



A NEW ERA FOR  
INFRASTRUCTURE DESIGN:  
**Integrating GIS and  
BIM Technologies**

**Liz Fulton** – GIS Operations Manager & **Blair Cheyne** – Technical Services Manager

# Agenda

This presentation will explore how Cardno is working to integrate GIS & BIM technologies in infrastructure & land development projects.

It will take a closer look at 7 aspects of integration and how they have been used across 4 projects.

A StoryMap of this presentation is available with the following link or QR Code.

<https://cardnoanz.maps.arcgis.com/apps/Cascade/index.html?appid=2a91a09ae17b432ebf4035f21621593d>



## who we are

Cardno has a **70 year history**, originating in Brisbane, Australia and growing to become a worldwide company.



**+6,000**

PEOPLE



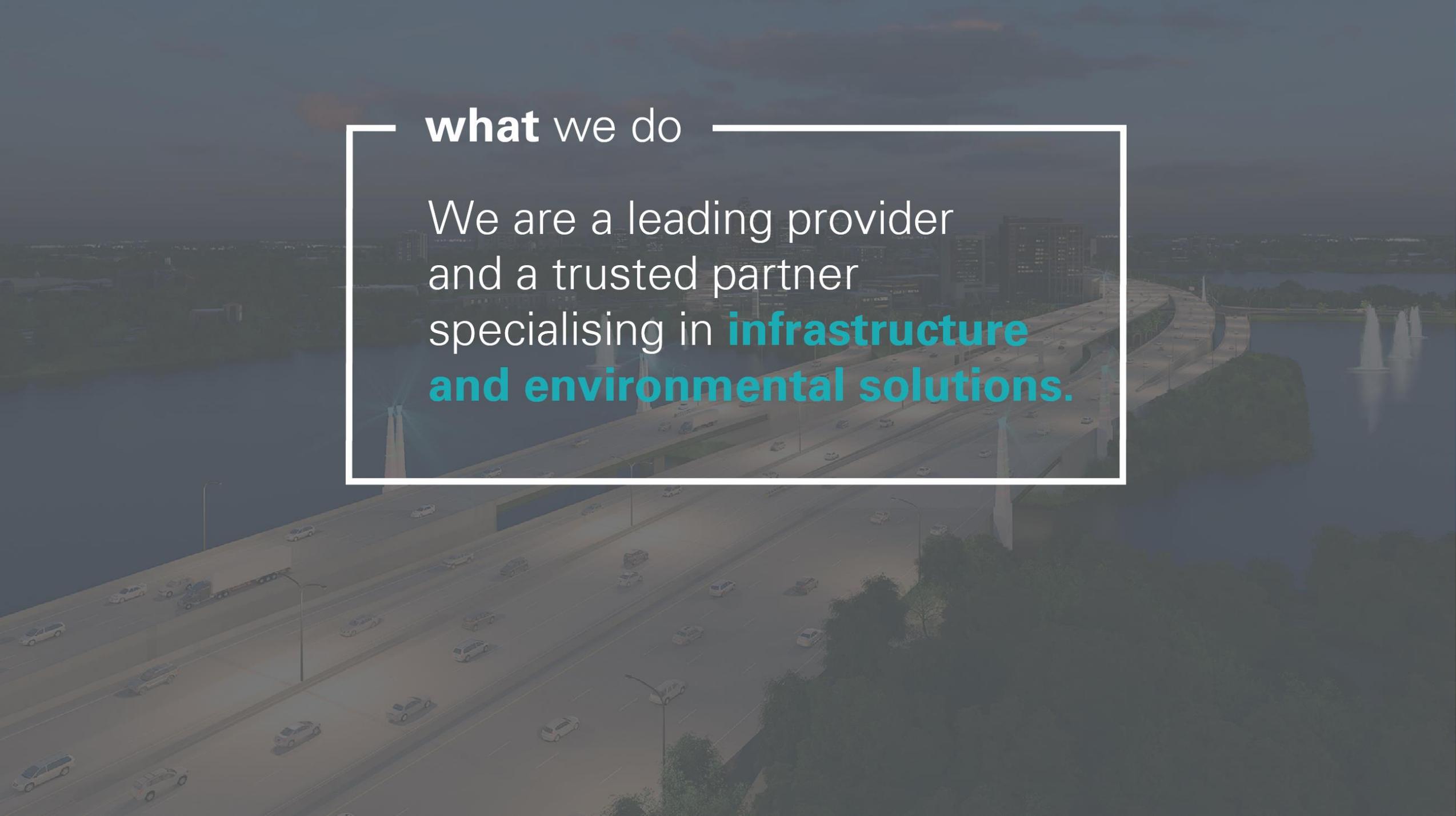
**130**

OFFICES



**100**

COUNTRIES



**what** we do

We are a leading provider  
and a trusted partner  
specialising in **infrastructure  
and environmental solutions.**

## Spatial Wall of Mystery

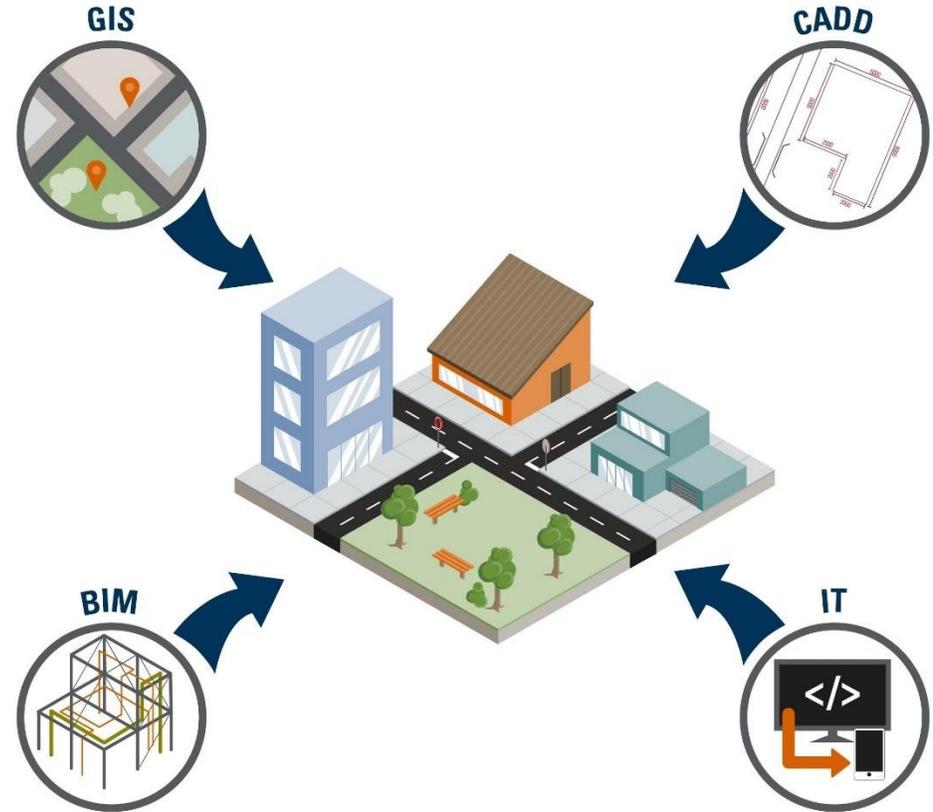
“It has been clearly recognised that a **‘wall of mystery’**, can exist between information required, formats, data sets and databases when communicating graphical and spatial data across departments and organisations.”

*- Ragnar Haabjoern, 2009 -*

# A convergence

In recent years there has been a growing trend towards enabling greater synergy between technology platforms, to ensure optimal infrastructure design.

In particular, the closer integration of GIS and BIM technologies – as announced recently by Esri and Autodesk – is seeing optimised designs, accelerated project approvals, reduced costs, smarter cities and more resilient infrastructure.

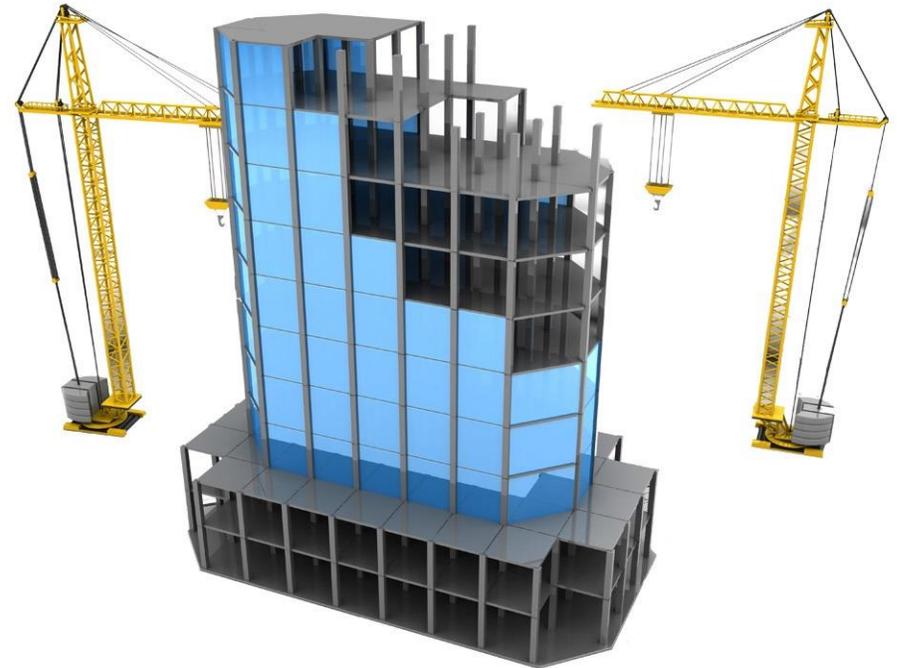


# Aspect #1 – Common Data Environment

A CDE is a centralised place for digital spatial and non-spatial information to be stored

Allowing for users to create, view, analyse, share and manage this information all whilst maintaining data integrity.

This information enables visualization and analysis in different ways, unearthing all manner of trends and relationships in a 3D model.



## Aspect #2 – Data Capture

Utilise technology to obtain, create and capture data that is fit for project purpose.

Existing Data may be readily available from government authority data custodians or commercial operators such as Satellite Imagery.

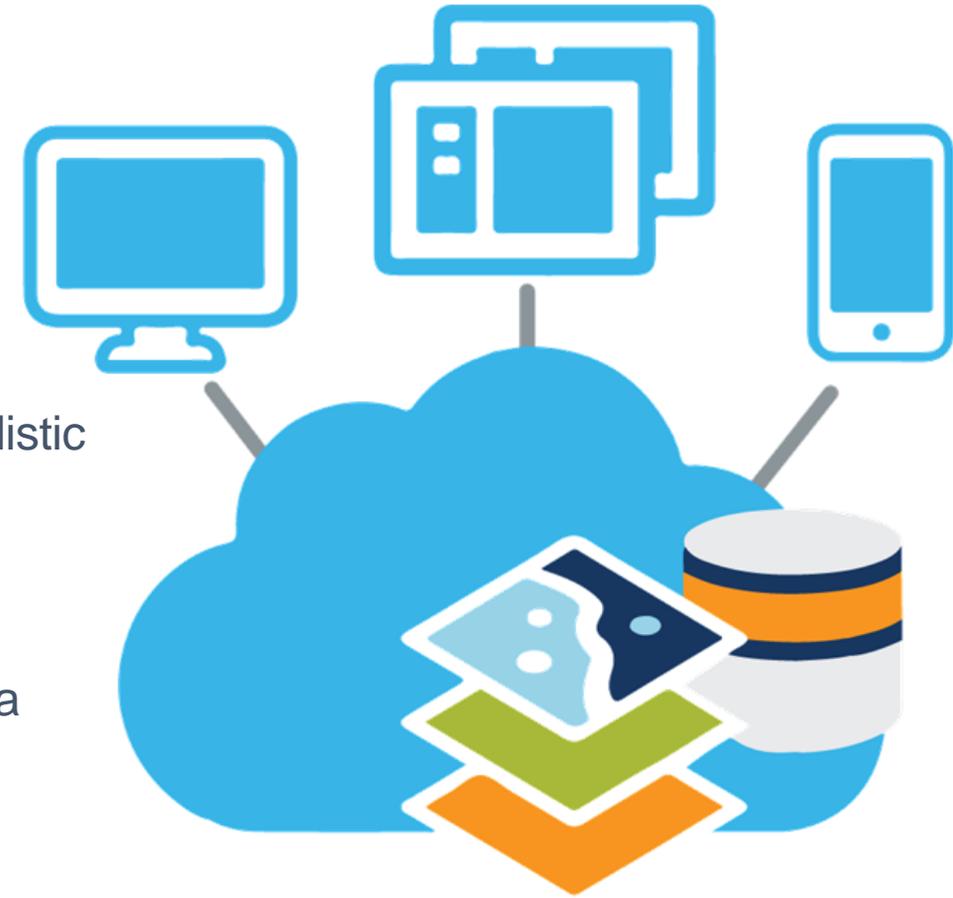
Onsite capture might include certified ground survey, aerial inspection & field capture using mobile technology

Generated desktop outputs such as spatial analysis & design layouts.



## Aspect #3 – Spatial Enablement

1. Ensure data requirements of all stakeholders are met
2. Provide access to conversion and interoperability tools
3. Design a framework for your data that is manageable and realistic
4. Take the time and budget to manage and “love” your data
5. Share spatial data in for various formats & platforms
6. Create tools to allow stakeholders to use and benefit from data



## Aspect #4 – Partnerships

It is important for all stakeholders to be actively involved in ensuring the success of the collaboration.

Create partnerships with vendors such as Esri & Autodesk to help find the right solutions for your organisation and projects to continually improve collaboration between platforms.

Gather technical experts from your organisation to focus on technology & increase sharing of capability across platforms & project teams



# Aspect #5 – Project Lifecycle

## Investigate

Combine information from multiple sources and multiple formats to identify & review site constraints.

## Design

Create a digital twin, and options to be able to investigate, visualise & understand the final constructed project

## Communicate

Stakeholder engagement from both the design teams, clients and community is key for a successful project delivery.

A centralised visual model will immerse these stakeholders into the "digital twin" to make strategic project decisions.

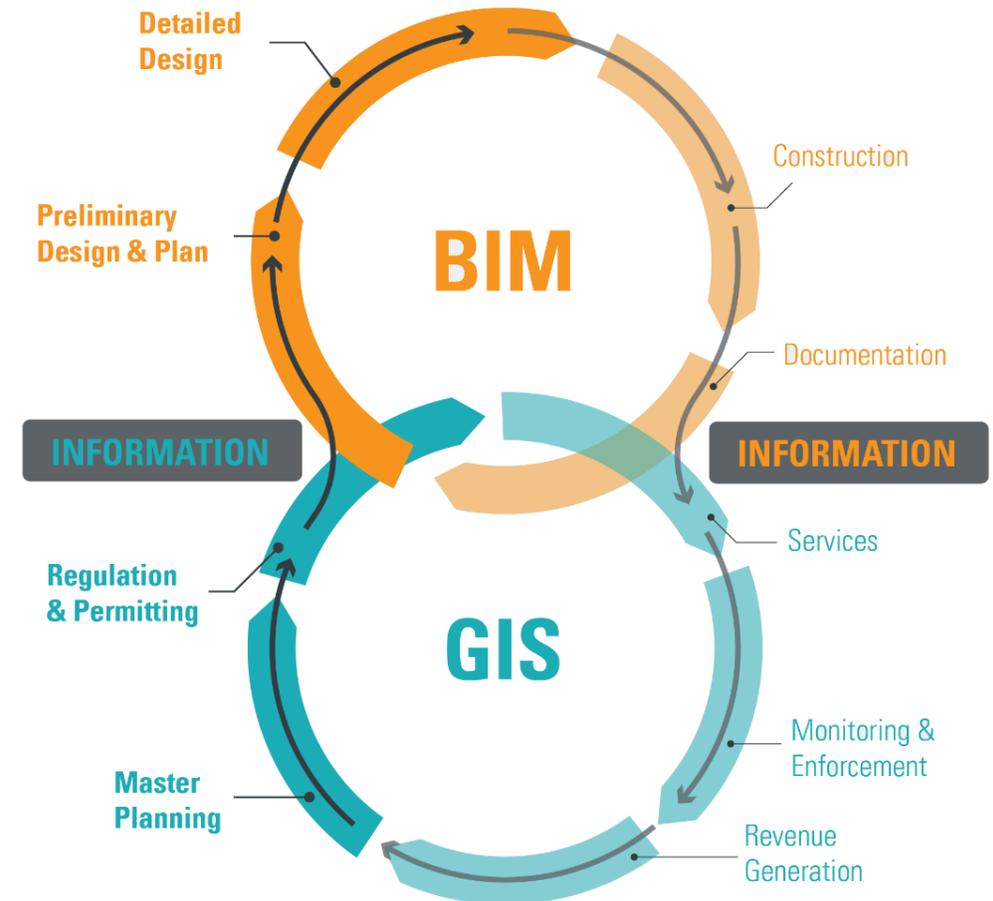


# Aspect #6 – Integration with Infrastructure Design

This collaborative environment allows disciplines to work together under one model, no matter what the platform or tool.

With an accurate digital design, resolutions are easily obtained & costings are more accurate.

As we progress through the design process the visual aspect of the project grows bringing our stakeholders along for the ride.



# Aspect #7 – Benefits of Integration

Increased productivity through refined and expanded workflows

Alignment across disciplines & encouragement to share workflows

Staff development opportunities to use new tools and platforms

Improved collaboration & engagement with stakeholders

Increased transparency of design throughout the whole process resulting in less bulk changes

Creates added value to clients with minimal budget impacts



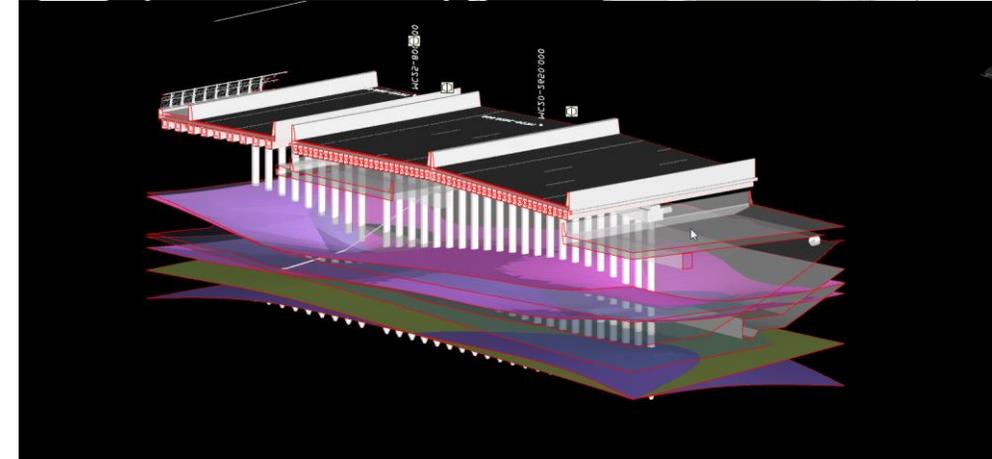
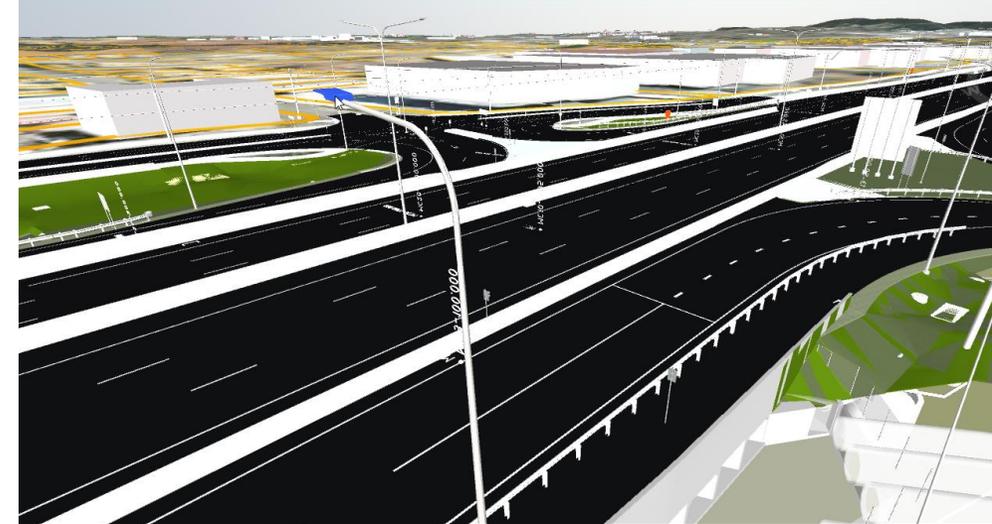
# Project Snapshot

## Infrastructure Design

The Rocklea to Darra upgrade Project is part of the master plan to finish the full 19km/12mi upgrade of the Ipswich Motorway and will tie into already completed upgrades.

The Integrated Joint venture team established a BIM Management plan, which included the use of Digital Markups, Collaboration systems.

This allowed design clarity through visualisation & attribute information and presented through a Navisworks federated model.



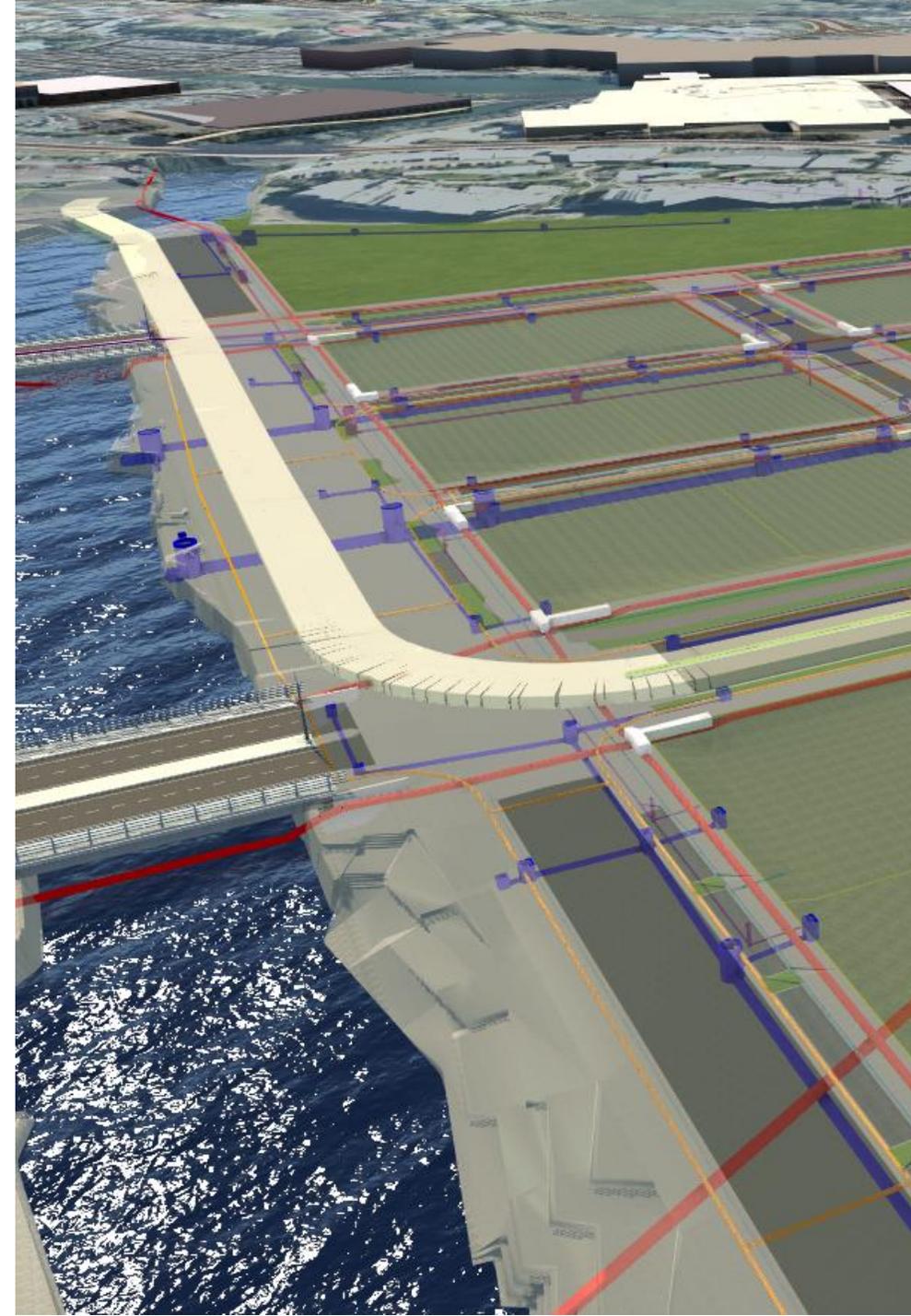
# Project Snapshot

## Integrated Utilities Design

A 53ha/131acre former golf course site that includes commercial, retail, residential & cultural precincts with 40% of the site to be parks and waterways.

As part of a Smart City approach, all data had to be accurate, spatially correct, & contain appropriate attributes.

With this came intelligent clash detection of the services allowing the construction teams to have clarity over the process.



# Project Snapshot

## Sporting Precinct

A \$22m sporting precinct to cater for all sports, ages and genders.

Data was gathered through multiple sources, shared via a spatial data store.

Due to the CDE, all of the data & design were able to come together in Infracore to create a model which we used to convey our design intent to the client.



# Project Showcase

## Calderwood Land Development

Calderwood is a 700ha land development site 2 hours south of Sydney. Cardno first started working on the project in 2003 & have continued to work on the project through master planning to the current construction & sales phase.

The site will yield 4,800 homes for an estimated 12,500 residents over 14 stages, due for completion in 2035.

It includes schools, childcare centres, parks, playgrounds, sportsgrounds, a village & town centre, as well as an extensive network of bike and walking trails.

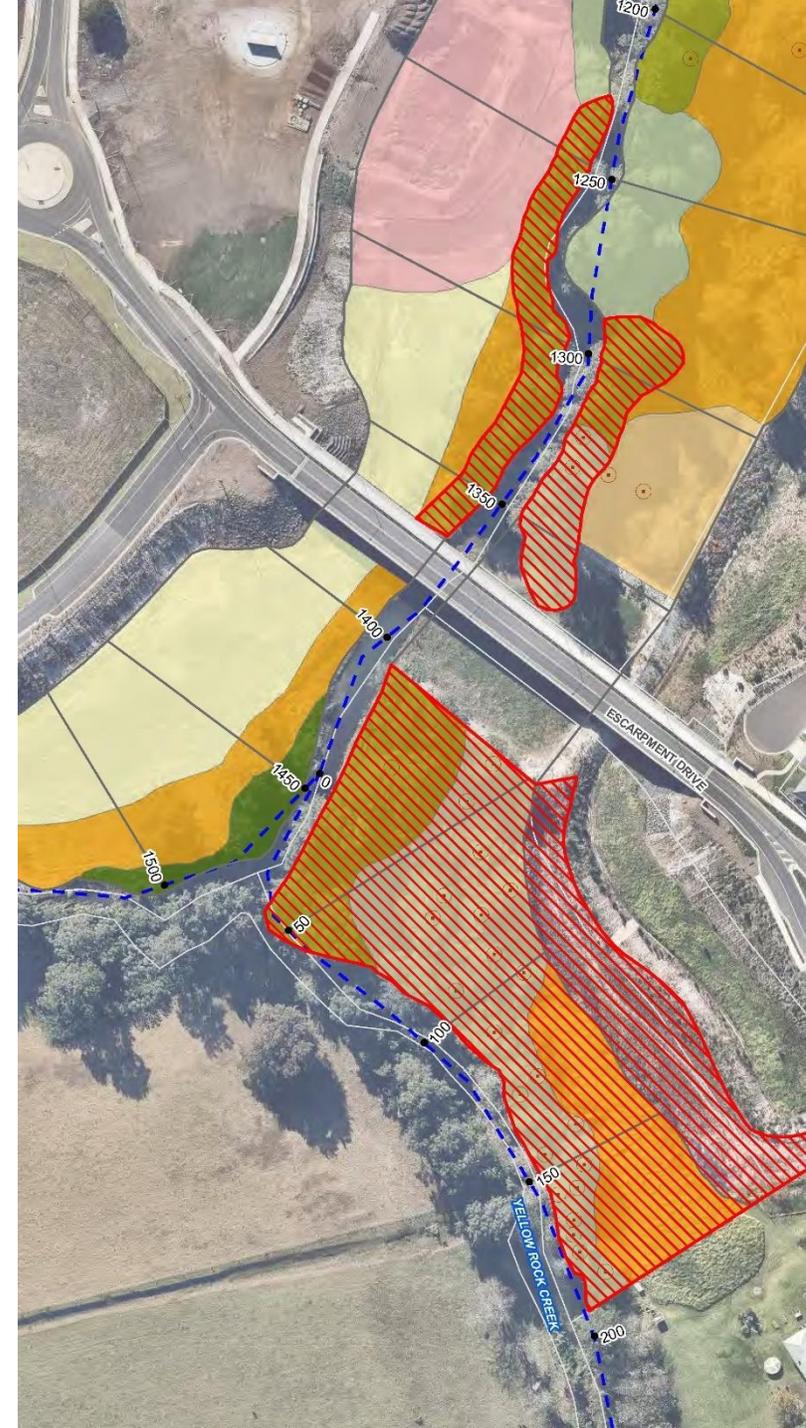


# #1 Common Data Environment Calderwood Land Development

The "Calderwood Spatial Data Store" was created to centrally store, manage and disseminate spatial data to all stakeholders.

This contained all the spatial data relating to the project in formats suitable for all required platforms.

All data was required to have naming conventions and metadata and follow a specified "Theme" based structure.



## #2 Data Capture

# Calderwood Land Development

**This project utilised a wide variety of data acquisition methods.**

- > Publicly available information e.g. Google Earth & government web services
- > Mobile GIS, starting with ArcPad through to Collector & Survey123
- > Aerial imagery from Nearmap and UAV
- > Elevation data from Aerial Laser Survey, ground survey and UAV photogrammetry
- > Acquired & created layout options, staging and master planning designs in CAD & GIS



## #3 Spatial Enablment

# Calderwood Land Development

The "Calderwood Spatial Data Store" in its earliest form was shapefiles and DWGs but progressed to a centrally managed data hub of Geodatabases and Xref DWGs accessible through all software including GIS, Design and viewing platforms.

All stakeholders working on the project had access to interact with all data for decision making.



## #4 Partnerships

### Calderwood Land Development

The project team partnered with the Autodesk EPS team, Esri Australia and the Cardno Technical Team to deliver cross platform solutions for the client.

Cardno was able to better communicate our design options, streamline our delivery of the development vision and assist our client's sales teams.



Microsoft



nearmap.com

# #5 Project Lifecycles

## Calderwood Land Development

Cardno adopted our lifecycle principles during the 3 stages of design.

**Investigate** - data integration with imagery, elevation, constraints & master planning information combined with civil design models

**Design** - bring the team up to speed using integrated modelling techniques to complete lot grading, solar & options analysis & utilities clash detection

**Communicate** - Utilised technology to deliver design intent, gain approvals & assist sales and marketing via smart devices, web portals, VR and AR.



# #6 Integration

## Calderwood Land Development

Interoperability was integral with 8 disciplines involved and a wide variety of software including ArcGIS Desktop/Enterprise/AGOL, Autodesk Infracore/Civil 3D/Revit/Navisworks, 12D, SMS, Tuflow, FME & MapInfo.

**This specifically led to enhancements such as:**

1. Visualisation using Autodesk Infracore with Virtual & Augmented Reality
2. Data Driven Pages in ArcGIS to produce hundreds of sales plans
3. FME for automated data conversion and sharing



## #7 Benefits

# Calderwood Land Development

**Compare Design Options** – Increased efficiency by reducing time & cost required to compare design options

**Improved Communication with Stakeholders** – User friendly deliverables to assist in communicating with approval authorities, clients and the greater community.

**Increased Efficiency in Sales** – Improved release information to assist with marketing and sales. High resolution 3D imagery in conjunction with interactive web portals and virtual reality.

**Coordinated Design** – Potential reduction in construction costs through better communication and planning through the design and construction process



# Take home messages

**Partnerships** - Work together as people & platforms to collaborate and create the best possible solution.

**Data Management** - GIS & BIM integration at its core is about data, you can't achieve optimal integration without making good spatial data the centre of your project.

**Benefits** - Don't just follow a mandate or a standard integrate your own business requirements.

# About the Presenters

**Liz Fulton** is GIS Operations Manager of Cardno throughout the Asia Pacific region. She is responsible for the Cardno spatial system including data, standards, training, infrastructure and users. Liz is passionate about the spatial and surveying industry who along with being a consultant is a member of the NSW Board of Surveying and Spatial Information and a GIS Educator who is always looking to spatially enable people.

**Blair Cheyne** is the Global Technical Services Manager at Cardno, where the Enterprise Technical Services team he leads is responsible for the working environment of GIS, BIM and CADD within the organisation. He works closely with business leaders to deliver innovative solutions to the ever changing digital project requirements of a global, multi-disciplined private consultancy.

Contact us – [ets@cardno.com](mailto:ets@cardno.com)

