



## Case Study: Aurecon and Seequent leading the way for digital engineering

### AUCKLAND'S CITY RAIL LINK (CRL), NEW ZEALAND

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#### THE PROJECT

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Auckland's City Rail Link (CRL) project is the largest infrastructure project ever to be undertaken in New Zealand. It is a 3.45km twin-tunnel underground rail link up to 42 metres below the city centre, transforming the downtown Britomart Transport Centre into a two-way through station that better connects the Auckland rail network. The total cost of the project is estimated to be around NZ\$3.4bn and is jointly funded by the Government and Auckland Council (forming City Rail Link Ltd).

Aurecon was awarded the role of Principal Technical Advisor (PTA). They are working alongside a consortium of engineers and architects and Aurecon's main responsibility is to deliver the reference design. Ground risk is a critical factor on any major infrastructure project and has a direct impact on time and costs. Aurecon needed to do a detailed technical analysis of the ground conditions to identify the risks more clearly and then be able to communicate and mitigate these risks. The use of Seequent's 3D geological modelling solution – Leapfrog Works, enabled the team at Aurecon to achieve this. Construction of the rail link is under way and the completion date is set for early 2024.



***“This is linear infrastructure so there's no escaping challenging ground conditions when you're building an underground railway and infrastructure.***

***We didn't want the construction team to encounter unexpected ground conditions that would compromise the project or delay it. We had to get it right. ”***

Philip Kirk, Geotechnical Team Leader, Aurecon.

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## THE SETTING

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With Auckland's population growth averaging 2.9 per cent very year, the city's transport infrastructure needs to accommodate this growth. During the past decade, Auckland's rail commuters have increased from 2.2 million trips a year to 19 million. As well as the construction of the tunnel, the CRL adds two new underground stations – Mount Eden and Karangahape Road. When finished, it will allow trains to pass through most Auckland stations every 5 to 10 minutes at peak times. Put simply, the new City Rail Link will double the number of trains on the network, double the capacity of people on trains to 30,000 an hour and double the number of people living within 30 minutes of the city centre.

The scale and location of this project poses challenges. The geology in the Mt Eden area of the project is particularly complex. There are three volcanoes, with quite different characteristics to the north and south of the rail alignment. Over time, the volcanoes have produced ash and lava deposits, which are mixed in with soft sediments from historical swamps and ponds, hard basalt rock, and sandstone.

Aurecon's team undertook an extensive drilling programme to provide information on these underlying ground conditions. "Understanding the ground conditions and the insights gained through the drilling programme are crucial in terms of progressing and refining the design on the CRL in the next 18 months. We have already unearthed volcanic rock, soft sediment and reclamation material along different parts of the CRL route".

**Philip Kirk, Geotechnical Team Leader, Aurecon.**

Over 200 boreholes have been drilled in various stages of this project, recovering almost 5km of core. Historical records of over 1,000 boreholes with over 21km of core from around the wider project area have also been used to understand and model the ground conditions.

Engineers and construction teams need to see how these ground conditions interact with structures so they can make informed decisions on structural design, services relocations and construction methods. "Leapfrog Works has been an instrumental tool to support our ground engineering team, who are the interface between science and engineering". Says Philip. "Geologists need to be able to communicate the uncertainty in the ground conditions in a way that the engineers understand, relevant to the design".

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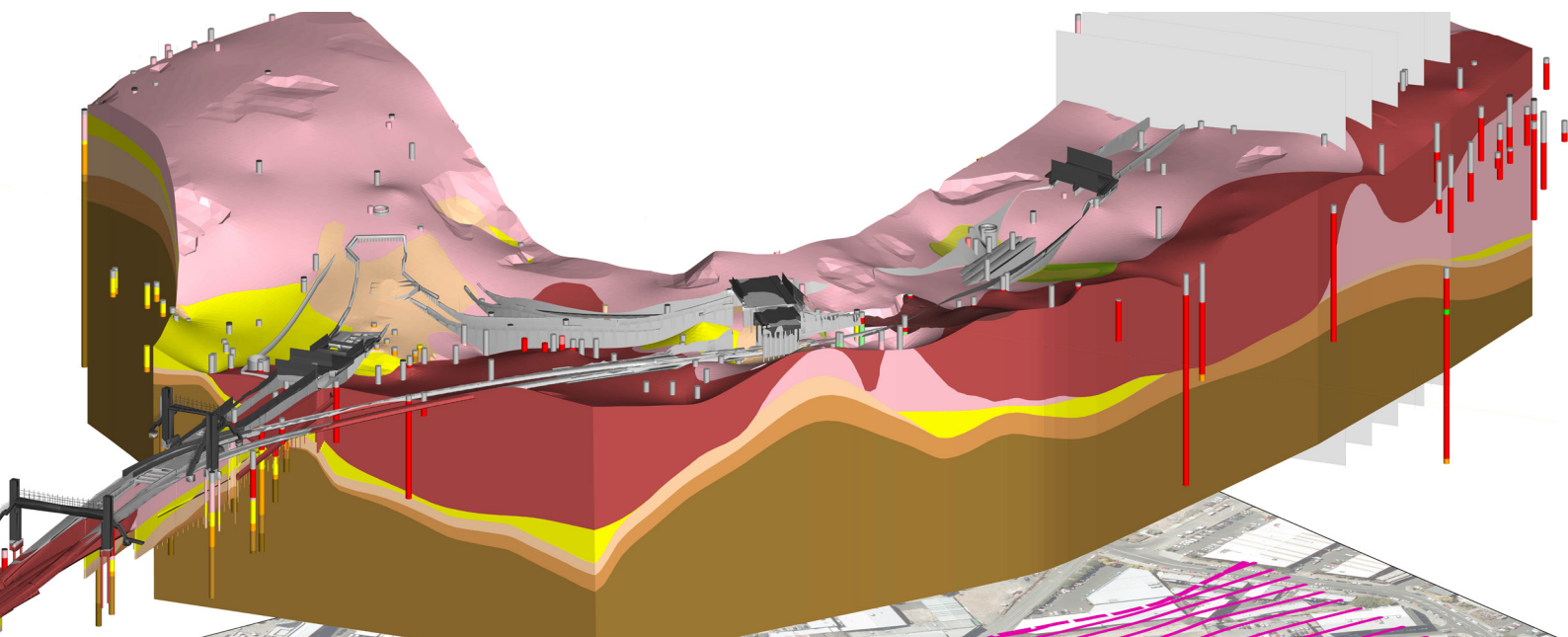
## THE RESPONSE

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Aurecon decided to use Leapfrog to assist in the detailed assessment of ground conditions. As they transform into a design-led organisation, rather than a traditional cost-out engineering company, it is technology like Leapfrog Works that supports their mission. Built specifically for the Civil Engineering industry, Leapfrog Works provides a complete solution for fast and dynamic modelling of ground conditions, analysis of the interactions with the engineering design, and intuitive 3D visualisation.

"Prior planning between engineers, supervisors, foreman and work crews is critical to ensure a smooth-running operation and identify potential clashes and eliminate delays. Often a decision will have downstream influences on other activities so good communication and managing change is key." — **Thomas Jefferd, Connectus Tunnel Box Project Engineer**

Aurecon prepared 3D geological models for parts of the CRL alignment and they used Leapfrog Works to deliver these geological assessments. "A lot needs to happen in order to construct the tunnels in the area with the most complicated geology on the project. This includes relocating stormwater and bridges and constructing several



new structures within a tight corridor.” Says Anita Nagy, Engineering Geologist with Aurecon.

“Leapfrog Works was really able to support the ground engineering team by facilitating better communication and interaction with our engineering design colleagues. The team were immediately surprised by how effective it was as a communications tool. This richer output of information is a vital tool for communication with project stakeholders. But even more importantly it’s about getting the designs right, from the start”.



Anita Nagy,  
Engineering Geologist,  
Aurecon.

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## THE OUTCOME

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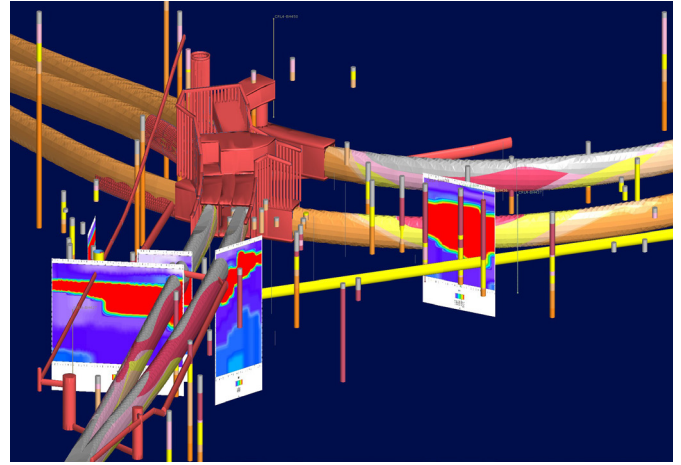
Leapfrog Works has helped Aurecon identify key opportunities in the reference design, that will ultimately save time and money over the course of the CRL project.

For example, shaft design details and ground improvement works at the Water Street shaft were revised and optimised to mitigate the ground risks in the area. This was an essential refinement to avoid project delays associated with inappropriate construction methods.

**“ We hope this is just the start of using 3D visualisation to communicate risks within a project and to help clients and contractors to make sense of them. This is the power of combining technical eminence and digital technology. ”**

Philip Kirk, Geotechnical Team Leader, Aurecon.

Tom Ireland, Aurecon Project Director for the PTA says, “I have found the 3D geological model an invaluable tool used to communicate ground risks to both stakeholders and contractors during the procurement phases. Better understanding of the ground conditions results in much better time and cost certainty.”



A great benefit of Leapfrog works is the dynamic nature of the application. The Aurecon team were able to change the ground model immediately, based on the live data coming from the onsite shaft borehole drilling. These changes to the model were then communicated quickly to the designer, who changed the types of pile to be used, thus saving the project team days and making sure the structure was as accurate as it could be.

Pat McLarin, Product Manager of Leapfrog Works, says, “We are really pleased that Leapfrog Works has been embraced by Aurecon on this major infrastructure project. The visualisation of the models is key and what that means in terms of risk and decisions to be made on the design. This has been really important to Aurecon’s ground engineers so that they can communicate more effectively to such a diverse group of stakeholders. Here at Seequent, we believe our innovative technology is leading the way in changes to the Civil Engineering industry and enables companies to embrace digital much more easily”.

As work continues on the City Rail Link project, Aurecon continue to use Leapfrog Works to deepen their understanding of the ground conditions and communicate changes and risks to the rest of the project team.

## Experience Leapfrog Works

Learn more or sign up for your FREE TRIAL [www.leapfrog3d.com/works](http://www.leapfrog3d.com/works)  
Or contact us at [support.civil@leapfrog3d.com](mailto:support.civil@leapfrog3d.com)