

An aerial photograph of a city, likely Singapore, showing a mix of urban development and greenery. In the foreground, there are lush green trees and a road with several vehicles, including a large truck. In the middle ground, there are several large, modern buildings with blue and red facades. In the background, a dense skyline of skyscrapers is visible under a blue sky with some clouds.

Leveraging 3D Mapping for Planning and Land Management

Singapore – Cadastral Perspective



Land Area : 718 sq km
Population : 5.4 million

Survey Districts : 64
Land Parcels : 137,000
Strata Parcels : 1.2 million

City in the Garden



Why **3D** Mapping?



Mixed Development

Toa Payoh Bus Interchange



Inter-locking Development

The Interlace Condominium



Walkway Link Above Road

Bugis Junction and Bugis + Shopping Centre



Mass Rapid Transit Development

More above ground and underground MRT station developments



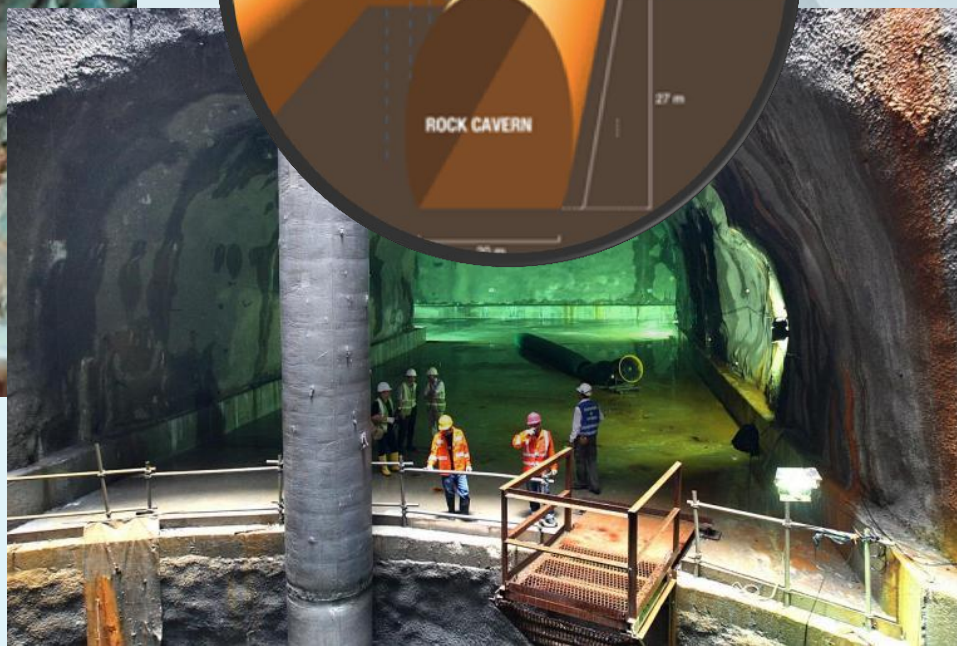
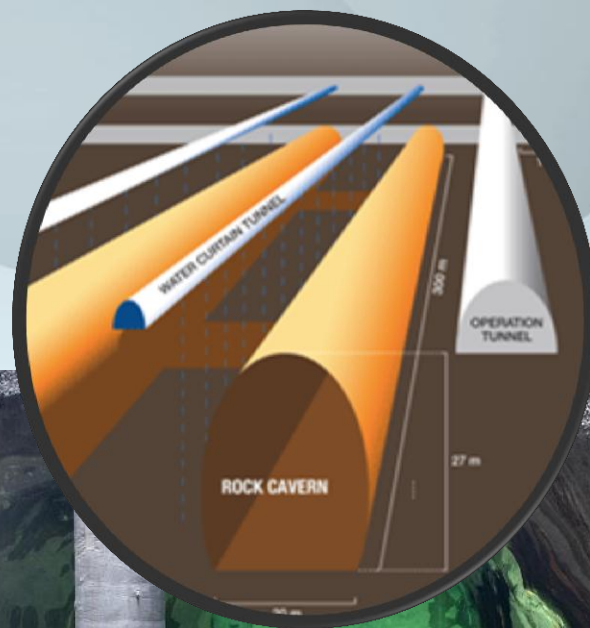
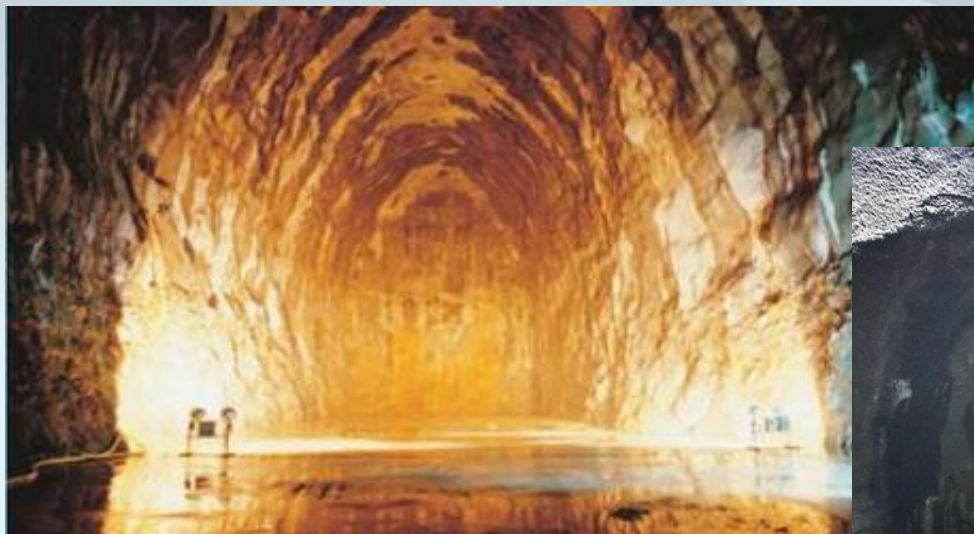
Underground Development Connected to MRT Station



ION Orchard

Underground Rock Cavern

Jurong Rock Cavern, South-east Asia's first underground rock cavern for oil storage



CNET > Tech Industry > Singapore plans to be world's first 'Smart Nation'

Singapore plans to be world's first 'Smart Nation'

The city-state unveils plans for sensors that can help manage traffic congestion, detect air pollutants, and even remind you to take your trash out.

by Aloysius Low [@longadin](#) / June 17, 2014 5:15 AM PDT

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3D Map Data is key dataset in supporting the development and operation of **Smart Nation**.

The Jurong Lake District in Singapore will be used as a trial area for Singapore's ambitious Smart Nation plan.

Urban Redevelopment Authority of Singapore

Outline

- I. Vision of 3D Mapping
- II. 3D Mapping Methodology
 - i. 3D Data Capturing
 - ii. 3D Map Data and Products
- III. 3D Data for Planning and Land Management
- IV. Beyond Planning and Land Management...
- v. What is Next?

Vision of 3D Mapping

- Whole of Government (WOG) initiative to create and maintain a high-resolution geometrically-accurate 3D national topographic map
- Develop once; Use by many
 - High resolution in order to meet the requirements of most agencies
 - Open standard format to facilitate data exchange, interoperability, and non-proprietary
 - Common authoritative 3D base map to support collaboration among agencies
 - Workflow for continuous maintenance to ensure data up-to-dateness

3D Mapping Methodology

Capture 3D Data

- Airborne Imaging and Laser Scanning
- Mobile Street Imaging and Laser Scanning

Create 3D Products

- CityGML exchange format
- Terrain Models, 3D Buildings, 3D Roads (LOD0, LOD1, LOD2)

Establish Standards & Database

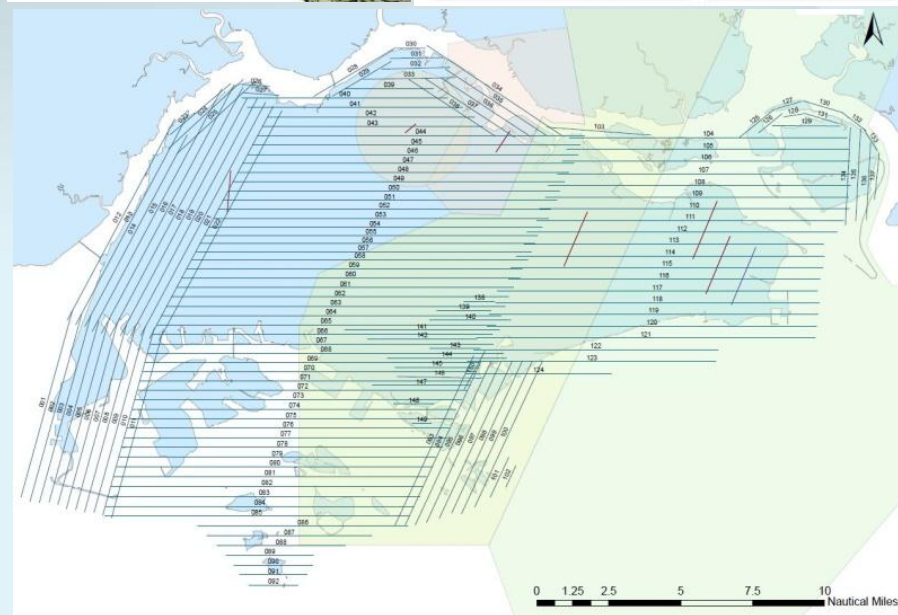
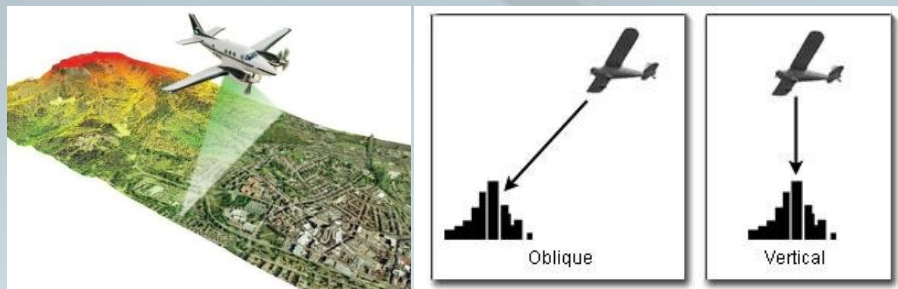
- CityGML Schema (OGC open standard)
- Nationwide 3D Map Database

Update Changes

- Terrestrial Laser Scanning / Topographic Survey / Unmanned Aerial System
- Satellite Imagery
- Building Information Model (BIM)

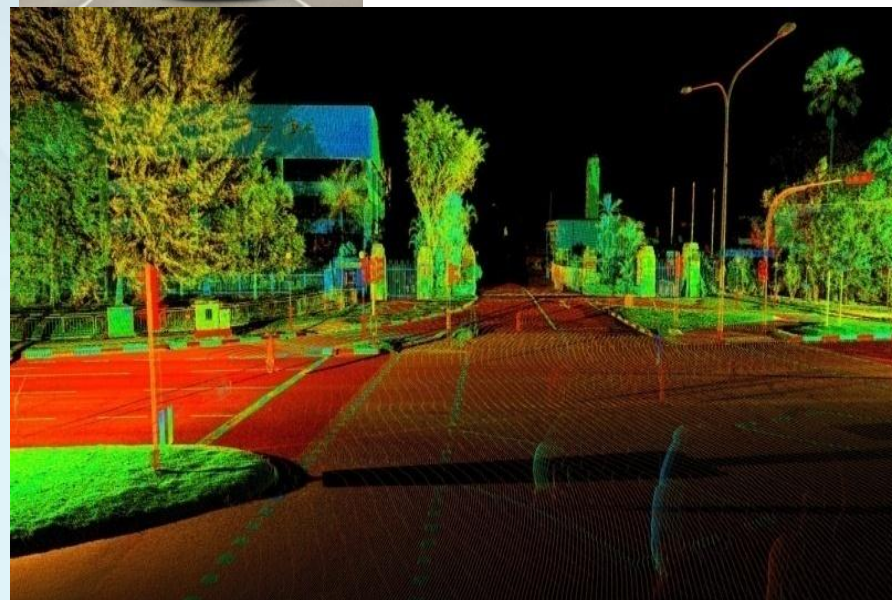
Data Capturing using Rapid 3D Mapping Technologies

Phase 1



Airborne Imaging & Laser Scanning

Phase 2

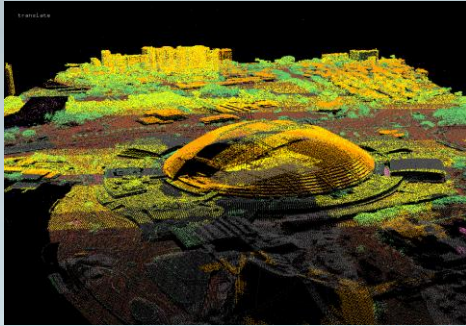


Mobile Street Imaging & Laser Scanning

3D Map Data and Products

3D Data

Airborne Laser Scanning Data

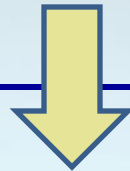
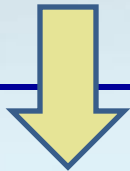


Airborne Vertical / Oblique Images

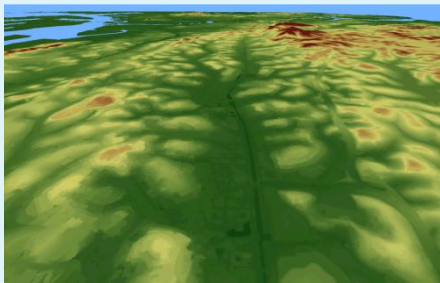


Mobile Laser Scanning Data

360° Camera Imagery



3D Products



Digital Terrain Model &
Digital Surface Model



Orthophoto



3D Building Models



3D Road Models

3D Data for Planning and Land Management

3D Data (CityGML)

Planning & Land Management

3D
Visualization

3D
Simulation

3D Spatial
Analysis

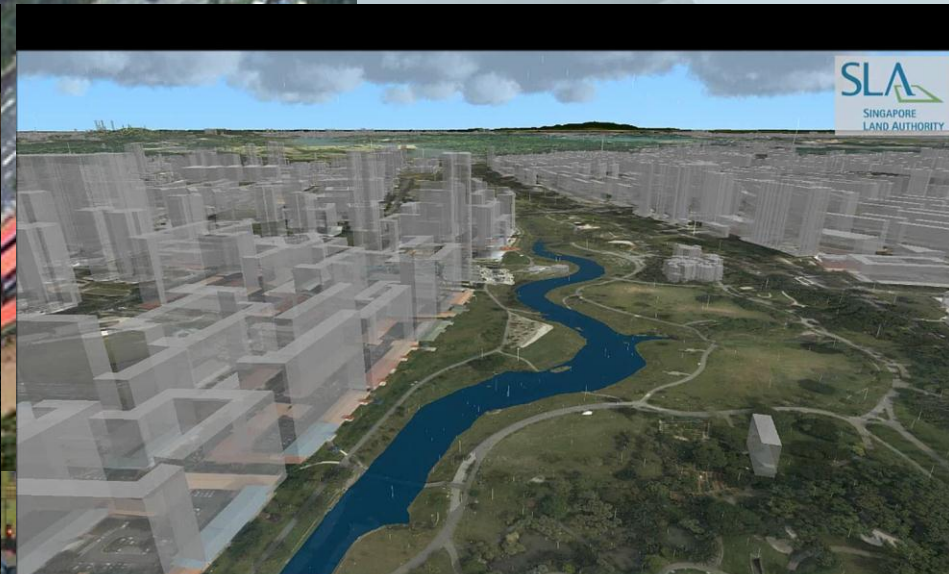
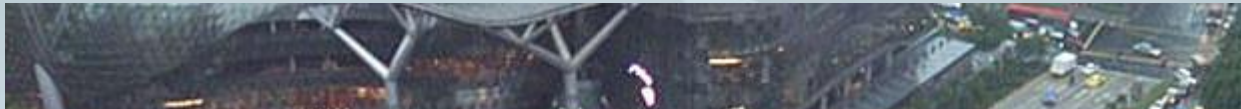
Flood Risk Management

What is needed?

Digital Terrain Model (DTM), 3D Buildings, Orthophoto

Purpose

Flood simulation, management, and improved mitigation plan



Flood Simulation

Tree Risk Mapping

What is needed?

Laser Scanning Data, Digital Terrain Model (DTM), Orthophoto

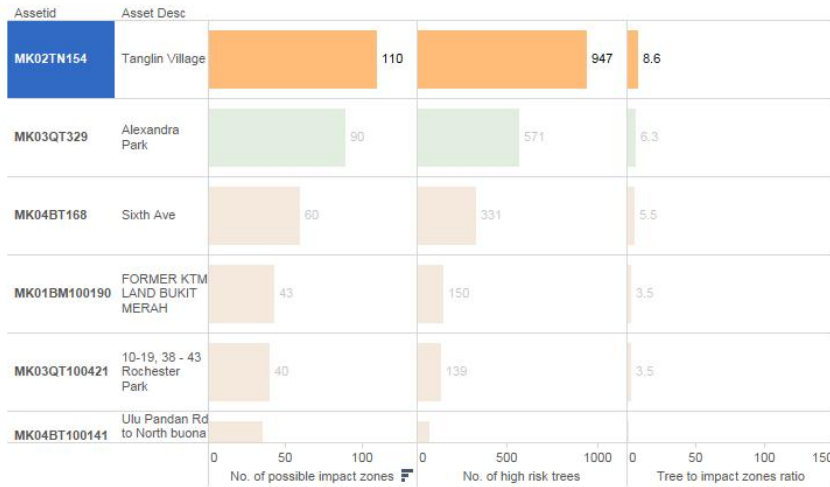
Purpose

Analysis of high risk fallen tree zones

Where are the high risk areas?

Please select maintenance contractor
(All)

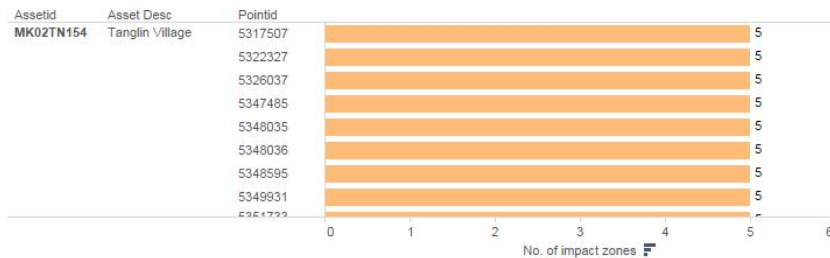
High risk zones



Location of high risk trees



High risk trees



Fallen tree incidents (2008-2013)



Horticultu

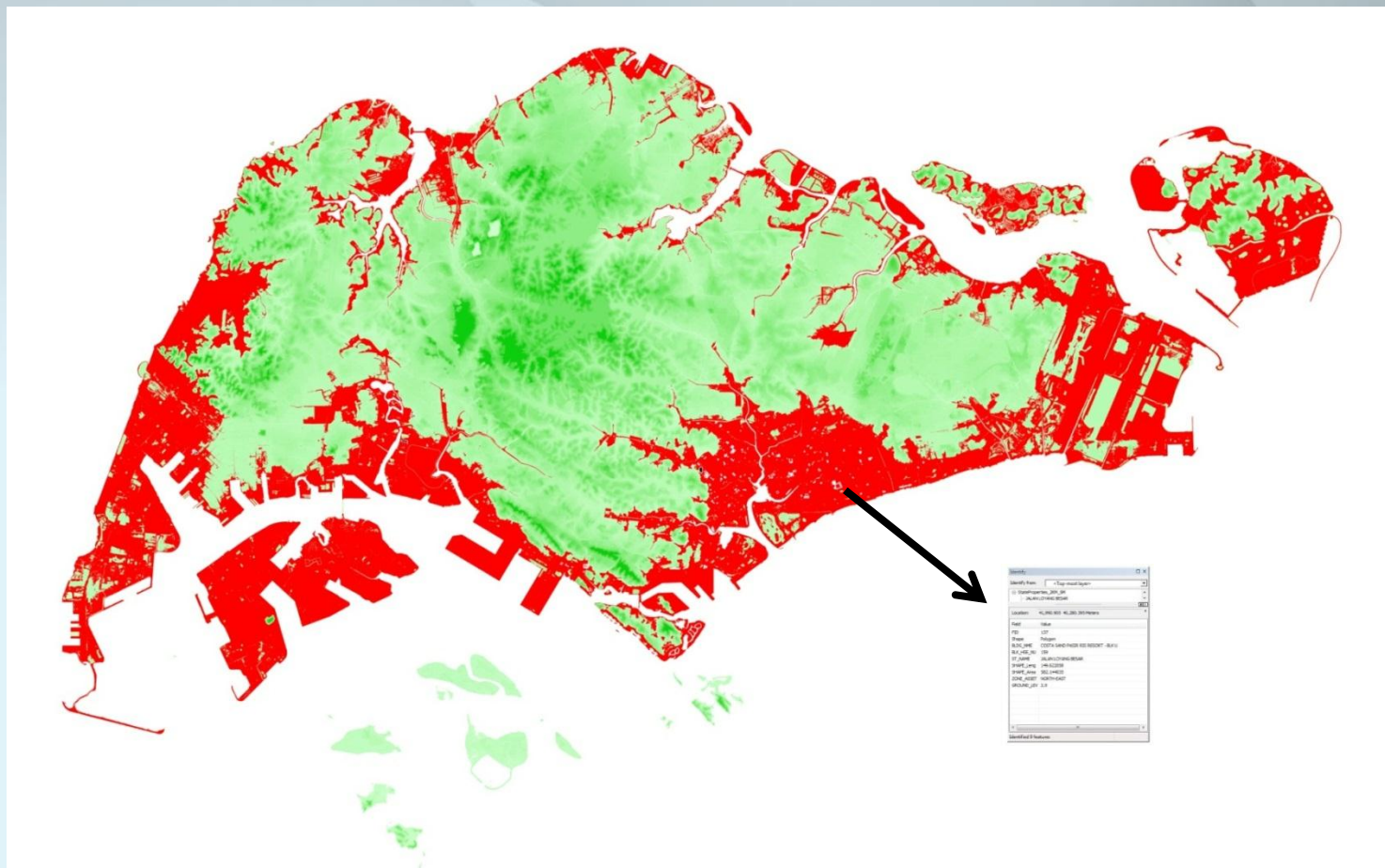
- Choo Kim Chuan Construction Pte Ltd
- National Parks Board
- Soon Sin Contracts Pte Ltd
- Kim Bock Contractor Pte Ltd
- Not Applicable
- Toh Kim Bock C-E Contractor Pte Ltd

Year

- 2009

Climate Change Adaptation – Sea Water Rise

What is needed?	Digital Terrain Model (DTM), 3D Buildings
Purpose	To identify properties at risk that near to coast and its protection measures



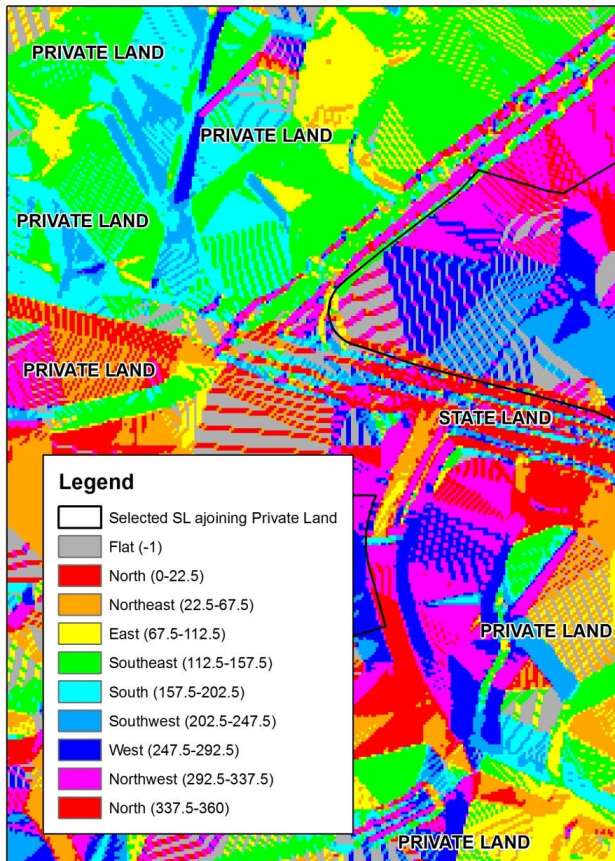
Slope Risk Management

What is needed?

Digital Terrain Model (DTM), Slope Map, Aspect Map, Orthophoto

Purpose

To identify high risk slope area where state land is adjoining private land



Building Height Control and Planning

What is needed?

Digital Terrain Model (DTM), 3D Buildings, Orthophoto

Purpose

For planning and visualisation of areas with special height controls and existing buildings



Building Height Control

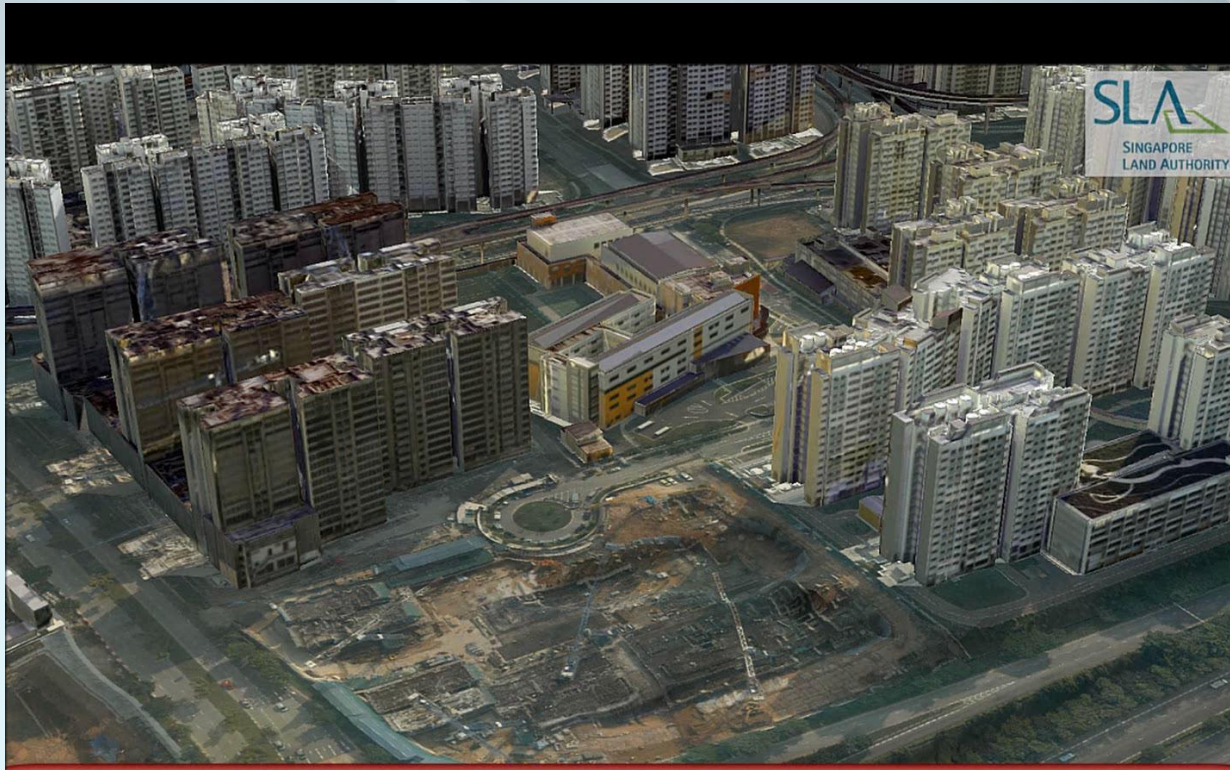
Development Planning

What is needed?

Digital Terrain Model (DTM), 3D Buildings, Orthophoto

Purpose

To investigate and study environmental impact of proposed new development to its surroundings



Proposed New Development

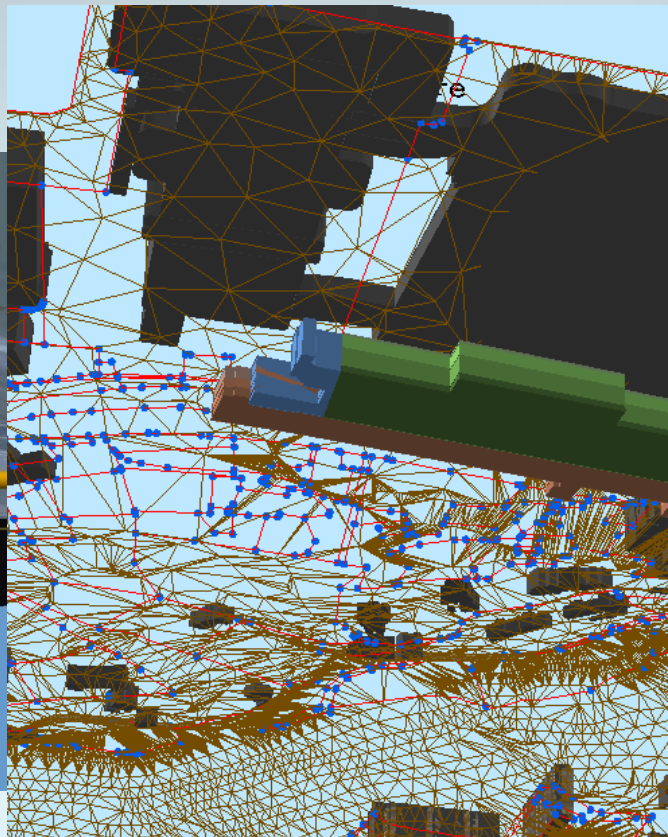
Underground Planning and Development

What is needed?

Digital Terrain Model (DTM), 3D Buildings, Orthophoto

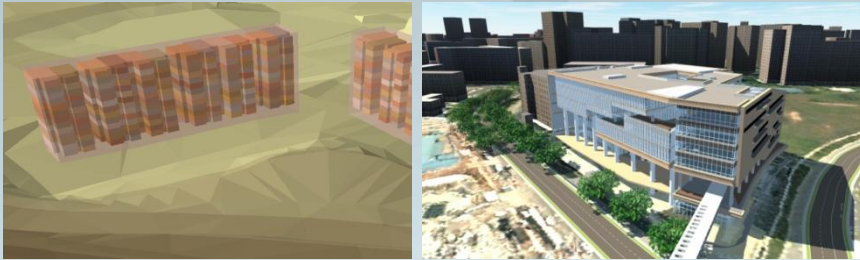
Purpose

To plan and manage underground spaces more efficiently with greater understanding of above ground structures

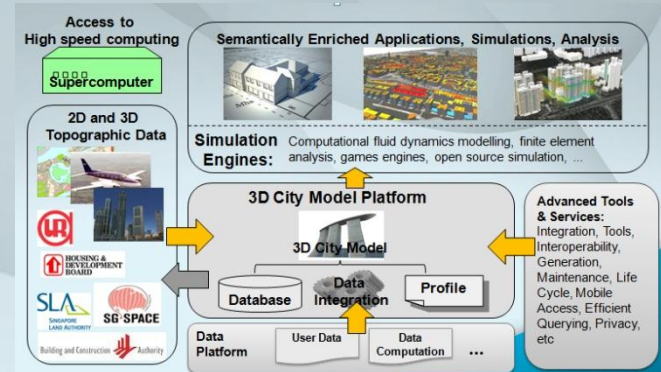


Underground Infrastructure

What is Next ?



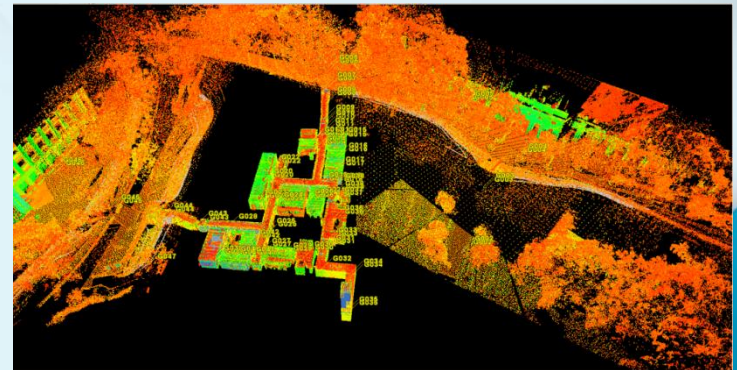
Integration with 3D Property Information and BIM



Intelligent Geospatial Data for Smart Nation



Indoor Mapping



Underground Mapping

Thank you