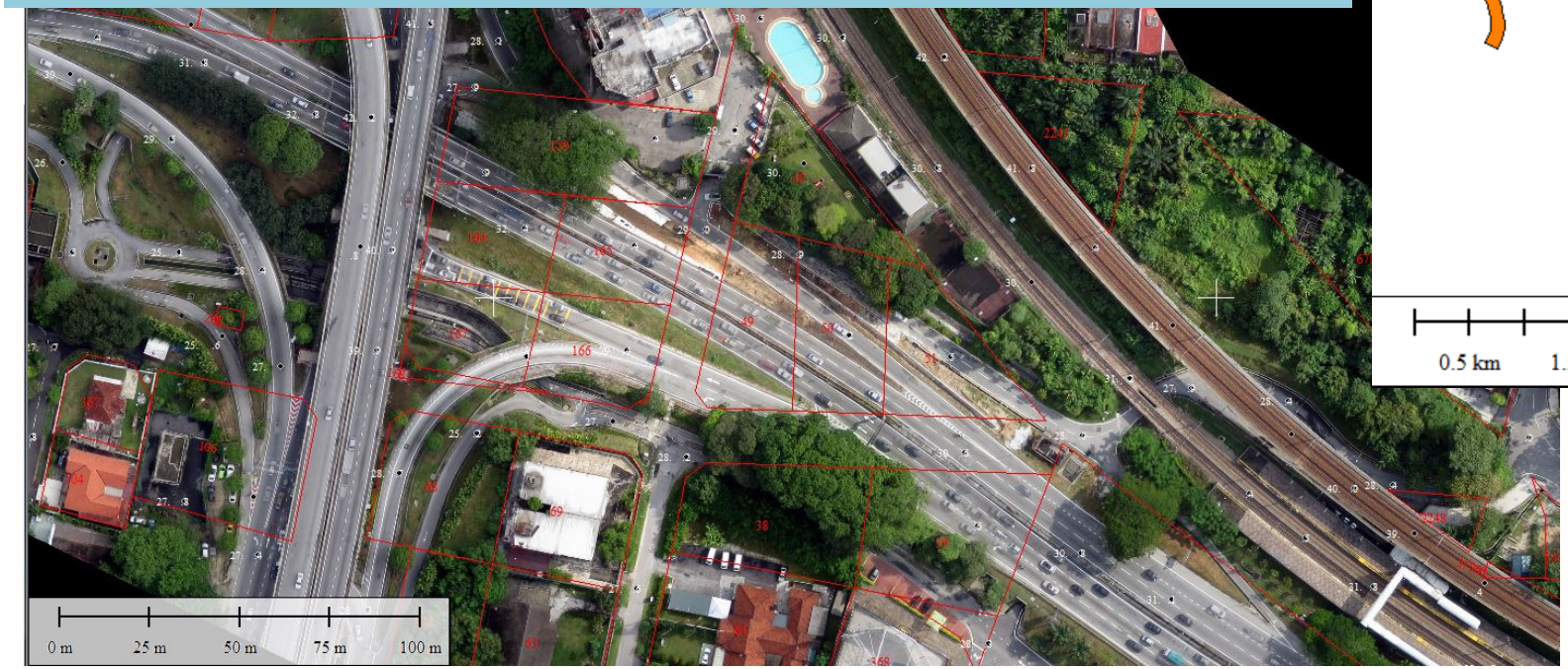
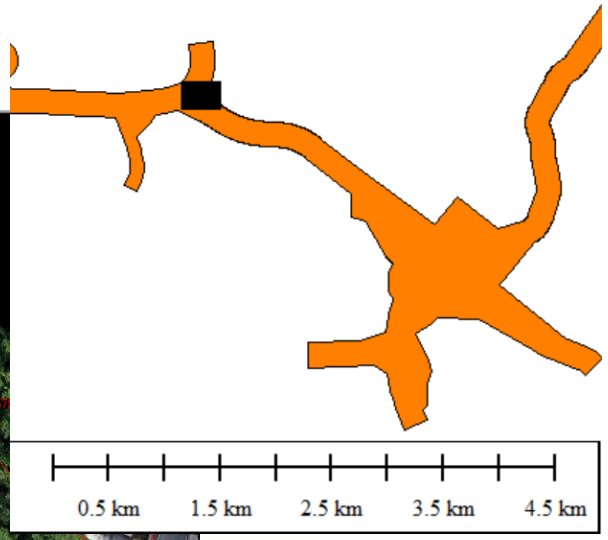
Seamless, map-accurate, high resolution, generous buffer, up-to-date





3D vector mapping

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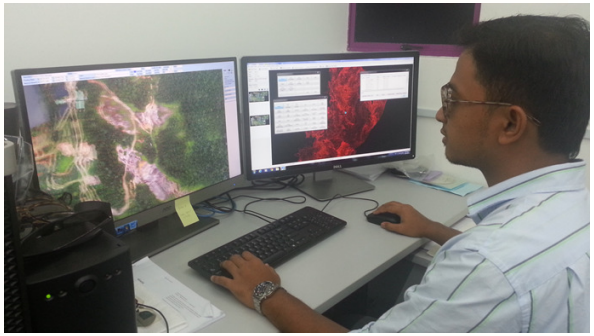
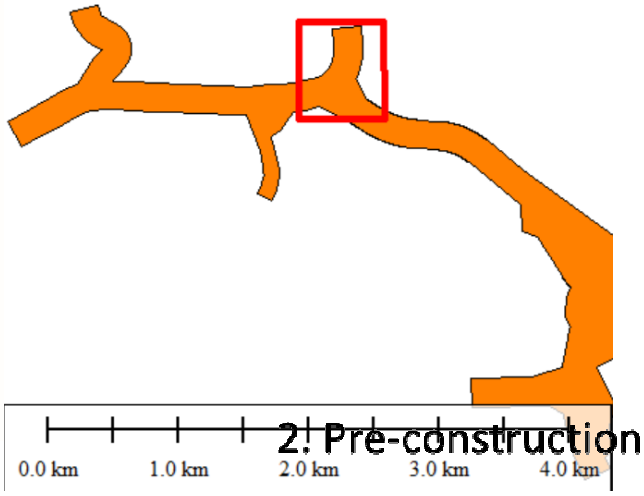


Stereo digitizing using DPW



2. Pre-construction

3D vector mapping

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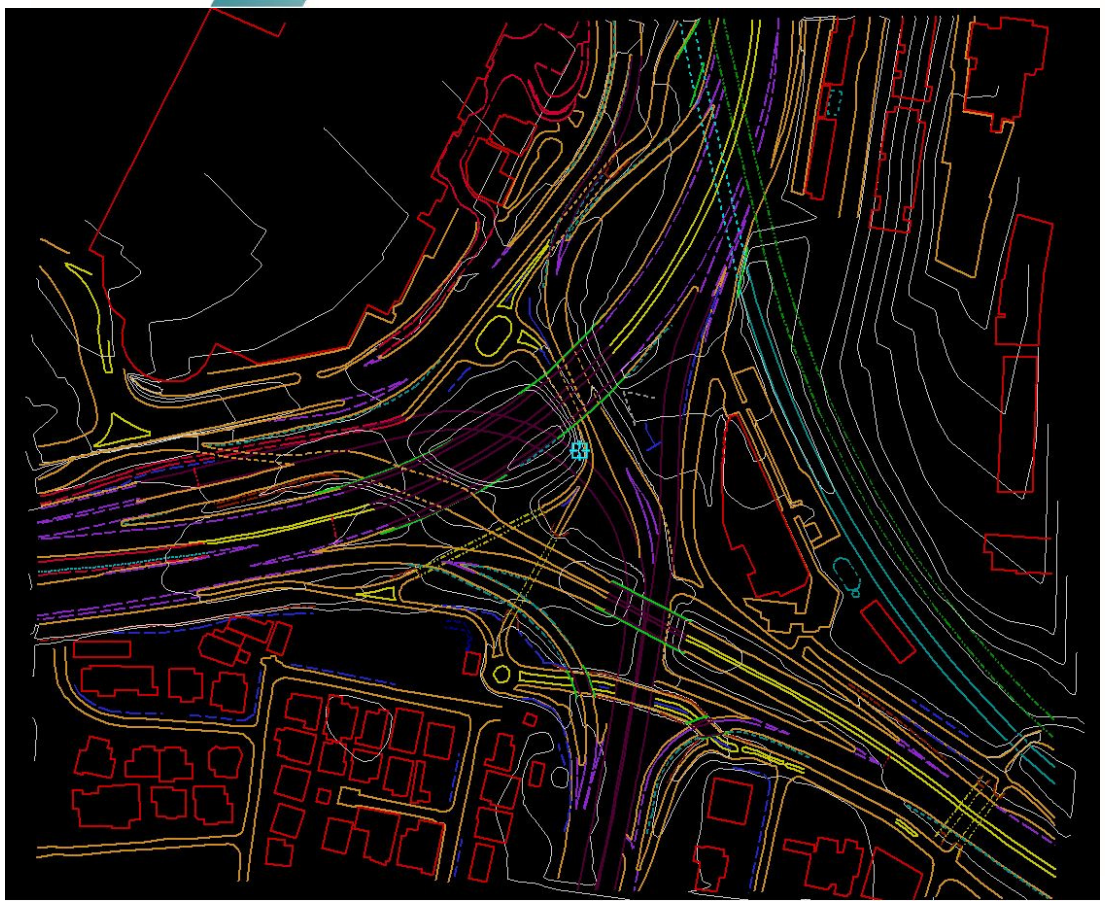
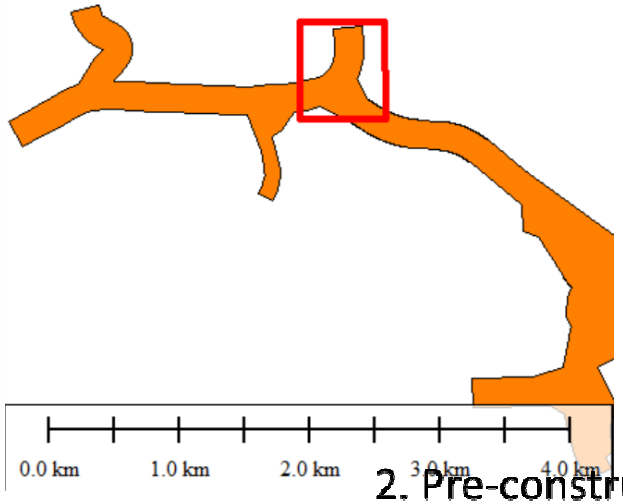


Stereo digitizing using DPW



2. Pre-construction

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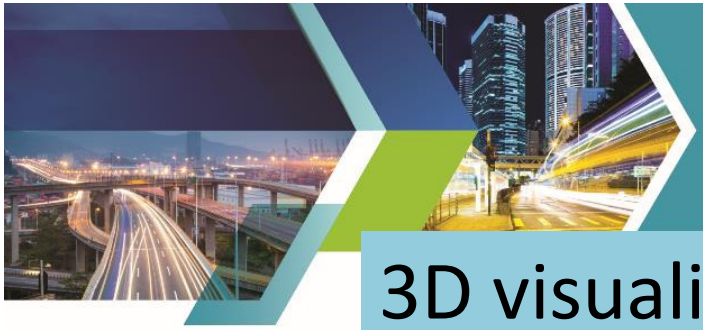
Communication, engagement and visualization in 3D



Pre-construction

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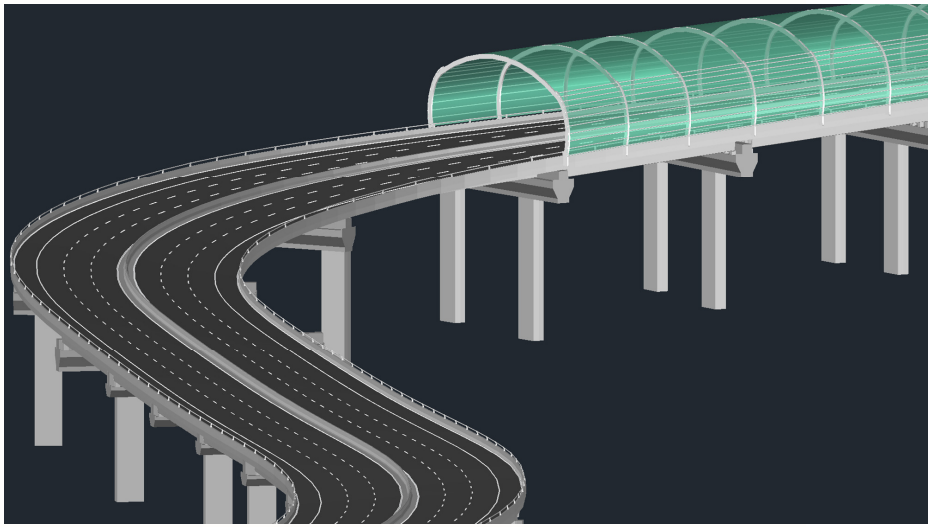
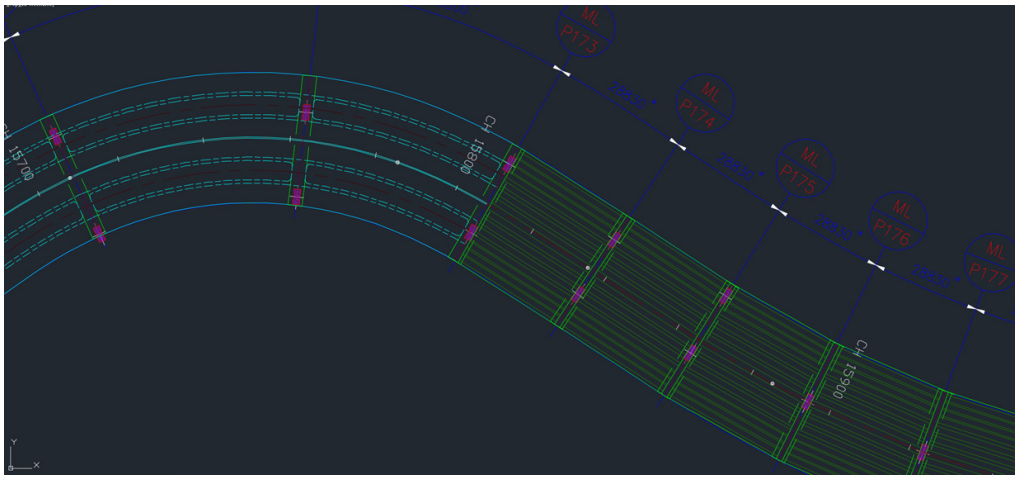
3D visualization is desirable and helpful





Pre construction

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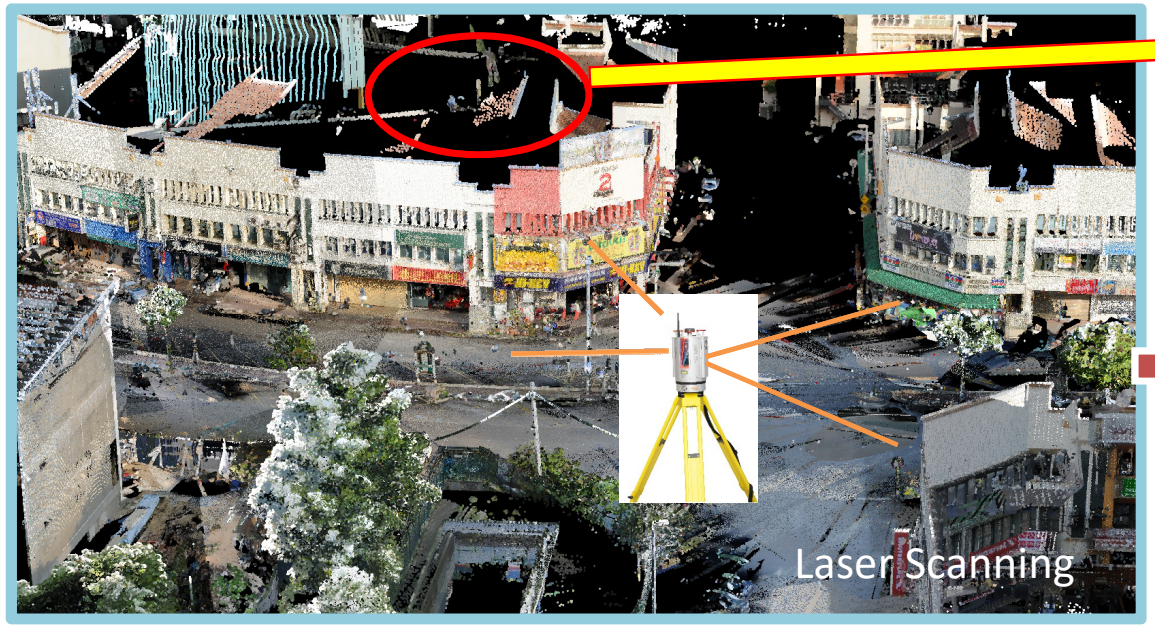
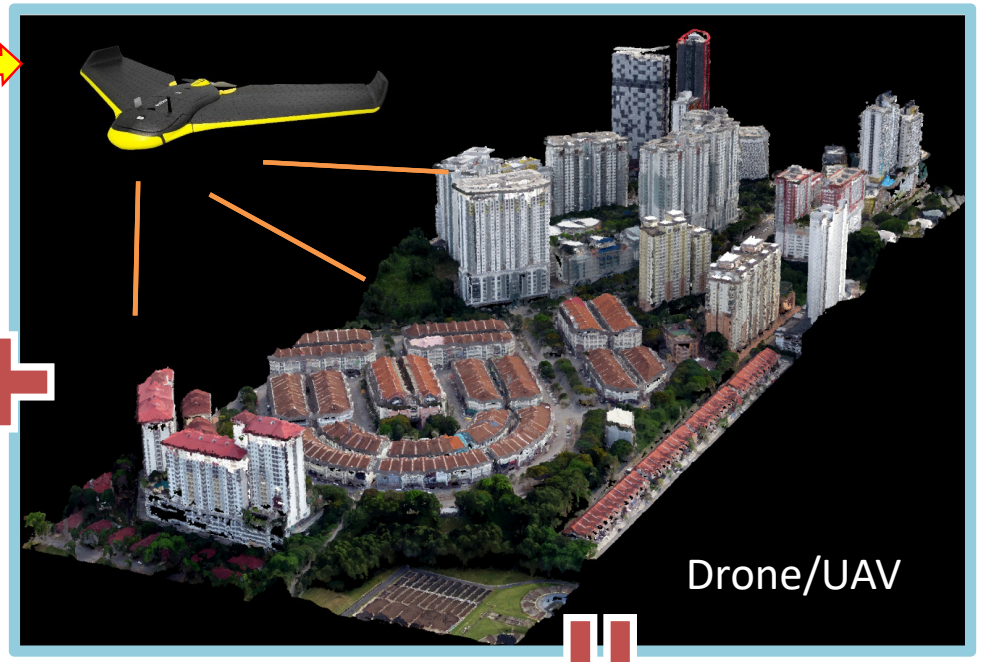
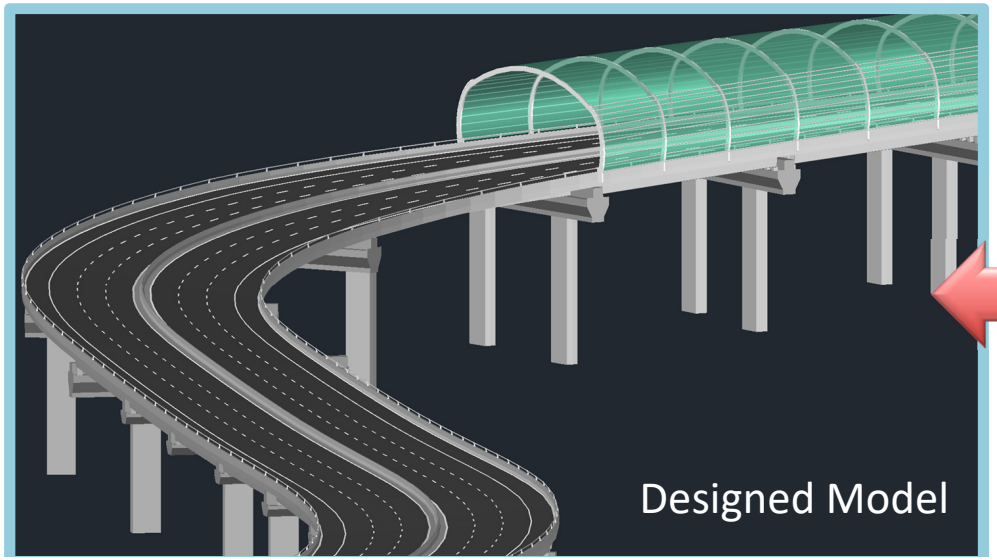
2. Pre-construction


Laser Scanning


Drone/UAV


Designed Model


Site Context

Pre-construction

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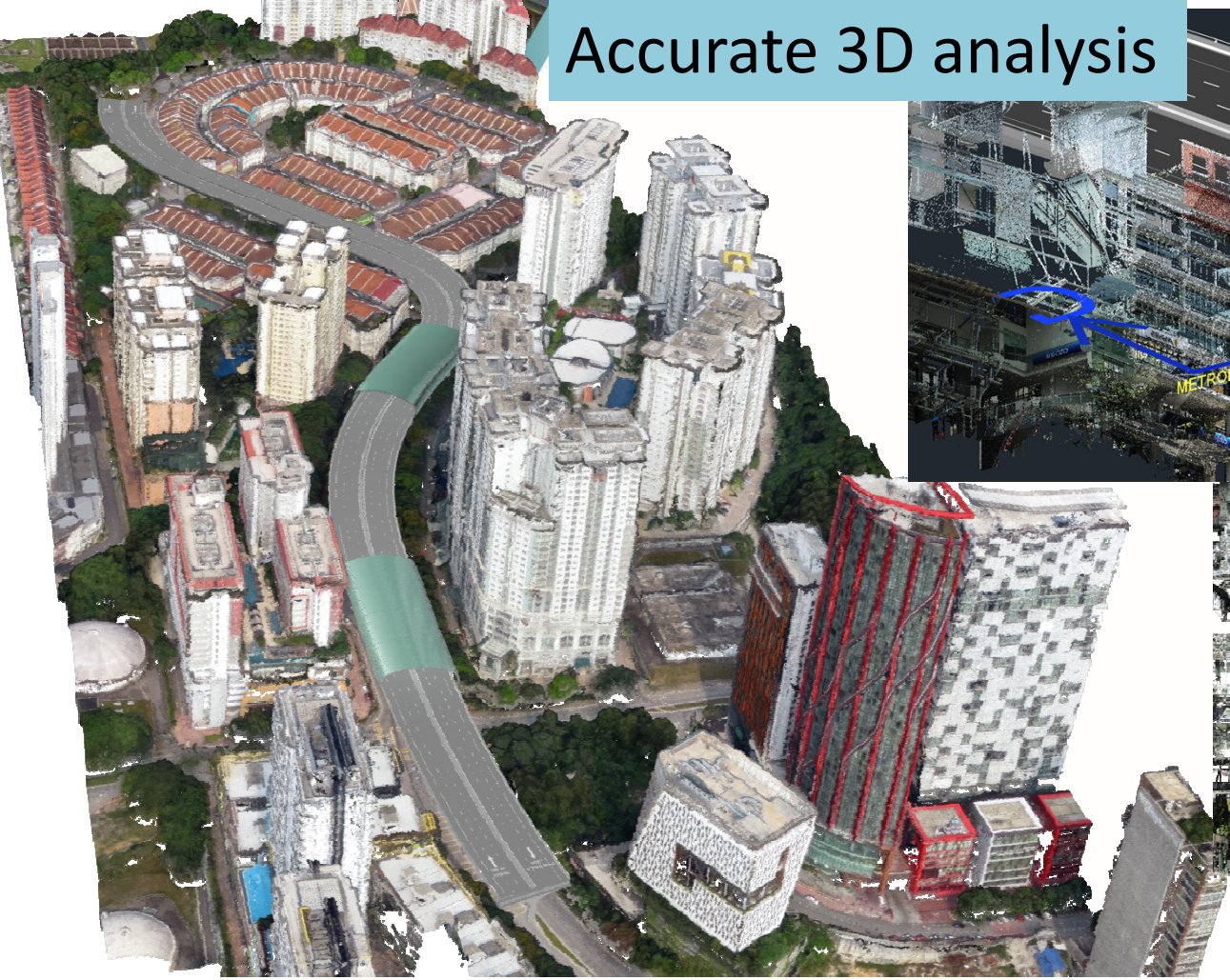
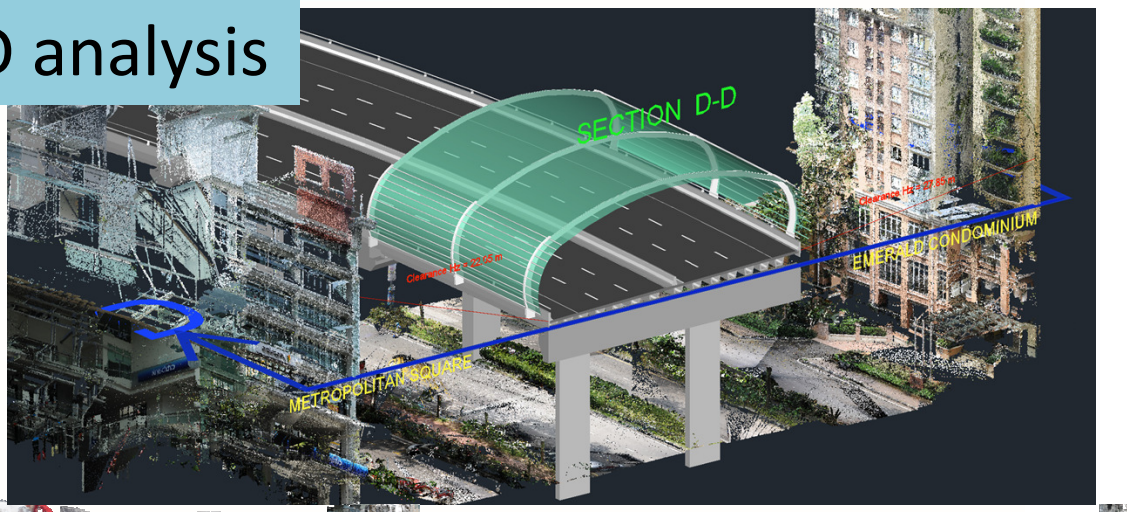
Accurate 3D analysis





Pre-construction

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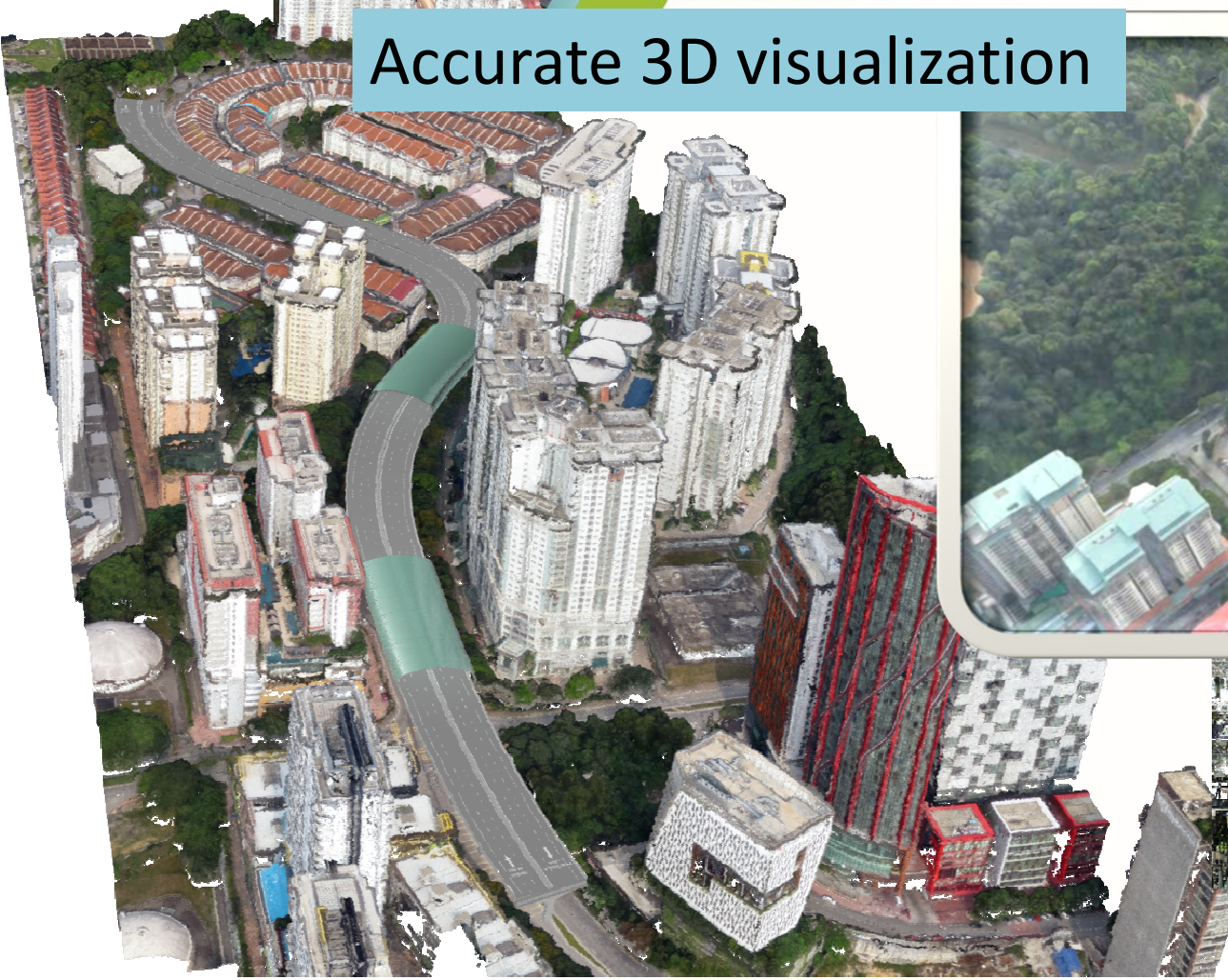
Accurate 3D visualization



Construction Stage

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Progress Monitoring

Demo Reel 2016

KOLA CGI Demo Reel 2016

3. Construction

Construction Stage

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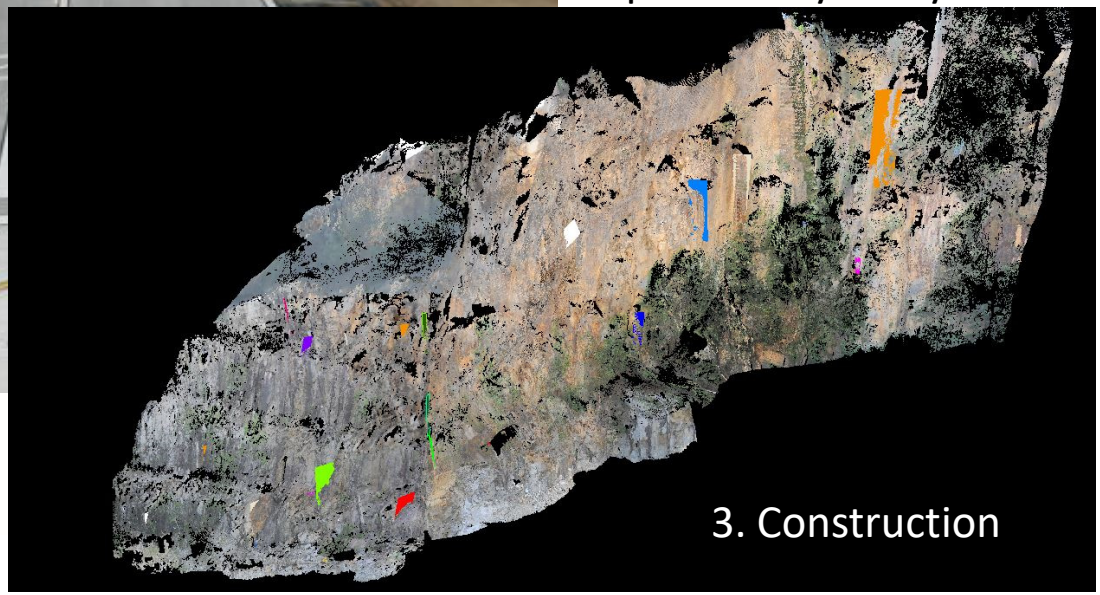
Quantitative Monitoring

Deformation Survey

Earth Work

Slope stability study



Post- Construction

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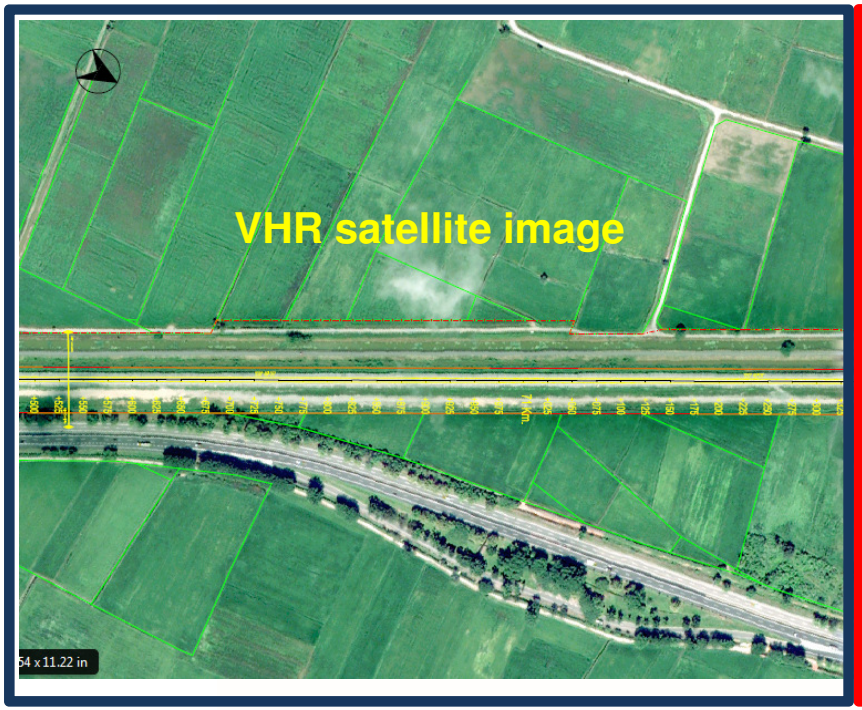
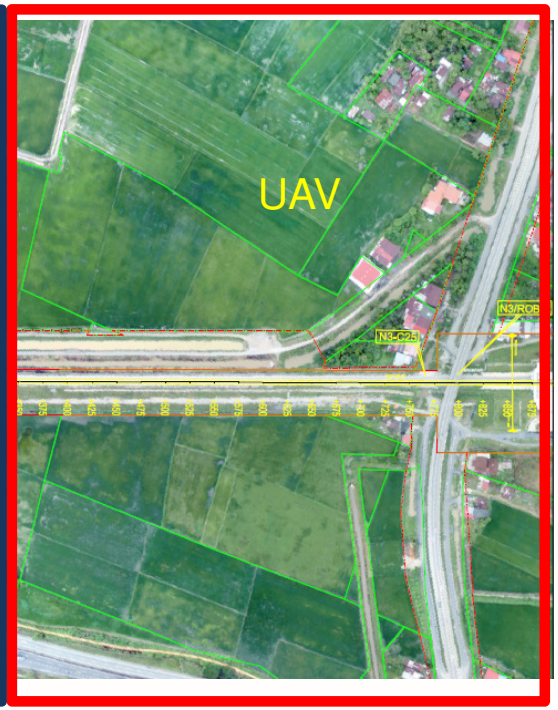
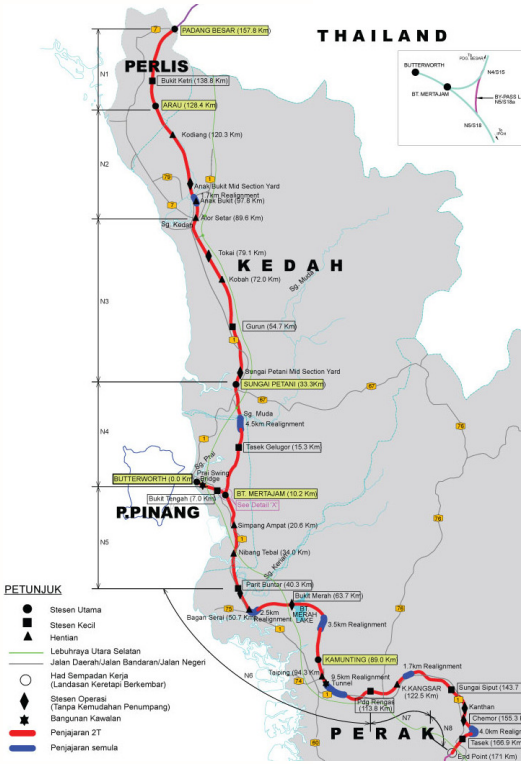
As-Built Survey

360km railway project : As built survey/documentation

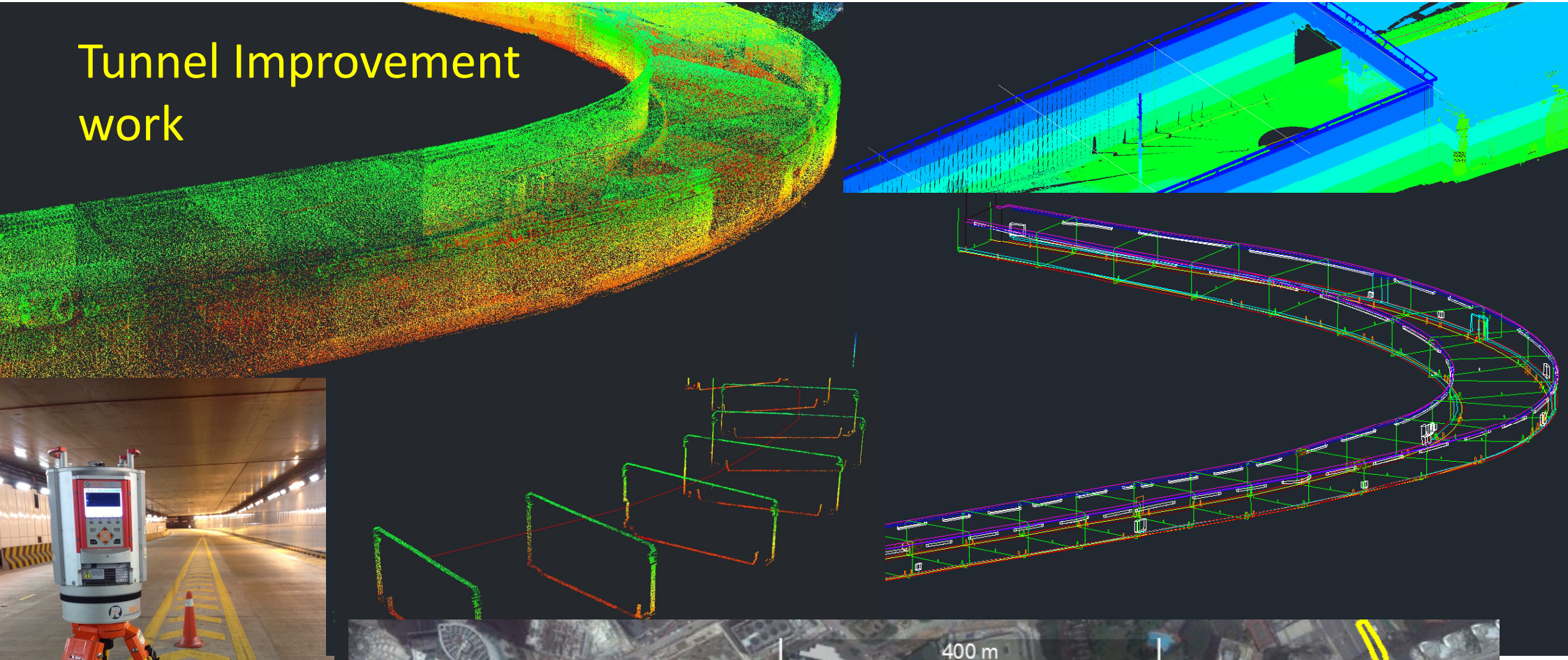






4. post-construction

Tunnel Improvement work



4. Post-construction

Post-Construction

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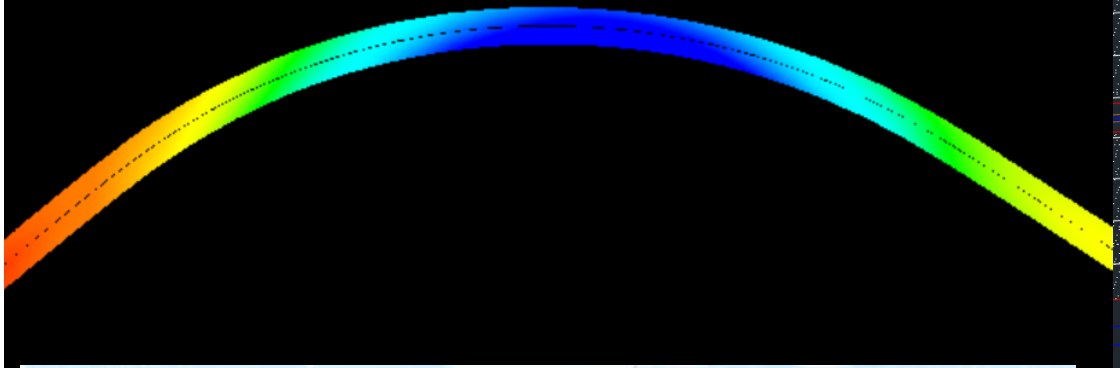
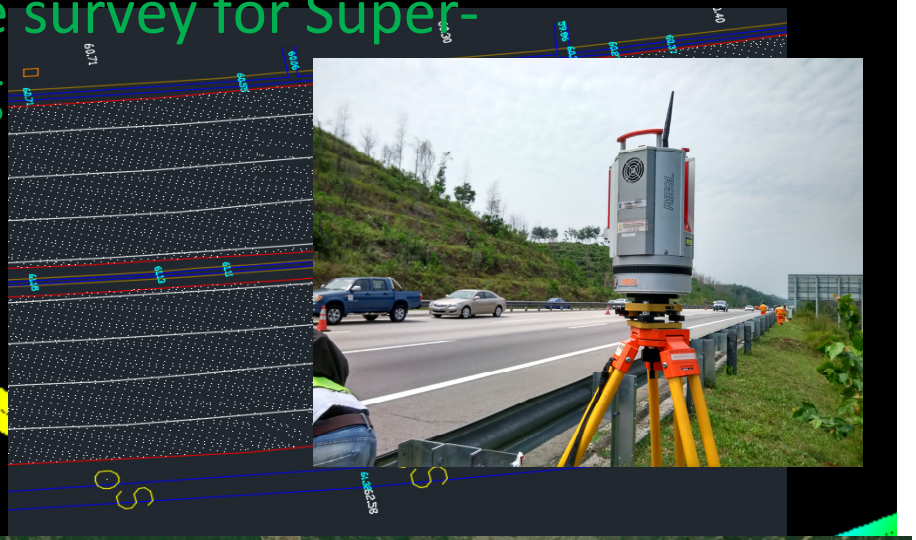
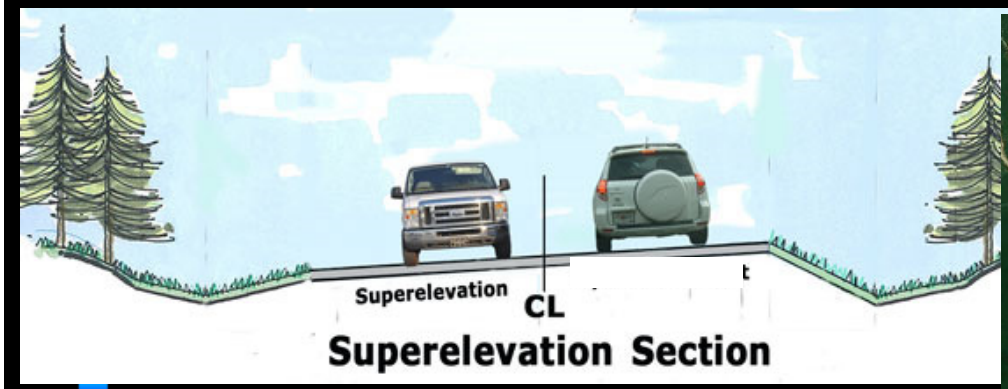
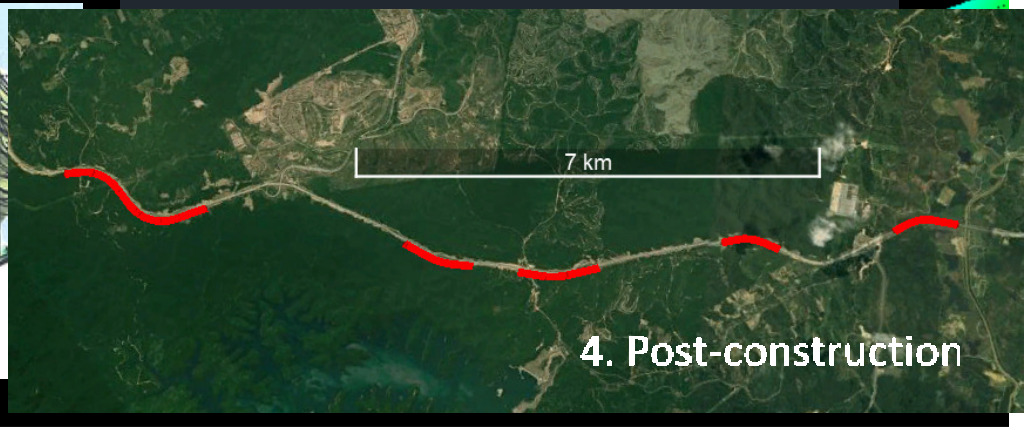
Improve road Safety: Pavement Surface survey for Super-elevation & Road Curve Re-engineering









Post-construction

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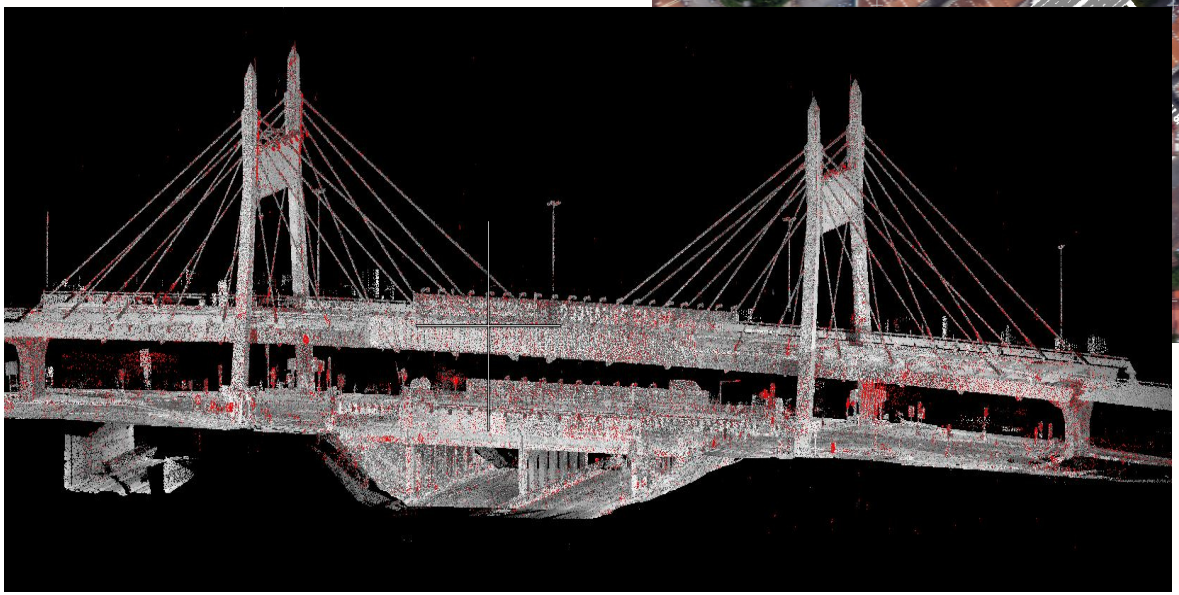
BIM & Asset lifecycle management



4. post-construction

Beyond Road

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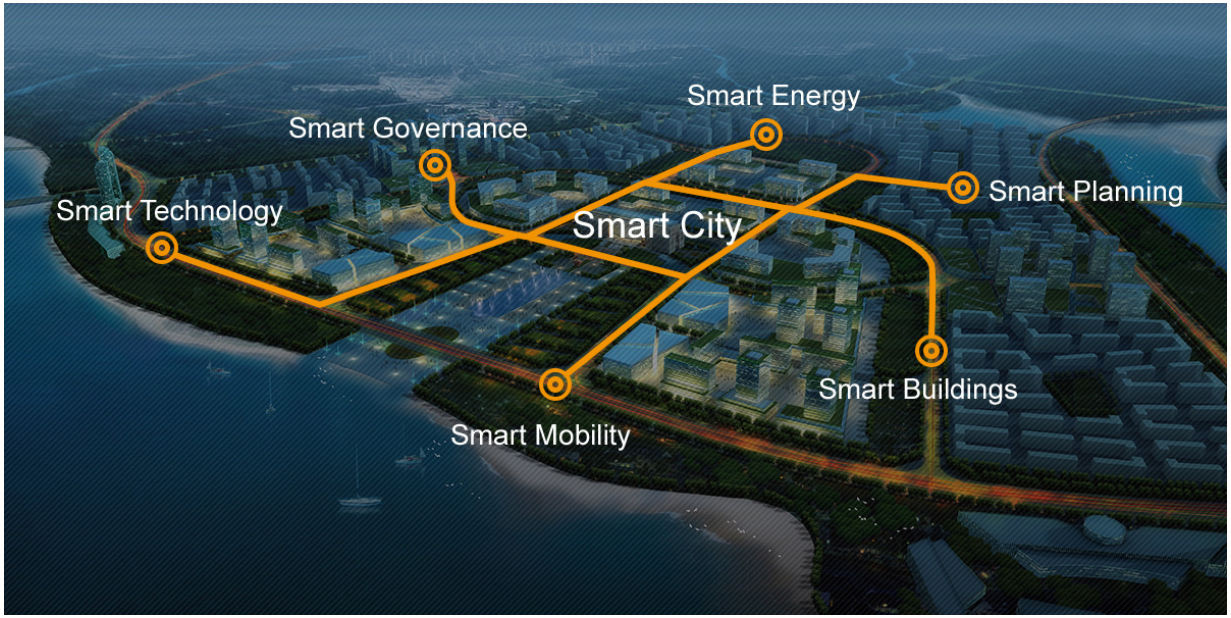
Smart City



5. Beyond..

Beyond Road

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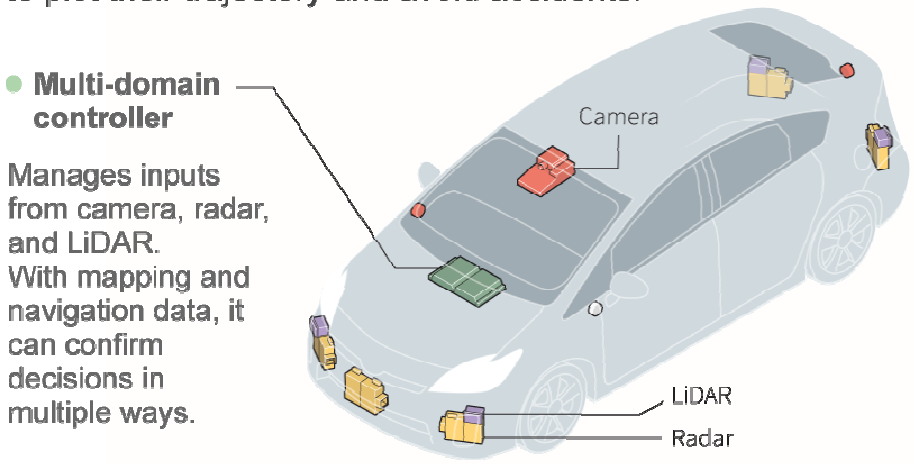
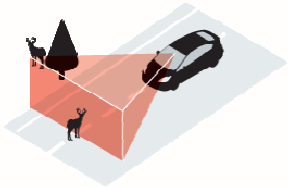
Autonomous Vehicles

How self-driving cars see the road

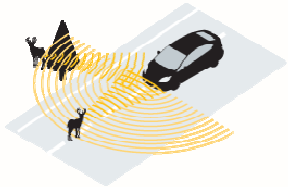
Autonomous vehicles rely on a host of sensors to plot their trajectory and avoid accidents.



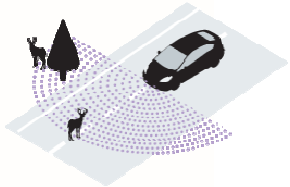


Camera
Takes images of the road that are interpreted by a computer. Limited by what the camera can "see".

Source: Delphi



Radar
Radio waves are sent out and bounced off objects. Can work in all weather but cannot differentiate objects.



LiDAR
Light pulses are sent out and reflected off objects. Can define lines on the road and works in the dark.

Challenges

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1. Wider adoption will take time: cost, learning curve and familiarization.
2. Further progress is desirable. But also depend on progress of supporting technologies
3. Regulatory restrictions