GHD
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CLIENT: Railcorp

SCOPE:

A model of the Combined Services Route (CSR) and its associated pits and structures.

12d DIMENSIONS:
- Road Design
- Rail

Project Summary

The Combined Services Route (CSR) project is for the proposed new city rail services from Glenfield to Leppington in NSW (GLRL project). The project involves the design of about 10km of rail track including earthwork, buildings, stations, roads, bridges and all the relevant power and signal services. GHD received the previously designed rail and surface tin, and was then involved in modelling the cables consisting of high-voltage cable, signal, and communication conduits running along and across the rail corridor.
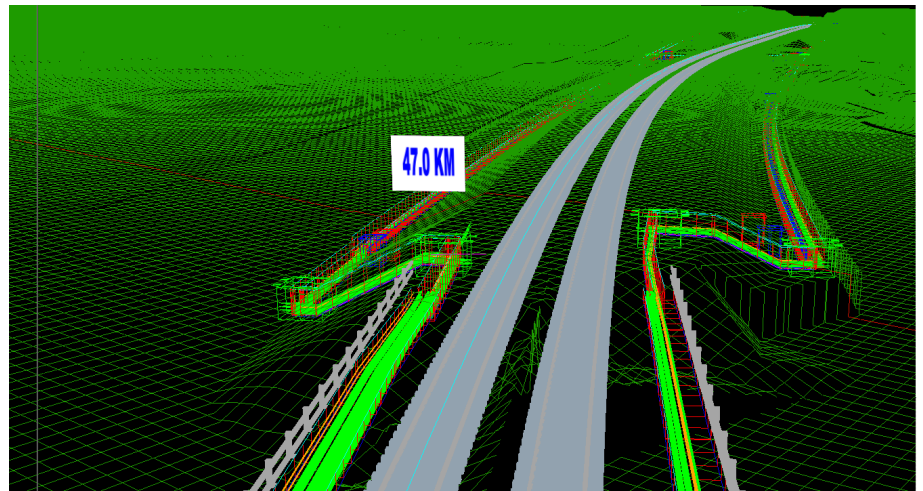
The various cables were modelled as conduits arranged in combined configurations running inside the different sizes of trenches. There were several hundred pits of various sizes for cable pulling and changes in directions. There were trenches that went across and under the railway (called ULX) and also cables above the ground placed inside galvanised service troughs (GSTs).

The Challenge

The CSR designed very often clashed with the drainage, sewerage and other objects. The earthwork, drainage and sewerage network were designed by different consultants.

As a result, the CSR route changed in location and height to accommodate various design and economic requirement, almost on a daily basis. Similarly, the pits, GST and ULX moved very often. There are hundreds of Apply Many functions that generate trenches and conduits along the 10km

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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Combined Services Route (CSR)

alignment with chainage generally corresponding to the pit locations. Any changes in length of the CSR and pit location require the chainage value in the MTF to be updated. Manually updating chainage in the MTF is very time consuming. A self-updating chainage MTF is required.

The configurations of the conduits are changed frequently, hence the templates need to be updated quickly. Manually updating the link in the template is time consuming and error prone. Tabulation of the template in Excel is required for other non 12d users for reference.

The pit quantity and locations are also changed frequently. The pits need to be shown in 3D for visualisation. Due to frequent changes in the design tin, a drape process had to be applied to the 3D pits.

In the visualisation process, the "string drive" video ran the entire length of 10km while still be able to provide a clear visual of the underground conduits, hundreds of 3D pits and its relationship with the other objects and the finished surfaces.

The Solution

Both the conduits and trenches were modelled with templates running along the superalignment with Apply Many functions. There are two very long super-alignments (the Up and Down Main) with more than 10km and several shorter ones. The configuration of conduits and trench sizes are grouped by types in alphabetical order.

The conduit super strings generated (which represent the HV, Sig and Com) are mapped to their respective diameter and colour with a map file. Pits are drawn in another package as single vertice blocks with individual embedded names. They are draped on the finished design surface but need to be output as 3D pits.

The outputs from 12d are the long sections, cross sections, pit schedules and visualisation.

Chains provided automation that sped up work and minimised error. Using the latest 12d modifier and computators, the chainages in the MTF were automatically updated with the change in the main alignment. Using computators, hundreds of marker point

strings (in numerical order) were created to compute the intersections of the CSR alignment and the pit locations (the point where the type of template will change). In a chain, the resolve commands updated their locations automatically. The templates were inserted via the MTF modifiers (fixed insert: start of other strings) that start from one marker string and run to the end of the next marker string. When the MTF functions were rerun in a chain, the conduits and trenches were updated automatically without manually updating the chainages.

The new conduit configurations were drawn in CAD. Initially the link of the templates was drawn as polylines in CAD by the drafting team. A simple list command extracted the info and pasted it into UltraEdit. The XY coordinates were then pasted into Excel spreadsheets that also generated the text version of the 12d templates. The templates in text format (in the form of '.tpl' files) were imported into 12d. Most of the generation of templates, MTF and chains was done using UltraEdit and its scripts.

Pits are imported as vertices and draped onto designed surfaces. Each type of pit carries its respective symbol. DWT files were created with the corresponding 3D blocks. Hence the exports from 12d were 3D pits with updated levels (Z-values). Later the 3D pits were re-imported (with Explode selected) into 12d Model as 3D objects for visualisations For visualisation, the using of mesh instead of texture tin enabled the underground pits and conduits to be clearly seen, while providing a feel of the design surfaces.

Some structures were rendered as faces to show the solid objects. Billboards with text of the chainage (in kilometres) were placed along the master rail corridor to mark the locations.

Result

The use of 12d Model on this project has enabled on-time completion and satisfied client requirements. Although no complicated macros were used, the application was innovative, particularly in draping 3D pits, auto updates of chainages and creating templates using Excel/ UltraEdit.

12d Model

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.
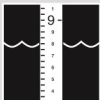
Rivers, Dams and Hydrology

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.**

12d Model