SCIRT Rebuilding Infrastructure

LEARNING LEGACY

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Setting national standards for utilities coordination and protection – SCIRT leads the way

Story: Utilities Location and Protection

Theme: Programme Management

A document which describes how SCIRT led the co-ordination of its huge repair programme with those of other utilities.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz

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Setting national standards for utilities' coordination and protection – SCIRT leads the way

Under Christchurch, thousands of kilometres of criss-crossing cables and pipes lay; a hidden world of essential services like power, sewerage and telecommunications, keeping the city ticking over.

Spaghetti junction: A jumble of underground services on Edgeware Road, Christchurch.

How would SCIRT manage and coordinate consistently and safely the repairs of damaged underground water and wastewater pipes with multiple other utilities similarly facing extraordinary repair programmes?

How would SCIRT mitigate the dangers of striking other utilities' networks and plunging the city into even deeper chaos?

Magnitude of the risks

Hitting existing services was not unknown in civil construction work. While everyone did their best to avoid strikes, they were expected.

It wasn't long before the SCIRT leadership team was doing the maths, calculating the alarming potential for service strikes given the magnitude of the repair programme. With more than 700 projects to complete, this multiplied the chances of strikes and raised the potential for workers and members of the public to be hurt or killed.

In the early days of the rebuild, many minds were focused on the health and safety challenges posed by the biggest infrastructure and city rebuild in New Zealand's history.

The unacceptable health and safety record of the country's construction industry compounded the angst.

Seek solutions

One of SCIRT's first initiatives was to create a utilities coordination role.

Dave Bain, new utilities coordinator, led the creation and documentation of detailed processes for SCIRT teams and contractors to locate and protect underground utilities.

Bain drew on the NZUAG (New Zealand Utilities Advisory Group) code of practice.

"My role was to work with all the other providers to make sure that when we were repairing the three waters networks, we were not hitting any of their services or damaging them and that we were coordinating our work with them," Bain said.

"We wanted to minimise the disruption for residents, road users and businesses when we went into an area. And we wanted to offer other utilities the opportunity to work in there at the same time.

"Importantly, we wanted to minimise the number of service strikes by our contractors on utilities' networks."

Lift the bar

SCIRT developed minimum standards for utility detection and protection that were adopted widely in New Zealand. They proved to be practical and transferable to any construction project and could be used more broadly than post-disaster recovery projects. The country's largest road funder, the New Zealand Transport Agency, adopted the SCIRT minimum standards and best practice for utilities for its road and construction contracts. That had influenced the civil construction industry performance.

The Christchurch City Council also adopted the standards for its "business as usual" programme and the Auckland Council utilised the standards for part of the city rail link project.

Bain also made a presentation to the New South Wales civil construction industry. It used the programme in developing its standards.

Early steps

A Utilities Management Plan was developed, outlining SCIRT's approach to coordinating its massive construction programme with those of other utilities.

Those utilities included overhead and underground power lines and telecommunications cables, gas pipelines, water, storm water and wastewater pipes and rail fibre lines.

The plan aimed to coordinate road design and utility services and settle any design and construction issues before physical work started, while striving for the more efficient use of resources.

Coordination challenge

One of the first major tasks was to streamline the process for accessing utilities' plans and maps. SCIRT designers needed to know where utilities were located in road corridors in order to avoid them during repairs.

In a typical civil construction project, designers would approach each utility separately to obtain service plans. Countless conversations and emails would ensue amid negotiations on new asset placement. This cumbersome process was impractical for the more than 700 SCIRT projects.

Over several months, SCIRT negotiated and secured an agreement with the major Christchurch utilities to electronically provide the rebuild entity with maps and network plans. Another agreement set out the rules of engagement for SCIRT and utilities working together to coordinate their work streams.

These were major achievements. The service plans were transmitted in a variety of forms, from paper records to older digital files. SCIRT's digital team moved the information into a compatible format with its GIS (Geographic Information System).

"GIS staff did a great job collecting all the information and making it useful for us," SCIRT designer Patrick Marshall said. "It saved gathering screeds of paper documents and plans from utilities individually."

The utilities also agreed that dedicated staff would liaise with SCIRT. While some utilities came to the party fairly quickly with the digital supply of network locations, others were naturally wary.

These large, conservative organisations managed multi-billion-dollar networks. The information was viewed as commercial property and not to be freely shared with the civil construction industry.

They also were concerned for the integrity of their networks and the safety of staff, and that some inexperienced subcontractors could be working nearby.

Criss-cross: Utilities cross over a new pipe at the intersection of Edgeware Road and Colombo Street in Christchurch.

Detective work: SCIRT team members use the Cat and Genny cable detection tool.

Gains in trust

It took some months to build the trust and collaboration required between SCIRT and the utilities and for all parties to realise their interests were aligned.

SCIRT initiated monthly meetings among the utilities to discuss the key issues and provide a briefing on upcoming work. It was the first time the utilities had all sat around a table for about 15 years.

Those meetings and the collaborative approach to processes and procedures on work coordination helped that trust take root.

“They needed us to show them that we could be trusted,” SCIRT executive general manager Ian Campbell said.

“SCIRT did that by developing minimum standards and put in place processes and procedures which gave them the confidence to work with us.”

Clear connection

Alongside the electronic transfer of information, SCIRT set up the Utilities Design Approval (UDA) system, a tool for tracking project progress.

For every project, SCIRT raised a UDA form in “Project Centre”, which was part of the organisation’s business information systems.

That UDA process was part of the project concept stage, where early design plans and project information - including expected start and finish dates - were placed on the UDA. It was then sent to the utilities and to the SCIRT Delivery Teams.

As a project moved into other phases such as detailed design and construction, more drawings and information were placed on the UDA and sent to the utilities, with a request for feedback.

Designers were required to:

- Talk with the ECI (early constructor involvement) coordinator from the Delivery Teams at the project concept stage.
- Provide utility clash analysis and document the results of utility location investigations.
- Engage with the utilities, and gain their agreement on the design and construction method for the SCIRT project and document that on the UDA form.

SCIRT design lead Iain Partington said UDA enabled an electronic dialogue about the SCIRT project where utilities could voice any concerns or issues.

These tended to be advice and warnings about their services near the SCIRT site.

Importantly, the UDA remained open as a record of correspondence and agreement between SCIRT and the utilities and helped keep track of a project from concept to construction completion.

However, it did not remove the need to talk to the utilities to resolve various issues.

“It meant that SCIRT’s work was visible to the utilities and it provided them with the opportunity to work at the same time in that street or area, if they chose,” Partington said.

However, the utilities rarely took up that opportunity.

Construction impact

SCIRT’s initiatives extended to the construction phase, where they had a major impact on Delivery Teams and their subcontractors.

Project managers, site engineers, supervisors, operators and spotters were trained to better read

service plans and locate services, and to a standard approved by the Delivery Team leader.

A non-compliance report had to be raised if a service strike occurred and procedures had not been followed.

In the event of a service strike, the crew was stood down and an investigation completed, as well as compulsory drug and alcohol testing of the crew.

Each contractor had to follow its internal disciplinary procedures.

Contractors were required to:

- Engage early with the SCIRT Design Team on the project.
- Contact utilities early on for their input.
- Accurately locate and produce adequate protection to utilities using industry best practice guidelines.

SCIRT raised the accuracy level for locating underground utility services.

Prior to the earthquakes, it was common to hand dig to visually confirm the underground position of utilities before construction started.

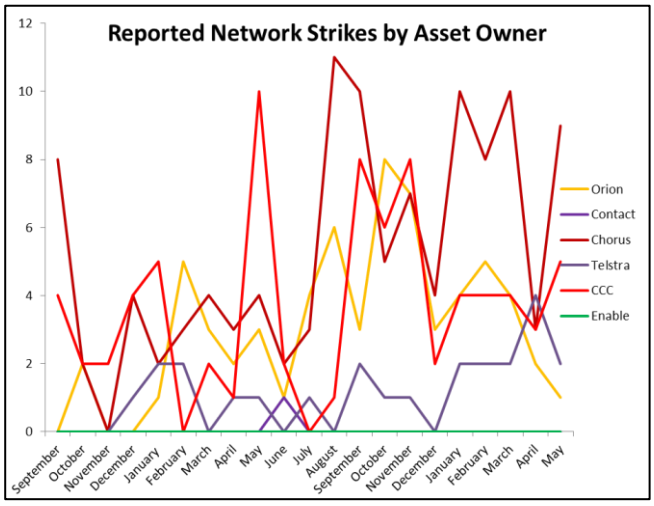
SCIRT decided that hydro or vacuum excavation to sight underground utilities was the default method. It was safer and less environmentally damaging than mechanical digging. High-pressure water loosened the soil, exposing the utility services.

This was one of the biggest industry changes for construction teams.

If hydro excavation was not practical or excessively expensive, the project engineer undertook a risk analysis and documented the reasons for not using hydro/vacuum excavation.

Other processes that were well established in Christchurch, such as the use of ground-penetrating radar (GPR) and radio frequency cables to confirm the underground location of services, were also expected to be used by the Delivery Teams and contractors.

Service location companies were required to provide the location to an accuracy of 100 millimetres, horizontally and vertically, one of the highest levels.



Impetus for change: SCIRT's record of service strikes in Christchurch up to May 2013.

However, these methods were more expensive.

SCIRT realised these costs had to be allowed for in project estimations.

A key commercial incentive for SCIRT Delivery Teams to follow the prescribed procedures for utilities location was that safety was a key area of performance.

Performance scores in several key areas determined work allocation.

Service strikes fall

The implementation of the utilities detection, location and protection programme had an impact on the rate of service strikes by SCIRT teams and subcontractors.

By 2016, the service strike rate had halved when compared with 2013.

SCIRT also introduced a measure to set the service strike rate in the context of the multitude of pipes, cables and power lines encountered by workers every day. For the life of the programme, SCIRT crews and subcontractors passed, successfully, 99.8 per cent of those lines, cables and pipes.

Utilities come to the party

Christchurch electricity network owner Orion was initially reluctant to share a lot of information with SCIRT and was concerned how it might be used by designers.

Orion network asset manager Shane Watson said the SCIRT UDA form was ideal for the sharing of information but to resolve more complex issues there still were plenty of phone calls.

A frustration for Orion was the constant change in SCIRT staff, requiring multiple conversations on the same issue.

“We could see how big an issue it was for SCIRT, with the sheer volume of work projects they had,” Watson said.

Orion also had its own programme of repairs, comprising some large recovery projects. However, it did not have much underground work to carry out.

Unfortunately, there was not a great deal of opportunity to work in shared road corridors because of the mismatch of repair project types.

“It sounds like a good idea but in a practical sense it is really hard to coordinate different contractors to be in there,” Watson said.

In addition, too many contractors in a shared space could slow process. Orion ran cables underground in a different way to pipes.

Working in the same corridor was achievable but not as straightforward as people thought, Watson said.

On occasions, Orion lines needed to be shifted to allow for SCIRT work and those were issues for discussion and negotiation to find a solution.

Similarly, in Aranui, where SCIRT built a new vacuum wastewater system, it was challenging to find space underground in the road corridor for the installation, street by street, of kilometres of new pipes.

From Orion’s perspective, it was not the cost of service strikes that was the major concern. It was the danger to staff and members of the public posed by the hitting of large electricity cables. That concern was amplified by the volume of SCIRT projects.

Watson said one of the benefits of the utility coordination system was improved productivity.

“In terms of the transfer of data, we didn’t see the volumes of paper going through that we could have seen,” he said. “I’m sure there was productivity gains there for Orion.”

Coordination between the utilities was critical given the extraordinary amount of work.

“It needed that coordination role that SCIRT led and it helped to resolve areas of differing interests,” Watson said.

National telecommunications network owner Chorus said the monthly SCIRT-led meetings were very useful.

It provided a platform for exchanging ideas and agreeing on how to work together, as well as providing updates on SCIRT’s upcoming projects.

Rob Ruiter, national lead for network protection at Chorus, said those meetings informed Chorus on the projects it needed to handle directly with SCIRT and the ones it could leave to contracted service providers.

While Chorus regularly talked to other utilities, the SCIRT-led process formalised those discussions.

The digital transfer of maps and plans from Chorus to SCIRT was difficult because of the broad age range of the Chorus (previously state-owned) network and the types of records, from paper to digital.

Marks the spot: Utility services in Aranui in Christchurch’s east are clearly marked.

Ruiter said the Chorus system did not lend itself to exporting information in a file type that was easily assimilated by other organisations.

However, SCIRT took the information in the Chorus format and managed to work it into SCIRT's more modern business systems.

He applauded SCIRT for setting up robust procedures and practices and developing a minimum standard for the industry.

Lessons learnt:

Utilities coordination is possible and critical for safety in post-disaster recovery: Utilities must meet, discuss and co-ordinate post-disaster repair programmes to ensure the safety of their staff, the public and their assets.

Bigger picture: Regular and open communication among utilities can provide an awareness and understanding of the bigger picture of the post-disaster repair and recovery demands in their areas.

Face-to-face meetings are effective: Monthly meetings of utilities' representatives in Christchurch, led by SCIRT, have provided a valuable forum for the airing of issues among utilities, information sharing on common challenges and an update on SCIRT's upcoming projects.

Prescribe processes for utilities location and protection: Detailed and clear procedures must be laid down that construction teams are required to follow to ensure the protection of underground utility networks.

Exploit modern IT systems: The digital transfer of utility network plans and maps to SCIRT has been a cost-effective and efficient way of streamlining a previously cumbersome and time-consuming process of gathering data from utilities.

(The UDA system offered a record of correspondence and agreement between SCIRT and the utilities and helped keep track of a SCIRT project from concept to construction completion.)

Coordination offers savings: Utilities in Christchurch have achieved savings through sharing costs and resources in areas where repairs have crossed.

High water: A water main strike in Gloucester Street, central Christchurch.