Digital Engineering for LG Roads Infrastructure Planning and Management

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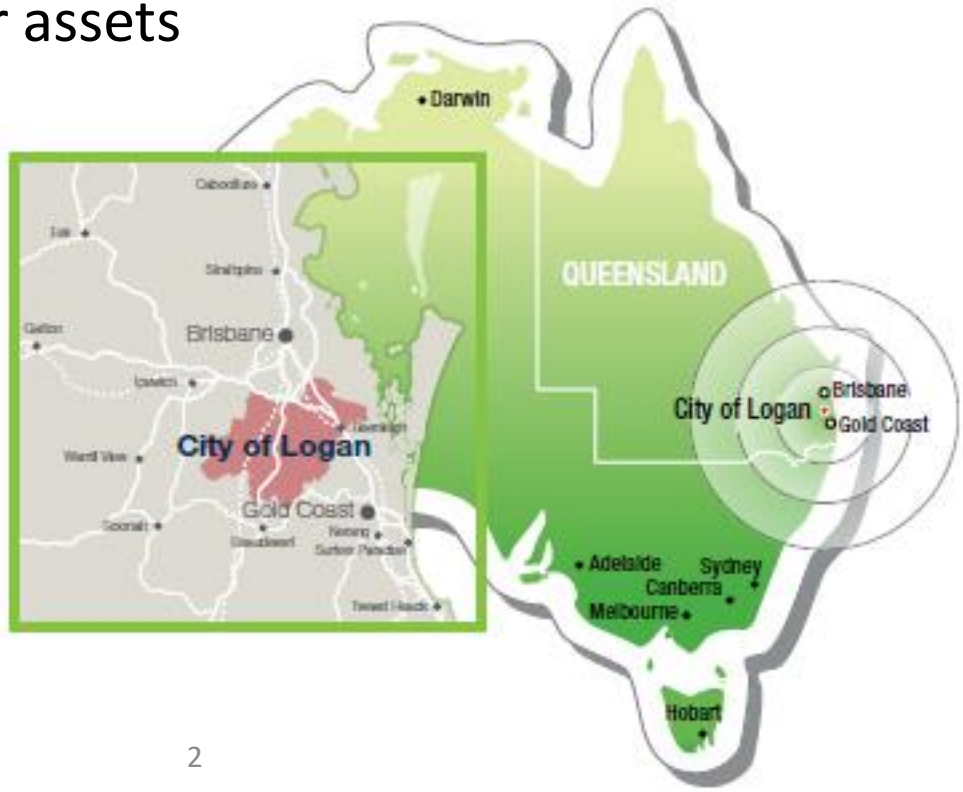
City of Logan

LOGAN CITY COUNCIL

City of Logan, Queensland, Australia

- Located between Brisbane and Gold Coast
- Mixture of rural and urban
- 300,000 + residents
- 1.9% annual growth rate
- $3.3B in road and stormwater assets
- 2,239km sealed roads
- $13.488 billion (GRP)
- $850 million annual budget



What is BIM

- Building (making of) information management
- Building (facilities) information modelling
- Building Information Management
- Virtual Design and Construction
- Better Information Management
- Digital Engineering
- Digital Twin
- Digital Replica??
- Digital Environment

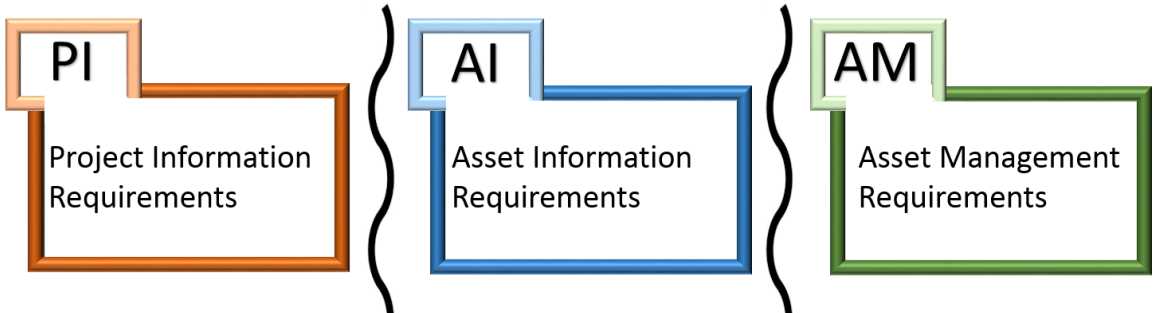
Context of BIM/DE – New/ Major Project focus

- ISO 19650 series
  - PAS 1192 series
- National Digital Policy (Federal Government, Australia)
- BuildingSmart Australia BIM guidelines
- State government
  - QLD BIM Policy and TMR implementation guides
  - Victoria DE Framework
  - NSW – Transport NSW DE framework
- Natspec BIM
- Digital built Britain

Digital Engineering (BIM) for Local Government Linear Infrastructure

- New LG linear infrastructure – Trunk/ Critical and Bridges
  - Project information lifecycle
    - Planning, Design and holistic delivery tool
  - Project completion to asset handover
    - Interoperability of project information requirements into Asset information requirements
      - ie. DE As Cons, still to be developed
  - Asset information requirements forms vital base for asset management information requirements

Digital Engineering Disconnect



Digital Engineering (BIM) for Infrastructure Planning and Asset Manager

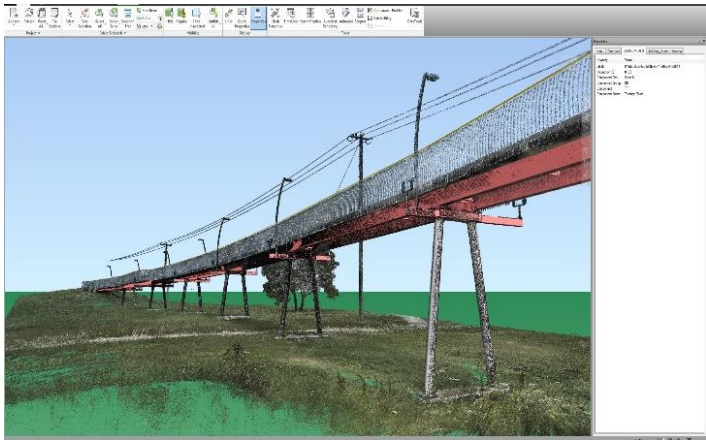
- LG long-life civil infrastructure
- Huge existing asset portfolio (with key/ trunk and critical assets)
  - Varying completeness / accuracy of as-con information
  - Multiple capital renewal and maintenance cycles
- Lets explore DE for ‘assets in operation’

Digital Engineering (BIM) Pilot Projects at Logan City Council

- Logan's historic Red Bridge
  - Structural repair and recoating
- Significant culvert network under business district
  - Critical un-mapped trunk drainage
- Mapillary
  - Computer vision/ object detection

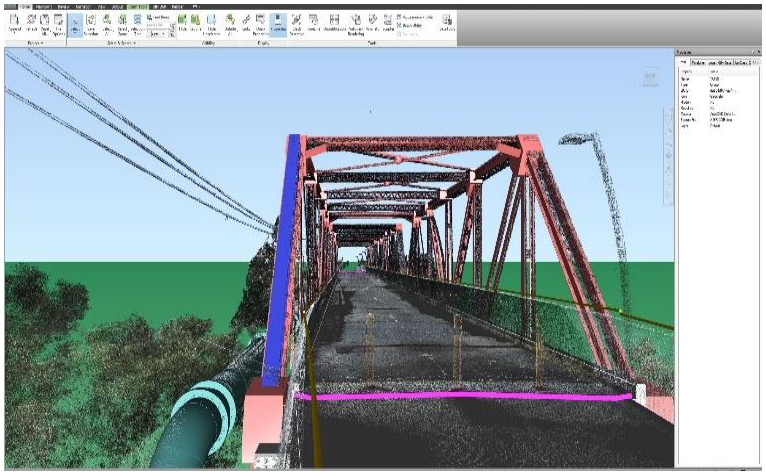
Digital Engineering (BIM) - Red Bridge Case Study

- Original construction 1930's
  - Last recoating (2000)
  - Est. capital recoating project ($1m)
  - Significant portion in scaffolding
- Project scope
  - Drone laser scan survey
  - Inspection records
  - 3d interactive asset information model
  - Asset renewal requirements
- Benefit opportunity
  - Provide BIM model to assist in tender preparation



Digital Engineering (BIM) Red Bridge Lessons Learned / Findings

- Assisted to navigate through constraints
  - Difficulty of using scaffolding over water
  - Proximity to overhead powerlines
  - Attached trunk water main
  - Asset renewal requirements
  - Environment impacts
- Information transfer
  - Limited IFC for civil
  - Geometric location of defects
  - Element level monitoring enabled

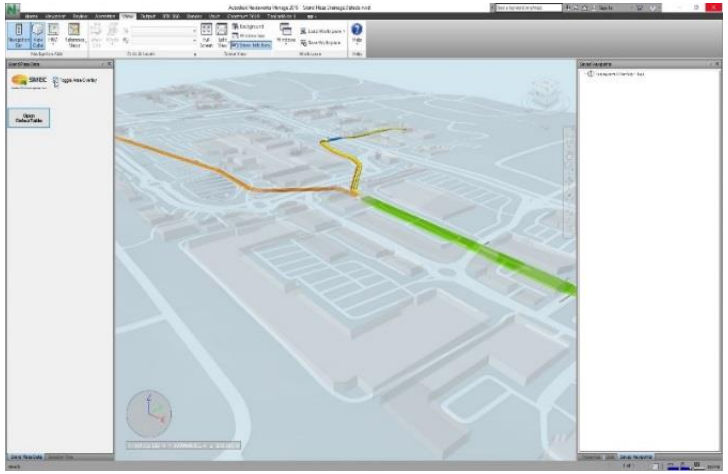


Digital Engineering (BIM) Major Culverts Case Study

- Assessments and life cycle management strategies
  - Interconnected underground major culverts (1.8km)
  - Under business district
  - Laser scanning to provide accurate location information
  - Assign condition rating
  - Scope and cost works program

DE (BIM) Major Culverts Lessons Learned / Findings

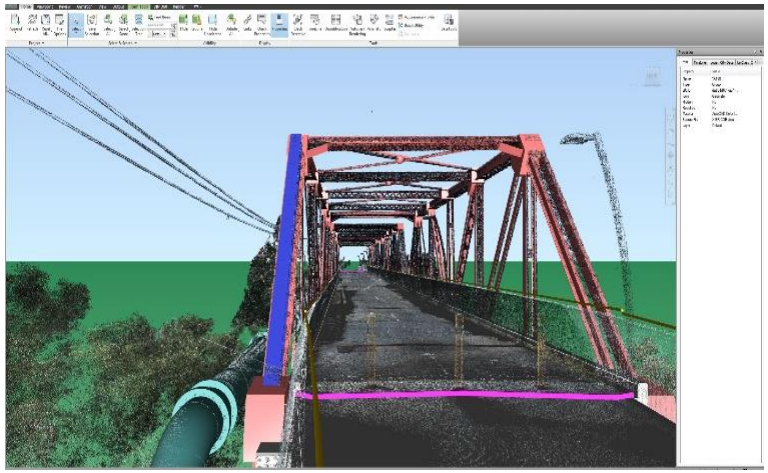
- Reassociating with defect image required
  - Linear referencing protocols?
- Future condition assessments using computer vision/ AI may provide accurate defect positioning
- BIM incorporation/ interface with Asset Info Systems and GIS



DE Findings and Conclusions

Overall positive outcome

- Usable model for assessing the assets and condition



Software Assessment

- Some more suited to LG
  - Existing data can be edited
  - Others task specific - good mobile solutions
  - Some non-civil tools had compatibility issues
  - Interoperability
- Monitoring
  - GPS accuracy
  - X, Y and Z

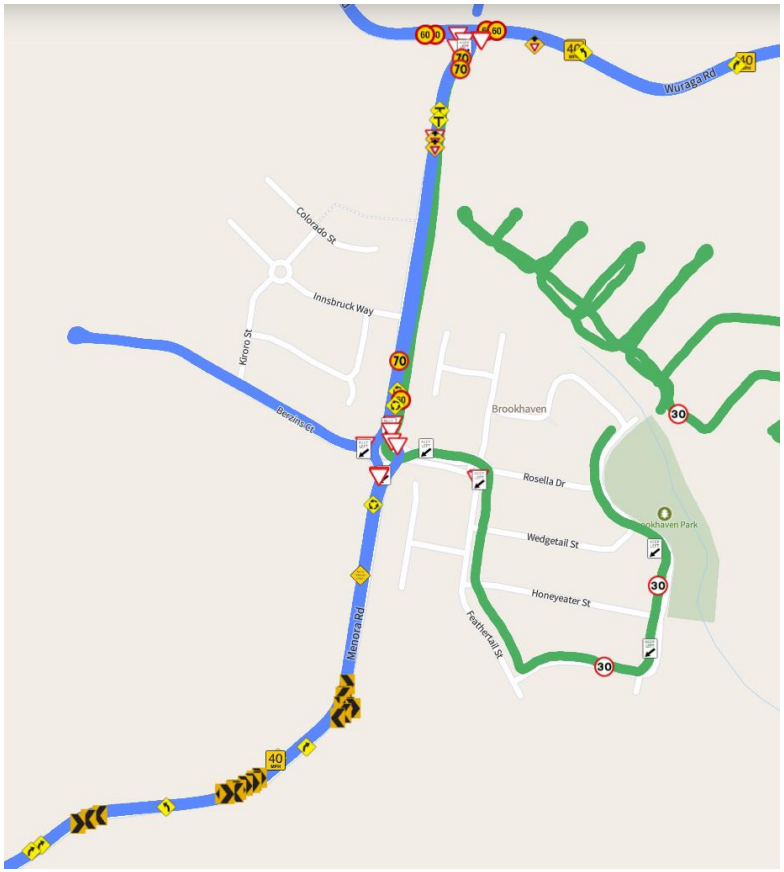
City of Logan's – Digital Road Environment

- Crowd source street-level images
  - Machine Learning
  - Object detection
    - Signs
    - Street Lights
    - Pavement markings
    - Defects

- Accessible, interoperable, cost effective cloud based platform
  - Easy to upload images by anyone with a smartphone app or GPS enabled camera (or 360 camera)

Video and Object Detection

- 2,257 km video uploaded (4.4M images)
  - Network video survey
  - GPS camera / phone
- Total objects detected – 13.3M
  - Traffic signs – 67,400
  - Manhole – 6,400
  - Street light / Pole – 40,700
- Defects
  - Commencing with Pothole
  - K & C, Footpath and Carparks to be explored



Digital Engineering (BIM) Mapillary usecases

- Supplementary to expensive network level surveys (every 2-3 years)
- Improves accuracy and validation of asset info pick up
  - Supplements
  - Ascon / ADAC and aerial photography
- Computer vision / AI technology maturing rapidly
- Capability in access reduced areas
  - Waterways, Parks
- Network coverage with high refresh rates

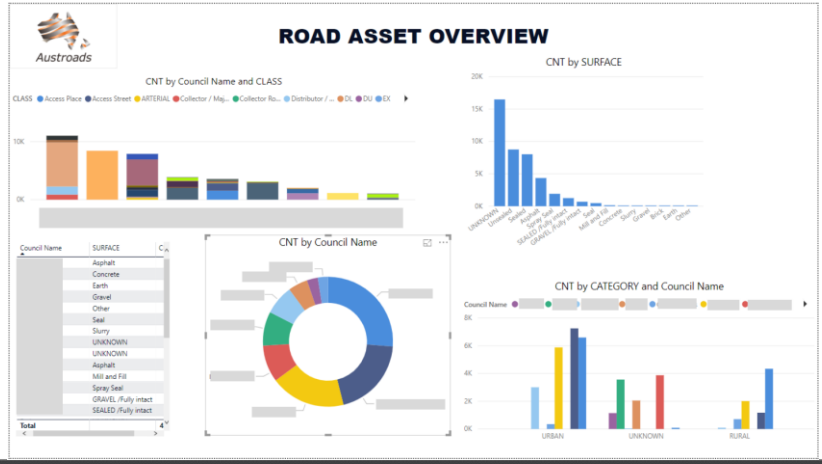
DE/BIM Projects in pipeline/ consideration at City of Logan

- Austroads Data Standard PHS dataset Pilot
- City of Logan's As Constructed Information Submission/ Management Portal
- Smart Cities and Suburb Program Funded Project (DE and smart technologies to enhance flood resilience in high risk areas)
- Pavement renewal and monitoring
  - Intelligent compaction
  - Geogrids and sensors
- SW pipe CCTV video portal with AI assessments (condition/handover)
- Proposed BIM As Constructed Model handover for Pacific Highway Service Roads (in partnership with TMR)

Austroads Data Standard LG pilot (Towards Transport IFC)

- Austroads Data Standard for Road Management & Investment
  - LCC in Austroads PHS LG pilot
    - Harmonisation assessment against standard
      - Access / Condition / Demand
      - Inventory / Location referencing
      - Network / Performance
      - Works and cost / Utilisation
- Potential for base IFC data along with leading work by TMR, TNSW and VicRoads

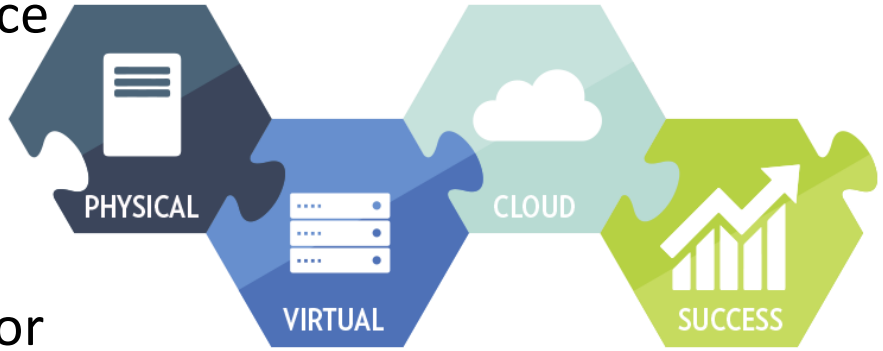
PHS function group	Council I
Access	100.00%
Classification	100.00%
Condition	63.16%
Condition (DIRD)	100.00%
Demand	100.00%
Inventory	82.35%
Inventory (DIRD)	100.00%
Location Referencing	66.67%
Network	25.00%
Network (DIRD/CGC)	0.00%
Performance (Asset)	100.00%
Perf. (Asset) (DIRD)	100.00%
Perf. (Financial)	57.14%
Perf. (Service)	33.33%
Perf. (Service) (DIRD/CGC)	100.00%
Utilisation	100.00%
Works and Costs	76.47%



Connected DE Environment

City of Logan's As Constructed Information Submission/ Management Portal

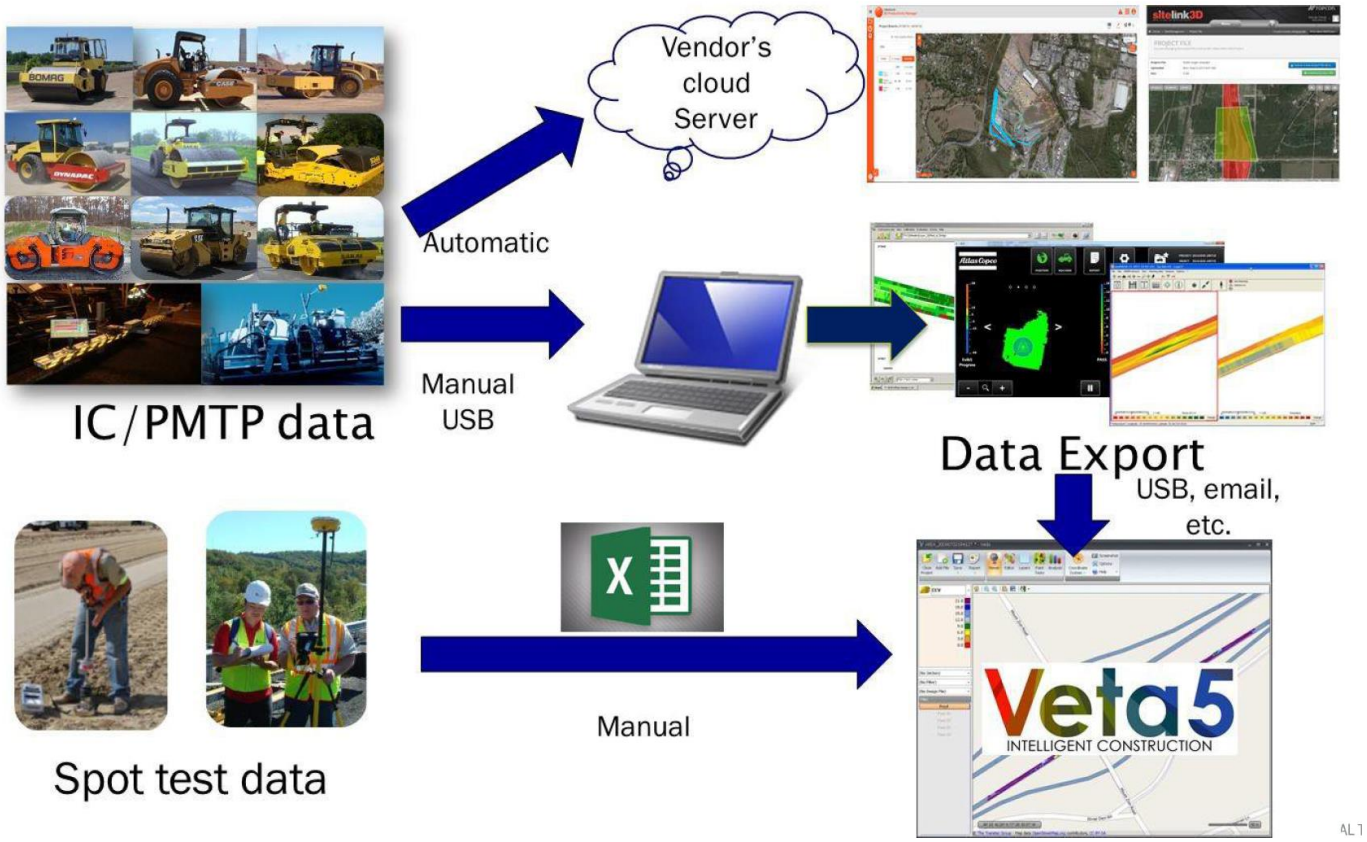
- Open Data portal for existing as con plans SW, Roads, W, WW as cons since 2017 for self download



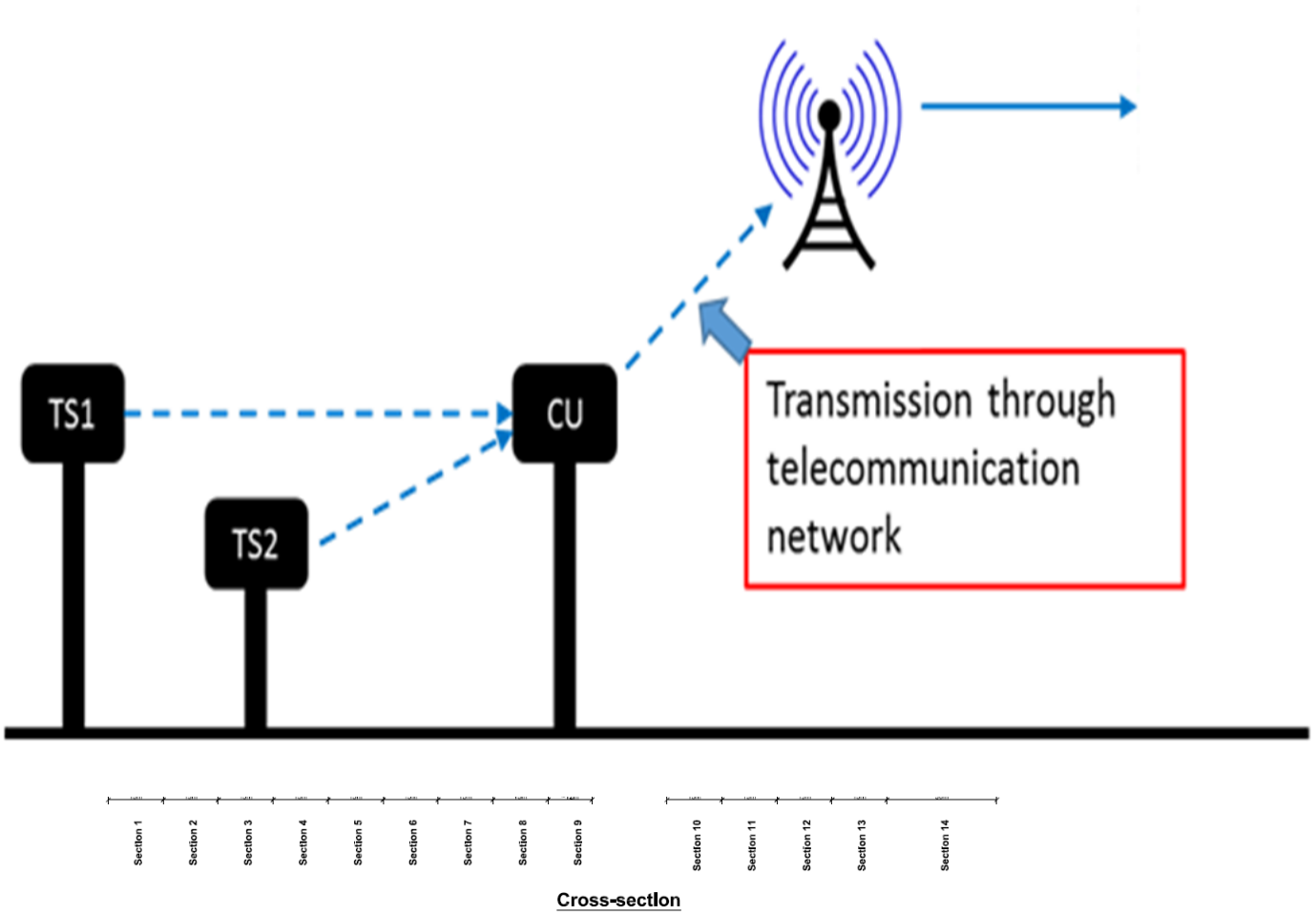
What is it?

- A cloud based geospatial front end for development industry for contributed/donated assets
- As constructed and related information, submission, validation and storage
- Guidelines for digital as constructed information submission is being developed

BIM in Pavement Renewal and Performance monitoring with Intelligent Compaction



Logan Street- Pavement Monitoring with Sensors



Flood resilience with DE and smart technologies

- A collaborative project with QUT, River and Catchment Engineering and Road Asset Management programs at Logan
- Implement and test the use of digital engineering and smart technologies to improve
  - asset and flood monitoring in the Slacks and Scrubby Creek catchment by integrating
    - data sources,
    - asset information,
    - Surrounding physical environment and
    - modelling for river and creek flooding (and likely scenarios)

Flood resilience with DE and smart technologies

Deliverable 3

- BIM enabled database that provides a holistic view of all stormwater assets and their performance
- Ground-truth repository to link flood modelling, prediction and asset management
- Foundation for asset related information for first-responders
- Base layer for general information provided externally

Flood resilience with DE and smart technologies

Deliverable 4

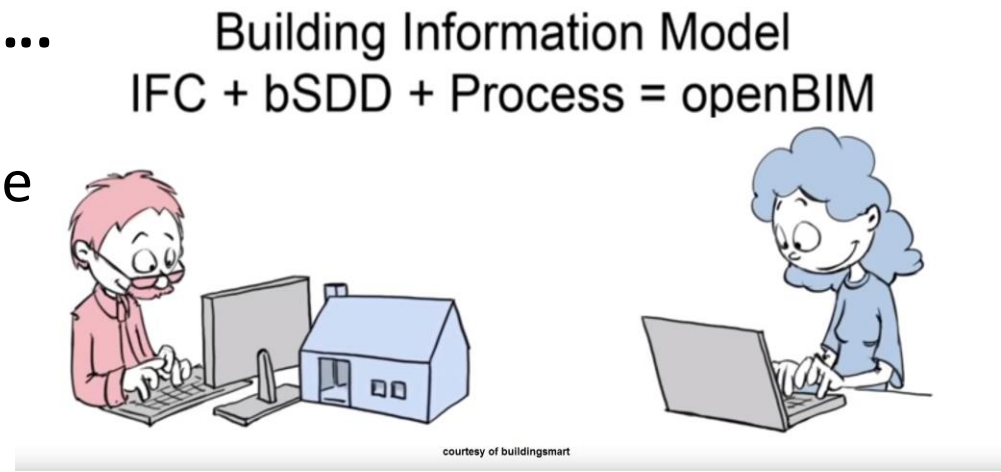
Tools for first-responders to gather and valuable information on site

Provide access to actual and predicted event data to coordinate actions

Access to latest technology | Augmented Reality connected to BIM database

Ability to filter the information for release to public

DE adoption for LG on its way….

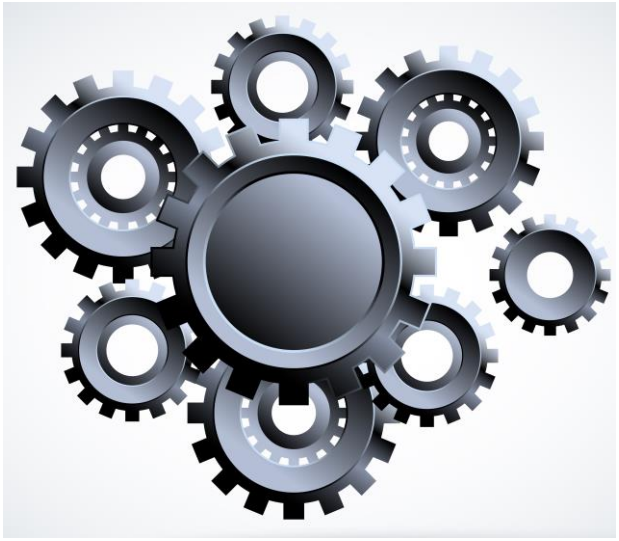


- Industry cooperation to overcome
  - Initial cost justification
  - Cultural shift
  - Skill/ capability barrier
- Prepare for Next-gen ALCM in context such as
  - Autonomous vehicles –
    - V2I info exchange
    - Infrastructure readiness and upgrades
  - Recycling/Reuse and sharing economy
    - Material, data and information re-use in Open environment
  - Stormwater harvesting and shared utility tunnels
    - with 3D cities and underground 3D

Let's Embark LG digital engineering framework for

- management of existing **critical/trunk** assets;
- new internally constructed; and
- contributed assets

- With development of LG specific
  - Tools,
  - Platforms,
  - Guidelines and
  - Practice notes (IPWEA DE practice notes!!)



Let's collaborate, learn and refine… from and for industry
e.g. Transport NSW DE framework, tools and guidelines

Release 1 (Sept 2018)	Release 2 (Apr 2019)	Release 3 (mid 2019)	Release 4 (end 2019)
Digital Engineering Standard, Part 1 – Concepts and Principles			
Digital Engineering Standard, Part 2 – Requirements			
The Interim Approach, Getting Started			
Digital Engineering Framework			
Terms and Definitions Guide			
Digital Engineering Execution Plan (DEXP) Template			
	Model Properties Specification		
	Scheduling for DE-enabled Projects		
	Specifying Digital Survey Requirements Guide		
	Project Data Guides – Application of Uniclass2015 for Transport, Project Data Building Blocks, Project Data Schemas		
	Project Management Guides – Project Deliverables Requirements, Using the MIDP, Using the DEXP		
	2D CAD Guides – The DE CAD Concession Guide		
	BIM Model Guides – Setting up for BIM, DE Design Review		
	Asset Data Guides – Master Asset List, Why not COBie		
		Asset Handover Guide (6D)	
		Systems Engineering Guide	
			Cost Guides (5D)
			GIS for DE Guides
			Visualisation Guides

Let's move together from solid foundations to vibrant future

with

DE/ BIM for across infrastructure asset lifecycle

Acknowledgment : Slide deck preparation input/support
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