ADVANCED NETWORK MANAGEMENT – Hamilton and the Wider Transportation Network

AUTHORS

Nathan Harper – Presenter
Associate Director – Transport Advisory, AECOM
DDI: +64 7 834 8996 Mob: +64 21 805 601 Email: Nathan.Harper@aecom.com

Qualifications
Bachelor of Engineering with 1st Class Honours (Civil) 2001
Master of Engineering (Civil), 2006

Professional Affiliations
Member of the IPENZ Transportation Group (2003-17), National Committee (2016-17)
NZ Modelling User Group, Chair (2016-17), Vice Chair (2015-16), Committee member (2008-17)
Institute of Transportation Engineers (2003-17)
GIPENZ

Robyn Denton
Network Operations Team Leader, City Transportation Unit, Hamilton City Council
DDI: 07 838 6910 Mob: 021 971 127 Email: robyn.denton@hcc.govt.nz

Qualifications
NZ Certificate in Engineering (Civil)
Graduate Diploma in Strategic Management

Professional Affiliations
Trafinz – Board and Executive Committee (since 2010)
IPENZ Transportation Group

John Kinghorn
Traffic Engineer, City Transportation Unit, Hamilton City Council
Mob: 021 805 650 Email: John.Kinghorn@hcc.govt.nz

Qualifications
Bachelor of Engineering (Civil) (Hons), University of Auckland, 2006
Diploma in Civil Engineering, Waikato Institute of Technology, 2003

Professional Affiliations
Member of the NZ Institute of Professional Engineers (MIPENZ)
Chartered Professional Engineer (CPEng)

ABSTRACT

The OneNetwork partnership between Hamilton City Council, the NZ Transport Agency and Waikato Regional Council has embarked on a Detailed Business Case to identify how best to carry out Advanced Network Management (ANM) for the city and wider region.

Problems identified by the stakeholders include a lack of data on how Hamilton's network performs, and that outdated technology and systems restrict our ability to respond to our current and future transport needs. The benefits sought from solving these problems are improved network management and monitoring capability, greater optimisation across the transport network, and better informed customers.

This paper and presentation will discuss the journey taken by the multi-agency group in establishing the 'chicken and egg' need for investment, developing and assessing a range of options, and ultimately recommending staged investment in a co-located Traffic Operations Centre. This facility will be a step change in proactively managing the Hamilton and wider transport system, to make the best possible use of the existing investment in our network.

INTRODUCTION

This paper provides a summary of the process in developing a Detailed Business Case (DBC) for Advanced Network Management (ANM) in Hamilton and the wider transportation network that ultimately recommended the establishment of a Transport Operations Centre (TOC).

Where this project is unique is the approach needed to assess and identify the need for investment in a TOC through the business case approach, whereas other existing TOCs can 'self-justify' more easily by already having available the network data needed to do so.

BACKGROUND

In May 2013, Hamilton City Council (HCC), Waikato Regional Council (WRC) and the New Zealand Transport Agency confirmed an intention to work in collaboration and established a 'OneNetwork Charter' which aims to increase focus on integrated transport networks by encouraging a combined approach to the management, operation and future planning of Hamilton City.

HCC manages over 100 sets of traffic signals including those in Waipa District, Waikato District and the State Highway network in the wider Hamilton area. HCC also has numerous ITS assets including a real-time parking system, travel-time network, variable message signs, bus and parking systems, and numerous other ITS assets. Hamilton is also rapidly growing, signified by a 50% increase in the number of traffic signal sites in the last 5 years.

Investigation into the concept of Advanced Network Management, such as that done in other large NZ cities, had been identified as a project by the One Network Steering Group who are keen to explore how we can make the most of the urban capacity that we already have in place via smart thinking and intelligent infrastructure.

A steering group was established between the project partners to oversee the business case process.

STRATEGIC CASE

Access Hamilton

Access Hamilton 2010 (refreshed in 2014) forms the overarching Strategic Case for investment in Advanced Network Management. This strategy was developed by HCC and supported by the NZ Transport Agency Board. The Access Hamilton Investment Logic Map identified that problems remain with transport in Hamilton that need to be addressed, and the benefits of investing to address these problems.

The Access Hamilton workshop identified the following problems with the strategic approach to transport in Hamilton:

- ***Problem One:*** Hamilton's poor safety record means a high social and personal cost to the city (35%);
- ***Problem Two:*** Historical and current land use patterns have led to transport services and infrastructure provision continually playing catch up (45%);
- ***Problem Three:*** The existing transport network supports high personal motor vehicle usage locking in continued high car use for the future (10%); and
- ***Problem Four:*** Continued high personal vehicle usage means increased pressure on the transport network in the future (10%).

The benefits of investment were identified as:

- ***Benefit One:*** Less social costs incurred by the city (35%);
- ***Benefit Two:*** More aligned decision making (35%);
- ***Benefit Three:*** Delay/reduce the need to add to roading infrastructure (30%).

Activity Investment Logic Mapping

Based on Access Hamilton, the stakeholder panel developed Investment Logic and Benefits Maps for the Advanced Network Management activity as shown in Figure 1. This confirmed that problems remain managing the existing network in Hamitlon, and directly links to problems two and four, and benefits two and three from the Access Hamilton ILMs.

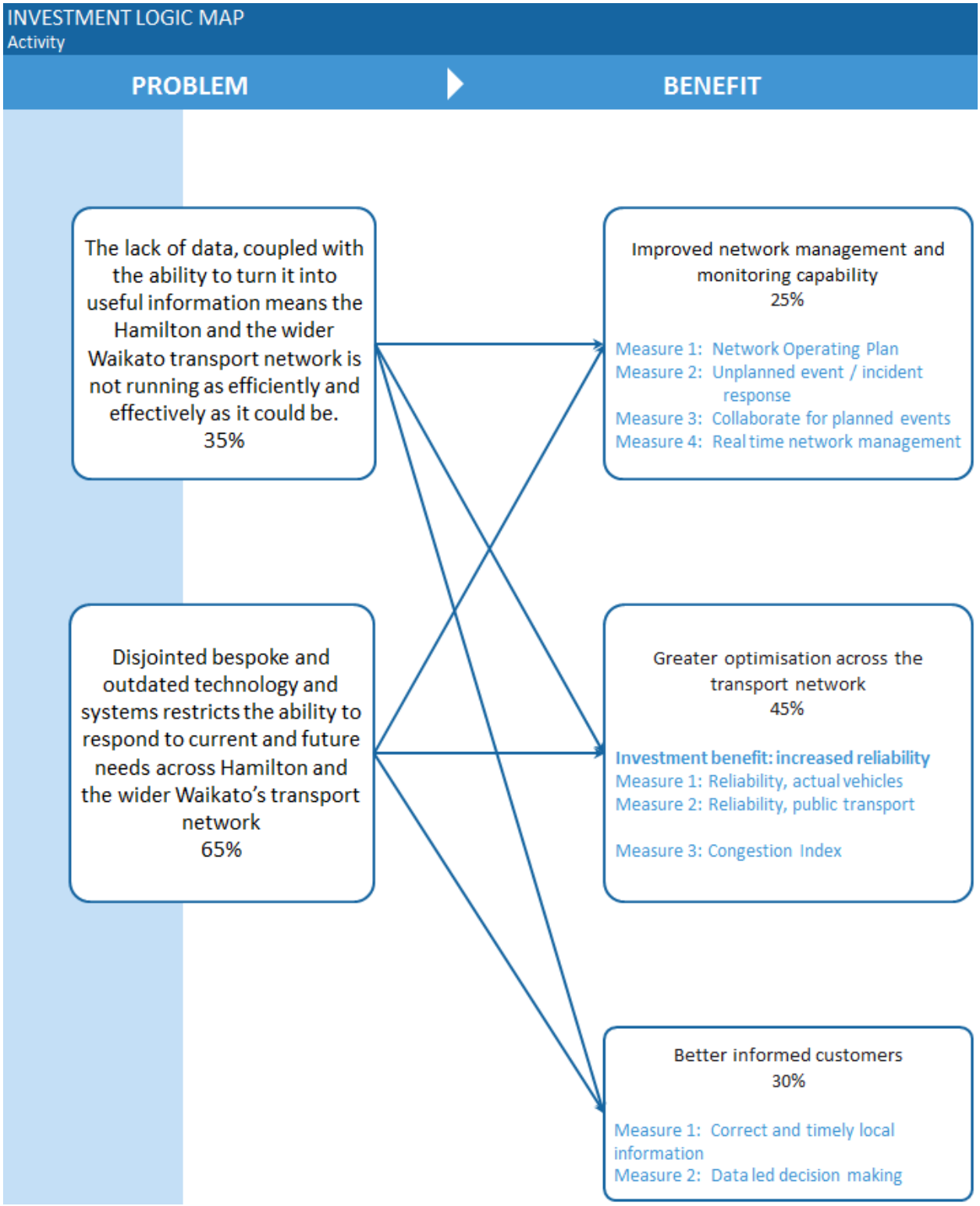


Figure 1: Advanced Network Management Investment Logic Map

Network Operating Framework

Implementation of initiatives such as the Network Operating Framework (NOF) that focus on strategic management leads to the increasing reliance on Intelligent Transport Systems (ITS). Traffic signals and other ITS are the main tools used to adjust network operation on a daily basis to make better use of existing capacity and minimise capital expenditure in transport infrastructure.

The SmartRoads NOF initiative was developed in Australia and adopted by the OneNetwork charter as a strategic investment for Hamilton. It recognises that the transport network is a complicated system with many competing demands and users. Rather than focussing on road maintenance and building network capacity, the NOF sets out to align and guide thinking on how best to make use of the existing transport network. The intention is that the network will adapt to respond to changing numbers of user groups throughout the day depending on where they are. Such an integrated process also allows explicit linking of transport to the adjacent land uses and agreed strategic objectives.

Figure 2: SmartRoads brochure cover

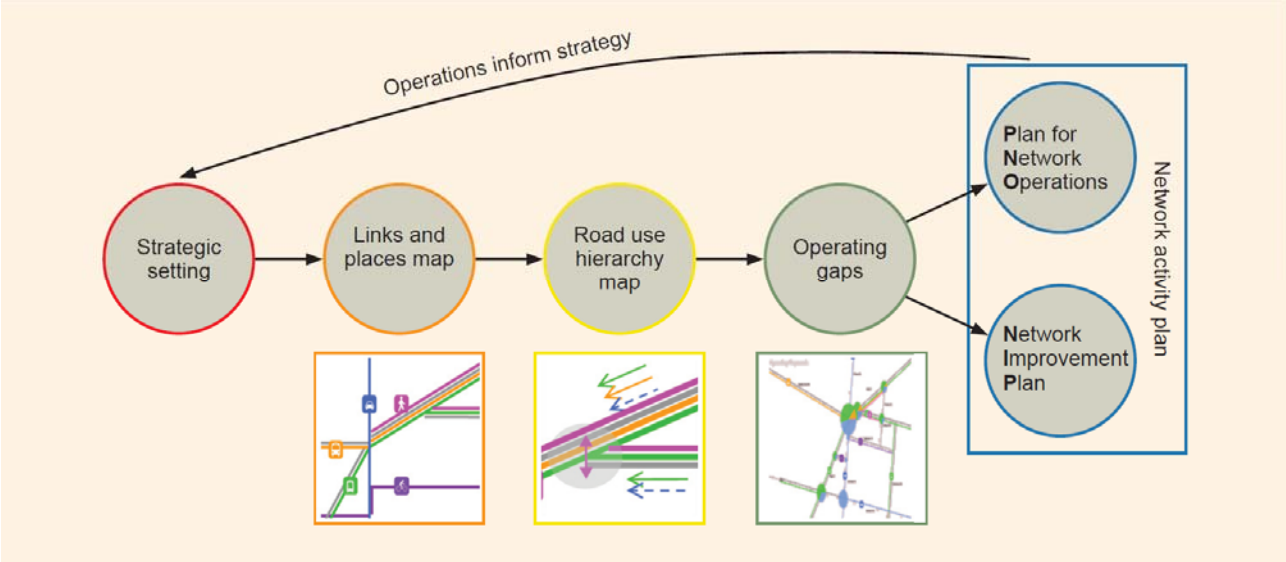


Figure 3: The Network Operating Framework Process

Hamilton has developed three documents under the NOF:

1. **NOF Overview Document** – The NOF Overview document sets out the NOF approach and priority for different types of transport users depending on the time of day and location. This puts into effect the strategic objectives and principles for the transport network that are held by each of the authoring organisations, such as Hamilton City Council's Access Hamilton. The strategic objectives and principles have also been summarised in the NOF Overview document.
2. **Network Operating Plan** – this document covers the day to day operation of the network in a way that seeks to optimise the existing infrastructure and reflects the priorities that have been assigned to each of the user modes by location and time of day. This document will be a key resource for the Network Operations Team (or TOC) and will guide the day to day

operation of the traffic signals on the network.

3. **Network Improvement Plan** – in many locations physical and operational changes will be required to the existing network infrastructure in order to achieve the level of service set out in the NOF Overview Document. The purpose of the Network Improvement Plan is to outline how and when those changes will be put into place.

The NOP will govern how the Network Operations Team and any TOC operate the network, and therefore it is a key strategic document for advanced network management. Any investment from this DBC will need to enable the NOC, and manage the network operations in accordance with it.

DETAILED BUSINESS CASE

Evidence Base

One of the challenges encountered in this business case was that current information to support the evidence base was limited. There was little measureable data available to support the two problem statements identified by the stakeholder panel (see Figure 1) and therefore no tangible evidence of the scale and magnitude of the problem could be presented.

For example, how do we know the network is not operating efficiently without the existence of journey time and other network operation information? And furthermore, how can the benefits of Advanced Network Management be quantitatively assessed?

There was some evidence available through existing strategies and studies indicating that there is a problem in data and network management in Hamilton. This includes Access Hamilton, the Network Operating Framework, Hamilton Integrated Transport Plan, and the Signals Operation Review (2011). In addition, modelling work undertaken as part of a number of projects within Hamilton, such as the Waikato Expressway Hamilton Section, the Hamilton Ring Road Wairere Drive Extension and Hamilton Southern Links, indicate that even with significant infrastructure improvements, problems related to journey times, journey time predictability and levels of service will continue to be problematic as traffic demand increases. The draft Hamilton Story (2013) brings together various work and shows that new infrastructure will reduce some of these identified problems, but over time the problems return for both the State Highway and local road networks.

These references were used in the Strategic Case to justify a need for further investment, along with a reverse assessment of investigating how much improvement would be required in order to economically support an investment in ANM.

Engagement

Of critical importance to this project was the successful engagement with stakeholders throughout the decision making process to achieve a greater ability to identify and develop a range of options, confirm options developed are fit for purpose, and to ensure buy-in to the decision making process.

A Community Engagement Plan (CEP) was developed early on that identified the consultation approach with the core team, key stakeholders and wider stakeholders.

The **core team**, responsible for day to day management, comprised of key team members from the consultant (AECOM) and clients (NZ Transport Agency and HCC)

Key Stakeholders, responsible for making decisions, included representatives from each of the three road controlling authority One Network Partners.

Wider stakeholders were engaged throughout the process which included field trips to other NZ TOCs (e.g. ATOC and TTOC) and discussion / workshops with WTOC, CTOC, HCC Transportation Unit, HCC crime prevention team, parking team, bus operators, maintenance teams, and civil defence.

Figure 4: Stakeholder Roles

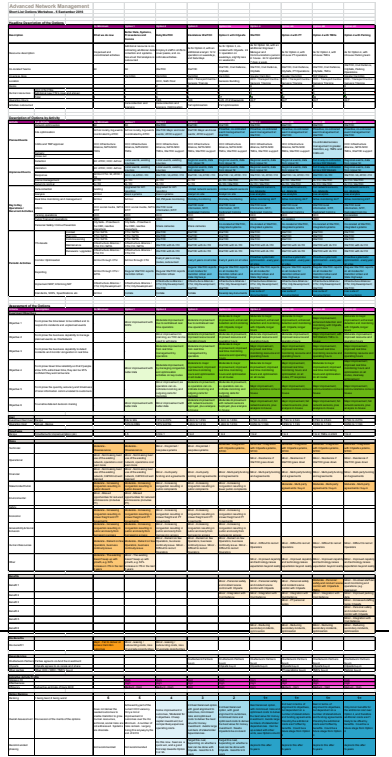
One of the key themes that came through from stakeholder discussions was the emphasis they placed on co-locating related activities and resources. As such, there was collective agreement that ANM activities would benefit from integration and co-location of the existing and required resources.

Option Development and Assessment

A long list of activities that would facilitate ANM was developed by the stakeholders to respond to the outcomes sought through the investment objectives. Activities were grouped into four key categories of Planned Events, Unplanned Events, Recurrent (day to day) Activities, and Periodic Activities as shown in Table 1

Table 1: List of Activities and Sub-Activities

Activity	Sub Activity
Planned Events	Network optimisation
	Site optimisation
	CARs and TMP approval
	Delivery
	Close out
Unplanned Events	Detection
	Validation
	Response
	Scene management
	Return to normal
Day to Day Operations / Recurrent Activities	Data collection
	Analysis
	Real time monitoring and management
	Inform
	Parking operations
	Public Transport operations
	Personal Safety / Crime Prevention
Periodic Activities	ITS Assets Management
	Corridor Optimisation
	Reporting
	Implement NOP; Informing NIP
	Standards, SOPs, Specifications etc.



A short list of options was developed through progressive

improvements to the long list of activities, and assisted by further discussions with other TOCs and stakeholders.

The shortlist comprises eight options, ranging from improving data, systems, procedures and communications using existing resources through to a fully functional standalone TOC. These later options would operate 24hrs, 7 days a week, require 5 additional FTEs, have varying degrees of integration with other partner units, and manage their own communications to stakeholders, clients and the public.

The options were assessed using a multi-criteria assessment by the project team against alignment to investment objectives, cost, timeframe, risks, benefits, dis-benefits, dependencies and an assumed indicative investment profile. A thumbnail of the option assessment is shown in Figure 5.

Figure 5: Option Assessment (right)

Recommended Option

Following the assessment of options and review by key stakeholders, the team agreed that a staged approach to implementation was desirable. The staged approach would be quicker to establish, speed up the collection and analysis of data to understand network performance, reduce costs in the short term, and be more politically acceptable and less risky to investors. There is also the ability to increase the ANM activities organically at a later stage to achieve greater integration and outcomes.

Given changing technologies and unknown land use growth in the future, it was agreed that the target investment timeframe of the preferred option should be around 3-5 years. It is likely that changing external factors will shape ANM activities beyond this timeframe, and it is too uncertain to predict how this will evolve beyond 5 years at this point in time.

The recommended approach is made up of two stages, Stage 1 being a stepping stone to the recommended Stage 2 being a standalone Transport Operations Centre (TOC). Figure 6 shows the recommended investment approach for AMN for Hamilton and the wider Waikato.

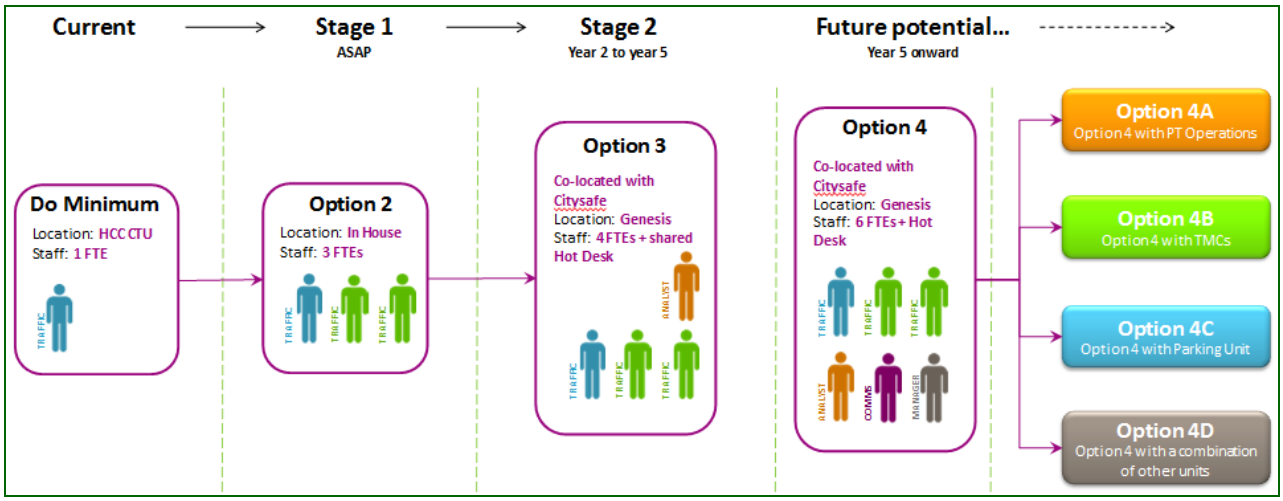


Figure 6: Recommended Investment Option

Stage 1

Stage 1 is seen as a 'quick win' as it delivers on the core needs of advanced network management without significant capital investment, whilst providing a good platform and way forward toward a standalone TOC in Stage 2.

Implementation of Stage 1 requires the employment of three full time equivalent (FTE's) engineering staff to be located in-house (assumed to be within the City Transportation Unit of HCC), who would carry out core tasks including:

- Real-time network monitoring during the weekday peak periods;

- Assist with optimising traffic management during planned events;
- Optimising the network during unplanned local events, including detection and validation of such events;
- Providing a public information updates on local network operation and incidents (via existing communication channels and teams such as the NTIT);
- Managing ITS assets, including developing renewal programmes and reviewing proposals for new infrastructure e.g. traffic signals;
- Coordinating regular reporting on Hamilton Urban network operation to the One Network Steering Group; and
- Implementing the Network Operating Plan.

The following activities would be managed by the staff but outsourced:

- Data collection (e.g. Bluetooth sensors which would be leased);
- Analysis of data (e.g. travel time data);
- Optimisation (Key routes to be optimised every two years through the use of consultants); and
- Additionally, staff members employed to deliver Stage 1 would play a significant role in establishing the Transport Operations Centre required for Stage 2.

Stage 2

Stage 2 provides a standalone TOC for Hamilton and the wider Waikato area. It is considered 'entry level' in terms of size and scale compared to other New Zealand TOCs, but is able to perform all key TOC activities to some degree. Implementation of Stage 2 requires the employment of an analyst to give a total of four FTEs.

These staff members would be co-located with City Safe and Civil Defence which enables efficiencies through resource sharing of staff and systems, and increased hours of operation to the point of 24 hours a day during weekdays and 21 hours a day during weekends. These operating hours would be able to be achieved sharing staff resource with City Safe. Peak periods for City Safe are offset from the traditional transport peaks, which would allow operations and CCTV monitoring staff resourcing to be shared efficiently.

A TOC of this nature would carry out the following activities over and above the activities undertaken in Stage 1:

- Real-time network monitoring during all peak periods (including Saturday), with monitoring staff on hand almost 24/7;
- Proactive network management of events by working closely with local TMC's and event coordinators;
- Optimising the network during and following unplanned local and regional events, including responsibility for the detection and validation of unplanned events for Greater Hamilton;
- Data collection using a combination of in-house data gathering (e.g. Bluetooth network) and external/commercial data sources, and analysis of data;
- Providing a public information updates on greater Hamilton network operation and incidents;
- Managing ITS assets, including developing renewal programmes and reviewing proposals for new infrastructure e.g. traffic signals (with support from the maintenance teams);
- Optimisation (all routes to be optimised every two years, with support from consultants);
- Regular reporting on the Greater Hamilton network operation for all modes of traffic;
- Implementation of the Network Operating Plan; and
- Develop local standards, specifications, and Standard Operating Procedures.

Throughout both stages staff would continue to work very closely with ATOC and TTOC. Close collaboration between regional TOCs will be vital to ensuring a consistent focus for the Waikato. It is envisaged that the TOC would also become a 'Centre of Excellence' with regard to data collection, analysis and reporting for the OneNetwork Partners.

Timeframe
Investment in Stage 1 should occur immediately upon approval of the DBC in order to achieve a step change in AMN for incident response, travel time reliability and real time congestion management. It is expected this interim option would be in place for approximately 12-18 months whilst the target investment option is implemented.

Stage 2 is anticipated to operate out to around 5 years, when it is likely that other partner units may organically collaborate with ANM activities, as shown in Figure 6.

Future Investment (5+ years)
Whilst outside of the scope of the current investment proposal, it is expected the TOC will encompass and house all relevant ANM activities for Hamilton and the wider Waikato. This would likely include further integration with the Parking Unit, the Traffic Management Coordinators (both local road and State Highway) and Public Transport Operations, as well as collaboration with key stakeholders such as the Police and maintenance contractors through the use of hot desks. This organic growth in size and capability has been the experience of the other TOCs nationally.

WHERE TO FROM HERE?

During the business case process two of the stakeholders finalised their plans to co-locate into new premises ('the Genesis building') in late 2017. The Genesis building is a centrally located IL4 rated new build, currently being constructed in close proximity to the HCC building.

An assessment of potential location options identified the Genesis building the ideal location as it provided the best benefits against each of the key considerations being cost, proximity to key partners & stakeholders, co-location benefits, resilience, and potential for growth. City Safe and Civil Defence are relocating their premises to the Genesis building in 2017, resulting in the co-location of the two organisations in a single location. Significantly, its rating as an IL4 building also forms the ideal location for the future TOC, whereby the transport operations benefit from the resilient building rating and efficiencies in co-location with key stakeholders. The ANM business case proved timely, and the opportunity was taken to secure this location for a TOC.

A governance board between the OneNetwork partners has subsequently been established and tasked with overseeing the contractual and funding arrangements during implementation of the preferred option.

We look forward to seeing NZ's newest TOC becoming established in the 2017-18 financial year.

ACKNOWLEDGEMENTS

We would like to thank the core team, project partners and all the stakeholders who willingly gave their time to bring their experience in assisting us with this business case.

Special mentions to:
- Steve Cox (NZ Transport Agency);
- Anuradha Fitzwalter (NZ Transport Agency);
- Andrew Wilson (Waikato Regional Council);
- Robyn Denton (Hamilton City Council);
- James Wickham (TTOC);
- Ryan Cooney (CTOC); and
- Matt Hoyle (ATOC).