Streamlining Workflows

The Integration of 12d Model, 12d Field, and GIS

Bundaberg Regional Council
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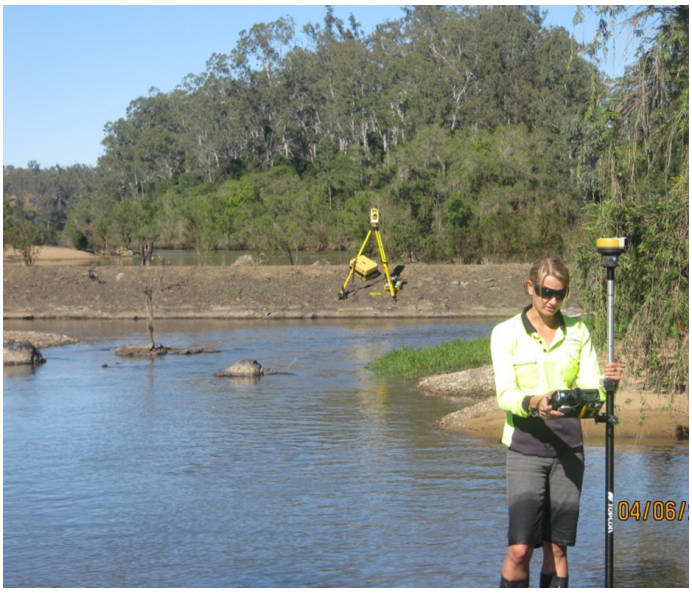
CLIENT: Bundaberg Community

SCOPE:

Combination of 12d Model, 12d Field, and Feature Data Object (FDO) technology in Council, allowing for their cost effective integration.

12d DIMENSIONS:

- Customisation



Survey field trials using Toughbooks with 12d Field and FDO technology. Wireless broadband allows direct connection back to ArcGIS servers.

Project Summary

The advent of new technologies such as 3D design models, high accuracy GPS, robotic total stations, GIS systems, portable computing and wireless broadband provides many tools to the modern engineer and surveyor. But it's the combination of 12d Model, 12d Field and Feature Data Object (FDO) technology in Council that allows for their cost effective integration.

For many years engineers, surveyors and designers have worked together and relied upon static data for use in their everyday work flows. Specialist software is traditionally used by each party and data is manually shared amongst teams by import/export. By integrating 12d Model, 12d Field, and FDO, this project has revolutionised that process, boosted productivity, and reformed historical practice.

Challenges

This project was developed as a result of challenging infrastructure delivery requirements following council amalgamations. More efficient methods of collecting and sharing accurate survey, design and "spatial" data were required due to a geographic area of 6500km2, limited design and surveying resources, restructure of operations, information technology network capacity, and file storage constraints, along with increased community expectations.

Council had previously implemented ESRI ArcGIS as its corporate Geographic Information System (GIS). In doing so it provided a central geospatial data store in MGA94 coordinates of all essential data including:

- Contours
- LiDAR
- Aerial Imagery
- Water, Sewer, and Stormwater Utilities
- Planning Scheme Mapping
- Flood Mapping

For their organisation, the move to the MGA94 coordinate system in detail surveys through to design enabled them to value-add, and integrate all of their geospatial data as well. The question was how this could be done without relying on traditional Shape File extractions. How could the surveyors operating in the field also access and utilise such vast spatial resources on demand?

In summary, Council's spatial data file sizes were large:

- Aerial Imagery in excess of 550GB;
- Over 1TB of LiDAR covering over 5000 km^2;

...and growing each year.

The following key outcomes were essential to success of this project:

- Establishment of partnership with Council's civil engineering software provider, 12d Solutions, to incorporate FDO technology into their 12d Model product for design and survey;
- Implementing a GIS "central data store" with direct linkages to design/survey software for raster and vector data;
- Eliminating the need for G.I.S. staff to provide spatial data to Designers and Surveyors;
- Eliminating GIS data duplication and processing issues during civil design and survey, in turn reducing file server storage;
- Providing surveyors on the ground with real time access to all survey, design and geospatial data in Council, regardless of location.

For more information

To find out more about how you can create better designs faster with the 12d Model solution for civil engineering design, visit www.12d.com.

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12d Model

Solutions

For many years, engineers, surveyors, and designers have worked together and relied upon static geospatial data for use in their everyday work flows. They tend to use their own specialist software to manually import spatial data from a GIS system which often includes property boundaries, storm water networks, water and sewer utilities. This often results in establishment of complicated management systems to control data quality and avoid duplication problems when sharing amongst project teams.

FDO Data Access Technology is an application for "… manipulating, defining and analyzing geospatial information regardless of where it is stored…and is free open source software" under a Lesser General Public License (http://fdo.osgeo.org/). For Council, it supported direct access to ESRI ArcSDE data store for vector data and a Web Map Service (WMS) of spatially referenced raster maps. It allows for sharing of spatial information regardless of operating platform.

A staged approach was taken to the implementation of FDO technology in council software to address the GIS connectivity issue. There were three key stages of delivery implemented in partnership with 12d Model software, in order of complexity:

- FDO provider for WMS – to connect to spatially referenced raster images
- FDO provider for ArcSDE - "read only" connections for vector data
- FDO provider for ArcSDE - "write" connections for vector data

Council's more urgent requirements stemmed from access to aerial imagery; this was a logical starting point and proved simplest to implement. All three stages of implementation were in place by late 2010 and are now common use amongst design and survey staff in Council.

The implementation of FDO technology in Council's work flows increased the return on investment (ROI) in their corporate ArcGIS system and 12d Model technology. It revolutionised how they conducted operations, and is likely to shift those of the wider industry experiencing similar problems.

While data connectivity between the GIS and 12d Model was resolved, the problem of how surveyors can use the data remotely to the office still existed. Council's old fleet of non-robotic total stations had come to their end of life. This provided Council with a unique opportunity to rethink how they delivered survey to the community and better interacted with the spatial data at their fingertips. 12d Field was implemented with new Topcon GPT-9003A robotic total stations to address this problem.

Council surveyors began to use Robotic Total Stations and GPS operated by 12d Field software on portable all-weather computers (Panasonic Toughbooks). In basic terms this meant:

- Conventional survey reductions in the office were no longer required as all data was collected and reduced on the fly, in the field, and instantly viewable on each surveyor's screen.
- The visual reference enabled instant error checking.
- Surveyors had access to the designer's entire 3D model for stake out, eliminating any requirement for manual data imports and data entry of coordinate tables.
- Full Windows functionality and access to remote file servers using NextG wireless broadband connections.

More importantly, it provided one of the only systems in the world that allowed Council to complete detailed survey using Robotic Total Station accuracy, and from the survey pole, instantly connect to and view any vector or raster data in real time from the ArcGIS system, regardless of their location in the region (this, of course, was on the proviso that they had wireless broadband coverage).

Using FDO connections, a central GIS data store, portable computers and wireless broadband meant that as long as the data existed in the ArcGIS system, the surveyor could connect to it and stake it out. If they needed to access aerial images in the field to see "what's over the next hill", they could. If they were asked on-site by construction crews to re-identify a water hydrant they just buried with asphalt (even though it wasn't picked up in their original survey), they could. They could do these things because Council assets such as water hydrants had already been collected accurately by RTK GPS and loaded into the GIS as part of their asset maintenance programs. This made them locateable using 12d Field by connecting directly to the ArcGIS system. In theory, if the data already existed in the GIS or file server, Council could better deal with the "While you're here can you set this out?" question which haunts the best of surveyors.

Opportunities explored

By using 12d products with FDO technology, designers were able to achieve all the advantages as well, being able to independently access any vector or raster data from the ArcGIS system. It improved efficiencies in investigation and detail design work. The FDO technology also allowed "write" access back to the GIS, enabling any CAD/Design work, or survey data for that matter, to be written to ArcSDE. This made it instantly viewable on their corporate web mapping system to hundreds of staff, or externally to the public through Council's internet mapping if required.

For example, being able to "write" data back to the GIS directly from the surveyor's pole in the field allowed them to collect accurate spatial data and instantly publish to ArcSDE where it could be viewed on the internet using web mapping applications. This type of scenario had been impossible for Council to achieve previously, but the integration of 12d Model, 12d Field, and FDO technology gave Council the flexibility to do so, whilst removing redundancy of data in the process.

Since FDO technology was implemented in Council, many other applications for its use were found, including significant benefits in data validation of spatial information. As designers connected and view the data, they were also able to validate it against survey accurate information that had been collected. It added to the process of continuous improvement, as more eyes looking at the data often leads to errors being found quicker and rectified faster, to the benefit of the whole organisation and wider community.

Spatial views were another development that Council applied within ArcSDE. By using unique IDs attributed to vector data, features such as road centrelines, water, sewer and stormwater utilities could be "linked" to the corporate asset management database and are now accessible via the FDO technology. Many thousands of attributes describing the asset could be viewed within 12d. This included basic information such as pipe diameters, material type and condition assessments through to more detailed info such as remaining useful life (RUL), road pavement and surface types, widths, and roughness values. Strategically, it satisfied the "single point of truth" issue and means that Asset Officers could be independently updating data which could be refreshed through the GIS and ultimately 12d, ensuring data was current.

Results

Queensland Floods

Bundaberg, like many Queensland towns, flooded twice during the devastating 2010 and 2011 floods. Hundreds of houses were inundated, and many roads washed away. The damage bill to Bundaberg Regional Council's road network was estimated at $60M. Queensland-wide, the cumulative bill was in the order of $7.5 billion, making the floods of 2010-2011 the largest and most expensive series of natural disasters in Australia's history. 12d Model software with FDO technology, along with 12d Field, played an important role, not only in helping to map catchments during the event, but also in the ongoing reconstruction that is underway and planned for some years yet.

Key benefits of the project:

- Council design and survey staff could independently access current spatial data in real time without the need for asking GIS personnel. If a dataset was updated on the GIS, it could be simply refreshed within 12d;
- Value-adding of existing software licences by allowing access to spatial data without having to learn or understand another software package, *e.g.* from 12d Model designers could connect to and manipulate data in ArcSDE;
- 'Single point of truth' for GIS data established, avoiding currency problems with multiple "versions", especially on large projects;
- Reduction of data duplication and file server storage (no export of static datasets and saving them to project files);
- Better decision-making in design with access to unlimited geospatial data;
- Reduced strain on wireless networks because staff no longer had to import and export 100Mb+ files;
- New ability to access topographic maps and large volumes of aerial mapping which could be overlayed on designs, making them easier to interpret;
- Better error-checking and validation of spatial data;
- Preliminary designs and initial investigations able to be done directly from GIS data such as high resolution aerial photography, utility schematics, contours and LiDAR point clouds, saving time in field trips;
- New ability to "publish" design and survey data to the GIS for display internal or external to the organisation.

Benefits are extensive to Council as this project provided spatial data from a GIS directly at the fingertips of those staff who used it most. Better still, it could be remotely accessed from the survey pole, on demand, in the field!

Commitment to Sustainable Practice

Sustainability is about reducing long-term cost through collaborative development. FDO technology is an open source solution; as such its ongoing development is driven by a worldwide user group.

During field trials and ongoing use, Council has been able to make significant productivity gains when considering the difference in time to access spatial data manually versus independently using FDO connections.

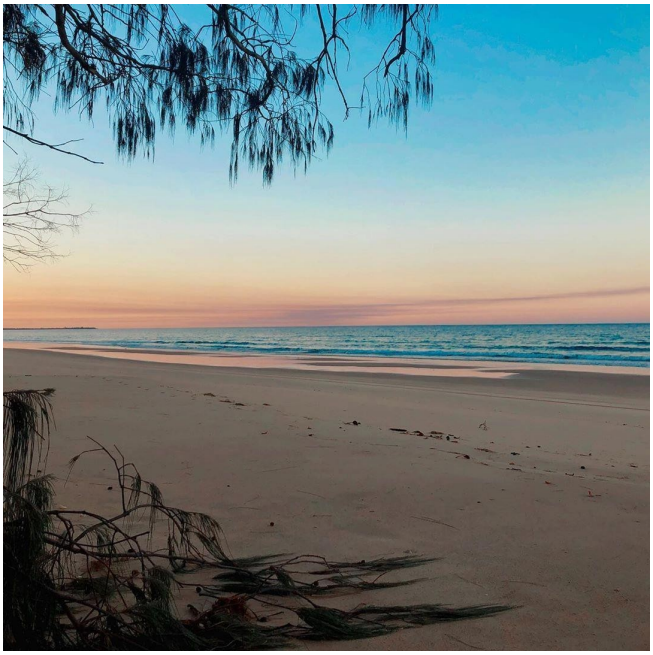
Many of the efficiency gains were somewhat difficult to quantify as they weren't always tangible. They included:

- Savings in file server storage and archival;
- Reducing risk of poor decisions from using old versions of static data;
- Eliminating time delays waiting for other staff to provide crucial information for your project;
- Significantly reducing the cost of site visits that may not have been required with access to spatial data (plus a reduced need for surveyors to "return to office" for on-demand requests for data not already pre-loaded to their controllers, but which could easily have been sourced remotely from the GIS).

Reduction in Environmental Impact

For Council's survey staff, FDO technology and the use of 12d Field offered fewer vehicle trips to the office for setting out data previously unknown to them. Along with reducing energy consumption for file server storage and archival processes, it ensured that Council's environmental impact is less than historical practice.

Fewer site inspections were required by designers and surveyors combining the use of 12d Model, 12d Field, and FDO technology. As an example, driving vast distances to ground truth some rural drainage catchments could be replaced with LiDAR point clouds in ArcSDE. Council estimated 90km per week in travel savings directly from the use of 12d Field and FDO technology. This equates to an annual reduction of about 1062kg in CO_2 emissions for the environment!



Burrum Coast National Park
Image source: www.queensland.com

Roads and Highways

12d Model's design option is the smarter solution for the design, modification and maintenance of Road and Highway projects.

Enjoy advanced 3D tools to design local and major roads, intersections, roundabouts, highways, interchanges and much more.

Ports and Dredging

12d Model is the solution for port infrastructure and dredging, easily managing the very large datasets and complex volume calculations often required by these projects.

A complete range of flexible and customisable volume calculation tools allow teams to extract and present the information quickly and easily.

Land Development

12d Model is the most versatile solution for the creation of sustainable land development projects, including residential, commercial and industrial developments, recreational areas, landfills, and agriculture projects.

Easily manage all aspects of your land development project from earthwork quantities, road design utilities and drainage design.

Airport Infrastructure

12d Model provides a solution for the design, construction and analysis of new airports, as well as the upgrade and maintenance of existing runways and airport infrastructure.

Easily manage large airport infrastructure projects and share data across multi-disciplinary teams.

Rail

12d Track has been specifically designed for the survey, design and construction of light, heavy and high speed rail projects.

Extensive railway tools in 12d Track allow the rail designer to quickly and easily design their projects. These options are built on the existing 3D modelling and design tools available in 12d Model.

Mining Infrastructure

12d Model's powerful set of exploration, site investigation, survey and analysis tools are crucial for the initial design, construction and ongoing operation of mining projects.

Comprehensive tools for the survey, design and construction of access roads, railways, earthworks and services allow for the coordinated design and management of mining infrastructure from within 12d Model.

Drainage, Sewer and Utilities

12d Model provides comprehensive tools for the design, analysis and optimisation of stormwater and sewer projects using rational, dynamic (hydrograph) and 2d drainage methods.

Powerful clash detection management allows for efficient 3D modelling of service networks such as gas, electricity, telecommunications and water prior to construction.

Surveying

12d Model is a complete surveying package providing the tools to manage all facets of surveyed data including LIDAR, topographical, as-built, conformance, traversing, geodetics, data mapping, labelling and much more.

The 12d Field option runs on a ruggedized tablet and gives the user access to full 12d Model functionality, allowing you to take the entire project into the field with the most comprehensive pick-up and set-out tools.

Oil and Gas

12d Model assists with the design, construction and mapping of oil and gas pipelines, original site exploration and the wide range of infrastructure required for oil and gas projects.

Accurate 3D modelling and the ability to share data between users allow teams to quickly and easily coordinate designs.

Construction

12d Model is the ultimate software for construction with powerful set-out options, direct interfaces to machine control and detailed conformance reporting and auditing.

Manage 3D data and control volumes, quantities and progress claims with 12d Model. Set-out your project and undertake conformance and as-built surveys live on-site using 12d Field.

Rivers, Dams and Hydrology

12d Model handles very large datasets and interfaces with a wide range of analysis packages, making it perfect for flood studies and the management of rivers and dams.

12d has partnered with industry leading analysis software, allowing users to apply 2D drainage analysis from within 12d Model.

Environmental

12d Model's ability to handle very large datasets combined with flexible and comprehensive 3D analysis and modeling tools make it perfect for a wide variety of environmental projects.

Existing workflows can adopt 12d Model easily as it allows users to directly interface with GIS systems and most software packages and file formats.

Why Choose 12d?

- **Powerful data processing & intelligent functionality.**
- **Modular, easy to update & completely customisable.**
- **Seamless integration with major industry software and hardware.**
- **Used in over 55 countries worldwide.**
- **Friendly support & training from industry experts.**

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