# IPENZ TRANSPORTATION GROUP CONFERENCE 2016: PRACTICE PAPER

## The sustainability journey of the City Rail Link

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## ABSTRACT

There is a perception that public transport is inherently sustainable, but delivering new infrastructure can come at an environmental cost even if the delivered outcome provides social, cultural, environmental and economic benefits.

The City Rail Link (CRL) seeks to address this issue by setting the benchmark for designing, building and operating sustainable infrastructure in New Zealand. From establishing targets and specific criteria, through to engaging with our contractors to construct in a more sustainable way, this paper will describe the sustainability journey taken by the CRL and the challenges and opportunities in striving to deliver sustainable infrastructure.

There is a focus on the 'early works' of the project for which we have engaged contractors on an Early Contractor Involvement (ECI) basis. Project context is provided as well as consideration of the implications for future works packages for CRL and for other transport infrastructure projects.

# INTRODUCTION

## Project context

The City Rail Link (CRL) is a public transport infrastructure project delivering increased capacity to Auckland's commuter rail network. The project, in the heart of Auckland, involves the construction of two 3.4km-long rail tunnels and two new underground rail stations with modifications to two existing stations. The designation to build and operate the CRL has been confirmed.

There are two main construction methods proposed for the CRL rail tunnels: Cut and cover with the tunnels dug from the surface, and tunnelling using a tunnel boring machine (TBM) which travels at some depth below the ground and significantly reduces impacts.

The cut and cover aspects of the works are being delivered in two 'early works' contract packages with an Early Contractor Involvement (ECI) approach. The remainder of the CRL, the 'main works', is at the reference design phase. Contract 1 (C1) of the early works includes underpinning the Chief Post Office (CPO) station building at Britomart and the construction of the tunnels under this and Lower Queen Street. Contract 2 (C2) involves the diversion of a stormwater main and the delivery of the two running tunnels up Albert St from Customs Street to Wyndham St. The ECI portions of the contracts were awarded in April 2015.

Auckland Transport (AT) is developing its procurement strategy for the construction of the main works and is currently undertaking market sounding, seeking early feedback on potential procurement considerations.

## Sustainability drivers

Sustainability is woven into the CRL Project Objectives, approved by the Auckland Transport (AT) board in 2012 (see below) as well as the Designation conditions issued in April 2014. The CRL project provides the opportunity to set a benchmark for designing, building and operating sustainable infrastructure in New Zealand.

The CRL Project Objectives are:

***Improve transport access into and around the city centre for a rapidly growing Auckland***

- *Future proofing for expected growth*

***Improve the efficiency and resilience of the transport network of urban Auckland***

- *Improving journey time, frequency of service and reliability of all transport modes*
- *Maximising the benefits of existing and proposed investment in transport*
- *Releasing the rail capacity constraint at Britomart*

***Significantly contribute to lifting and shaping Auckland's economic growth***

- *Supporting economic development opportunities*
- *Providing the greatest amount of benefit for cost*
- *Enabling a more productive and efficient city*

***Provide a sustainable transport solution that minimises environmental impacts***

- *Limiting visual, air quality and noise effects*
- *Contributing to the country's carbon emission targets*

***Contribute positively to a liveable, vibrant and safe city***

- *Enhancing the attractiveness of the city as a place to live, work and visit*

- *Protecting our cultural and historic heritage for future generations*
- *Helping safeguard the city and community against rising transport costs*

AT is in the process of establishing an organisation-wide sustainability framework. It is intended that work from the development of the framework will feed into the development of the CRL framework and vice versa.

## Sustainability context

There are two aspects to the sustainability of the project, the 'what' we are delivering and the 'how' we are delivering it. Whilst this paper focuses on the 'how', the context for both is described below.

The what we are delivering

Currently road transport contributes to over a third of Auckland's greenhouse gas emissions – see figure 1. The delivery of CRL will contribute to Auckland Transport achieving a more sustainable public transport system. It will double the peak capacity of the rail network as well as significantly reducing travel times, giving more vehicle commuters a viable alternative to their cars. It will also future-proof the network, allowing for potential rail expansion.

As such, providing the CRL at the earliest opportunity, to specification and within budget, has the potential to provide the most substantial sustainability benefits for Auckland through attracting drivers away from their cars. Ensuring that the project provides a service that meets users' needs and expectations and provides welcoming and appealing facilities will enhance patronage and consequently the sustainability of the project.

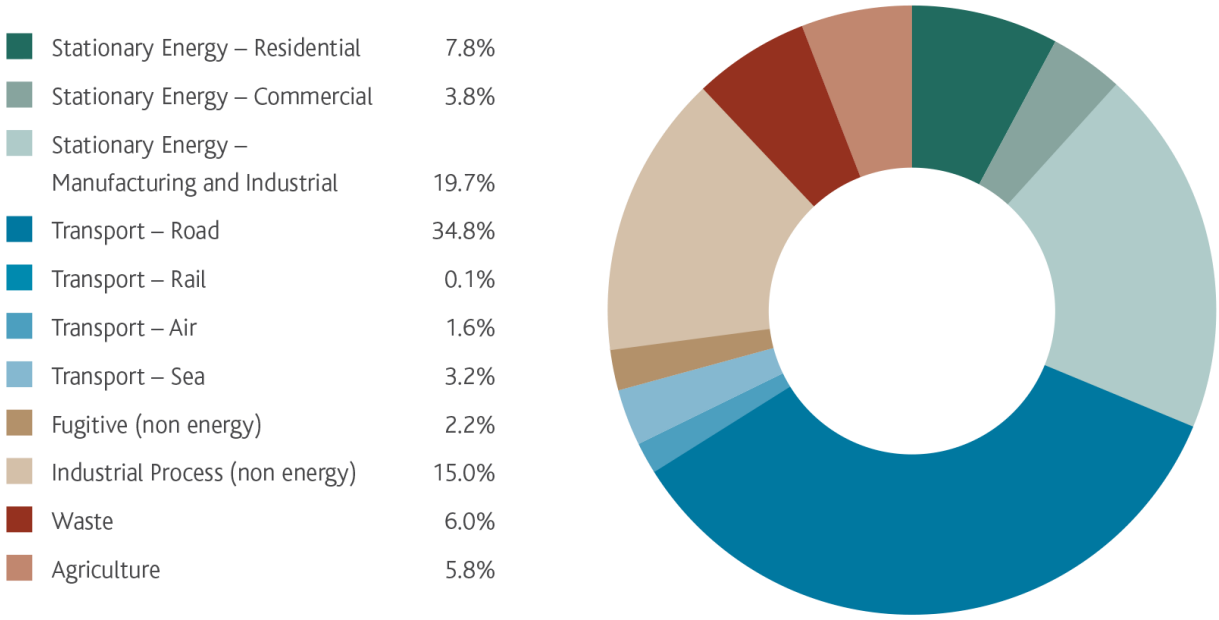


**Figure 1** Auckland's Emissions Profile (source The Auckland Plan)

The how we are delivering it

Constructing and operating CRL will have an impact. The materials, energy and water used and waste generated through construction, as well as operational energy, water and maintenance materials all contribute to the footprint of the CRL. This paper looks at the work undertaken by AT to address this by setting and applying sustainability objectives for the

early works contracts, applying the Infrastructure Sustainability (IS) rating tool and working with the contractors to reduce the project footprint.

### Construction footprint

As we move through the detailed design for the early works and the reference design for the main works, we have greater certainty around the impact of the construction of CRL. It is currently estimated that the project will use:

- Over 5,000 tonnes of structural steel
- Over 215,000 cubic m of reinforced concrete

and have:

- About 1km of cut and cover or top down box construction
- Over 50,000 sq m station footprint
- Over 3km of single bored tunnels
- Over 1 km of mined tunnels and adits
- 40 escalators
- 20 lifts

and produce:

- Over ½ million cubic m of excavated material.

## THE SUSTAINABILITY JOURNEY

### First steps

In 2013, a review was undertaken of sustainability frameworks and rating tools used by over a dozen large infrastructure projects in New Zealand and overseas. Eleven sustainability frameworks and rating tools from five different countries were reviewed for relevance to the CRL and the wider AT. The findings of this work concluded that the Infrastructure Sustainability (IS) rating tool from the Infrastructure Sustainability Council of Australia (ISCA) was the most appropriate for CRL, albeit lacking the cultural context required for NZ.

Using an existing established framework means we are not reinventing the wheel, and having a framework that is not solely tied to rail projects means that there is potential for other AT projects to benefit from the learnings in applying the tool. Adopting an Australian framework was also seen as beneficial in terms of receiving a level of (relatively) local support, with the ISCA offices located in Sydney.

### Infrastructure Sustainability

Infrastructure Sustainability (IS) is a rating system that evaluates sustainability across the design, construction and operation phases of the infrastructure lifecycle. It is a certification scheme that provides independent verification of sustainable outcomes. Targeting certification against this scheme requires the submission of documentary evidence to ISCA for independent verification.

| Themes | Categories | Score possible |
|---|---|---|

| | | |
|---|---|---|
| Management and Governance | Management Systems | 10.5 |
| | Procurement and Purchasing | 5.0 |
| | Climate Change Adaptation | 5.0 |
| Using Resources | Energy and Carbon | 10.5 |
| | Water | 7.0 |
| | Materials | 7.0 |
| Emissions, Pollution and Waste | Discharges to Air, Land and Water | 10.5 |
| | Land | 7.0 |
| | Waste | 7.0 |
| Ecology | Ecology | 10.5 |
| People and Place | Community Health, Well-being and Safety | 5.0 |
| | Heritage | 5.0 |
| | Stakeholder Participation | 5.0 |
| | Urban and Landscape Design | 5.0 |
| Innovation | Innovation | 5.0 |

**Table 1** IS themes and categories

There are six broad themes with 15 categories (see Table 1). The IS rating has a 100 point scale plus 5 bonus points available for Innovation. There are three certified levels shown in Table 2.

| Score | Rating Level |
|---|---|
| < 25 | Not eligible to apply for a certified rating |
| 25 - 49 | Commended |
| 50 - 74 | Excellent |
| 75 - 100 | Leading |

**Table 2** IS rating levels

AT, along with Auckland Airport and Panuku Development Auckland (previously Waterfront Auckland) all have projects that are or have been NZ IS pilot projects The pilot projects have collectively worked with ISCA to tailor a number of the IS credits to the New Zealand context to be trialled through the pilot phase.

## Setting the IS target

To enable an appropriate target to be set for the IS rating, a self-assessment of the early works was carried out against the IS criteria, using the evolving reference design. This involved engaging with the project's planners, engineers and architects to understand where the project currently sat in the context of the IS criteria and what the project could strive for. An initial conservative assessment, erring on the side of caution, resulted in an estimated score of 53.4, falling just within the 'Excellent' rating level. To some extent this provided initial endorsement of the quality of the outputs and the engineering solutions for CRL. It also demonstrated that it was within reach to target the Excellent rating level for the Design and As-Built certification phases.

At the time of setting the target no certified projects in Australia had achieved a 'Leading' rating and as a pilot project in NZ, targeting a Leading rating was not considered realistic for the project. Targeting Excellent was seen as an appropriate level to enable management systems to be developed and lessons learnt to be fed into targets for future construction packages or other AT projects.

As the reference design progressed and a better understanding of the IS framework was gained, it was established that it was realistic to set a target for the project of 65 points – a comfortable 'Excellent' score. Creating this target stretches the project to innovate and creates a comfortable buffer to protect the likelihood of achieving the Excellent when it comes time for verification.

During the reference design phase an IS Management Plan was developed setting out how we will deliver the rating. As a project we also worked to get early verification of some of our credits so they could become examples of 'how to' for us and our contractors.

## IS Project Outcomes

The *Management and Governance* categories of IS aim to influence internal project or asset management including decision-making, supply chain management and management of specific risk including climate change. Driven by the IS requirements, environmental and social considerations have been included within the risk register for CRL and in decision-making processes; both an environmental and sustainability policy statement have been included within the CRL project management system; and climate change risk workshops have been held with the project team leading to specific risks being incorporated into, and managed through, the main project risk register. Piloting these aspects on the CRL has provided the opportunity for understanding the benefits for introducing them to the wider organisation.

The *Using Resources* categories of IS focus on modelling and measuring resource consumption (energy, materials and water), identifying and implementing feasible opportunities to reduce consumption, and thereby achieving significant reductions in resource use across the infrastructure lifecycle. Undertaking this work is enabling us to better understand the operational impacts of the project and, applying dollar costs, provides inputs to undertake whole of-life-costing.

## Early Works Contract Requirements

One of the key outcomes sought through the ECI process for the two early works contracts was for the contractor to support the development of a Detailed Design that was optimised to provide the best outcome with respect to technical, operational, construction, health & safety, stakeholder, sustainability and all other relevant considerations.

It was key to set sustainability targets within the ECI contract to ensure the contractor understood, and was required to respond to, our sustainability goals. Four key requirements linked with the sustainability work stream were written into the ECI phase of the early works contracts, these required the contractor to:

1. Contribute to and not hinder the completed project's ability to achieve an "Excellent" certified Infrastructure Sustainability (IS) rating, with a target of 65 points
2. Develop a Waste Management Plan with the goal of zero waste to landfill through construction
3. Provide data and support the project in the creation of a carbon footprint
4. Provide monthly reporting on energy and water use and waste generation

The contractor was also required to provide a Sustainability Manager to manage the achievement of the sustainability objectives and support the construction team in the integration of sustainability into construction methodologies and documentary evidence required to support the achievement of the IS rating.

Further embedding sustainability outcomes into the contract, the integration of sustainability objectives and IS targets into construction methodology was included as one of the key performance indicators (KPIs) reported on monthly.

## ECI activities

At the start of the ECI phase, Sustainability Managers from C1 and C2 held workshops with their respective construction teams to upskill them on the project's sustainability objectives and to generate sustainability opportunities registers. These workshops identified ways and means that the project can reduce materials, energy and water use and waste generation. These opportunities have been tracked during the ECI phase with some identified as not applicable and others planned for construction. The use of a hybrid excavator for earthworks was identified as an opportunity, but due to the nature of the excavation in the construction methodology it was established that the potential savings would not be realised on either contract and so this has not been adopted. After investigations however it has been established that the use of a 5% biodiesel blend in construction plant and machinery is feasible with associated reductions in greenhouse gas emissions.

C2 identified an opportunity to reduce carbon associated with construction by switching from a diesel generator to the use of grid electricity to drive the pipejack for the new stormwater main. Investigating this option identified that as well as a predicted 10% reduction in greenhouse gas emissions for construction, avoiding the need for a dedicated diesel generator would result in a cleaner, quieter local environment. This initiative has been adopted and is expected to contribute to a total 19% reduction in greenhouse gas emissions for C2 construction.

Sustainability forums have been held bringing C1 and C2 together to collaborate and share on project developments, learning outcomes and initiatives to drive sustainability across the two early work contracts. One of the outcomes of the collaboration has been C1 and C2 aligning the sustainability questions going out to their suppliers and sub-contractors, assisting with providing consistent messages to industry around the CRL project's expectations.

With AT measuring the carbon footprint of the project, our contractors were provided with a 'simple' carbon calculator so that during design optimisation, when options were being evaluated, the carbon impact could also be considered. Including this in the decision making process has been valuable in terms of understanding materials and energy use as well as potential waste creation resulting from design and methodology changes.

In terms of the IS process, during the ECI phase the contractor provided input into the IS Management Plan drafted by AT. 'Technical Clarifications' required on the IS guidance and 'Scope Outs' (credits not applicable to our works) were also identified and issued to ISCA. These have been resolved to assist us in moving forward with the right priorities.

<u>Waste management planning</u>

Part of working towards achieving zero waste to landfill during construction has been the production of Waste Avoidance and Resource Recovery Management Plans, identifying anticipated waste streams during the ECI phase and applying the waste management hierarchy: avoid, reduce, reuse, recycle, treat and as a last resort – dispose.

For C1, where there will be refurbishment of existing facilities, a focus area is the reuse of items from the CPO into both the temporary facilities being located to the rear of the glass

house and in the finalised CPO. As well as identifying opportunities for fixtures and fittings to be used in other AT facilities, investigations have taken place into repurposing materials such as the potential reuse of existing bluestone tiles as an aggregate in the finished polished concrete floor. For C2 a focus area is the productive reuse of spoil, and where practicable reducing excavation volume.

### Working with Mana whenua

The CRL Mana whenua forum, comprising eight Auckland Iwi, meets monthly. A design sub-group of this forum meets separately to focus on integrating cultural narratives into the station architecture and public realm design, reporting back to the main forum.

The IS framework was presented to the CRL Mana whenua forum at the time that the ECI contracts were being tendered. Strong concerns were raised by Mana whenua about the use of an Australian tool, with little or no consideration of cultural values. As discussions evolved over time, a sustainability sub-group of the forum has been established and we are now working with Mana whenua to identify opportunities to respond to New Zealand's cultural context within this framework.

A selection of nine credits (of the 52 within the IS framework) have been chosen to focus on and these are progressively being reviewed and amended to address principles of kaitiakitanga (guardianship). As this work progresses alongside AT developing an organisational sustainability framework, we are considering how this work might be applied more widely than just for CRL.

## FUTURE WORK PACKAGES

As AT carry out market sounding on the procurement approach for the main works, thinking about sustainability for this significant portion of design and construction is progressing. How sustainability is incorporated into the contract(s) for the main works may differ depending on the procurement approach. We are working to understand where real gains are being made in the early works and what requirements and activities are driving change.

ISCA recognise that currently the IS framework does not fully address all aspects of social sustainability and in Australia have undertaken scoping studies for both a workforce and an economic theme for the rating tool. We recognise that the CRL early works have also not fully addressed social sustainability to date and with the main works sustainability strategy are working to consider the social legacy of the project.

## CONCLUSION

The IS framework has enabled the project to kick-start its sustainability journey, acting as a catalyst for engaging with the project team to understand and gauge the project's performance and talk about what was achievable. Using IS has also provided a framework for AT to engage with our contractors during the ECI process. Overall we are making progress and delivering change, making strong gains in some areas but requiring better systems in other areas to have a greater impact on outcomes.

Embedding sustainability requirements into the ECI contracts has driven real change, resulting in the C1 and C2 construction teams being actively involved in identifying and investigating sustainability opportunities; measured predicted savings in greenhouse gas emissions from construction activities and waste avoidance and resource recovery plans being produced well ahead of construction starting. Undertaking this work during the ECI phase means that we are setting ourselves up to succeed during construction.

We are working to submit our IS Design rating for verification early 2016 – systems and processes are key to managing the work across all the credits that we are targeting. The early works are being a good 'pilot', a test of our sustainability goals. There is more we can do, and will be looking to do, for the main works.

The Management Systems category of IS is very strong, providing valuable guidance that can be applied to infrastructure at a project or programme level and this may be where the real benefit lies for AT as an organisation. The scale of CRL and the fact that the project sits within AT means that lessons learnt can be shared with AT as well as the wider industry. Understanding requirements and activities that are driving the best outcomes enables us to pick and choose the most productive parts of our sustainability work to implement at an organisational level and share with other projects. Once construction of the early works is in full swing, further lessons learnt can be shared and implemented across the business. This is just the start of the sustainability journey for CRL.