

Empowering Land and Geospatial Agencies-*a New Era*



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Digital Twin

*a Platform for Providing
Geospatial Information
Intelligence and Smart
Services*



THE GLOBAL GOALS
For Sustainable Development

For Sustainable Development
THE GLOBAL GOALS



CSDILA



Advancing Industries & Societies with *Location Intelligence and Digital Twins*

... a **World-Class Interdisciplinary Research and Innovation** Centre that:

- advances the science and knowledge base, and
- develops the digital technologies and platforms

in location intelligence, land administration systems, spatial data infrastructures to transform the geospatial enablement of industry and services to benefit wider society.

Key Drivers

- Population Growth & Increasing *Complexity*;
- *Emerging Markets, Global Trade, Safety and Supply Chain*;
- Ageing Infrastructures;
- Environmental Sustainability, Climate Change;
- Increasing Disasters-a *Worldwide Problem*; ***Pandemic-COVID***;
- **Digital Economy** and Smart Societies;
- Land Administration System Modernisation agenda;
- The Role of location information in **Industry 4.0**, and Technological Trends
- **Connected, automated** and shared services;
- Future planning (**Digital Twin**- *leveraging BIM*);
- Needs and opportunities in the context of **Sustainable Future for All-SDGs**;
- IoT, AI, AR, making sense of smart data, smart utilities, 3D, 4D,.. ***nD data***...



Centre for Spatial Data Infrastructures and Land Administration (CSDILA)

Local Challenges to Global Action Global Market to Local Opportunities

Bridging the Gap...from Local to Global

Est. 2001

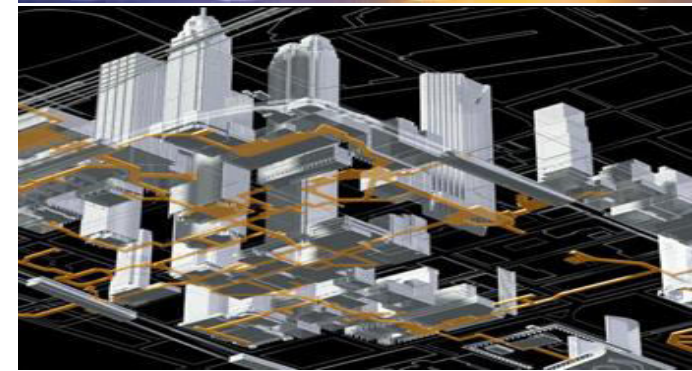
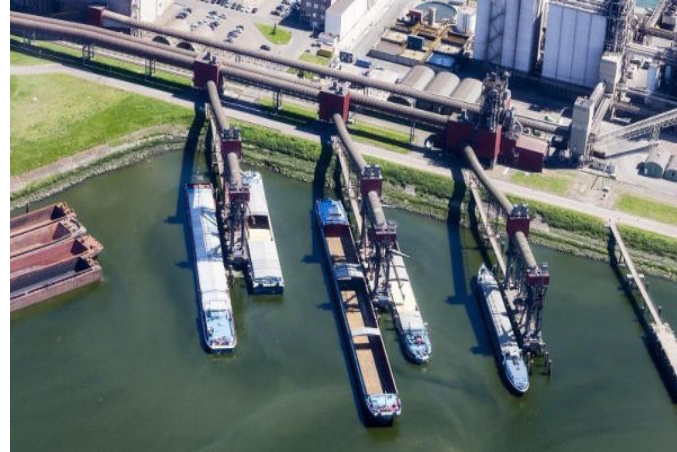


CORE CAPABILITIES

Centre for Spatial Data Infrastructures and Land Administration offers an extensive range of scientific, strategic and innovative services in the following areas to meet the needs of industry, governments and research community:



Infrastructure - Complex Intersection between Land, Hinterland, and Marine Environment



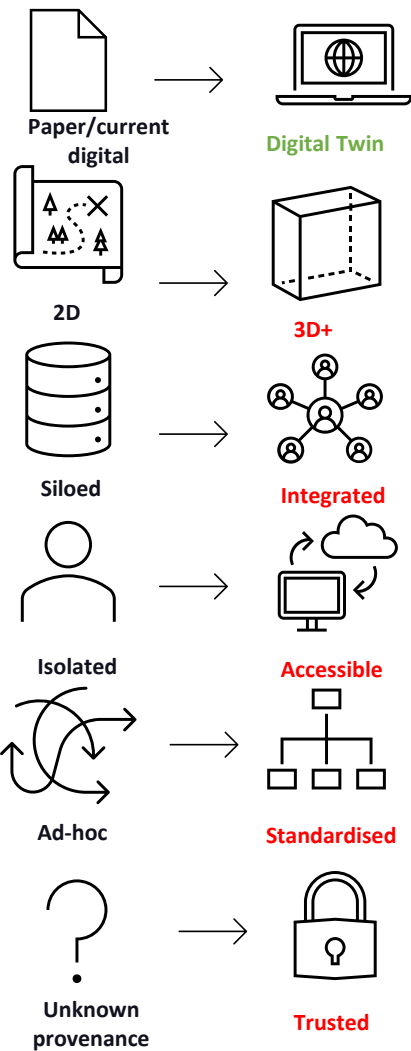


Critical surface and subsurface infrastructure and physical assets such as buildings, roads, bridges, rail lines, tunnels, utilities, processing plants, refineries as well as resource industries **form the backbone of Australia's productivity**. Yet, according to the Australian Infrastructure Audit (2015) **most infrastructure used in 2030 will be in a substandard state of repair**.

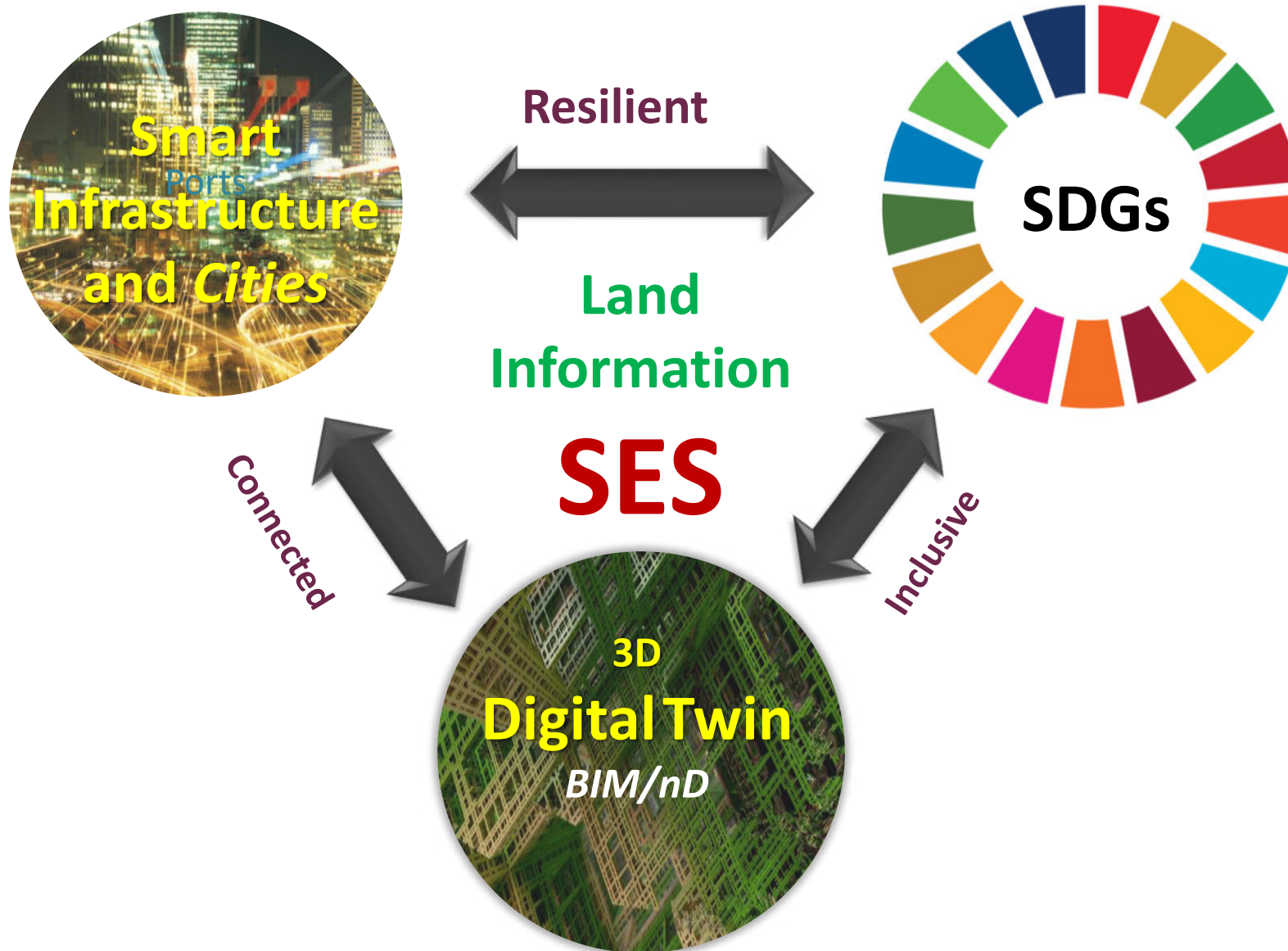


Complex Urban and Regional Environments

A primary reason for the limitations in addressing the interdisciplinary challenge of sustainability is the **lack of an ecosystem of open, harmonised and interoperable information models and datasets across land, built environment and natural environments.**

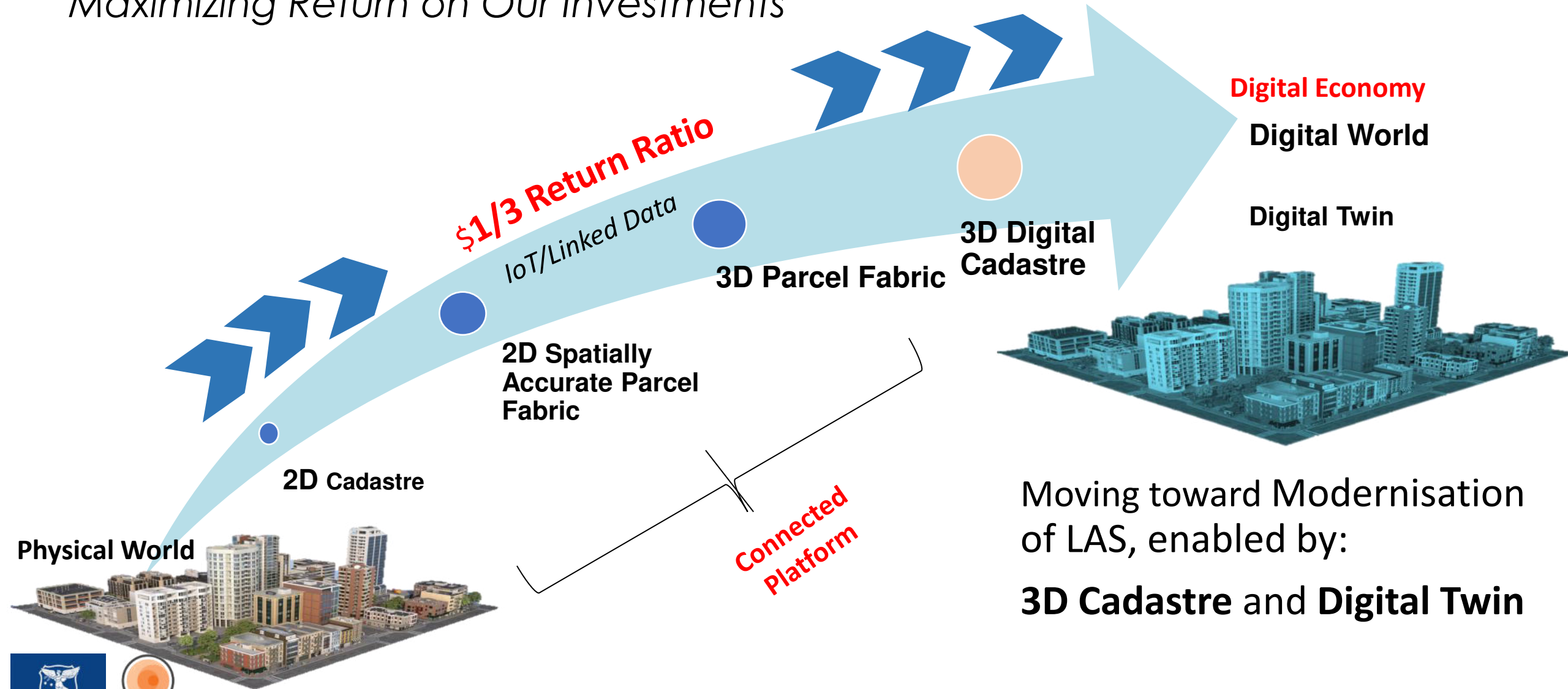


Interconnected FUTURE For ALL

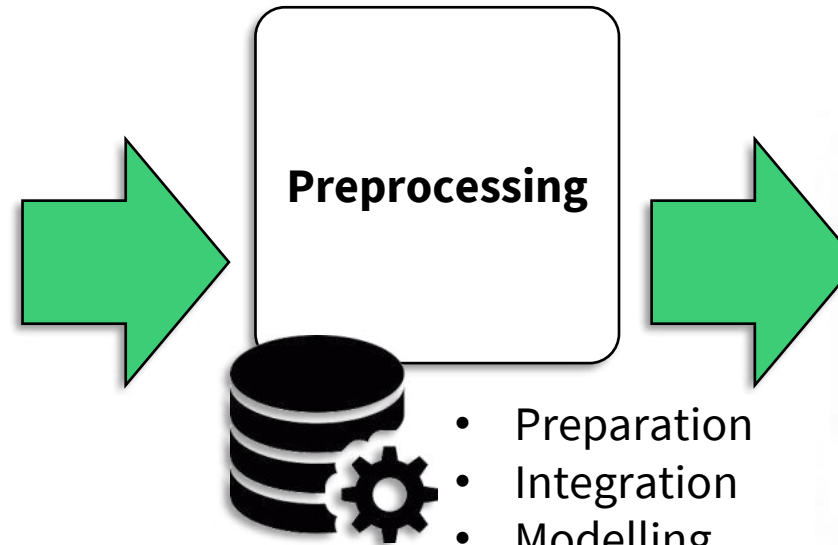


From Physical World to Digital World-

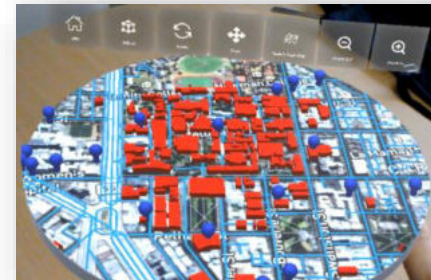
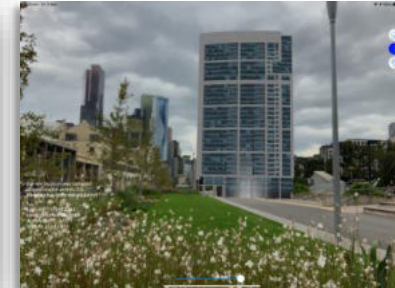
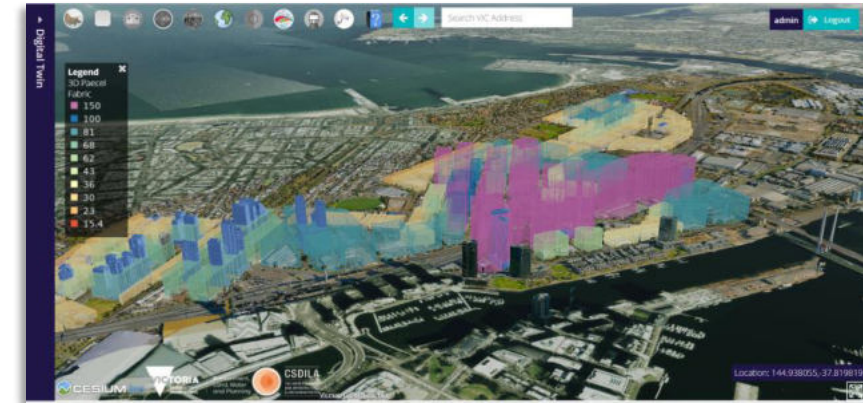
Maximizing Return on Our Investments



3D Suite Data Workflow



- Preparation
- Integration
- Modelling
- Hosting
- Publishing



Design Philosophy: A Highly Customisable and Open Ecosystem



Data



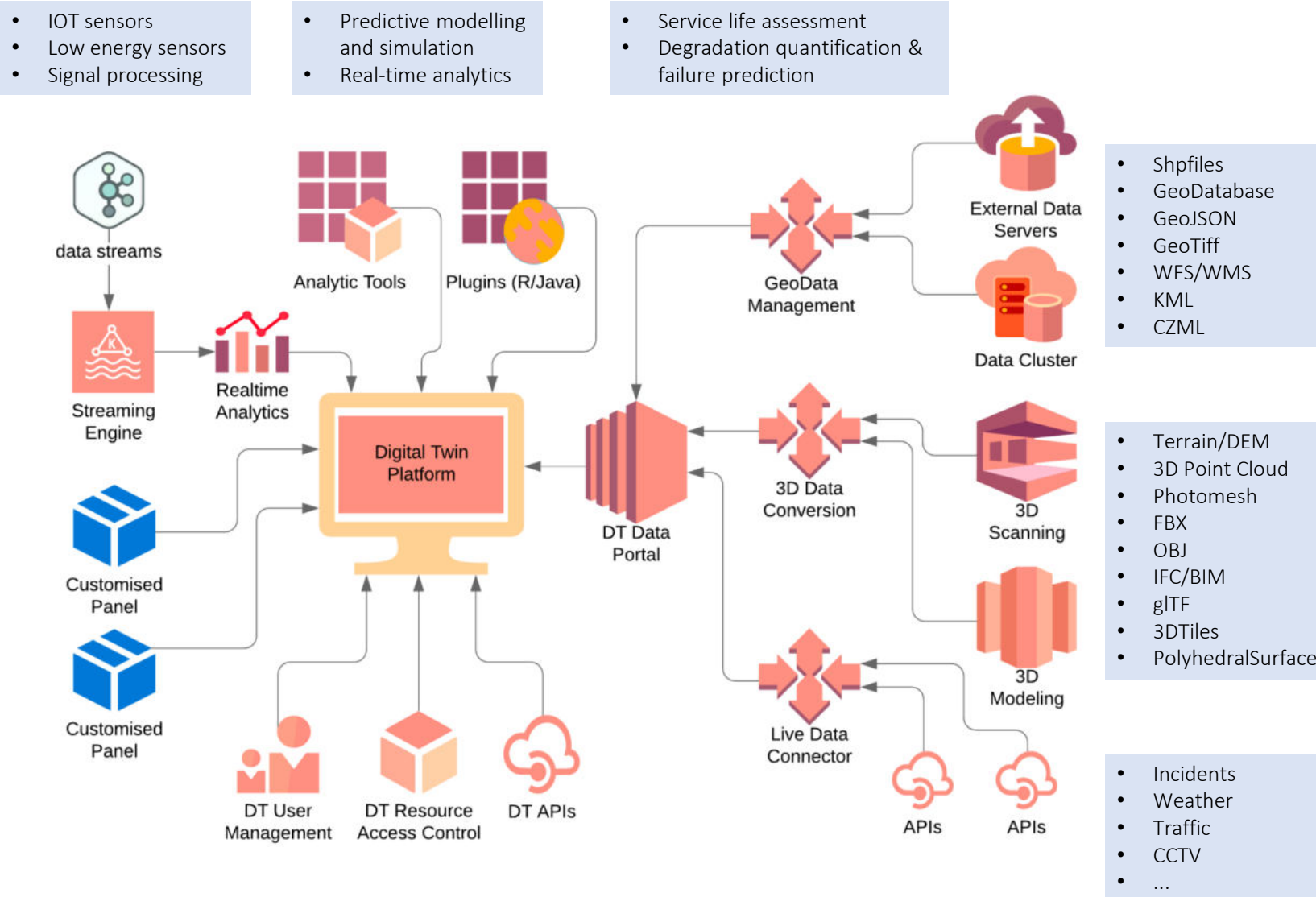
Model



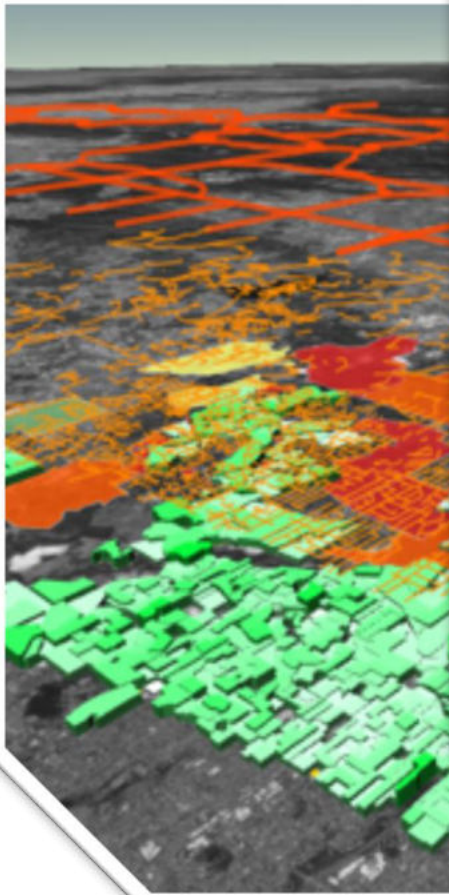
Script

High-level System Architecture

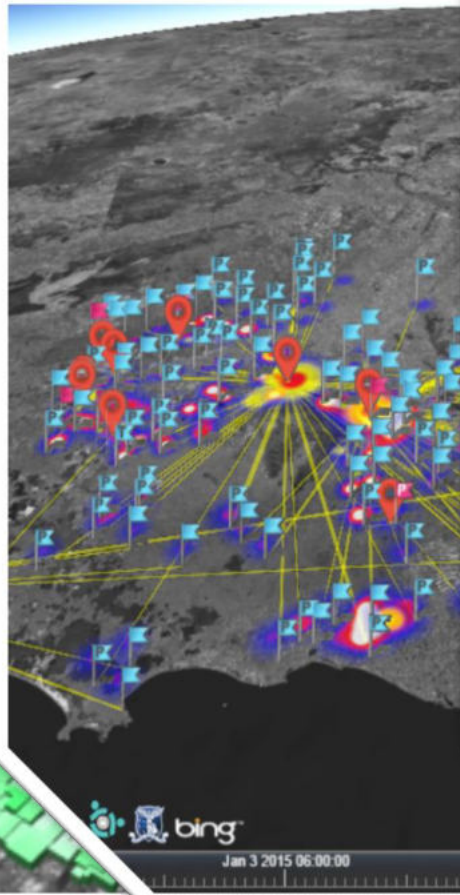
System Components



Core Capabilities



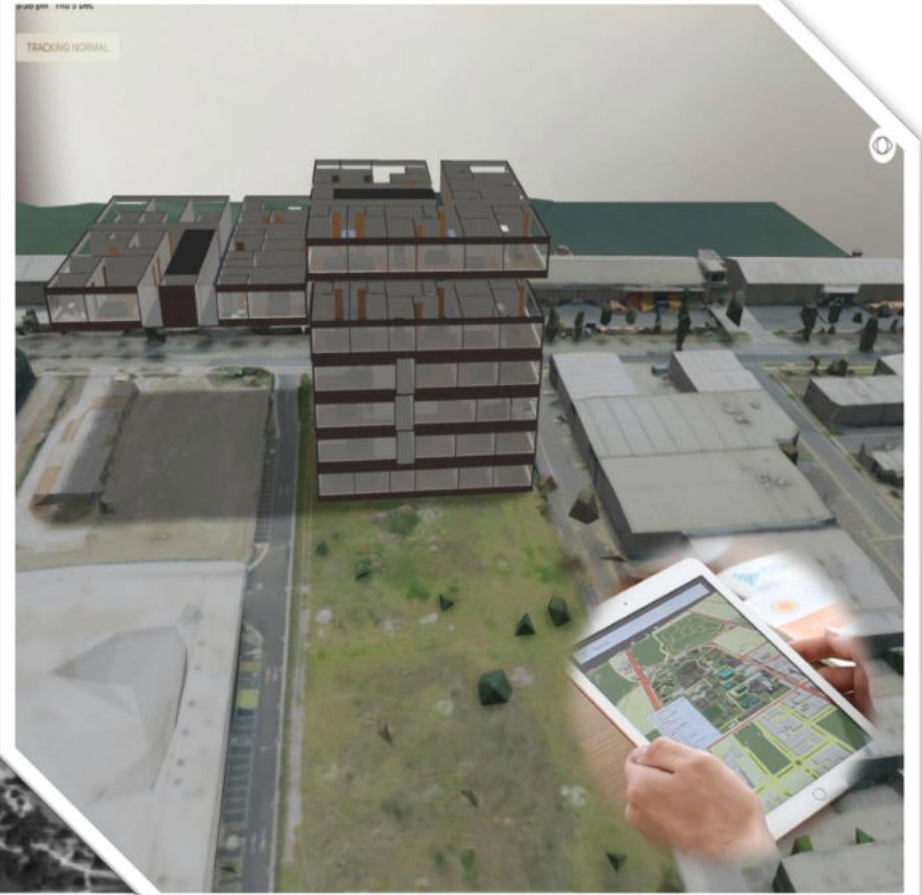
Multi-source Data
Integration



Modelling & Simulation



Advanced Urban
Analytics



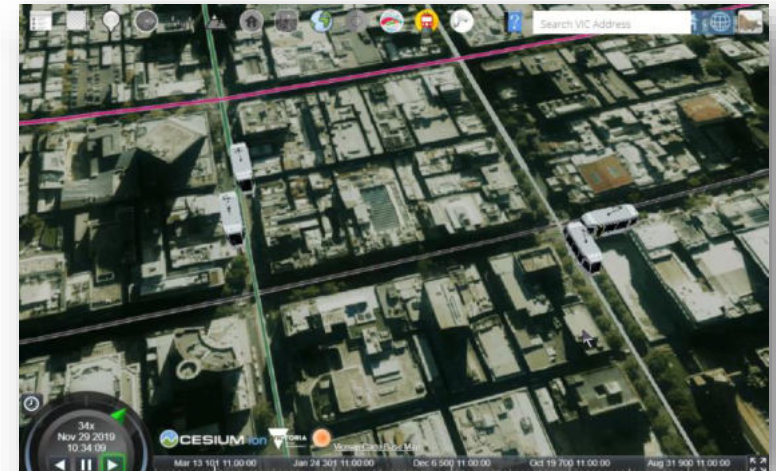
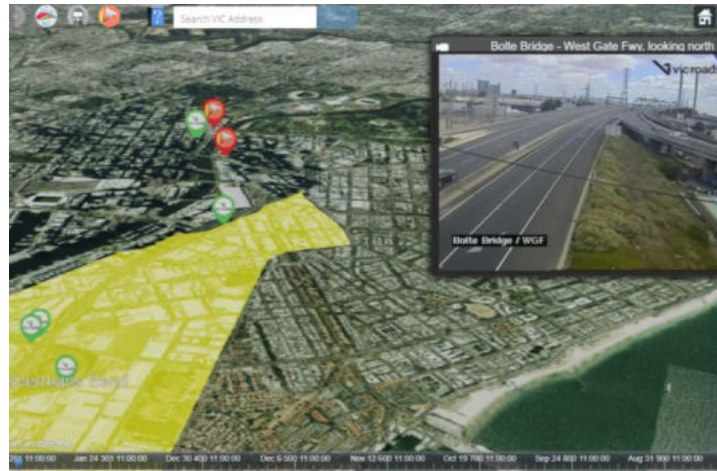
Augmented and Virtual
Reality Capabilities

Application Areas

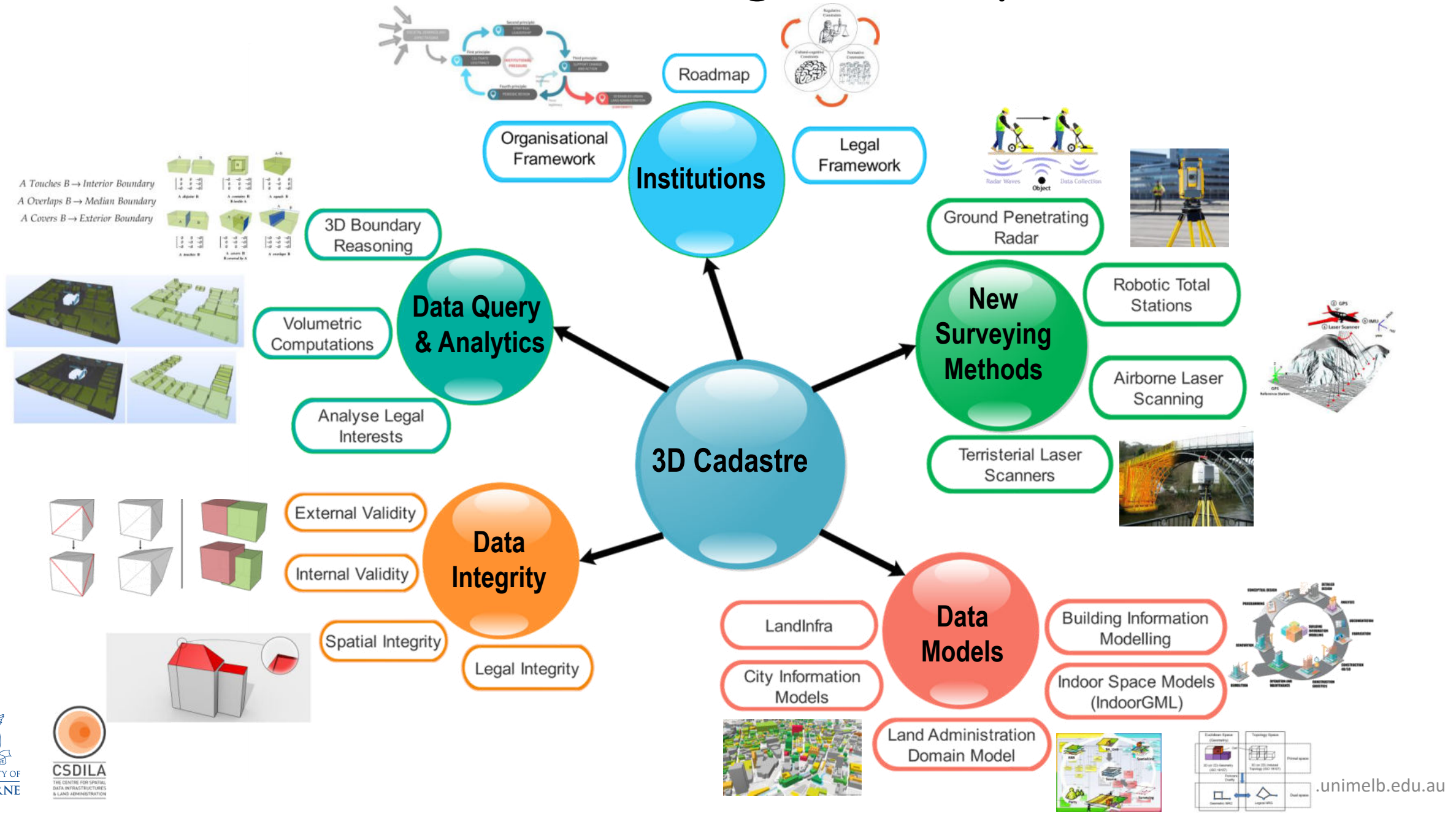
- Digital Twin
- 3D Cadastre Research
- Disaster Management
- Urban Planning Support
- IoT and Real-time Data Analytics
- Space Management
- Sustainability and Resilience

Digital Twin - Fishermans Bend, Australia

- An enterprise solution for web-based visualisation of massive 3D datasets
- A collaborative environment for 2D and 3D data sharing with sophisticated access control
- Visualising different 3D data formats (e.g., BIM, CityGML, Obj, FBX, 3DTiles, DEM, point cloud)
- In-house 2D/3D data format conversion and hosting capabilities
- Visualising high resolution photomesh
- Sensor network data integration, visualisation and analysis (e.g., building occupancy, building energy index)
- Real-time data visualisation (e.g., Public transport mobility visualisation)
- BIM based 3D Cadastre query and visualisation
- Planning analysis tools (e.g., quantitative shadow analysis, sky view factor)
- Providing plug-in capability for adding analytical tools

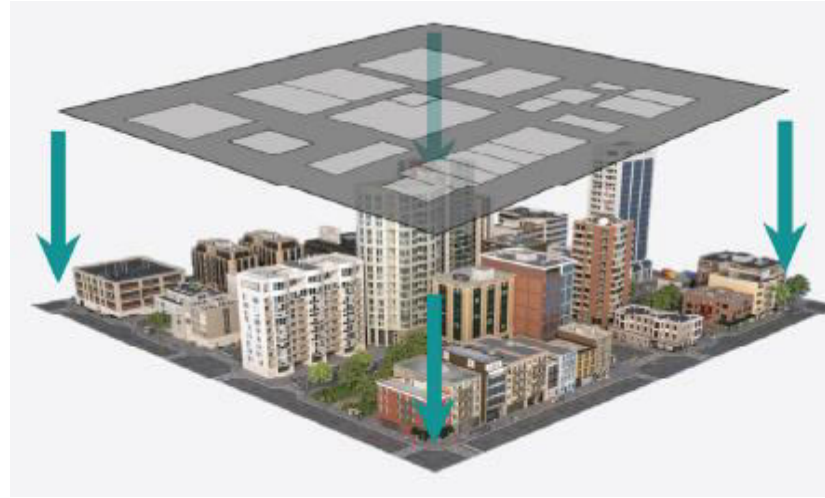


3D Cadastres – Modelling & Development



Cadastre Maturity Levels

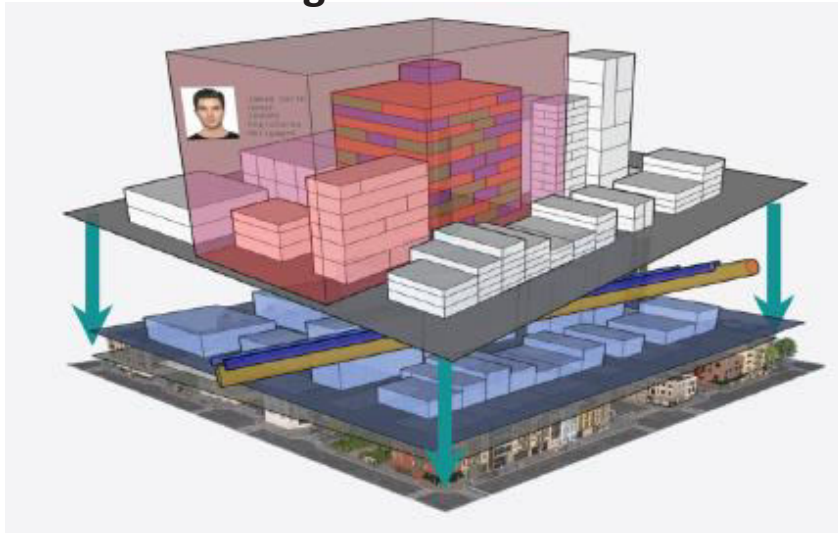
Level 1 – 2D Digital Cadastre



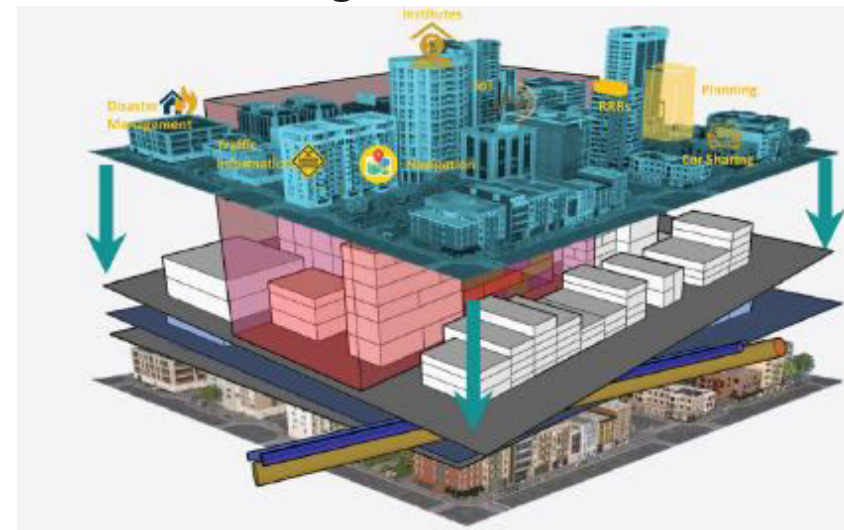
Level 2 – 3D Parcel Fabric



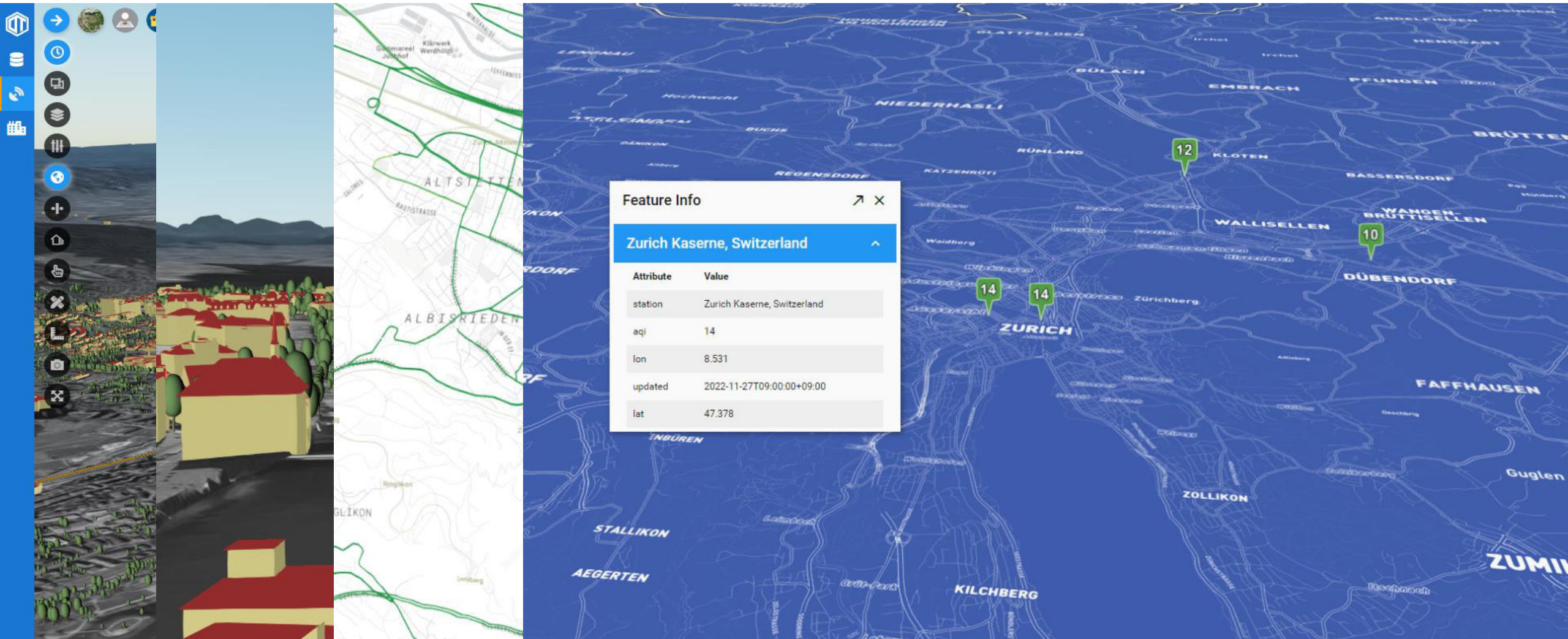
Level 3 – 3D Digital Cadastre



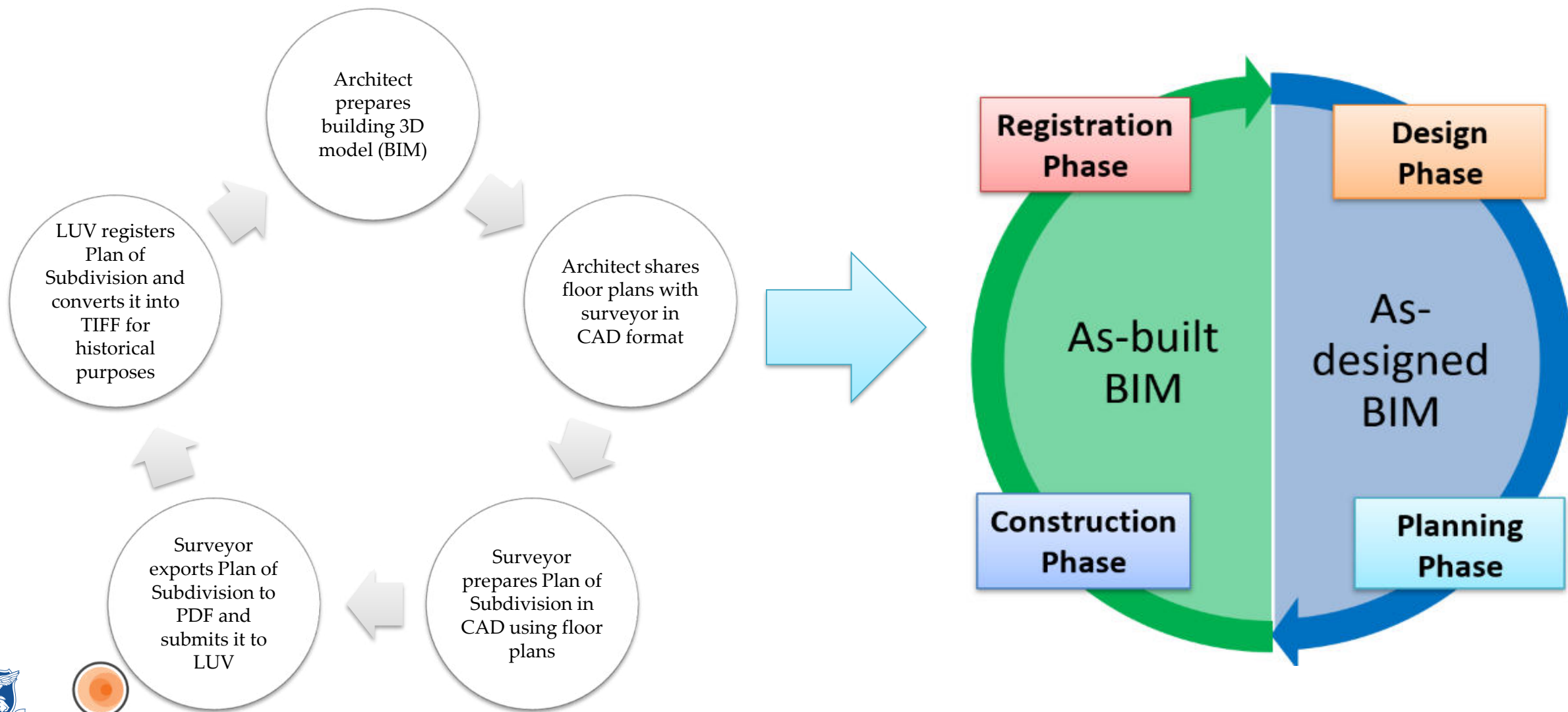
Level 4 – Full Digital Cadastre in DT



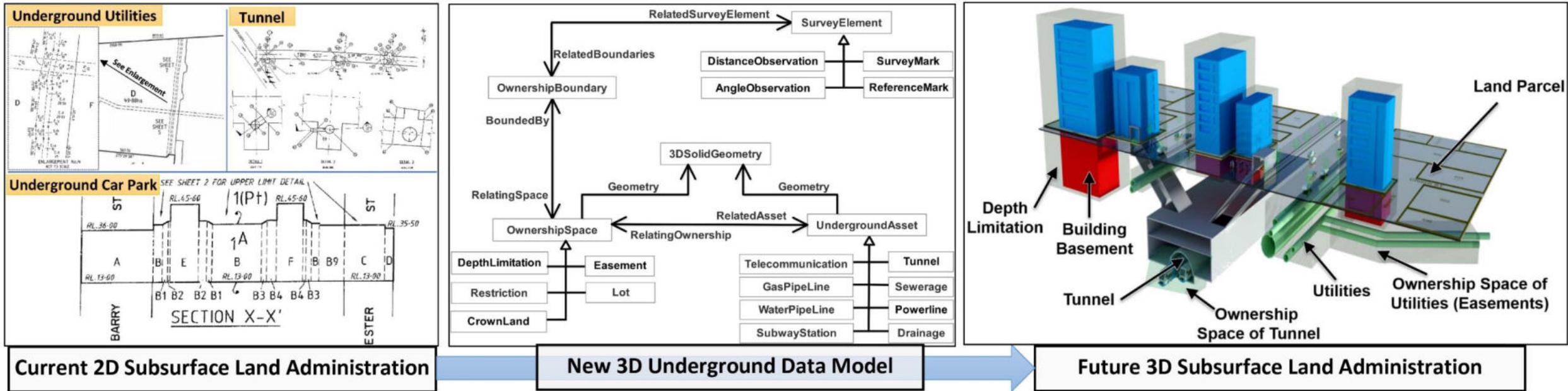
Digital Twin - Zurich, Switzerland



Moving from 2D Paper/PDF to BIM-Driven Workflows



Data Model for Underground 3D Cadastre

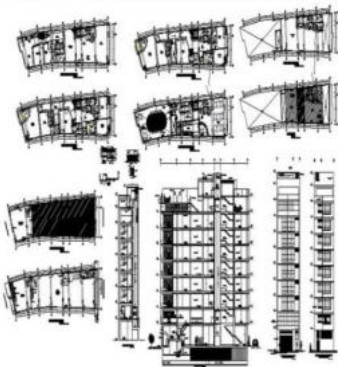


We are developing a **new 3D data modelling approach** to managing **subterranean ownership RRRs** by **referencing** these RRRs to the **physical reality** of the **underground environment**

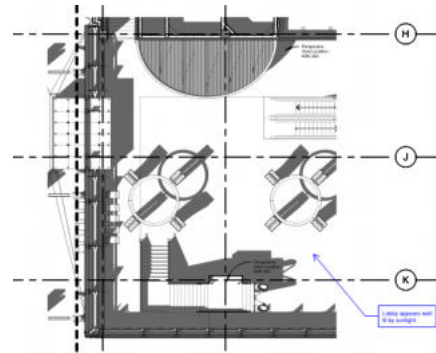
Spatial Planning – Digital Assessment

Current

- PDF-based
- 2D-based
- Complex
- Fragmented Business



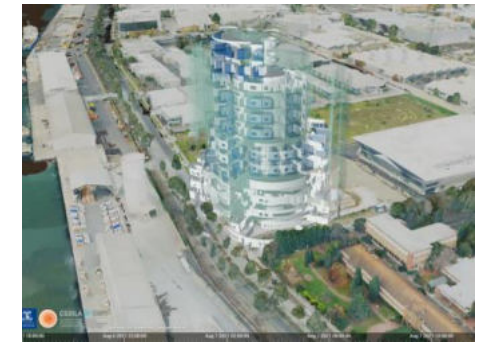
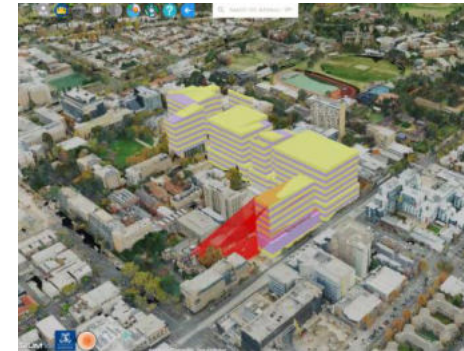
<https://www.pinterest.com.au/pin/689543392926806950/>



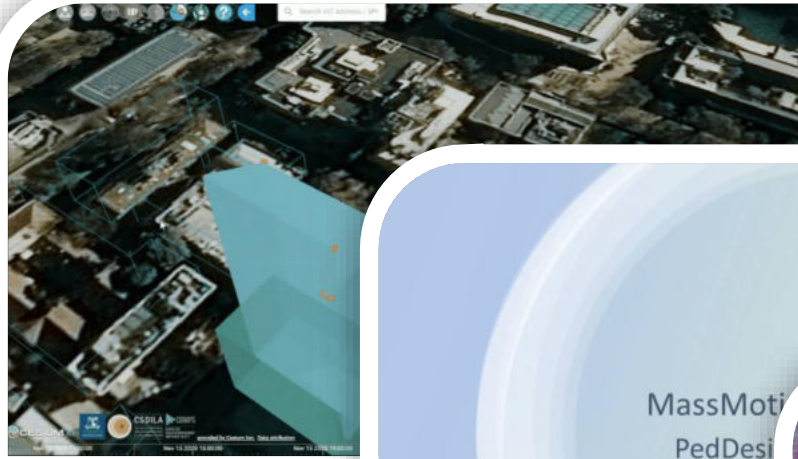
<http://bim4scottc.blogspot.com/2013/04/solar-study-floor-plan-doesnt-show.html>

Future

- Digital Twin
- 3D-based
- Standards and coherence
- Integrated and streamlined



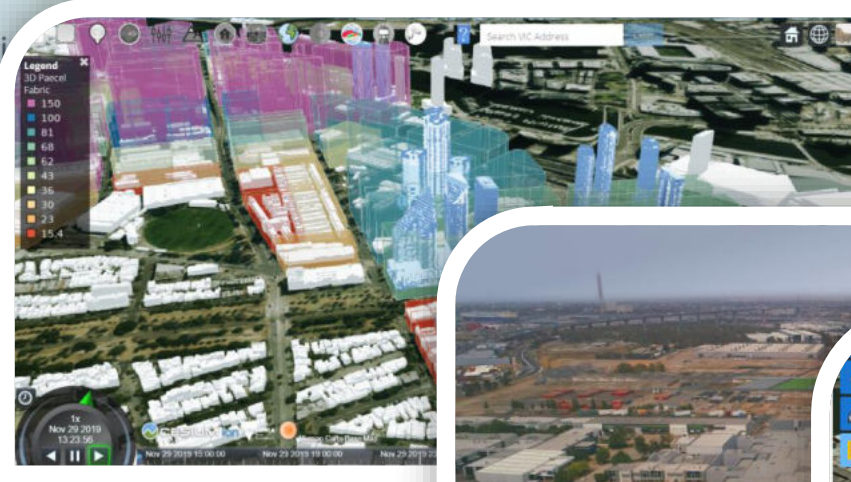
Urban Planning Support



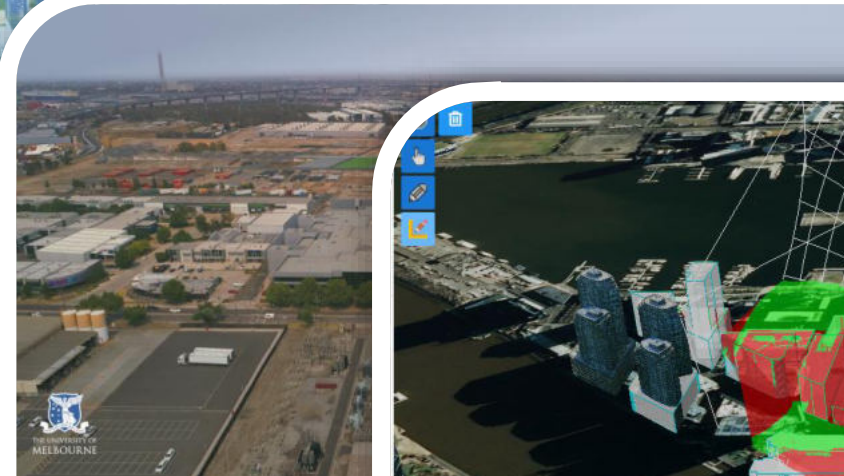
Planning Support
System Rule-based
Building Envelop
Control



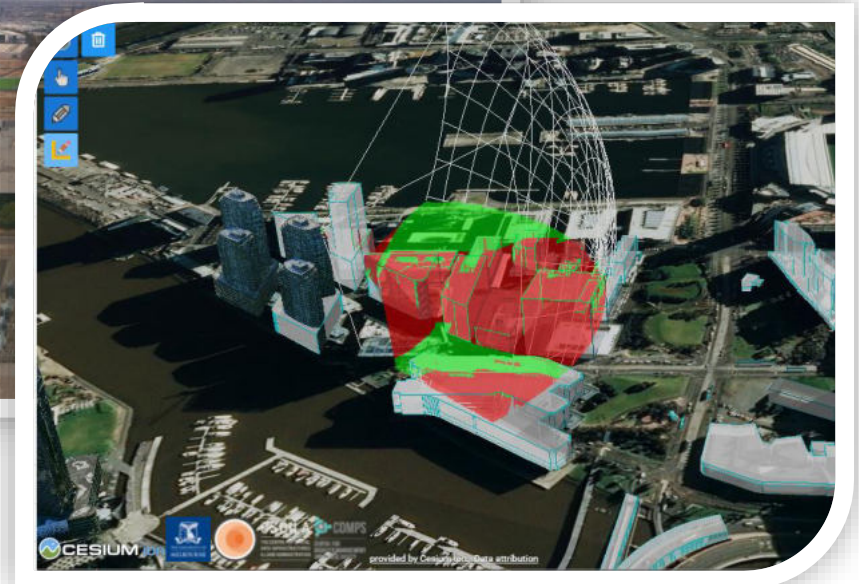
Integrating with
Public Health
Analysis



Urban Skyline
Current - Future



360 Visualisation

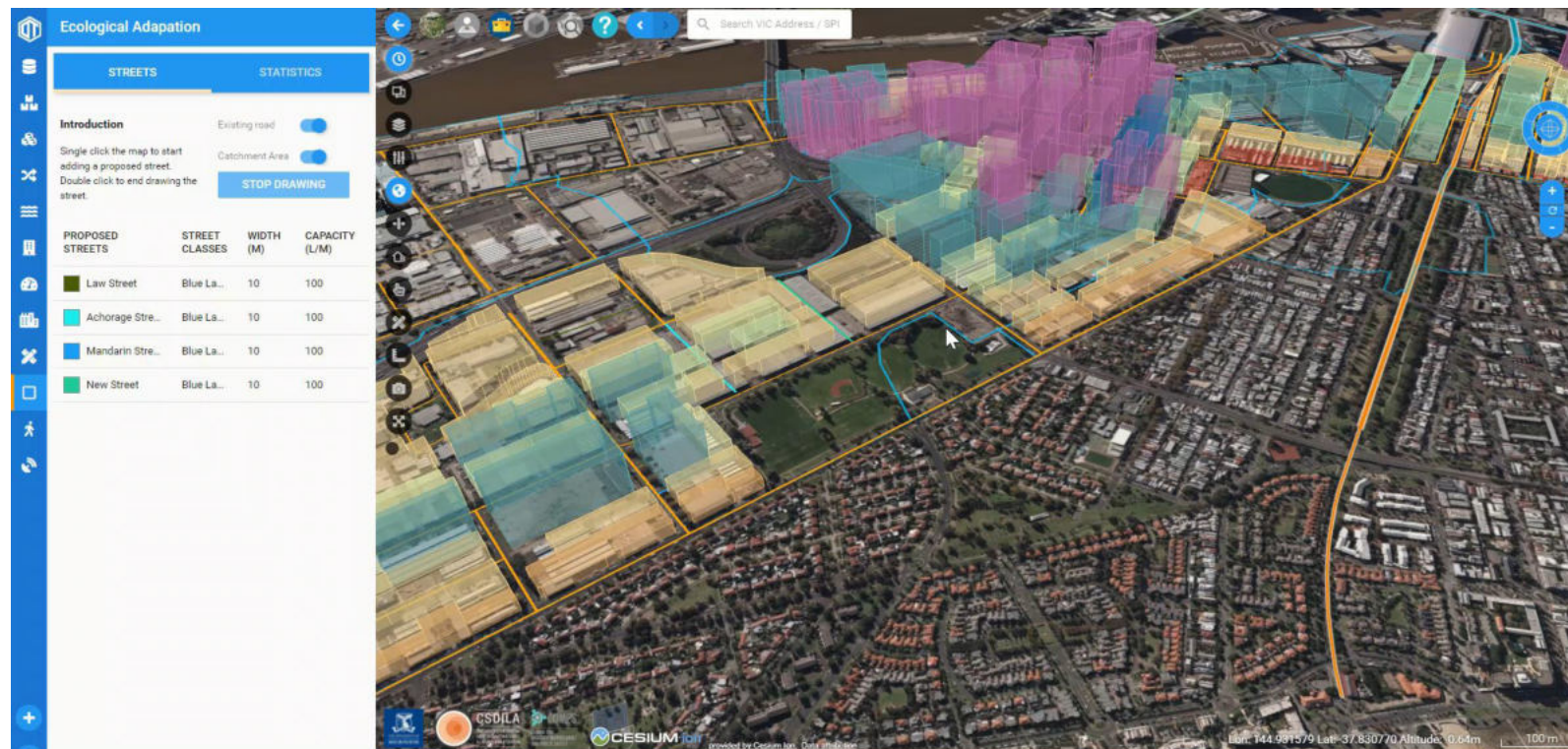
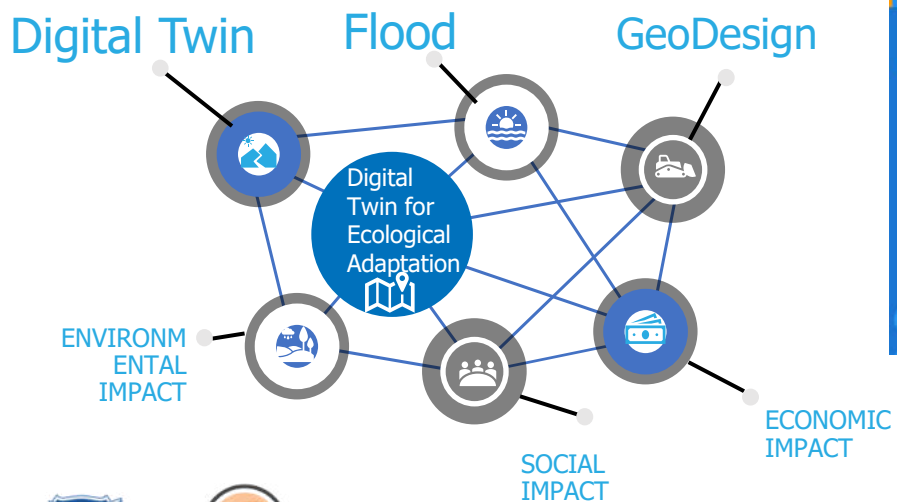


Viewshed Analysis

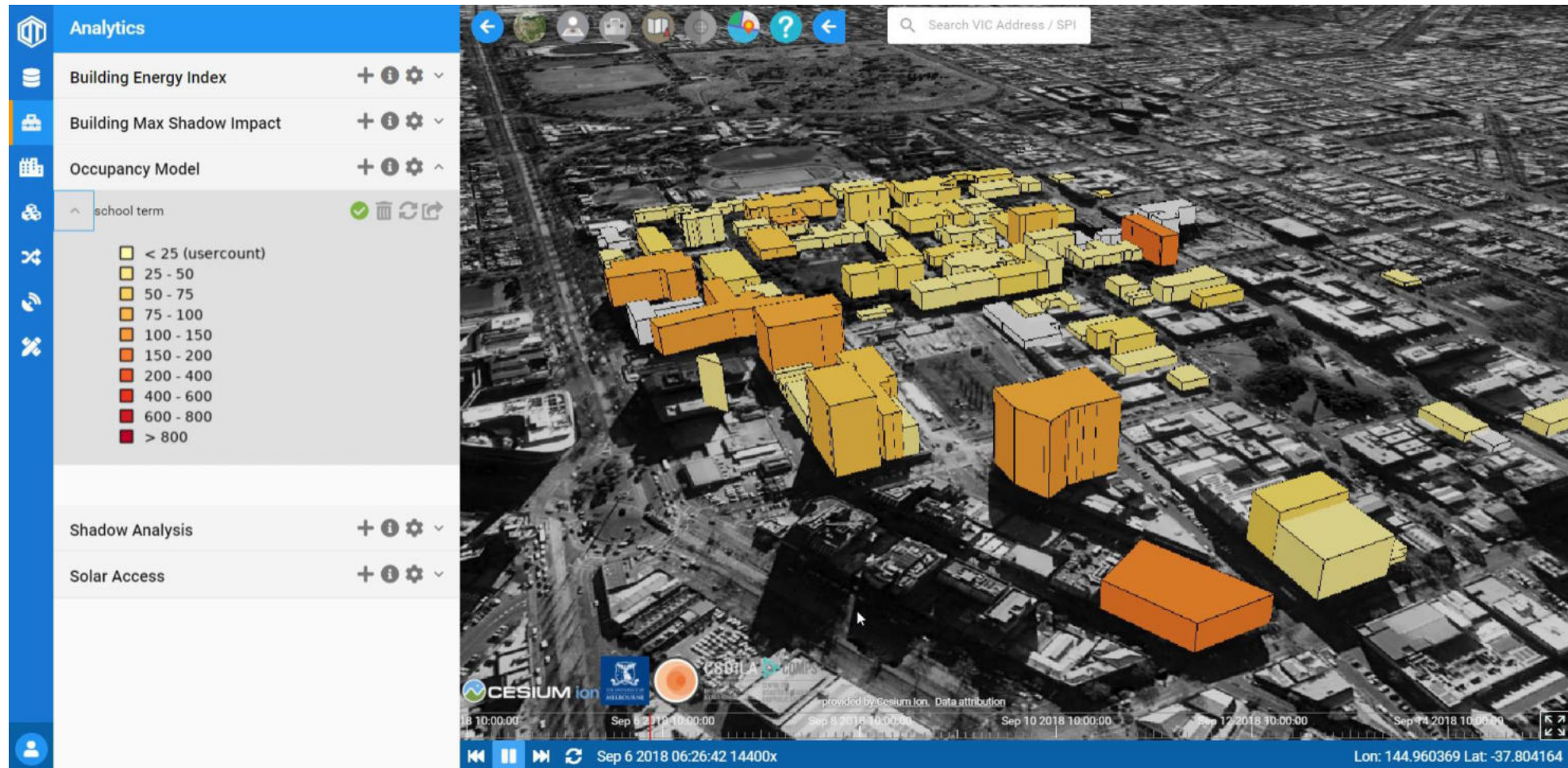
csdila.unimelb.edu.au

Urban Ecological Adaptation – Water Sensitive Urban Design

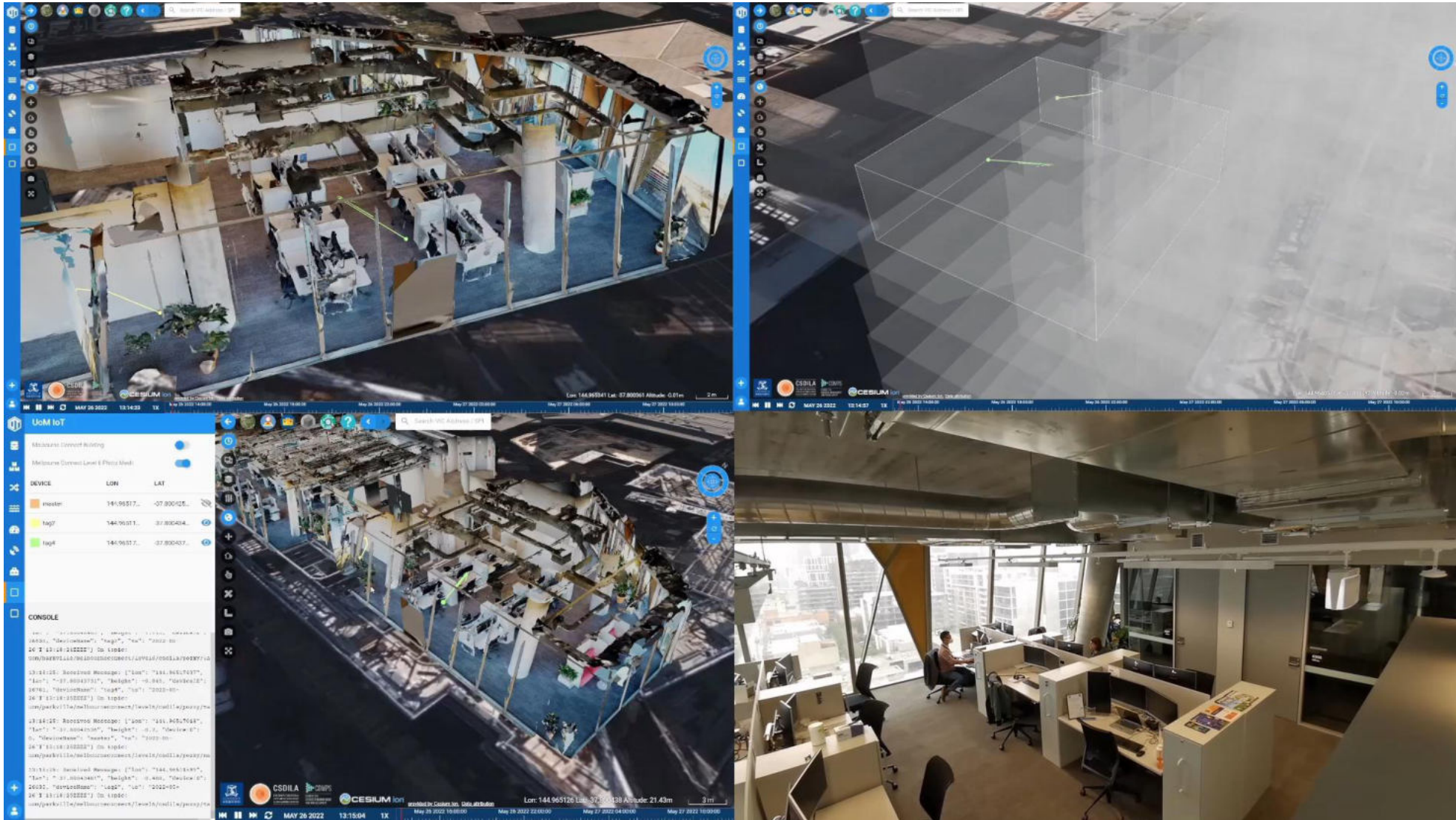
- A collaboration between transport planners, landscape designers, geospatial scientists, and urban planners



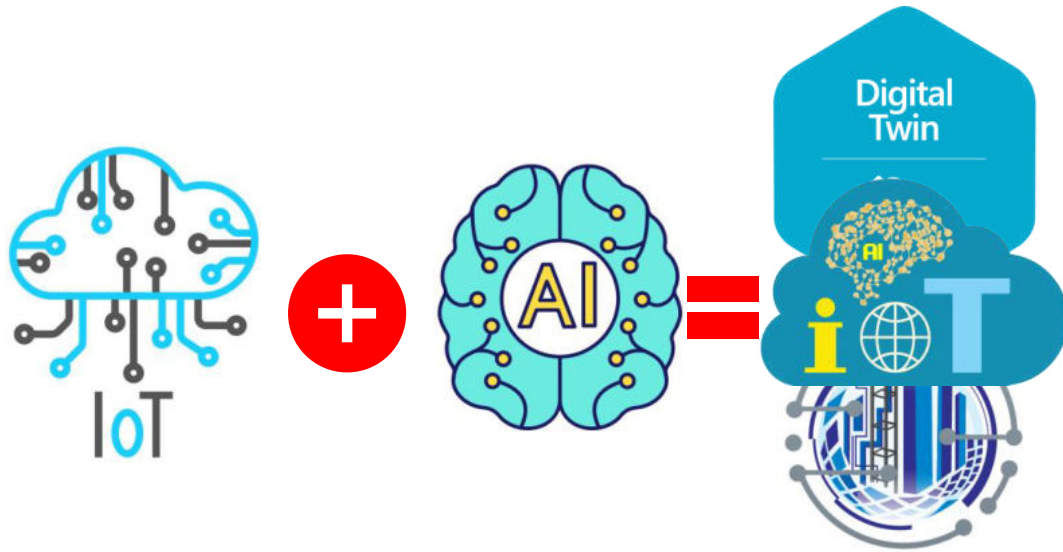
IOT - Space Occupancy



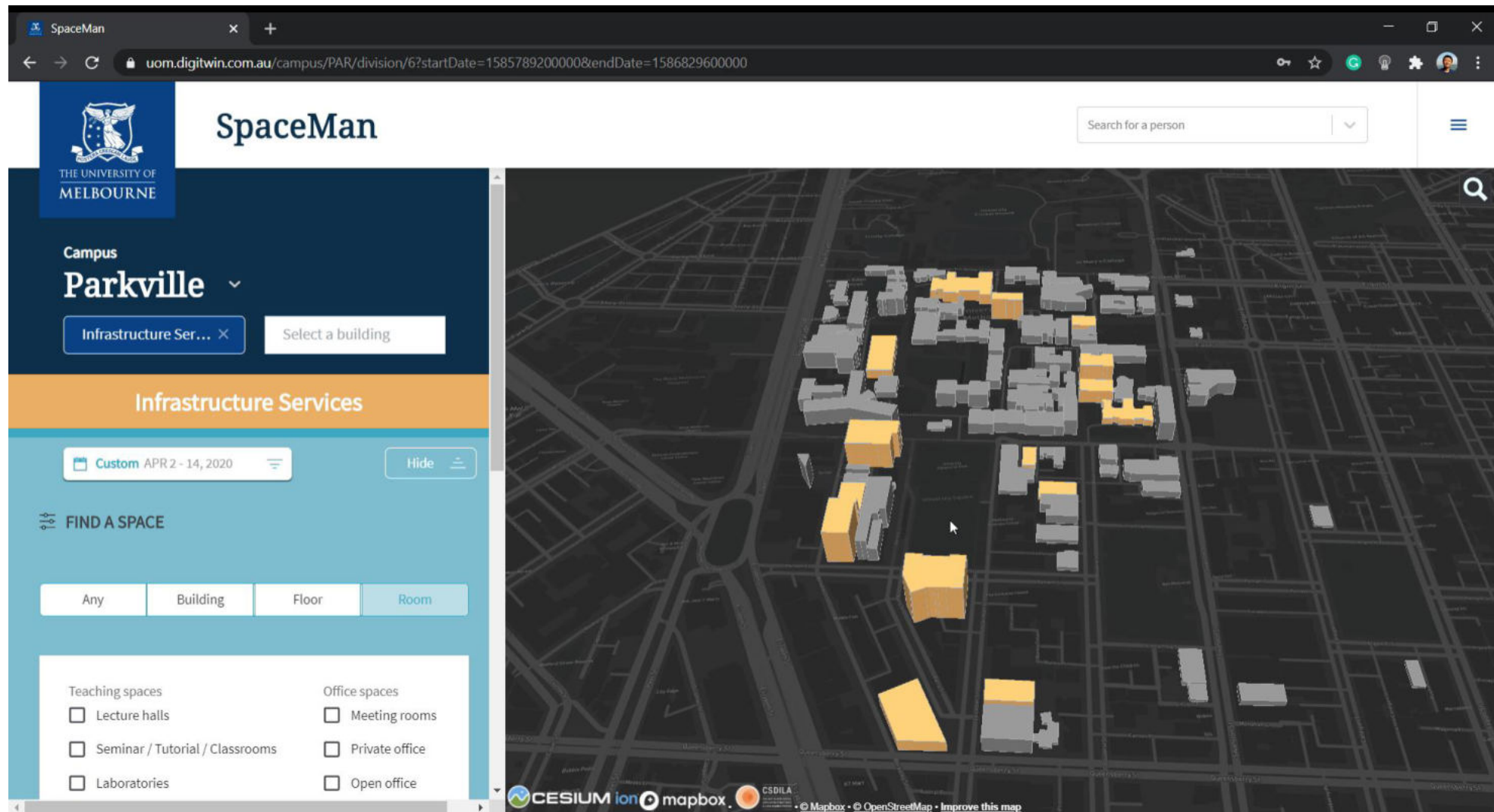
IOT - Real-time Positioning



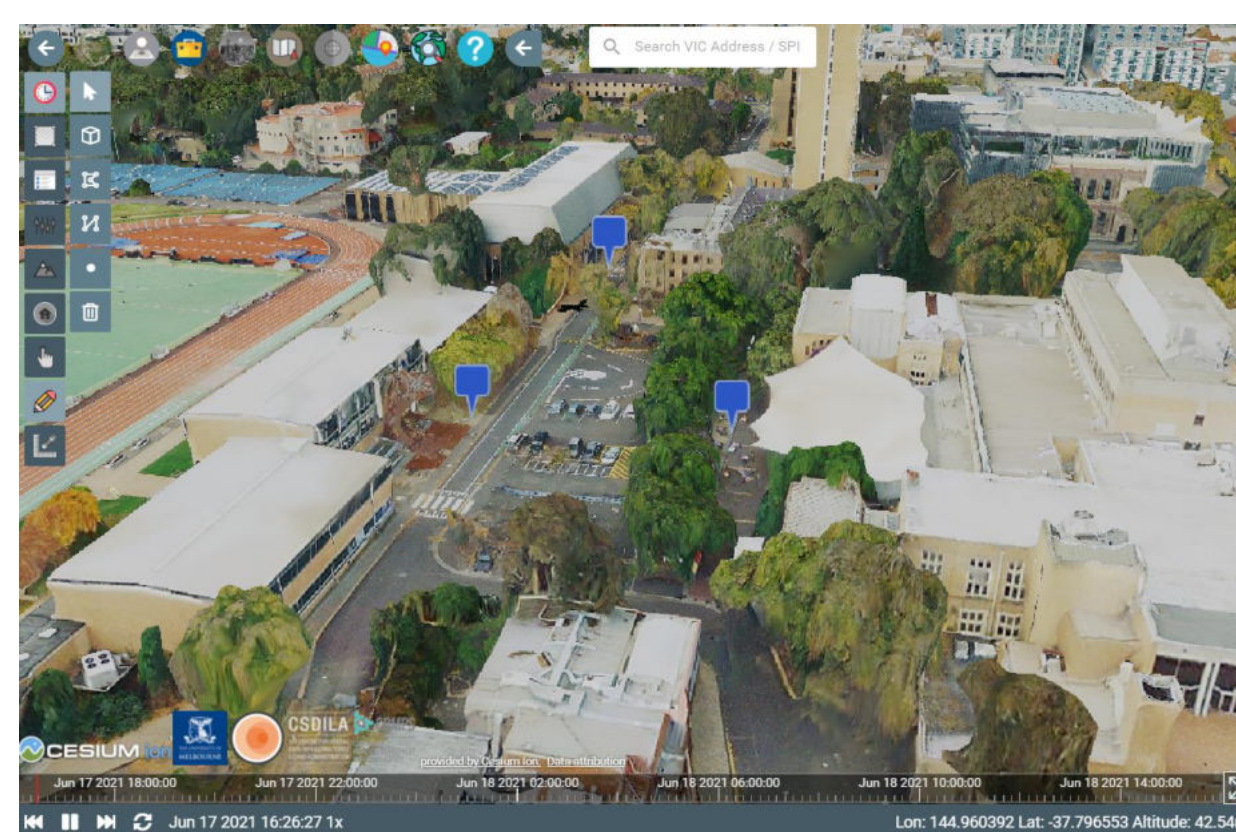
Artificial Intelligence of Things (AIoT) in Digital Twin



Space Management - 3D Floor Plan



Space Management - Virtual Campus



Challenges and Future Research

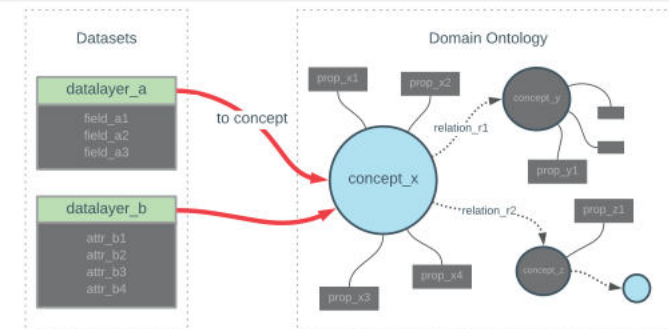
Data

- Automating the workflow of IFC to 3D Tile conversion to create a Fit-for-Purpose LoD;
- Creating an ontological approach for standardisation and harmonisation of different 2D/3D data formats;

Technology

- Developing a **Digital Thread** capability through a two-way communications with external models, simulators, applications, libraries via web APIs and CLI (Command Line Interface), complying with open data exchange standards and protocols.

Impact Radar for 2022



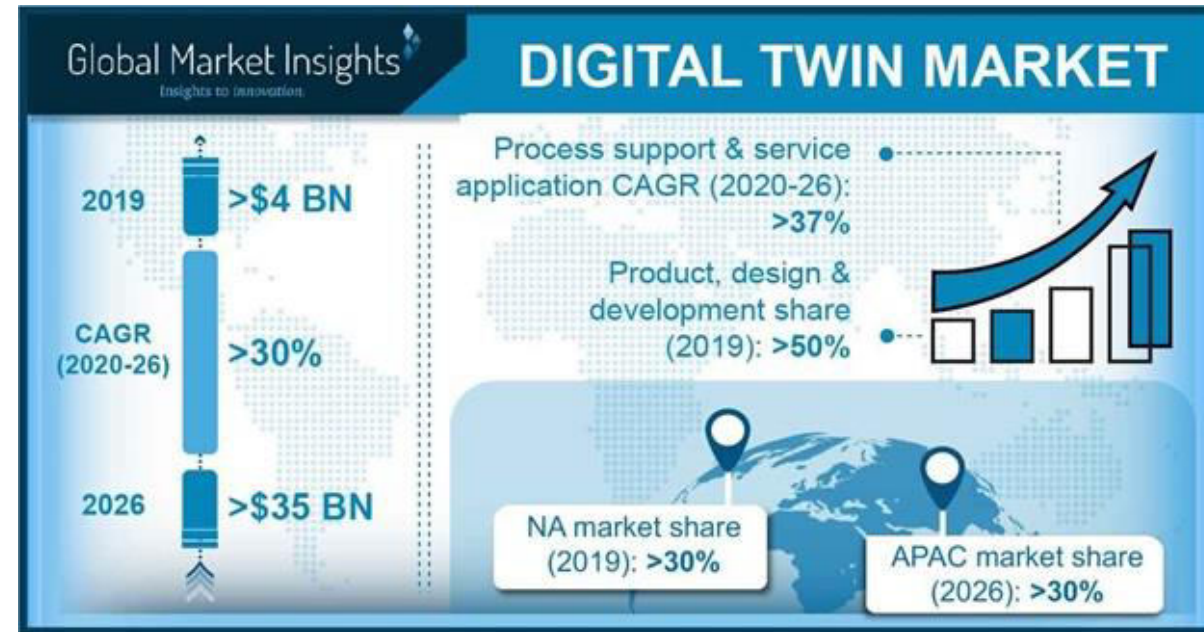
Challenges and Future Research (Con.)

Governance

- The value proposition of Digital Twin is not fully understood by different stakeholders;
- Defining the security and privacy principles

Capacity building, Advocacy, and Awareness

- The Digital Twin lifecycle should be defined and agreed upon by all stakeholders (learning from other standards; e.g. OGC);
- Upskilling and refreshing the professional community with potential use cases



<https://www.gminsights.com/industry-analysis/digital-twin-market>

THE FUTURE IS BRIGHTER

Thank You
We welcome new
partnerships and
collaborations.



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