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Auckland Transport, the New Zealand Transport Agency, Auckland Council, Kiwi Rail and Auckland International Airport

South-Western Airport Multi-Modal Corridor Project

Scoping Report

June 2011

INFRASTRUCTURE | MINING & INDUSTRY | DEFENCE | PROPERTY & BUILDINGS | ENVIRONMENT

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Executive Summary

Project overview, problems and opportunities

GHD was commissioned to undertake a study to identify the preferred route(s) and configuration of multi-modal transport connections to and from the Airport and agree the best manner in which such routes can be protected and provided for. The study area was defined in the RFT and has been broadly described as the south-western area of Auckland.

The extent of the indicative multi-modal corridor was defined in the RFT and ranged in the north from the existing Manukau Harbour Crossing to the Airport and the Manukau commercial and industrial areas to the east.

The study is being undertaken in three defined phases. This Scoping Report, along with an Indicative Business Case and a Sub Regional Strategy represent to outputs from the first phase of the study.

The Scoping Report is intended, on the approval of Auckland Transport, the New Zealand Transport Agency, Auckland Council, Kiwi Rail and Auckland International Airport, to form the basis for developing a Scheme Assessment for the project.

Central to the project, during the first phase, was the identification of the core problems which in part frustrate the ability to realise a number of opportunities. The project aims to address both the problems and opportunities. The core problems have been identified as:

- Insufficient capacity to meet transport demand;
- Quality of the transport system detracts from visitor experience and attractiveness of alternative modes; and,
- A lack of connectivity between communities, transport networks and land uses.

In addition to the three core problems there are three opportunities:

- An opportunity to realise the economic potential of the airport and its surrounding business community;

- An opportunity to transform neighbourhoods and communities through the careful integration of strategic planning, urban design, transport investment, and coordinated public sector intervention and support; and,
- An opportunity to facilitate a regeneration of industrial/commercial and residential land use within Auckland's south west through improved access.

Project objectives and vision

Following identification of the problems and opportunities a set of project objectives were established. These objectives took into account not only the specific project problems and opportunities but also the broader objectives contained within national, regional and district policy documents. The overarching objectives of this project and future protection of the preferred corridor(s) are to:

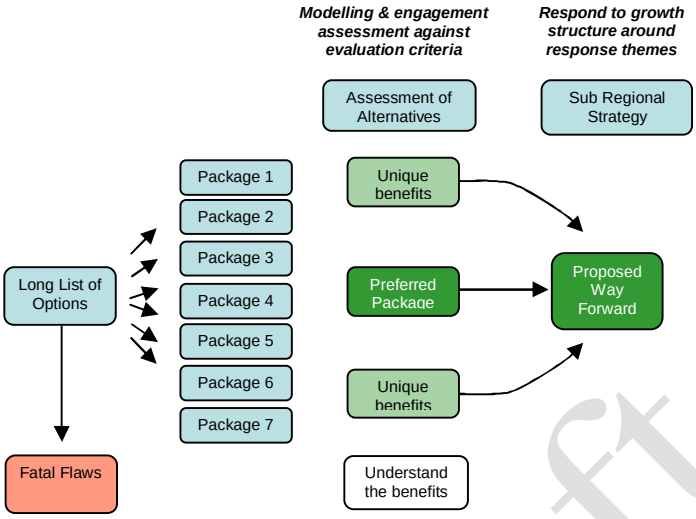
- Increase the capacity and efficiency of the transportation network to accommodate demand;
- Improve journey time reliability for freight and airport related traffic;
- Improve the visitor experience in order to enhance the reputation of Auckland and New Zealand within the global market;
- Broaden and enhance transport choices within the study area and the region to improve connectivity;
- Improve connectivity and access within the study area for local communities and facilities;
- Enable growth and development aspirations within an integrated and sustainable transport system;
- Capture economic benefits associated with the Airport Corridor and its role as a Global Gateway; and,
- Support the health and vibrancy of communities within the study area, by providing acceptable levels of access to employment, community facilities and recreational assets.

Achievement of these objectives and addressing the problems and opportunities would facilitate, if combined with complimentary land use changes, the realisation of a broad vision that the project team developed for the project. The project vision is ***to improve Auckland's ranking as an international city capitalising on the airport as a gateway to Auckland and New Zealand, whilst enhancing connectivity and the liveability and viability of communities in the study area.***

Option assessment

The first phase has concentrated on understanding constraints on topography, land use, ecology and geology as well as operational considerations including alternative modes of transport and their relative merits.

In undertaking the study a long list of multi-modal transportation options were established to meet the project objective and address the project problems. This long list was then narrowed down using a fatal flaw assessment to seven packages that represent a range of alternative solutions.



These packages were assessed during the scoping study. The primary RTN components of the seven option packages that were developed are summarised in the table below. In addition to the listed primary RTN components additional measures are recommended to be investigated but are not currently included in the benefit cost analysis.

Package descriptions

Package	Description
Package 1	A heavy rail loop from Puhinui to Onehunga via the airport design to run standard Electric Multiple Units (EMU's) operating elsewhere on the Auckland network
Package 2	A light rail line running from the airport to Onehunga and connecting either to a light rail network running into the CBD or a heavy rail station at Onehunga
Package 3	A busway running from the airport to Onehunga and connecting either to a busway or bus priority network running into the CBD or a heavy rail station at Onehunga
Package 4	A heavy rail branch line connected to the existing rail network in the vicinity of Puhinui running to the airport operating standard EMU's as used elsewhere on the Auckland rail network
Package 5	A heavy rail branch line connected to the existing rail network at Onehunga running to the airport operating standard EMU's as used elsewhere on the Auckland rail network
Package 6	An option involving running buses along motorway hard shoulders
Package 7	A heavy rail branch line connected to the existing rail network at Otahuhu running to the airport operating standard EMU's as used elsewhere on the Auckland rail network

Assessment of the Packages

The packaged were evaluated against an evaluation criteria as well as statutory documents. This included consideration of social and environmental issues, LTMA, GPS

and RLTS compliance. A summary of the assessment, as it relates to the project outcomes and success criteria for the strategic case, is included the following table.

Assessment summary [1]

Criteria	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7
Demand	Very Positive	Positive	Positive	Very Positive	Very Positive	Average	Positive
Quality	Very Positive	Positive	Positive	Positive	Positive	Average	Positive
Connectivity	Very Positive	Positive	Positive	Very Positive	Positive	Positive	Positive
Land use	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Feasibility	Moderate	Easy	Difficult	Easy	Moderate	Easy	Moderate
Cost	High	High	High	Medium	High	Low	Medium
BCR	Low	Low	Low	Medium	Low	Low	Low
Indicative Ranking of Packages [2]	**1**	**5**	**6**	**2**	**3**	**7**	**4**

Key **Effectiveness** - Impact of option against problems and opportunities

Very positive	Positive	Average or Neutral	Negative	Very negative

Economic efficiency (BCR) Very low < 0.5; > 0.5 Low < 1; > 1 Medium < 2, > 2 High < 4; Very high > 4

Key Risks

The most significant risks identified for the project going forward are:

- The project is delayed or does not proceed as a result of insufficient funding being available;
- The modelling assumptions are found to be overly optimistic or pessimistic leading to either project benefits not being achieved or demand for PT exceeds capacity;
- Public/stakeholders favour an option different from the study findings leads to pressured to amend the proposed way forward; and,
- Wider network constraints inhibit capacity / frequency and lead to erosion of benefits for the project.

[1] Rating is on a five point scale ranging from very positive to very negative

[2] The indicative ranking is based on a relative assessment of its contribution to achieving the project outcomes and success criteria for of each package. No weighting has been applied and it should be recognised that this ranking has been used to identify a primary package only. It is recommended that the proposed way forward include components, where deemed appropriate, from other packages so as to provide a resilient network wide solution more capable and likely to address all of the criteria.

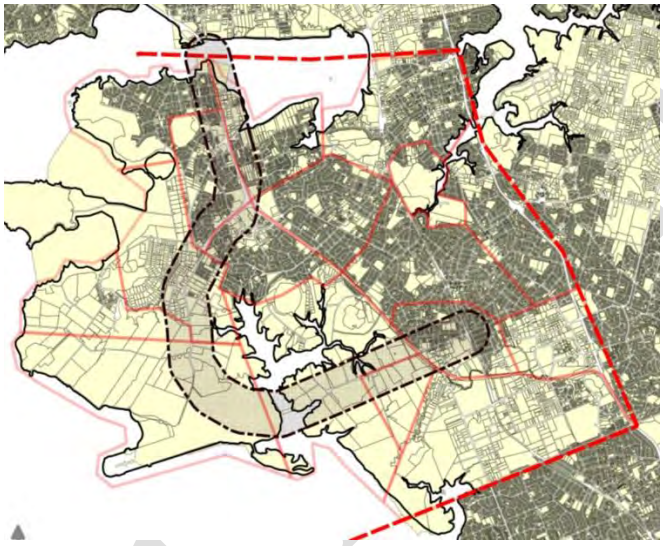
The way forward

The proposed way forward, alternate and do minimum options are described below along with additional recommended measures that are common to all options.

Proposed way forward

It is recommended that the proposed way forward consists of a primary RTN involving a heavy rail loop from Puhinui to Onehunga via the airport designed to run standard Electric Multiple Units (EMU's) as will be operating elsewhere on the Auckland network

The proposed way forward:



- Provides the most effective response to the 3 key problems by:
  - Reducing congestion within the existing network by removing trips from the roading system;
  - Providing a high level of capacity to sustain feasible frequency that meets demand and improves accessibility across the wider region; and,
  - Attracts the greatest number of PT passengers as a result of the quality of the service expected to be provided.
- Provides direct integration with the region wide rail network and leverages off the current substantial investment in electrification, new rolling stock, signalling improvements and station upgrades;
- Reduces interchange penalties for longer trips located across the rail network

The Expected Cost Estimate (FE) for the primary RTN component of the proposed way forward included in Appendix I is $1,543M million with a 95 percentile estimate of $1,980M which provides a Benefit Cost Ratio of 0.6. This confirms that the economics for this project are in the order of magnitude similar to other transformational projects and that at an indicative level the project should proceed to the next stage to allow further development of the business case and identification of an alignment.

Alternate way forward

In addition to the proposed way forward it is recommended that the next phase of the project include investigation and analysis of an alternate way forward consisting of a bus based RTN. This alternative option provides a well differentiated alternative for

comparison that has some cost advantage and the ability to connect into bus based investment across the wider region.

As a result in addition to the proposed way forward it is recommended that the next phase of the project include investigation and analysis of an alternate way forward consisting of a bus based RTN. To the north this would run from the airport to Onehunga and connecting either to a busway or bus priority network running into the CBD or a heavy rail station at Onehunga. To the south this would run from the airport to Puhinui or Papatoetoe and connecting either to a busway or bus priority network running to the east and AMETI and / or to a heavy rail station at Puhinui or Papatoetoe.

Do minimum option

In addition to the proposed way forward and alternate option it is recommended that the next phase of the project include investigation and analysis of a do minimum option that excludes the provision of a RTN. Rather buses would run on the motorway alongside general traffic without provision for bus lanes and connect to a heavy rail station at Onehunga in the north. To the south buses would run along SH20B alongside general traffic without provision for bus lanes and connect to a heavy rail station at either Puhinui or Papatoetoe.

This do minimum option involves taking forward only those project included in the current RLTP.

Additional measures

In addition to providing for a primary RTN corridor(s) it is also recommended that a number of other transport measures be put in place. These are recommended for all options but would require more rapid instigation with the do minimum option.

The additional measures include:

- Upgrade of the state highway network involving:
  - Widening of SH20B to 4 lanes;
  - Connection of SH20A and SH20B;
  - Kirkbride grade separation; and,
  - A southbound connection of SH20A to SH20;
- Complimentary public transport services including:
  - Connecting the airport to Otahuhu and key centres in between. This would be a QTN in the short term with potential progression towards RTN; and,
  - Reconfiguring local bus routes to be more direct and frequent connecting key centres within the study area with the airport business district.
- Safe cycling connections for both commuting and recreational cyclists; and,
- Improving network resilience through a new district arterial road linking Ascot to Favona thereby providing an alternative to the only other route north (SH20A).

Conclusion

The proposed way forward assumes that complimentary land use opportunities will be leveraged off this project and that a number of wider network enhancements (Appendix O) will be constructed. The proposed way forward is recognised as an important component of an overall transportation network across Auckland. It aims to better connect into and leverage off this wider network. It assumes that in providing a primary corridor(s) other complimentary services and active modes will be promoted through investment. In doing this it is anticipated that the proposed way forward will help realise the economic potential of Auckland's Southern Opportunity Area[3] and provide the capacity needed to meet the demand generated through the associated growth.

Creating high quality PT, cycle and walking facilities present people with credible choice. It is recognised that the Auckland Region has a significant programme of soft measures to encourage the use of non car based travel. Some of these include school travel plans, workplace travel plans, cycle and walking projects and associated education programmes. The ability to support alternative modes, thus easing congestion and the need for ever increasing expenditure to address that congestion, requires both soft and hard measures. The hard measures included in this project represent a strong commitment to supporting the development of credible choice to car based trips.

Recommendation

It is recommended that:

1. This Scoping Report along with the Indicative Business Case and Sub Regional Strategy be accepted by the Project Partners;
2. The Project Partners approve the project to proceed to the second phase to allow the development of a refined business case and a scheme assessment; and,
3. The proposed way forward, alternate and do minimum options are taken forward to the second phase to then be assessed in more detail and allow the identification of a preferred option and alignment.

Although preliminary geometric design, traffic modelling, cost estimates, economic evaluation, consultation and planning assessments have been completed for the project more detailed investigation, design and analysis is needed to confirm the preferred option and alignment within the selected corridor(s). This is proposed to be undertaken during phase two to allow a preferred alignment to be identified.

[3] As defined in the Auckland Spatial Plan Discussion Document covers the majority of the study area for this project and has been given the highest priority in terms of the development of area plans for the sub region. Auckland Council's spatial area planning team will commence the development of these plans in July 2011, which is timed to coincide with the beginning of Phase 2 for this project.

1. Introduction

1.1 Project purpose

The purpose of this project is to identify the preferred alignment(s) and configuration of multi-modal transport connections to and from the Airport and agree the best manner in which the alignment(s) can be protected and provided for.

1.2 Purpose of the scoping report

The Scoping Report has been prepared for the following purposes:

- To identify the range of packages available and confirm those most appropriate to take forward to scheme assessment;
- To outline key issues that require further investigation during the scheme assessment phase and to identify potential risk items.

The report generally aligns with the NZTA's Standard Professional Services Specification Z/18 (Scoping Report). It includes, where adequate information is available, the development and evaluation of alternative packages, corridors, modes and alignments. The report is structured as follows:

- **Executive Summary:** A summary of the key findings and recommendations of the report;
- **Section 1 Introduction:** Gives a brief background and overview to the study;
- **Section 2 Key Problems and Opportunities:** Summaries the projects problems and opportunities which are described in detail in the Indicative Business Case;
- **Section 3 Site Description:** Provides a broad context about the study area along with a summary of initial investigation work undertaken during phase 1;
- **Section 4 Option Development:** Describes the process followed to develop a short list of packages appropriate for evaluation;
- **Section 5 Assessment of the Options:** Summarises the assessment process used to determine the relative merits of each package and the relative ranking of the packages which is described in more detail in the Indicative Business Case;
- **Section 6 Economic Evaluation:** A summary of the preliminary economic evaluation which will be further developed as the Indicative Business Case is developed into the Business Case;
- **Section 7 Risk:** A summary of the key project risks;
- **Section 8 Stakeholder Relationship Management and Consultation:** Summarises the consultation undertaken during phase 1, the parties involved and the techniques used;

- **Section 9 Preliminary Design Philosophy Statement:** A summary of the approach taken to developing the design**;**
- **Section 10 Proposed Way Forward:** A description of the recommended elements from all the evaluated packages to take forward to the Scheme Assessment Stage as the proposed way forward; and
- **Section 11 Scope and Limitation of this Report:** A disclaimer statement.

The Scoping Report is intended, on the approval of Auckland Transport, the New Zealand Transport Agency, Auckland Council, Kiwi Rail and Auckland International Airport, to form the basis for developing a Scheme Assessment for the project.

1.3 Background

The Government's top priority for transport is to maximise the sector's contribution to economic growth and productivity. Auckland Airport catered for 13.5 million travellers in 2010, including 72.0 per cent of international visitors to New Zealand. A study recently commissioned by Auckland International Airport Ltd (AIAL) estimated that the Airport and associated business development accounted for 21 per cent of regional GDP (13 per cent nationally) in 2006 and 174,000 jobs (319,000 nationally).

The Government's planned outcomes for transport include a high quality transport system for Auckland and over $1 billion a year is being invested in the Auckland transport system with the aim of enabling efficient and effective use of the transport network. A strategic review of access to the airport[4] identified the need for both roading and public transport improvements to meet this long term demand. The existing capacity will not provide for predicted growth and will have a negative impact on the effectiveness and efficiency of the network as well as on productivity.

A progressive approach to investment is recommended, recognising opportunities for land use integration and affordability constraints, given investment needs across NZ and other parts of the network. The 2010 Auckland Regional Land Transport Strategy (RLTS) has identified the need for improvements to airport access to be a mixture of compatible State Highway and rail rapid transit network improvements between 2021 and 2041. Studies of Rapid Transit Network (RTN) options[5] have looked at possible options, however a need to consider a progressive investment path based on a 'one network' approach has been identified.

In 2007, Auckland Regional Transport Authority engaged Beca to produce a report entitled "Planning for Rapid Transport Corridors in South West Auckland Metropolitan Area". This report recommended that the next stage of planning be undertaken as early as possible to enable corridor protection and future station locations to be identified. In doing so this would allow surrounding land use planning to occur in an informed and complimentary manner.

[4] SH20A/20B Strategic Access to Auckland Airport, NZTA 2009

[5] Planning for Rapid Transport Corridors in South West Auckland Metropolitan Area, Beca 2007

The urgency to clarify the way forward and protect possible corridors has been triggered by:

- Encroaching land development in the area. There are currently several private and public proposed plan changes for land use development within the study area which are currently going through the statutory planning processes. Given the growth rate in the area and expected further development a preferred multimodal route needs to be "future proofed" early to protect against further land development and encroachment;
- The development of AIAL airport master plan. This plans provide an opportunity to integrate land use and transport planning, realise efficiencies in the transport network at a local level at the airport and its local surrounds. From an airport master plan perspective, the required pace of implementation is considered to be greater than previously anticipated; and,
- There is opportunity for continued integration of the South Western Corridor Multi Modal Project with the broader work being undertaken in Auckland's Spatial plan (the "Auckland Plan"). This offers an opportunity to use the transport system as a catalyst to the transformation of areas within the south west part of Auckland and also realise efficiencies in the transport network and develop a more effective system at both a city and local level.

In 2010 a Memorandum of Understanding was developed by Auckland Transport (AT) and NZ Transport Agency (NZTA) together with Auckland Council, KiwiRail and AIAL to undertake the South-Western Airport Multi-Modal Corridor Project. This MOU provided the framework for the parties to work together to identify the preferred multi-modal transport corridors and configurations to provide connections to and from Auckland Airport and prepare documentation for route protection.

In January 2011, GHD was commissioned by project partners to undertake the project under the co-management of Auckland Transport and NZTA. Phase 1 of the project includes the development of an Indicative Business Case, Scoping Report, Sub Regional Strategy and Public Transport Progression Plan.

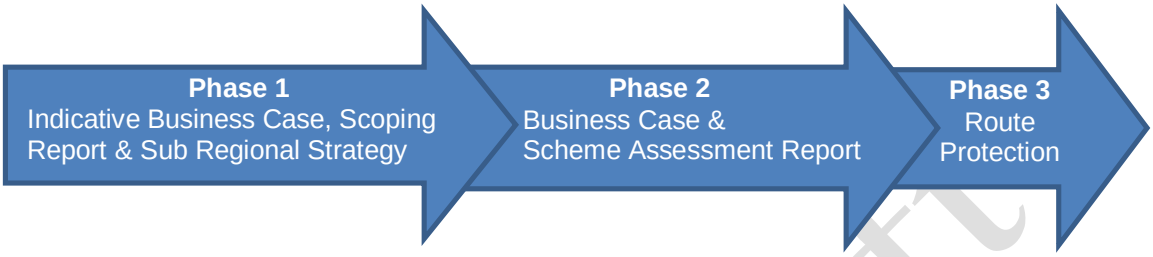
In May of 2011 GHD produced a Sub-regional Strategy along with an Infrastructure Progression Plan and an Indicative Business Case. These documents should be read in conjunction with this document as they provide specific insight in to material not covered by this report or provide context and further technical or economic detail.

This Scoping Report has been produced in May 2011 following completion of phase 1 of the project.

1.4 Project development process

The project is being undertaken in three phases:

Figure 1 Project phases



Each phase is separated by a "Hold Point" and this Scoping Report represents a key deliverable at the end of phase 1. Figure 2 describes the process followed during the first phase.

The project has been developed with input and direction from a number of key stakeholders that formed a governance partnership. To provide a forum where discussions could be held and consensus reached on critical issues, an Implementation Executive Group (IEG) was established. This group consists of representatives from each of the Project Partners:

- Auckland Transport (AT);
- NZ Transport Agency (NZTA);
- Auckland Council (AC);
- Auckland International Airport Limited (AIAL); and,
- KiwiRail.

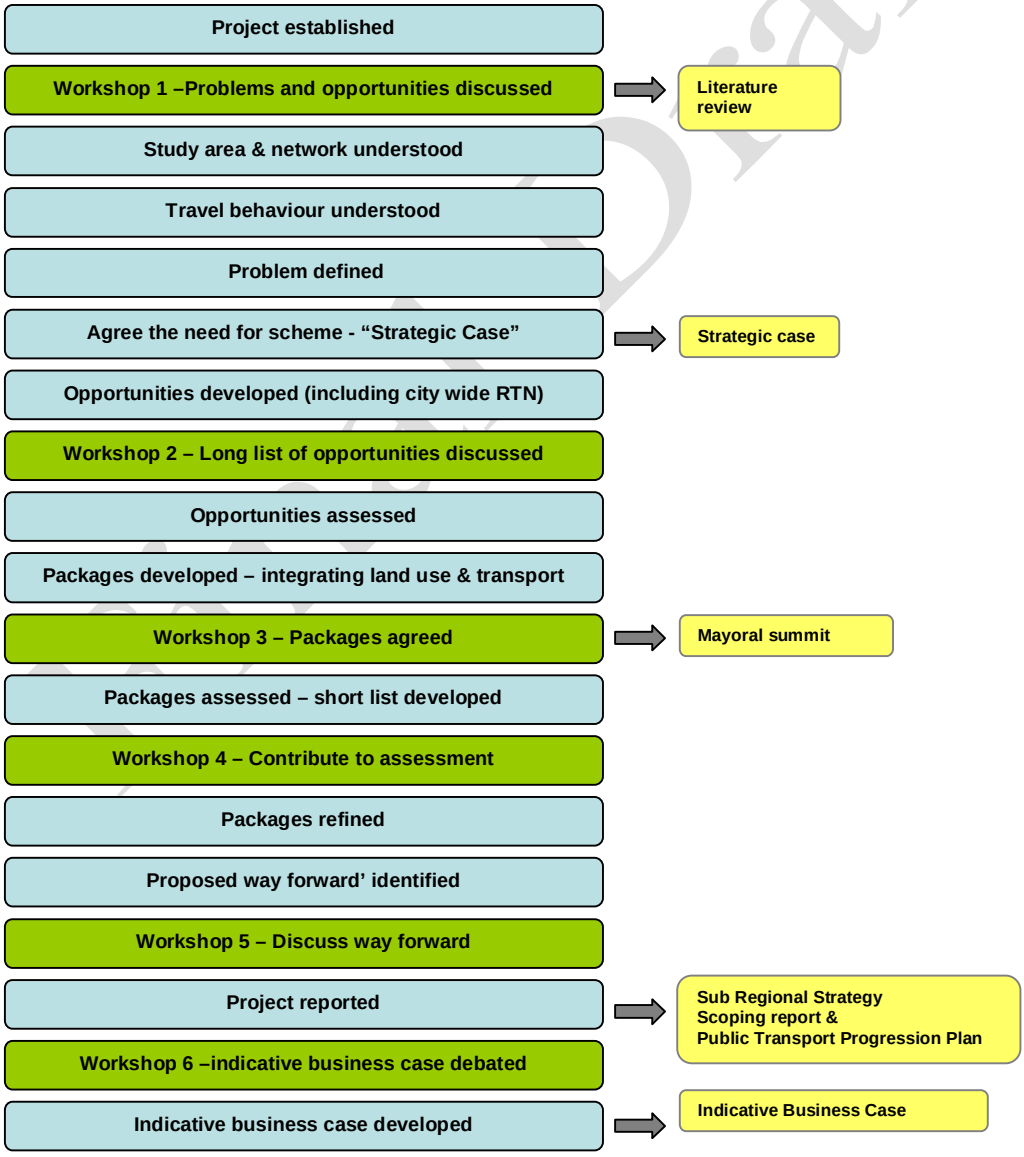
The key function of the IEG was to act as the management board for the project and ensure that the individual organisations remained informed and involved in the top level decision making including promoting agreed recommendations. A Stakeholder Steering Group (SSG) was also established which provided guidance throughout the project and acted as a sounding board for the project team with regards to key findings in phase 1. Representation from these two groups is outlined in Table 1 below.

Interaction between the project team and each of the Project Partners was facilitated through a series of one to one meetings and technical workshops. The IEG along with a number of Technical Advisory Groups (TAG's), were consulted, both individually, and as a group throughout the process of developing outputs.

Table 1 IEG and SSG membership

IEG member organisations	SSG member organisations
Auckland Airport;	IEG membership;
KiwiRail;	Mangere-Otahuhu Local Board;
NZTA;	Otara-Papatoetoe Local Board;
Auckland Transport; and,	Auckland Transport Board; and,
Auckland Council.	Auckland Council Transport Committee.

Figure 2 Project process



2. Problems and Opportunities

2.1 Introduction

This section describes the core transport problems needing to be addressed. In addition to these problems this section also highlights several key land use opportunities. Following establishment of these problems and opportunities the project objectives are described. This section concludes with a project vision that is seen as viable if a package is identified that that addresses both the core problems and key opportunities and meets the project objectives.

2.2 Problems

Three core problems have been identified:

- Insufficient capacity to meet demand;
- Quality of the transport system detracts from visitor experience and attractiveness of alternative modes; and,
- A lack of connectivity between communities, transport networks and land uses.

Prior investigations and studies have specifically referred to one or more of these core problems including:

- The *Auckland Airport Future Economic Impact* Assessment highlights the productivity potential of the Airport Business District but recognises the need for the surrounding transport network to meet the demand generated as a result;
- The ability of the roading network to meet long term development plans for the airport and, its surrounding environs is questioned in a number of documents including *Auckland's Public Transport Network Plan*, the *SH20A/20B Airport Access Strategy* as well as the *Planning for Rapid Transport Corridors in Southwest Auckland Study*. The agreed SH20A/20B Airport Access Strategy is to provide a certain level of roading improvements followed by the provision of a high capacity public transport system;
- Problems associated with connections to the city – both journey time reliability and perceived quality issues have been identified. The journey to the airport is a major factor in passenger satisfaction. This is highlighted in *Auckland Airport's Planning Vision*;
- Accessibility and connectivity contributing to economic and social problems in the area are outlined in a number of *Growth Strategies* and *policy documents* for the region. In particular, the Mangere Gateway Vision notes access and connectivity as issues for the community; and,
- The scale of infrastructure required to provide a Rapid Transport Corridor(s) to the airport poses problems in terms of affordability and economic justification. These problems are highlighted in *Economic Assessment for Auckland Rail Loop*, as well as

the peer review of the *Planning for Rapid Transit Corridors in Southwest Auckland Study*, and the *CBD Rail Loop Business Case.*

2.3 Opportunities

In addition to the identified core problems the following key opportunities have been identified:

- To realise the economic potential of the airport and its surrounding business community within the airport environs;
- To accommodate additional industrial/commercial and residential land use within the study area based to some extent on increased accessibility provided through an improved transport network; and,
- The gradual transformation of neighbourhoods and communities by the careful integration of strategic planning, urban design, transport investment, and coordinated public sector intervention and support, including the provisions of health facilities, sports and recreation facilities and local amenities;

The core problems and opportunities outlined above are described in more detail in the Sub Regional Strategy and also included in Appendix B.

2.4 Project objectives

2.4.1 LTMA objectives

NZTA is required to fund the transport system in a way that contributes to an integrated, safe, responsive and sustainable land transport system. NZTA must therefore take into account how the project meets the following LTMA objectives:

- Assists economic development;
- Assists Safety and Personal Security;
- Improves Access and Mobility; and,
- Protects and Promotes Public Health; and,
- Ensures Environmental Sustainability.

The Government Policy Statement indicates the Government's focus of prioritising transportation projects that assist in generating economic development and growth. These LTMA objectives are reflected within the project objectives outlined below.

2.4.2 Project objectives

The overarching objectives of this project and future protection of the preferred route(s) were developed through a series of workshops. They are specifically aimed at addressing the identified problems and opportunities. The objectives also took into account broader objectives contained within national, regional and district policy documents. The

overarching objectives of this project and future protection of the preferred corridor(s) are to:

- Increase the capacity and efficiency of the transportation network to accommodate demand;
- Improve journey time reliability for freight and airport related traffic;
- Improve the visitor experience in order to enhance the reputation of Auckland and New Zealand within the global market;
- Broaden and enhance transport choices within the study area and the region to improve connectivity;
- Improve connectivity and access within the study area for local communities and facilities;
- Enable growth and development aspirations within an integrated and sustainable transport system;
- Capture economic benefits associated with the Airport Corridor and its role as a Global Gateway; and,
- Support the health and vibrancy of communities within the study area, by providing acceptable levels of access to employment, community facilities and recreational assets.

The MoU[6] indicated an expectation that the project determine future arrangements for the following:

- The Long Term State Highway footprint for SH20A and SH20B and connections to SH20 and a progression plan for infrastructure delivery;
- Rail rapid transit connections including station locations to the Airport, along SH20, SH20A and SH20B alignments and the interface between these connections and the Airport passenger terminals;
- A progression plan of public transport infrastructure and service provision over the next 30 years identifying progression from bus to rail based public transport;
- Long term corridor cycle and walking routes and linkages; and,
- Identifying current and potential future integrated transport/ land use opportunities along the multimodal connections to the Airport including those that could utilise freight rail where rail is a rapid transit option.

2.5 Project vision

Implementing a package of solutions that addresses both the core problems and key opportunities would be instrumental in realising the projects visions. The vision is ***to improve Auckland's ranking as an international city capitalising on the airport as a***

[6] 2010 a Memorandum of Understanding was developed by Auckland Transport (AT) and NZ Transport Agency (NZTA) together with Auckland Council, KiwiRail and AIAL to undertake the South-Western Airport Multi-Modal Corridor Project

gateway to Auckland and New Zealand, whilst enhancing connectivity and the liveability and viability of communities in the study area.

3. Site Description

3.1 Study area

The primary study area is outlined in Figure 3 which defines the area in which a corridor(s) will be protected. The area of influence is much wider and it has been necessary to consider the integration with the wider Auckland network.

Figure 3 Study area

The strategic nature of the project in terms of identifying connectivity options between the Airport economic area and greater Auckland Region is clear. The airport is New Zealand's largest airport. There exists a significant amount of commercial land available for development in the vicinity of the airport. Transport linkages to the airport are currently limited and there is an opportunity to facilitate economic development and accommodate growth in and around the airport through the provision of improved transport connections.

Within the study area the network consists of a local road network and a partially completed motorway network that does not connect into the airport. Plans are in place to extend the motorway system by connecting SH20A and SH20B with the airport. The closest rail facilities are located on the NIMT located several kilometres to the east of the airport and the Onehunga Branch Line located immediately to the north of the recently completed Manukau Harbour Bridge that currently terminates in Onehunga. Dedicated bus facilities available in the study area are limited to bus lanes on some arterial, although on shoulder running for buses has been planned for SH20.

A review of the topography of the study area indicates that there is a relatively flat topography throughout the study area (Appendix A).

3.2 State highway category

The National State Highway Strategy (NSHS) was developed in response to the New Zealand Transport Strategy and sets out how the state highway network will support the government's land transport objective and priorities. Part of this involved reintroducing a system of state highway categorisation to recognise the different functions of different highways.

SH20, SH20A and SH20B are identified as National State Highways using the following criteria:

- Connects places of national significance such as major cities, international ports and airports;
- Facilitate the long distance inter-regional movement of people, goods and services throughout the country; or
- Carries at least 400 HCV's or 10,000 vehicles per day.

3.3 Existing transport corridor designations

Current designations within the study area are limited to existing corridors that cater for rail and road. A key outcome from the final phase of this project will be the designation of one or more corridors and by doing so provide direction for land use and planning across the study area. Figure 4 provides an overview of the transport infrastructure within the study area.

Figure 4 Existing transport infrastructure

3.4 Public transport

There are three bus services which travel to Auckland airport; the airbus express, the Manukau Airporter 380 and the route 375 bus service.

The airbus express does not have any stations in the study area and is therefore unavailable for local residents. It is an express service travelling along Mt Eden Road

from Britomart (Auckland CBD) and joining SH20 at the Hillsborough Road interchange. The bus then travels directly along SH20 and SH20A to the airport.

The Manukau Airporter is a service that provides the fastest, most reliable and frequent public transport option to the airport from Manukau and Papatoetoe. Although this service does not represent either a QTN or RTN service.

The 375 bus service is a local connector network (LCN) that travels an indirect route through the study area to the airport. There is currently no bus that travels from Mangere Bridge to Auckland airport. The current bus services are inadequate to provide the forecast public transport mode share.

There are numerous taxi and shuttle services available to Auckland airport which offer a more comfortable service than general public transport for passengers and their luggage, although the cost of these services is high. The reliability of these services is dependent on the level of service of the road corridor.

The reliability of existing public transport to the airport is expected to decline over time as increasing congestion within the suburban network, between the central city and the airport, occurs.

Currently general public transport accounts for a small percentage of trips into the area. The main bus service into the area is the airport express which is operating within capacity.

There is currently no rail connection to the airport.

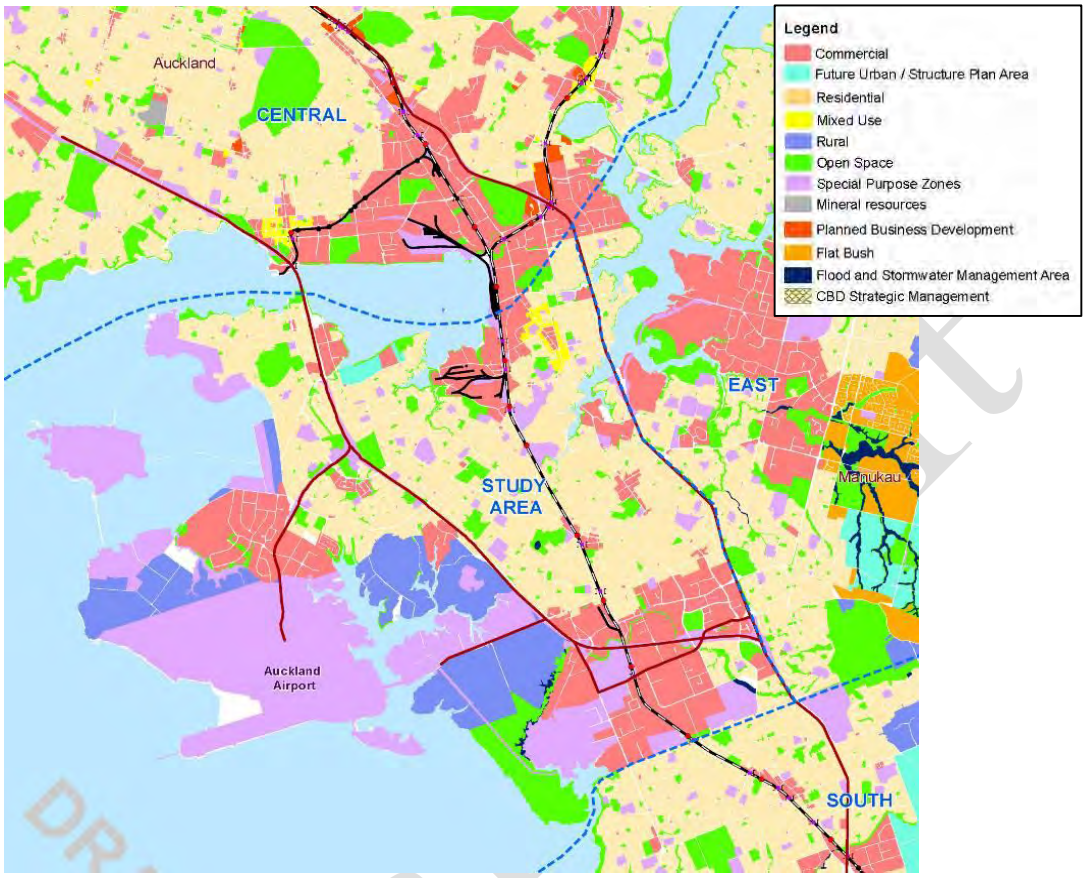
3.5 Crash history

Given the nature of this project crash history has not been investigated during this first phase.

3.6 Surrounding land use

The current pattern of land use within the study area is described in Figure 5, which is the generalised zoning from relevant District Plans. This provides an indicative representation of current land uses.

Figure 5 Current land use



Within the study area there are a number if specific areas of environmental, cultural or heritage value which helps to define communities within the study area. These include the Ambury Regional Park which acts as a significant open space area on the north western coastal edge, and which contains areas of both ecological and amenity value.

This north-western coastal environment also includes Puketutu Island and further to the south, the culturally and archaeologically significant Otuataua Stonefields. The coastal margin and waterways such as Oruarangi Creek have special significance to tangata whenua.

To the east of the Airport lies the Area surrounding the Pukaki Inlet, Waiokauri Creek and the Puhinui Reserve. These areas are of particular significance to tangata whenua, and their relationship to their ancestral land, water and sites. Through mechanisms such as the Eastern Access Agreement and the associated land use controls in the operative Manukau District Plan 2002, tangata whenua have sought to maintain the open space and rural characteristics of this area, and to avoid urban development pressures on areas of significance and the Pukaki Marae.

This has implications in terms of the choice of corridor configuration and alignment, and the associated pattern of land use change over time. This is particularly the case in relation to corridor options to the south-east of the study area adjacent to Puhinui Road.

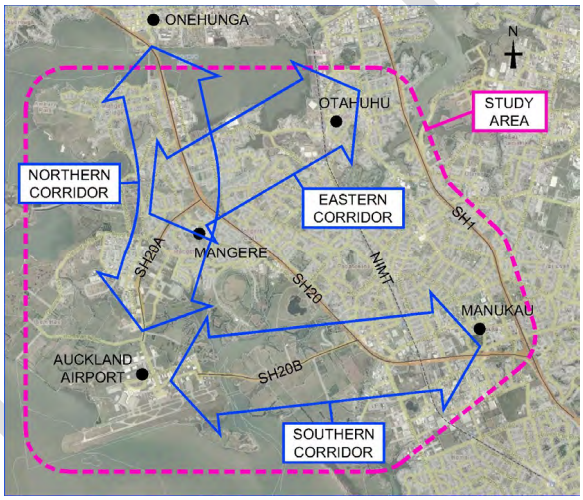
3.6.1 Community, population and employment

The study area today reflects a development pattern based around jobs and the effects of infrastructure investment. For further information the reader is directed to the sub regional strategy which describes existing community, population and employment characteristics for the study area.

3.7 Geology

The Preliminary Geotechnical Appraisal Report (Appendix C) concludes that the study area is mapped as being underlain by the full suite of Auckland geology ranging from Recent Alluvium, Puketoka Formation, volcanic tuff, East Coast Bays Formation and fill.

The results of the desktop study indicate that all three of the proposed corridors across the study area are underlain by a similar extent of Recent Alluvial and Puketoka Formation deposits. The main geological hazards expected along the corridors will be flooding of streams and low lying areas from prolonged or intense rainfall and slope instability. The northern and eastern corridors encounter volcanics of the Auckland Volcanic Field whilst the southern corridor does not. However, the southern corridor is indicated to encounter more fill than either the northern or eastern corridors. As such, it is considered that geotechnical conditions along each of the proposed corridors are likely to be similar and therefore alignment selection within the corridors is anticipated to be influenced by other factors.

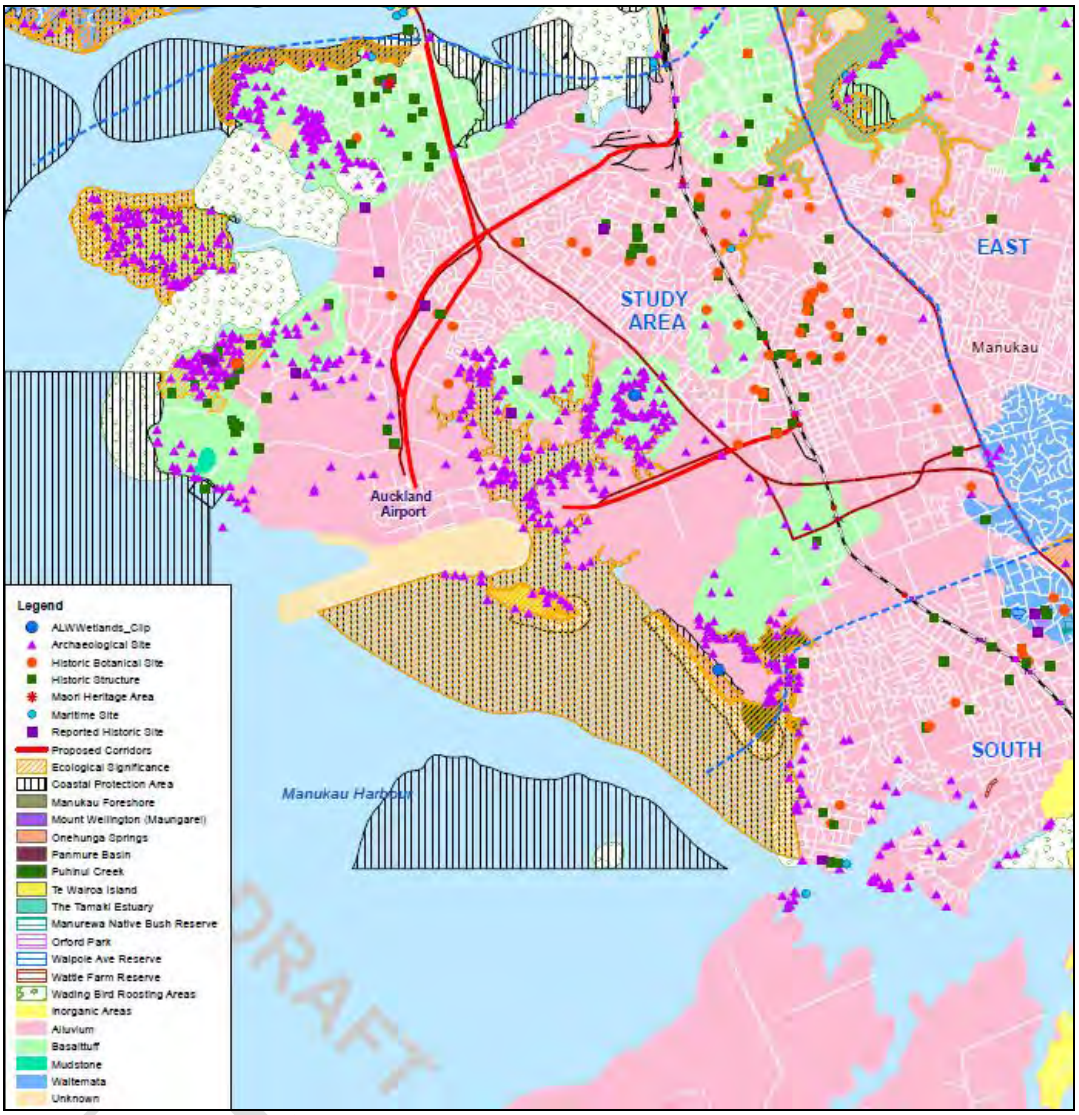


Once the corridor(s) have been confirmed, it is recommend that further Geotechnical Assessment be undertaken to identify specific geotechnical features along the corridor affecting the works and to inform more detail geotechnical investigation and analysis that will be needed when the detailed design is undertaken.

3.8 Ecology

Most of the study area can be regarded as being “sensitive” to impact from development of transport corridors. Coastal areas are sensitive to direct loss and stormwater discharges. Undeveloped land or agricultural land may provide habitat for fauna or contain native flora. Residential areas can be adversely impacted by noise and air quality. Cultural sites can be adversely impacted by direct loss or be affected by noise, air or water discharges. Existing industrial areas can be sources of ground contamination and are therefore a potential pollution source during construction and maintenance phases. Figure 6 summarises the various environments found within the study area. Appendix L contains more detailed plans including a preliminary environmental constraints map.

Figure 6 Environmental constraints



The Environmental Constraints and Opportunities Report (Appendix L) concludes that whilst there are a number of specific locations within the study area that are sensitive, there are no identified environmental fatal flaws along any of the three corridors. There is however comment that eastern corridor (package 7) is likely to represent the least environmental impact of the three corridors.

During the next phase of the project it is recommended that further investigation be undertaken once the preferred corridor(s) has been selected and specific alignments are assessed within that corridor to investigate mitigation options for the impacts of constructing and operating the corridor(s).

Given that construction is not expected in the near to medium term it is recommended that an environmental assessment and investigation to determine potential areas of

contamination, both in the soils and groundwater be undertaken at a point closer to the time of construction.

3.9 Archaeology and heritage

There are a number of significant sites throughout the study area with archaeological and geological significance and are primarily located within the Rural/ Puhinui Rural and coastal locations within the study area. These sites are particularly of significance to Iwi and have been identified in previous studies undertaken by MCC, including Plan Change 14. It is acknowledged that further involvement with Iwi will confirm the full extent of sites valued by Iwi within the area and should continue during subsequent phases of the project.

Key sites within the study area are listed in section 3.9.1 below, and are further detailed in the Environmental Constraints and Opportunities Report included in Appendix L.

Figure 7 Mangere Mountain – A visual and cultural feature

3.9.1 Significant Sites

The study area comprises of a number of significant sites, which are of archaeological or Iwi significance. These sites have been identified in conjunction with Proposed Plan Change 14 for the 'Mangere Gateway Heritage Area' and are areas that contain significant natural, cultural and built heritage sites, which need to be recognised and protected. These sites include:

- The Manukau Harbour and views to the Manukau Heads;
- Makaurau Marae and papakainga area;
- The Otuataua Stonefields Historic Reserve, which is a waahi tapu site and includes archaeological remains of pre-European Maori settlement and early European dry-stone walls. The reserve also contains remnants of mature coastal forest and a rare native cucumber species;
- The newly restored Oruarangi Creek and boat ramp;
- Three landing reserves (haupapa) along Oruarangi Creek;
- Location of early Mission site where the Kingitanga movement originated adjacent to coast south of Ihumatao Road;

- The remains of Maungataketake (Ellet's Mountain) and Otuataua Mountain;
- The buried Kauri forest at the end of Renton Road;
- The newly restored Manukau Harbour coastline which includes seven new beaches adjacent to the Otuataua Stonefields;
- Bird hides introduced into the newly restored coastline for bird watching of rare migratory birds;
- Public walkway along the newly restored coastline extending from Ambury Farm Park to the Otuataua Stonefields and along the southern coast of Puketutu Island;
- The Mangere Gateway Heritage Project which is a walking, cycling and driving route being developed to link and promote visitor attractions in the Mangere area to Auckland International Airport;
- Te Araroa – the walkway that extends from Cape Reinga to Bluff enters Manukau City over the old Mangere Bridge and then follows the walking component of the Mangere Gateway Heritage Route along Kiwi Esplanade, through Ambury Regional Park, along Watercare's coastal walkway, then through Otuataua Stonefields Historic Reserve and Oruarangi and Ihumatao Roads before heading to Auckland International Airport and into Manukau City alongside the Puhinui Stream;
- Historic house on Oruarangi Road – scheduled item 92 in the Manukau Operative District Plan;
- Paul Homestead on Oruarangi Road – scheduled item 78 in Manukau Operative District Plan;
- Rennie Homestead on Oruarangi Road – scheduled item 73 in the Manukau Operative District Plan; and,
- Puketutu Island, Ambury Farm Park, Mangere Mountain and visitor centre, and Mangere Esplanade reserve with its geological 'aa' lava feature nearby.

3.10 Utility services

A desktop utilities investigation was undertaken, and report produced Appendix M, to:

- Provide a record of the initial consultation with Utility providers and forewarn them so that they can commence planning for how key infrastructure may be designed, constructed, operated and maintained within the study area to avoid and mitigate any adverse effects on a new transport corridor;
- Record the investigation carried out to identify the location of primary utilities within the study area;
- Provide contact information and material that can be used as a basis for further consultation with the utility providers for future planning;
- Record both current and future planned significant infrastructure that would be classed as backbone, primary or strategic in nature that passes through or located within the study area;

- Make an assessment of whether those utilities pose a significant constraint to the positioning of proposed transport corridors;
- Identify what further investigation is recommended during future stages of the project;
- Identify opportunities that could that a transport corridor could facilitate for utility providers; and,
- Provide for inputs into cost estimates and risk assessment.

Whilst utility services crossing or located within a transportation corridor can have a detrimental impact on the efficient management, operation and safety of the corridor it is not seen as a primary constraint on this project. However appropriate allowance for these utilities to be constructed, accessed and maintained without significantly impacting on the transport corridor needs to be considered during subsequent stages of the design. To minimise any potential detrimental effects, Auckland Transport will need to carefully control and manage the placement of any utilities within the preferred corridor over the coming years.

With this in mind it is recommended that:

- Auckland Transport seek to enter into long term cost share arrangements with individual utility providers either as global agreements or specifically in relation to opportunities posed by a future primary transport corridor leading to the airport; and
- Further discussions with utilities providers takes place during subsequent stages of the project as refinement of corridor options occurs to allow more accurate estimation of the impact on utilities and to establish a more refined cost estimate.

4. Option Development

4.1 Approach

In response to the problems defined in section 2 of this report a number of option packages were developed including previously considered schemes described in Beca's report entitled "Planning for Rapid Transport Corridors in South West Auckland Metropolitan Area". The approach adopted in developing option packages included:

- A review of literature of previous schemes and analysis of current and future demands within the study area;
- Identification of a long list of options;
- Discarding of options from the long list where possible through a preliminary screening assessment; and,
- Compilation of discrete packages for more detailed evaluation.

4.2 Developing the long list of options

The long list of options for initial assessment was derived from a number of sources and included a number of modes (section 4.2.1) and corridors (section 4.2.3) and by taking a region wide perspective (section 4.2.2).

The literature review identified several options that were the subject of previous investigations or related studies. Although in some cases, the literature discounted these options after investigation for a variety of reasons, for this study, all potential options were incorporated in the long list to ensure viable options were not prematurely discounted or excluded from this study.

The stakeholder engagement process was also used as a key mechanism to identify and capture options for the long list. This engagement is described in more detail in section 8 of this report. However in summary it included a number of meetings and workshops with stakeholders.

4.2.1 Modes assessed

Consideration was given to a variety of transport modes, and these were grouped into the following:

- Ferry and other water based public transport;
- Private car and taxis;
- Heavy Commercial Vehicles;
- Buses included guided buses and articulated buses;
- Light rail of all forms including trams, elevated rail lines, street level rail lines;
- Heavy Rail;

- Active modes including pedestrian and cyclists; and,
- As yet unproven individual transport systems (such as pods).

In assessing the land based PT modes a number of key characteristics were established to assist in defining those modes. These characteristics are outlined in Table 2 below.

Table 2 Characteristic of Alternative PT Technologies

Characteristics	Class of Transit Technology				
	Light Rail (non-automated)	Busway	Suburban / Heavy Rail	Metro / MRT Rail	Automatic Guided Transit
Typical Max line Capacity [7] (pax/hr/direction)	4,000 - 11,000	2,000 - 14,000	5,000-20,000	30,000+	2000 - 10,000
Type of Installation	Generally on-street, but can be above ground or underground. Can mix with pedestrians in CBD	Generally on-street, but can be above ground or underground	Generally rail crossings are not grade separated. Typical rail, sleepers and ballast.	Generally in tunnel or grade separated from surrounding urban area	Generally above ground but can be in tunnel. Needs completely separated guideway
Station Spacing / and Stopping Patterns	Typically 500m - 1 km. Vehicles usually stop at all stops	Typically 500m - 1km. Can provide passing bays to allow mix of express and stopping services	Typically 1.5-2km, but can be up to 6km. Usually all stops.	Typically 0.6km – 1.2km. Can provide for express as well as all-stops services but this reduces capacity	Generally 1 km or more. Vehicles usually stop at all stops, although some systems such as Austrans can have off-line stations
Station Facilities	Can be relatively simple. More recent systems include extensive shelters, real-time passenger information etc	Can be relatively simple. More recent systems include extensive shelters, real-time passenger information etc	Moderately large scale, less intensive when compared with metro.	Usually large scale and expensive.	Varies with specific system. Generally cheaper than heavy rail
Typical average line-speed including stops	20 -30 kph	20 - 40 kph	50 – 200 kph	30kph and above	20 kph and above

[7] Some systems in a particular capacity may have lower or higher capacity than that quoted.

Characteristics	Class of Transit Technology				
	Light Rail (non-automated)	Busway	Suburban / Heavy Rail	Metro / MRT Rail	Automatic Guided Transit
Maximum gradient	Usually 6-10%	Usually 6-12%	Usually 3%	Usually 3%	Varies with system; Austrans can climb up to 20%
Minimum radius	Typically 20 m	Typically 12-15 m	Typically 200 m but preferably 400m or more for faster systems		Varies with system; can be as low as 8m for Austrans and 20 m for some monorail systems
Propulsion	Electric	Usually diesel, but increasingly CNG. Some systems allow for electric	Electric or Diesel Powered	Electric	Electric
Noise	Relatively quiet	Can be a problem for diesel and CNG powered vehicles	Noise problems for diesel powered engines and on tighter corners.	Some noise problems, especially on tight corners, but often system is underground	Generally very quiet
Air pollution	No local emissions	Some particulate and NOx emissions	Where diesel powered, NOx and some particulate emissions	No Local emissions	No local emissions
Energy Efficiency	High	Moderate	Med - High	Very High	Varies with system but generally high
Relative cost [8]	Moderate	Low-Moderate	High	Very High	Moderate but depends on system

[8] Capital costs are usually measured as $m per track-km, and operating costs as $ per passenger-km. Both measures vary significantly between modes and within modes, based on the specifics of the particular application and system. For example underground heavy rail systems cost typically $80 - $100 million per double-track km, while busway systems range from $10 - $30 million per double-lane km. Much depends on the extent to which systems need to be in tunnel or elevated

4.2.2 Region wide assessment

Figure 8 A regional approach

While this study has a discrete study area as described in section 3.1 of this report, option development initially was undertaken from a region wide perspective. Key markets and demands were identified across the Auckland Region (Figure 8). These markets included:

- Within the Study Area;
- North Shore;
- CBD;
- East Auckland;
- West Auckland;
- Central (Isthmus); and,
- South of the Study Area.

Options that catered for these markets either directly or through interchange were considered.

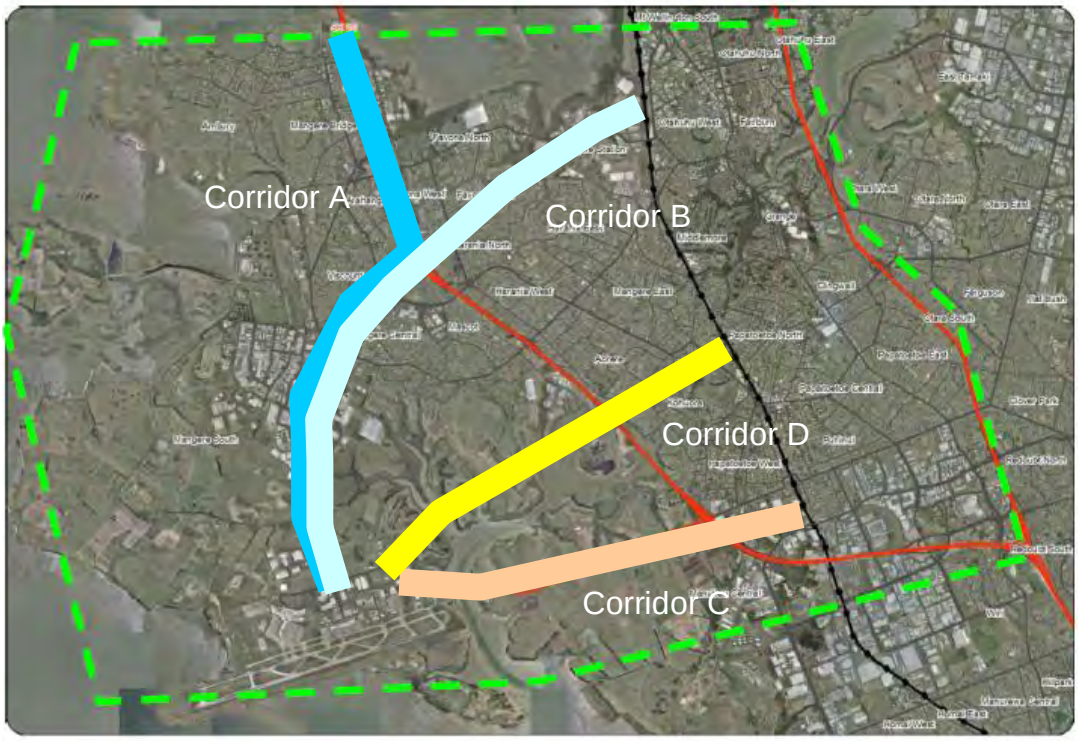
4.2.3 Identifying corridors

With the exception of water based transport, the geography of the study area limits the number of corridors available. Four general corridors were identified:

- A northern corridor running adjacent to SH20A and SH20 crossing the Manukau Harbour linking the airport with the Onehunga area (Corridor A);
- A north-eastern corridor running adjacent to SH20A linking the airport with the Otahuhu area (Corridor B);
- A south-eastern corridor crossing Pukaki Creek and linking the airport precinct to the area around Papatoetoe and Manukau area (Corridor C); and,
- A eastern corridor crossing the Pukaki inlet and linking the airport precinct to the area around Papatoetoe (Corridor D).

See Figure 9 for a diagrammatic representation of these corridors. The long list of options included each of the different transport modes along each of the four corridors or servicing each of the key markets.

Figure 9 Identified corridors



4.3 Discarded options

An initial assessment of the long list of options was undertaken to narrow down the list and remove options deemed not worthy of further evaluation. This assessment aimed to identify fatal flaws based on the following assessment criteria (which are a basic subset of the evaluation criteria included in Appendix G):

- Demand – Will the option provide the capacity that is expected to meet long term demand;
- Quality of Service – Will the option provide the visitor experience, frequency and reliability of service that is expected to enhance the reputation of Auckland;
- Land use – Does the option compliment desired land use, improve connectivity and access;
- Cost – Is the cost of providing the option likely to be prohibitively expensive; or,
- Feasibility – Is the option proven elsewhere and / or are there practicable solutions to the physical, technical and operational challenges of the option.

This led to a number of different options on the long list being discarded as described in Table 3 below.

Table 3 Options discarded from further evaluation

Option	Fatal flaw	Reason for discounting
Ferry Services	Demand	Ferry services expected to cater for a limited demand.
	Feasibility	Physical and environmental constraints are likely to be significant requiring new infrastructure within the costal marine environment and modification of the coastal marine environment to allow for the passage of ferries on low tides
Personal Transport Pods	Feasibility	There is currently a very limited international track record for such devices. However it is not inconceivable that corridors identified for other transport modes could be converted and used for alternate systems should those systems evolve to a point where they merit further evaluation
Eastern Corridor across Pukaki inlet (Corridor D)	Land use	Provides limited additional benefit over the north-eastern and south-eastern corridors
	Feasibility	Necessitates crossing a wide expanse of the Pukaki inlet which has environmental and heritage sensitivities
Freight via rail to the airport	Demand	Although freight to the airport is significant (amounting to about $12.8 billion in 2010) it typically consists of high-value, low-volume and time-sensitive consignments. In overseas locations rail typically does not provide a significant means of transport for freight to and from airports for reasons likely to be similar to these
	Quality of Service	Freight trains have different operating characteristics to those for Electric Multiple Units (EMU's) having slower acceleration and deceleration and typically lower operating speeds and their interleaving with EMUs would result in a loss of effective capacity on the rail connections
	Feasibility and cost	Freight trains require heavier structures and shallower gradients than the relatively light EMUs proposed for the corridor. Providing for freight is likely to result in significant cost increases in the provision of infrastructure
	Land use	The operation of freight trains could compromise proposals for residential and commercially focused transit orientated development in the corridor and so diminish the development potential of the new infrastructure

4.4 Option packages

Having narrowed down the long list of options with the fatal flaw assessment, the remaining options were then grouped into packages for further assessment. These packages were seen as representative of the modes and corridors not removed from the initial short listing process. Seven option packages were developed for option evaluation Appendix E. These packages consisted of several 'layers'. These layers include:

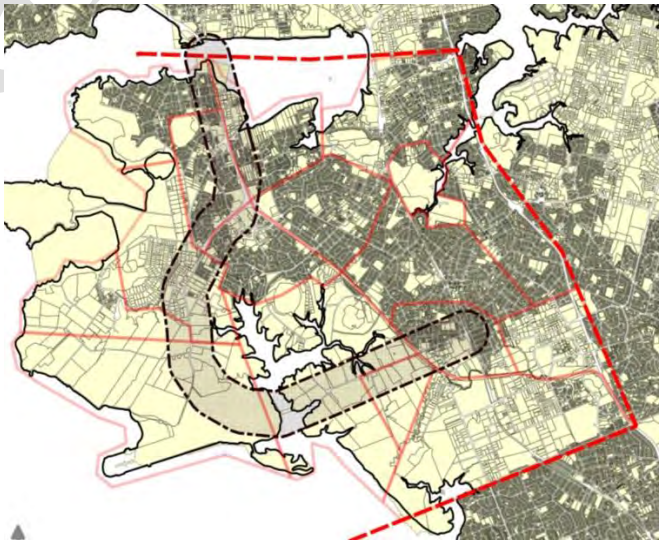
- Primary Public Transport Corridor(s). This connection is the most significant differentiator between each of the packages and formed the basis against which other layers were added;

- Complementary public transport improvements. These generally consist of bus service upgrades anticipated to be needed to complement the primary public transport connection and service demand areas in which the primary connection will not adequately cater for that demand;
- Highway Upgrades. These upgrades have been identified to meet the demand that is either not accommodated by improved PT facilities or is required to meet other latent demand;
- Land use changes that will be facilitated by the improved accessibility of the primary PT improvements or that are necessary to sustain a particular level of demand. Specific growth nodes that may be suitable for Transit Oriented Development have been identified based on existing planning documents and strategies as well as the existing environment;
- Walking and Cycling. Provision for walking and cycling is included within each of the packages to accommodate these modes and integrate with other modes, particularly PT; and,
- Local Road Amendments. Where necessary changes to the local road network have also been considered.

The packages were developed to enable a balanced assessment of the relative benefits and adverse effects of key elements within the study area. As such each package is not necessarily mutually exclusive and the proposed way forward was anticipated to consist of elements from more than one option package.

4.4.1 Package 1 - Rail loop

The primary public transport connection for this package includes a new heavy rail connection connecting to the North Island Main Trunk Line at Puhinui in the south, through the airport precinct, before heading north across the Manukau Harbour and connecting to the Onehunga Line and/or Avondale-Southdown Rail Line. Six stations are provisionally identified along the corridor within the study area along with an upgraded station where the loop connects at Onehunga.



Beyond the study area, local bus improvements are proposed east towards Flat Bush, while within the study area improved services connecting Mangere East, Favona and Mangere North. Cycle facilities would be provided along the corridor.

Prior investment in a rail connection to the north has been made by way of structural provision on the existing Manukau Harbour Bridge to accommodate a single tracked under slung rail line. This package currently assumes that the connection would utilise this provision. However prior to confirming that the existing structure can be utilised it is recommended that investigation of alignment options to connect a rail alignment to this on either end of the bridge take place if this package proceeds to phase 2. If alignments are found not to be feasible then another bridge would be needed to facilitate crossing of the Manukau Harbour.

Given the nature of the corridor sections could be single tracked for provision for double tracking at stations and if needed other locations to accommodate passing. Designation should however proceed on the basis of providing double track along the full length of the corridor to accommodate an ultimate double track option.

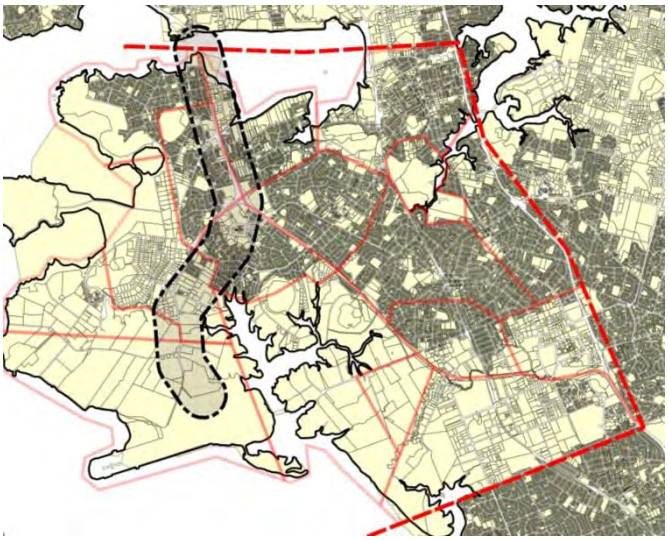
Where the rail corridor crosses existing road corridors then these would either be grade separated or require closure of the road connection so as to eliminate at grade crossings. Where the rail runs through AIAL land it is currently anticipated that a significant portion of the corridor will need to be either elevated or located below ground to eliminate significant conflicts.

This package closely aligns with the recommended RTN network in the Regional Land Transport Strategy and represents the most comprehensive Rapid Transit Connection.

Along the corridor Mangere Town Centre is well suited to a public sector led Transit Oriented Development (TOD). This would however require the population growth projections in Plan Change 26 to be revisited. Further opportunities exist in the current and proposed employment lands along the corridor, specifically Ascot Road and the Southern Gateway areas, for a public sector led TOD, despite these areas currently being identified as having a low classification. Puhinui also has ability for TOD with large lot areas, strong social infrastructure, and a mix of uses.

4.4.2 Package 2 - Light rail to the north

The primary public transport connection for this package includes a new light rail connection from the airport precinct, servicing the Mangere Town Centre, Favona and Mangere Bridge suburbs, heading north across the Manukau Harbour. Outside the immediate study area Light Rail is envisioned to service suburban areas before entering the CBD. Several corridors are available north of the Manukau Harbour Crossing. However



these have not been investigated in any detail as they are outside the scope of this study. Five stations are provisionally identified along the corridor within the study area along with three new stations on the northern side of the Manukau Harbour.

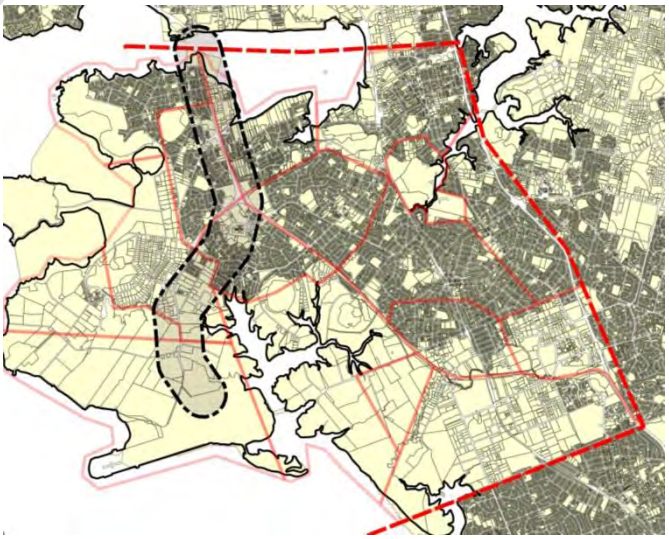
Included in this package are highway upgrades for SH20B in conjunction with enhanced bus connections to the east. Local bus improvements would be included in the package running east and west through Mangere Town Centre, Favona, Mangere East and Papatoetoe. Cycle facilities would be provided along the corridor.

Provision for another bridge to facilitate crossing of the Manukau Harbour is currently anticipated. However further investigation is recommended if this option proceeds to investigate the possibility of utilising the existing harbour bridge crossing.

Given the nature of light rail it is expected that if existing corridors were utilised then a number of these would require widening to accommodate its provision. Where the light rail alignment crosses other road corridors then these would either be at grade with priority provided to light rail or grade separated. Where the light rail alignment runs through AIAL land it would also be constructed at grade.

As with the rail loop package this package offers a public sector led TOD opportunity at Mangere Town Centre. This would however require the population growth projections in Plan Change 26 to be revisited. Further opportunities exist in the current and proposed employment lands along the corridor, specifically Ascot Road, for a public sector led TOD. Subject to the final alignment Mangere Bridge Town Centre may also present an opportunity for TOD. A light rail corridor profile may provide opportunity to better integrate with a town centre than other modes which might arguably have more significant severance effects.

4.4.3 Package 3 - Busway to the north



The primary public transport connection for this package includes a new busway connection from the airport precinct, servicing the Mangere Town Centre, Favona and Mangere Bridge suburbs, heading north across the Manukau Harbour. Outside the immediate study area the busway is envisioned to service suburban areas before entering the CBD. Several corridors are available north of the Manukau Harbour Crossing. However these have not been investigated in any detail as they are outside the scope of this study. Five stations are provisionally identified along the corridor within the study area along with three new stations on the northern side of the Manukau Harbour.

Included in this package are highway upgrades for SH20B in conjunction with enhanced bus connections to the east. Local bus improvements are identified running east and west through Local bus improvements would be included in the package running east and west through Mangere Town Centre, Favona, Mangere East and Papatoetoe. Cycle facilities would be provided along the corridor.

Provision for another bridge to facilitate crossing of the Manukau Harbour may be necessary. However given the provision of bus shoulder lanes on the existing Manukau Harbour Bridge it is currently assumed that this package would involve connection of the busway to either end of the existing bridge. It is recommended that investigation of options to cross the Manukau Harbour and connect in to Onehunga be investigated in phase 2 if this package proceeds to that phase.

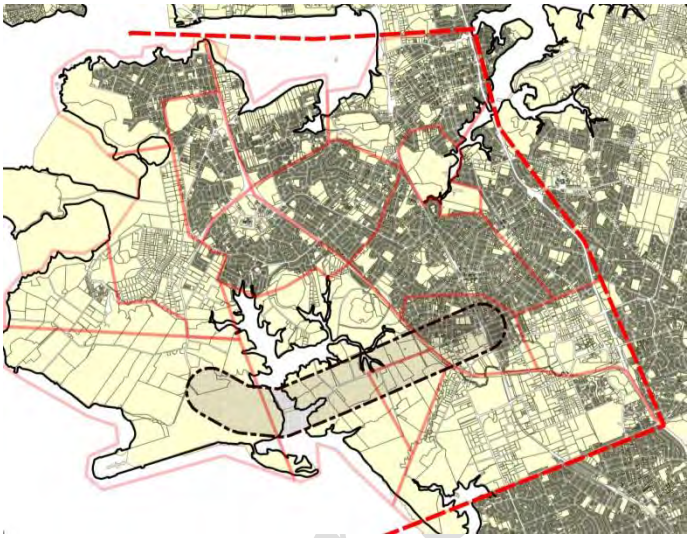
Given the nature of a dedicated busway it is expected that either a new corridor would be provided or existing corridors would be widened to accommodate its provision. The difference being the provision of a RTN or QTN and the relative volumes that the corridor can accommodate. The project currently assumes the busway would require either grade separation or at grade intersections with priority provided to the busway where the busway crosses existing road corridors. Alternatively there may be a requirement to close some intersecting roads so as to minimise delays along the busway. Where the busway connects to AIAL land it is anticipated that it would connect into the local road network with some prioritisation measures provided as needed.

The development of a public transport interchange at the airport is also expected given the need to provide for a number of different services. The interchange would be integrated with the Airport Master Plan in order to accommodate any future relocation in response to development of the second runway and the reconfiguration of terminal facilities.

As with light rail the busway provides greater alignment flexibility than a heavy rail corridor and potentially provides more accessibility to the service for existing suburban centres.

This package offers similar opportunities for a public sector led TOD to the previous package at Mangere Town Centre which would require the population growth projections in Plan Change 26 to be revisited. Further opportunities exist in the current and proposed employment lands along the corridor, specifically Ascot Road, for a public sector led TOD. Subject to the final alignment Mangere Bridge Town Centre may also present an opportunity for TOD. In each case the alignment is likely to be more removed than the light rail package and present more severance effects. However the mode choice in this package removes the need to change modes that applied to Package 2 and is likely to more easily link to the regional and sub-regional bus services. In this way the busway is anticipated to “leverage” off wider network improvements more easily than the light rail option.

4.4.4 Package 4 - Rail connecting in the south



The primary public transport connection for this package includes a new rail connection from the airport precinct to the North Island Main Trunk Line at Puhinui. This connection is in effect a subset of Package 1. Two stations are provisionally identified along the corridor within the study area along with a connection to the Manukau station.

Local bus improvements would be needed northwards through Favona, Mangere Bridge, and Mangere East with increased services outside the study area along Dominion and Pah Road. Connecting services would also be anticipated beyond the study east towards Flat Bush. Cycle facilities would be provided along the corridor.

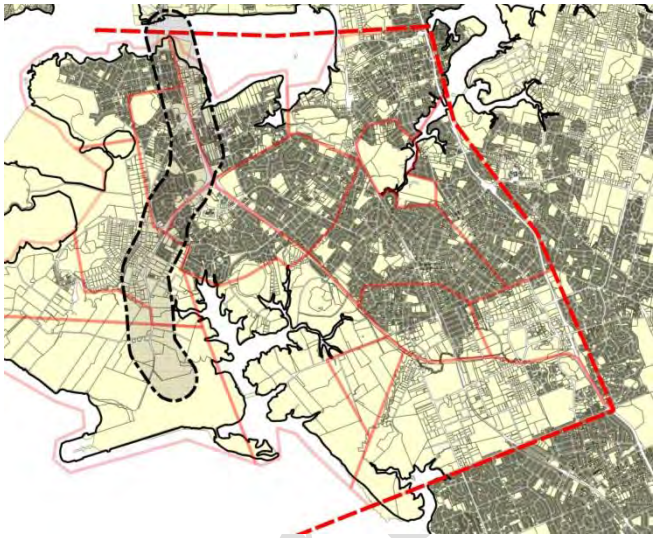
Given the branch nature of the corridor double tracking of the entire length is anticipated to accommodate demand and designation should proceed on that basis.

Where the rail corridor crosses existing road corridors then these would either be grade separated or require closure of the road connection so as to eliminate at grade crossings. Where the rail runs through AIAL land it is currently anticipated that a significant portion of the corridor will need to be either elevated or located below ground to eliminate significant conflicts.

From a land use perspective there Puhinui represents a significant opportunity for TOD with large lot areas, strong social infrastructure, and mix of uses. However, land values are low indicating that a public sector led process would be required to gain the maximum benefit. There are also additional opportunities in the current and proposed employment lands along the corridor for a public sector led TOD despite these areas being identified with lower classifications.

This option tends to serve areas beyond the study area and along the NIMT, rather than the western parts of the study area itself. It provides for travel to the airport from destinations further afield, but does so without serving origins and destinations within the western part of the study area. Given that many airport employees are likely to be drawn from the surrounding area, this option would seem to miss a major opportunity to attract regular users.

4.4.5 Package 5 - Rail connecting to the north



The primary public transport connection for this package includes a new heavy rail connection from the airport precinct heading north across the Manukau Harbour and connecting to the Onehunga Line and/or Avondale- Southdown Rail Line. This connection is in effect a subset of Package 1. Five stations are provisionally identified along the corridor within the study area along with a new station where it connects at Onehunga.

Highway upgrades for SH20B would be included in conjunction with enhanced local bus connections to the east connecting Middlemore, Papatoetoe and Manukau City with the corridor. Other connections would include Flat Bush beyond the study area, and Mangere East, Favona and Mangere North within the study area. Cycle facilities would be provided along the corridor.

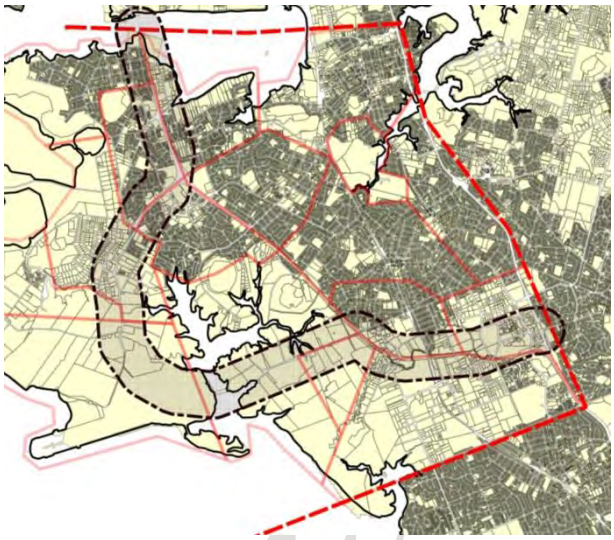
Prior investment in a rail connection to the north has been made by way of structural provision on the existing Manukau Harbour Bridge to accommodate an under slung rail line. This package currently assumes that the connection would utilise this provision. However prior to confirming that the existing structure can be utilised it is recommended that investigation of alignment options to connect a rail alignment to this on either end of the bridge take place if this package proceeds to phase 2. If alignments are found not to be feasible then another bridge would be needed to facilitate crossing of the Manukau Harbour.

Given the branch nature of the corridor double tracking of the entire length is anticipated to accommodate demand and designation should proceed on that basis.

Where the rail corridor crosses existing road corridors then these would either be grade separated or require closure of the road connection so as to eliminate at grade crossings. Where the rail runs through AIAL land it is currently anticipated that a significant portion of the corridor will need to be either elevated or located below ground to eliminate significant conflicts.

Along the corridor Mangere Town Centre is well suited to a public sector led TOD. This would however require the population growth projects in Plan Change 26 to be revisited. Further opportunities exist in the current and proposed employment lands along the corridor, specifically Ascot Road, Favona and outside the study area Onehunga for a public sector led TOD, despite several of these areas currently being identified as having a low classification.

4.4.6 Package 6 - Bus lanes on motorway shoulder



The primary public transport connection for this package consists of bus priority provided along motorway shoulders both northbound and eastbound from the airport. Northbound services would run along SH20A then SH20 to cross the Manukau Harbour to the north and primarily utilise the Waterview Motorway connection to central Auckland. Eastbound services would run along SH20B and then SH20 to Manukau. Connections with the wider bus network would occur at motorway interchanges. To the south, Manukau and Puhinui Station provide connections with the wider rail network.

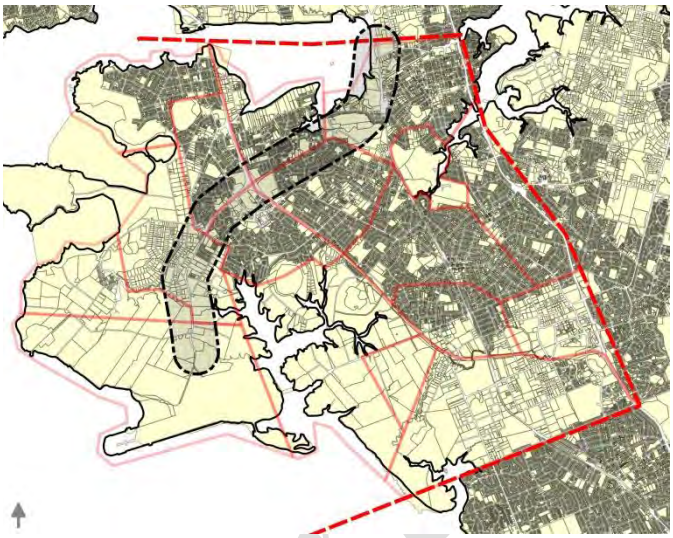
This package would be complemented by local bus improvements in Papatoetoe and Mangere Town Centre along with enhanced bus services out of Manukau. Potential highway upgrades are also contemplated for SH20B to accommodate increased demand.

The development of a public transport interchange at the airport is also expected given the need to provide for a number of different services. The interchange would be integrated with the Airport Master Plan in order to accommodate any future relocation in response to development of the second runway and the reconfiguration of terminal facilities.

This package is seen as a low cost means of providing PT services between the Airport precinct and the wider PT network. It is anticipated to provide modest benefits in terms of modal change and therefore necessitate a more significant level of highway upgrades than other packages.

Limited land use opportunities, in terms of TOD, are anticipated as the bus services would run along the existing highway and have limited connection with communities. Station locations are restricted and it is expected to be difficult to achieve effective land use / PT integration which supports community outcomes.

4.4.7 Package 7 - Otahuhu



The primary public transport connection for this package includes a new rapid transit connection (modelled and assessed as rail but could also potentially be provided by way of a Bus RTN) from the airport precinct heading north-east via Ascot, Mangere North, Mangere Town Centre, Mangere North and Favona connecting to the North Island Main Trunk Line at Otahuhu. Four stations are provisionally identified along the corridor within the study area along with a connection to the Otahuhu station. North of Otahuhu additional track may be needed through to where the eastern line branches off the NIMT.

Highway upgrades for SH20B would be included in conjunction with enhanced local bus connections to the north and south connecting Onehunga, Middlemore, Papatoetoe and Manukau City with the corridor. Other connections would include Flat Bush beyond the study area. Cycle facilities would be provided along the corridor.

If this package were to proceed as a stand alone connection, then given the branch nature of the corridor double tracking of the entire length is anticipated to accommodate demand and designation should proceed on that basis. However if combined with package 4 then some sections of the corridor could be initially single tracked with provision for double tracking at stations and if needed other locations to accommodate passing. Designation should however proceed on the basis of providing double track along the full length of the corridor to accommodate an ultimate double track option.

Where the rail corridor crosses existing road corridors then these would either be grade separated or require closure of the road connection so as to eliminate at grade crossings. Where the rail runs through AIAL land it is currently anticipated that a significant portion of the corridor will need to be either elevated or located below ground to eliminate significant conflicts.

Along the corridor there are a number of locations suited to TOD. Ascot, Mangere Town Centre, Favona and Otahuhu are all well suited to a public sector led TOD. Further opportunities exist in brownfield locations south west of Otahuhu with relatively high value and large land parcel areas. This package provides land use opportunities in the Mangere East and Otahuhu areas that are not available in other packages.

4.4.8 Package commonalities

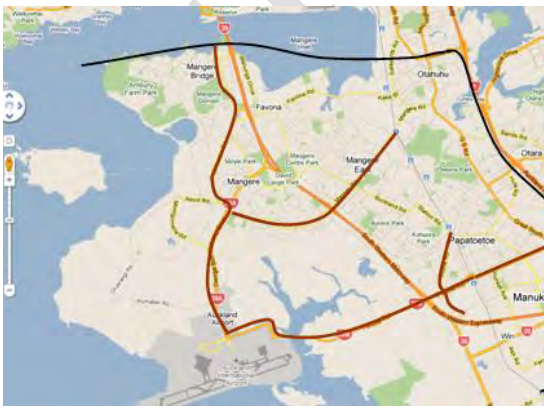
There are a number of common elements included in all packages which represent a base scenario. As outlined below these elements should be investigated further following the confirmation of the specific RTN alignment and station locations. The package commonalities include cycle facilities, local bus requirements, freight requirements and local network improvements. Full details are provided in Appendix P, Appendix Q and Appendix R respectively with the exception of local network improvements which are not covered at this stage. Below is a summary.

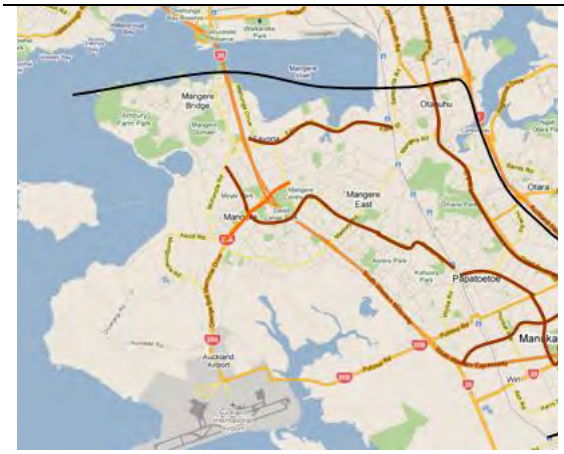
4.4.9 Package commonalities – Walking and cycling

It is recommended that Auckland Transport review the potential for walking and cycling improvements either in conjunction with the primary corridor project or expand the scope of phase 2 (Appendix P). As part of the Area Plan process for the Mangere-Otahuhu Area Plan, and as an output of the consultation process, opportunities for improving walking and cycling routes across SH 20 and SH 20A should be investigated with the aim of improving the accessibility of Mangere Town Centre with its adjacent communities.

There are certain walking and cycling problems and opportunities that should be addressed by all packages and are independent of the various proposed RTN options. The primary focus is towards providing direct links to and from the airport for commuters. A secondary focus is to strengthen various other transverse connections to improve accessibility across the study area by active mode. A further key opportunity that has been identified is to encourage vibrant and liveable communities by providing a recreational link which is aimed at improving visitor experience.

Table 4 Baseline walking and cycling elements

Element & Route	Description
Direct route aimed at Commuters - On-road Facilities 	Coronation Rd, Mackenzie Rd and George Bolt Memorial provide a direct route between Mangere Bridge and the airport. This route improves upon and provides missing connections between existing on-road cycleways to provide a more legible and safer route to Auckland Airport. Massey Rd has been identified as the route that provides the main access from Mangere East towards Auckland Airport. This route will be a new on-road facility that connects with the direct route along George Bolt Memorial Drive towards the airport. Puhinui Rd provides a direct route between Puhinui and Auckland Airport, with a link from Papatoetoe. This route will require new infrastructure and links well with the rail stations at each of Papatoetoe and Puhinui.
Other connections (serving school trips and commuters) - Off-road & On-road Facilities	Great South Rd has been identified as the route that connects Otahuhu and Papatoetoe

Element & Route	Description
	through to Manukau. Improvements are required to connect existing route segments and provide a safer and clearer connection between these communities. Favona Rd is the route that connects Mangere Bridge and Favona with Otahuhu. This route will require new infrastructure that will improve the connection between these communities. Improved connections between existing on-road route segments on Bader Dr and Buckland Rd will better connect Mangere Bridge and Mangere East with Mangere Town Centre by providing a transverse link. Improvements to existing off-road facilities along George Bolt Memorial, between Kirkbride and SH20 interchange, will connect Mangere Town centre with the SH20A route
Recreational cycleway - Off-road & On-road Facilities 	This walkway / cycle route is in line with the PPC14 and the Te Araroa national cycleway. This link will connect the airport and Mangere Bridge. It is an indirect route that serves a mainly leisure, recreational and heritage-focussed user experience. This route will follow the Manukau Harbour coastline and provide links to key cultural and heritage sites in the area such as the Otuataua Stonefields and Mangere mountain. On-road facilities are required to be provided along Ihumatao Quarry Rd, Orurangi Rd, Ihumatao Rd, George Bolt Memorial Dr and Tom Pearce Drive. On-road facilities will also be required on Roscommon Rd and Wiri Station Road as identified and described in baseline element A.

4.4.10 Package commonalities – Local bus

It is recommended that Auckland Transport review the potential for local bus improvements either in conjunction with the primary corridor project or expand the scope of phase 2 (Appendix Q). There are a number of opportunities to improve local bus services in the study area and Table 5 to Table 8 below identify a number of issues and opportunities that are recommend to be incorporated in the proposed way forward and which are independent of the various proposed RTN options.

Table 5 Issues and opportunities for local bus services to the Airport

Specific Outcome & Success Criteria	Issues / Opportunities
Increased efficiency within the transport network	Current LCN services are not efficient, and they require multiple interchanges in some cases. Potential re-alignment
Improved public transport access to areas of employment particularly for local communities typified by high levels of social deprivation	The Airport is a major employment centre and currently Favona and Mangere Bridge have poor access, both have high levels of social deprivation
Improved public transport links between key centres	Airport has regional significance and should be served primarily by QTN services with complimentary LCN services
Modal shift towards public transport	There is an opportunity to provide improved PT services to the Airport that will encourage a mode shift away from private vehicles
Improved quality (frequency, travel time and experience of public transport services)	There are opportunities to improve local bus priorities, bus lanes and other facilities that will improve the quality of service to this major centre
Improve the public transport travel time reliability	The 375 service follows an indirect route along many of the local roads; this route is likely to experience delays. Opportunity to replace with QTN / complimentary LCN
The public transport services connect safely and reliably with community facilities and centres of employment	Currently there is a weak connection to the Airport from some areas and the 375 service is unlikely to be reliable

Table 6 Issues and opportunities for local bus services to the west of Wiri

Specific Outcome & Success Criteria	Issues / Opportunities
Increased efficiency within the transport network	Provide efficient LCN services to the West of Wiri, should this area develop as anticipated
Improved public transport access to areas of employment particularly for local communities typified by high levels of social deprivation	Potential for high levels of employment, therefore need to provide reliable access from population centres that should be in the form of a single 'leg' trip
Improved public transport links between key centres	Opportunity to provide link to emerging employment centre
Modal shift towards public transport	If the service provided caters for commuters it will likely encourage a mode shift
Improved quality (frequency, travel time and experience of public transport services)	Currently no services are designed for this area, so opportunity to provide high quality services as required
Improve the public transport travel time reliability	Services will need to be reliable if they are to gain high levels of patronage from commuters

Specific Outcome & Success Criteria	Issues / Opportunities
The public transport services connect safely and reliably with community facilities and centres of employment	Currently, there is no connection to this area apart from QTN service 380 that travels along Puhinui Rd. Future services should connect with other community facilities

Table 7 Issues and opportunities for local bus services to Manukau City Centre

Specific Outcome & Success Criteria	Issues / Opportunities
Increased efficiency within the transport network	Most population centres in the study area rely solely on the LCN 348 service to get to / from Manukau City Centre. With the exception of Favona, services from population centres are for the most part efficient. May require adjusted alignment / additional services
Improved public transport access to areas of employment particularly for local communities typified by high levels of social deprivation	Favona has high social deprivation rating and is again poorly serviced. Opportunity to improve service
Improved public transport links between key centres	Require a more resilient connection to Manukau by including an additional service to compliment the existing 348 service
Modal shift towards public transport	Opportunity to encourage mode shift through improved services and accessibility is likely as it will reduce costs associated with private vehicle travel as prices increase.
Improved quality (frequency, travel time and experience of public transport services)	There are opportunities to improve local bus priorities and other service improvements along a designated route through the study area
Improve the public transport travel time reliability	Travel times are poor from Mangere and Favona
The public transport services connect safely and reliably with community facilities and centres of employment	Current services connect fairly well, although the services are un-reliable and are not robust

Table 8 Issues and opportunities for local bus services to Otahuhu

Specific Outcome & Success Criteria	Issues / Opportunities
Increased efficiency within the transport network	Generally there is good access to Otahuhu; however the LCN services are not particularly efficient. They serve only one function, which is travel to Otahuhu. Need to incorporate services to other areas that can serve multiple purposes
Improved public transport access to areas of employment particularly for local communities typified by high	Papatoetoe does not have a high level of access by way of local bus services. This area is however serviced by the RTN. General opportunity to enhance

Specific Outcome & Success Criteria	Issues / Opportunities
levels of social deprivation	the current levels of access to be more efficient
Improved public transport links between key centres	Need to provide more legible services to Otahuhu
Modal shift towards public transport	Bus services need to be improved to encourage a mode shift. Otahuhu is a multi-functioning centre that requires a high level of transport oriented services
Improved quality (frequency, travel time and experience of public transport services)	Opportunities exist to improve the quality of services by way of improved user experience and legibility
Improve the public transport travel time reliability	Travel times are generally quite good. Mangere Bridge and Favona should have faster services and this may be that Favona Rd currently restricts existing services
The public transport services connect safely and reliably with community facilities and centres of employment	Connections to Otahuhu need to be strong and serve multiple purposes to improve the efficiency of the local network and allow for various user groups

4.4.11 Package commonalities – Freight

In considering options for providing improved rail links to the airport, an initial review was undertaken of the issues associated with their use for the movement of freight as well as passengers Appendix R. This review found that freight via rail into the airport precent was not seen as having significant benefits. However the provision of improved linkages to the airport that shifted trips from road based modes to dedicated PT corridors was seen as beneficial to road based freight movements. The benefit being the reduction in congestion as a result of modal shift. This benefit is realised for both freight bound for the airport and also the significant amount of freight bound to and from warehousing and storage services (about 27% of the total for the region) located in the Airport Northern Development Area that serves both local and national markets.

4.4.12 Package commonalities – Local network improvements

It is recommended that Auckland Transport review the potential for local network improvements either in conjunction with the primary corridor project or expand the scope of phase 2. The improvements should be reviewed following agreement of the Regional Land Transport Programme and Auckland Transport prioritisation.

4.4.13 Package commonalities – State highway network improvements

It is recommended that NZTA review the potential for network improvements either in conjunction with the primary corridor project or expand the scope of phase 2. The improvements recommended include:

- Connection of SH20A and SH20B (involving a cost sharing arrangement with AIAL on who's land the connection would take place);

- 4 laning of SH20B from the airport to Puhinui interchange and upgrading of the interchange;
- Kirkbride grade separation; and,
- A Southbound connection of SH20A to SH20.

5. Assessment of the Packages

5.1 Context for the evaluation criteria

The assessment framework and evaluation criteria have been built around the five cases identified within Treasury guidance document entitled *Better Business Cases for Capital Proposals* Version 2.0 August 2010. The Treasury guidance requires a "Five Case Philosophy" for preparing a business case. These five cases to be addressed are outlined in Table 9 below.

Table 9 Treasury's five cases

The Cases	Assessment
Strategic case – the project is supported by a robust case for change	The effectiveness of the package in addressing the problems identified in the strategic case and achieving the project objectives will be assessed.
Economic case - potential value for money	Economic efficiency will be addressed through consideration of the direct BCR. Other economic benefits will be identified but not quantified at this stage.
Commercial case – provider capacity and capability	This will consider the viability of the option or package in terms of the likelihood that the services will materialise.
Financial case – potential affordability	This will consider the affordability of the package based on public and private investment opportunities
Management case – potential achievability	This will consider how achievable the option or package is.

The indicative business case establishes the strategic case for this project. It outlines the purpose of investment and the likely benefit that the investment will bring. This Scoping Report describes the relative merits of the packages considered and draws on material included in the indicative business case.

During the first phase of the project, and in accordance with the expectations of the indicative business case, the five cases (and therefore the evaluation criteria) are assessed to varying degrees of detail.

5.2 The evaluation criteria

In response to the problems defined in section 2 of this report a set of evaluation criteria were established as summarised in Table 10 and included in Appendix G. These were established and refined over a number of weeks and involved workshops and one on one discussion with key stakeholders. Each package has been assessed against these criteria (the detail of which can be found in Appendix H) with the aim of identifying the relative merits of the packages and to establish a proposed way forward.

Table 10 Evaluation criteria

Business Cases		Project Objective	Project outcomes and success criteria
Category	**Element**		
Strategic Case – Problems	Insufficient Capacity	To increase the capacity and efficiency of the transportation network to accommodate demand	Increase in person capacity to meet demand for travel
			Increased efficiency within transport network
		To improve journey time reliability for freight and airport related traffic	Increased PT Travel time reliability
			Increased travel time reliability particularly for freight and airport related traffic
			Reduction in travel time delay for people and freight within the corridor
	Quality	To broaden and enhance transport choices within the study area and the region to improve connectivity	Improved public transport links between key centres
			Modal shift towards public transport
		To improve visitor experience in order to enhance the reputation of Auckland and NZ within the global market	Improved visual amenity of the route to and from the airport
			Improved quality (frequency, time and experience) of public transport services
	Connectivity	To improve connectivity and access within the study area for local communities and facilities	Public transport services connect safely and reliably with community facilities and centres of employment
			Local road and street network assists internal connectivity, manages traffic volumes and reduces accident rates
			Increased walking and cycling opportunities
Strategic Case – Opportunities	Regional growth	To enable growth and development aspirations within an integrated and sustainable transport system	Development of higher density nodes supported by transport investment and modal choice
			Accommodates high levels of growth and development

Business Cases		Project Objective	Project outcomes and success criteria
Category	**Element**		
	Airport economic potential	To capture economic benefits associated with the Airport Corridor and its role as a Global Gateway	Unlock the economic potential of the airport environs to increase contribution to regional and national GDP and employment generation
	Liveable Communities	To support the health and vibrancy of communities within the study area by providing acceptable levels of access to employment, community facilities and recreational assets.	Improved access to employment opportunities
			Improved access to social infrastructure
Economic	Potential Value for Money		Acceptable benefit cost ratio
			Wider economic benefits leveraged from development
Commercial	ROI		Appropriate Return on Investment
Financial	Affordability of Package		Minimise Capital requirements (affordability)
			Minimise Operation & Maintenance costs
			Private sector funds leverage potential? (fundability)
			Staging Potential?
Management	Achievability of Package		Feasible package
			Environmental, social and cultural impacts acceptable
			Operational Constraints can be addressed

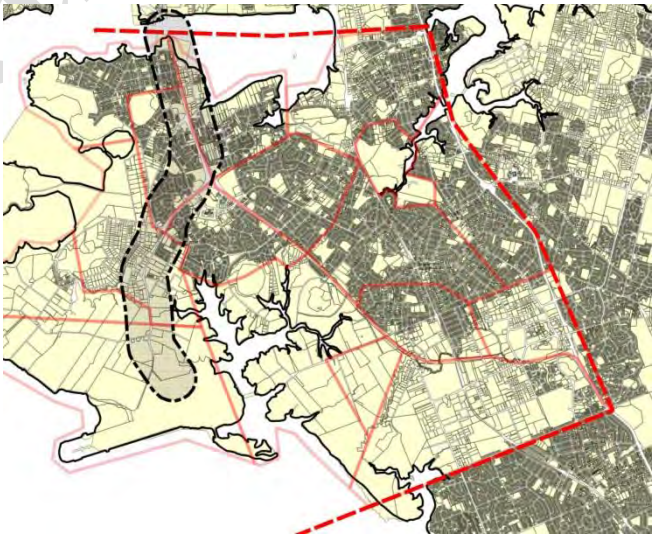
5.3 Social and environmental considerations

5.3.1 Introduction

The packages that are being assessed run along three broad corridors. In undertaking an assessment of the social and environmental effects it was deemed appropriate to base the assessment on the broad corridors rather than by mode given that the impacts within the corridor are expected to be broadly similar. Three potential corridors were considered in terms of their social, environmental, cultural and heritage constraints. Each corridor traverses a distinctly different area. This section provides a summary on each of the three corridors and discusses the constraints within each. Further detail on social and environmental issues can be found in Appendix T and Appendix L respectively. Iwi engagement also commenced during this phase with further details available in Appendix W. Following selection of the proposed way forward it is recommended that a more detailed assessment be undertaken to evaluate specific alignment options within the corridor(s).

5.3.2 Northern corridor

The Northern Corridor traverses through the northern area of the study area. The corridor does not cross any major waterways although it may cross minor stormwater culverts. There are a number of known historic structures, reported historic sites and archaeological sites close to the corridor. From the available information there are two known historic botanical sites also within approximately 500m. One Maori heritage site (Mangere Piriti Urupa (St James)) is present approximately 800m from the proposed corridor along Church Road in Mangere.



In addition to the cultural heritage sites, there are a number of significant ecological sites reported to occur within the proposed corridor area. The Manukau Foreshore is of ecological significance and is located approximately 400m from the proposed corridor. This area supports an expansive roosting habitat for wading birds and extends east of the corridor into Mangere Inlet. Further, the majority of the coastal foreshore within the corridor area falls within the CPA.

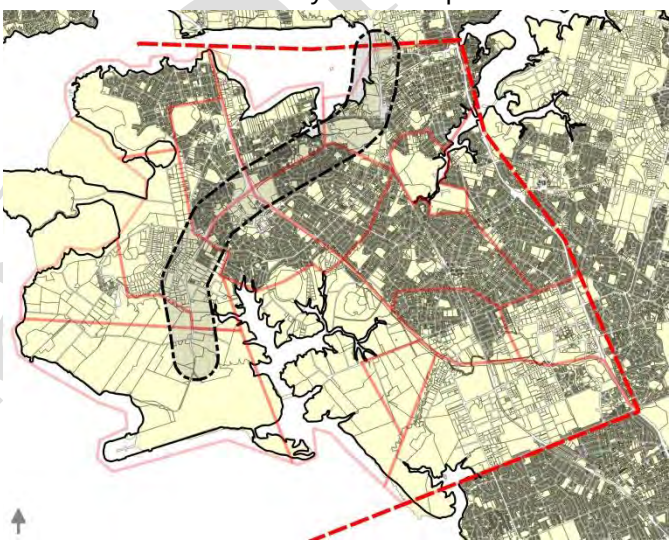
The northern corridor is mainly made up of a mix of residential and industrial land. This corridor has good potential for regeneration via publicly funded TOD. It is also expected to have a relatively significant impact on the communities it passes through over time as

regeneration occurs. In the sort term designating this corridor is expected to have relatively minor impact on the social and environmental status quo. However over the longer term and particularly during the construction phase there are likely to be significant social and environmental impacts that will require mitigation at that time. Noting that the purpose of the corridor is to improve the performance of the overall transport system, reduce emissions through modal shift and congestion relief. As the project progresses and if this corridor is identified as one which will be taken into phase 2 then further investigation and evaluation is recommended for specific alignments along the corridor.

5.3.3 Eastern corridor

The Eastern Corridor crosses the study area in a west to east direction traversing predominantly urban and industrial land uses. The intensification of land uses in this area has reduced the number of remaining ecological sites and is therefore considered a more viable option in terms of minimising ecological impacts.

While there are few reported ecological sites, the corridor may cross the upper reaches of the tidal creek along the eastern margin of Mangere Inlet. This area is known to contain extensive stands of the mangrove *Avicennia marina* and may therefore provide suitable roosting and foraging habitat for wading birds. Similarly, mangroves are known to provide a preferred habitat for juvenile fish. Additionally, there are a number of historical structures, archaeological sites and historic botanical sites close to the corridor.

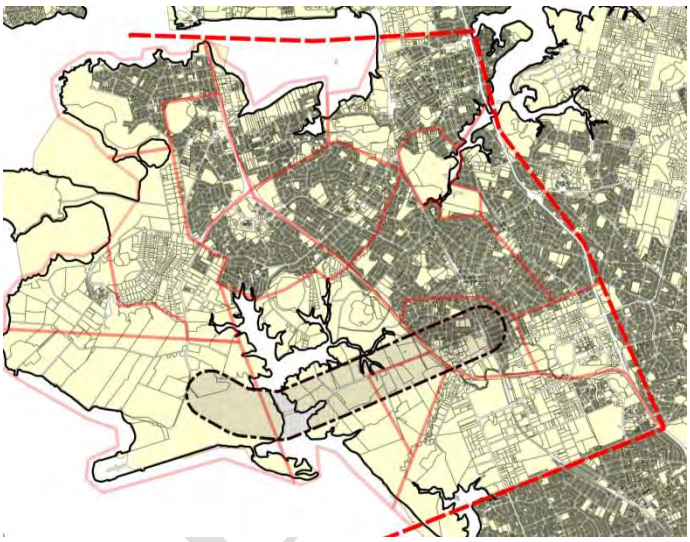


The eastern corridor consists of a mixture of residential, commercial and industrial land. This corridor is deemed to have the greatest potential for regeneration via publicly funded TOD. It is therefore also the corridor that would be impacted most significantly over time as this regeneration occurred. However in the sort term designating this corridor is expected to have relatively minor impacts on the social and environmental status quo. Over the longer term and particularly during the construction phase there are likely to be significant social and environmental impacts that will require mitigation at that time. Noting that the purpose of the corridor is to improve the performance of the overall transport system, reduce emissions through modal shift and congestion relief. As the project progresses and if this corridor is identified as one which will be taken into phase 2 then further investigation and evaluation is recommended for specific alignments along the corridor.

5.3.4 Southern corridor

The Southern Corridor is within the Manukau area and traverses the southern area of the study area. The corridor crosses the Puhinui Inlet, a site of cultural importance to Maori. Puhinui Inlet is within the Coastal Protection Area (CPA)[9] and is recognised as an area of ecological significance.

While there are no wading bird roosting sites identified within the inlet, it is likely the area is used by migratory birds for rest and occasional feeding. Further, there are a number of archaeological sites of unknown source within the area particularly along the margins of the inlet and associated creeks. Additionally, one historical botanical site is present approximately 100m from the immediate west of the corridor however the completeness of the site is unknown at the time of writing. A wetland has been identified approximately 1.5 km to the north. Construction is unlikely to have a direct impact on the wetland, however while wetlands are generally low lying depressions there is the possibility of contaminated runoff (e.g. heavy metals, suspended solids) to contaminate the water.

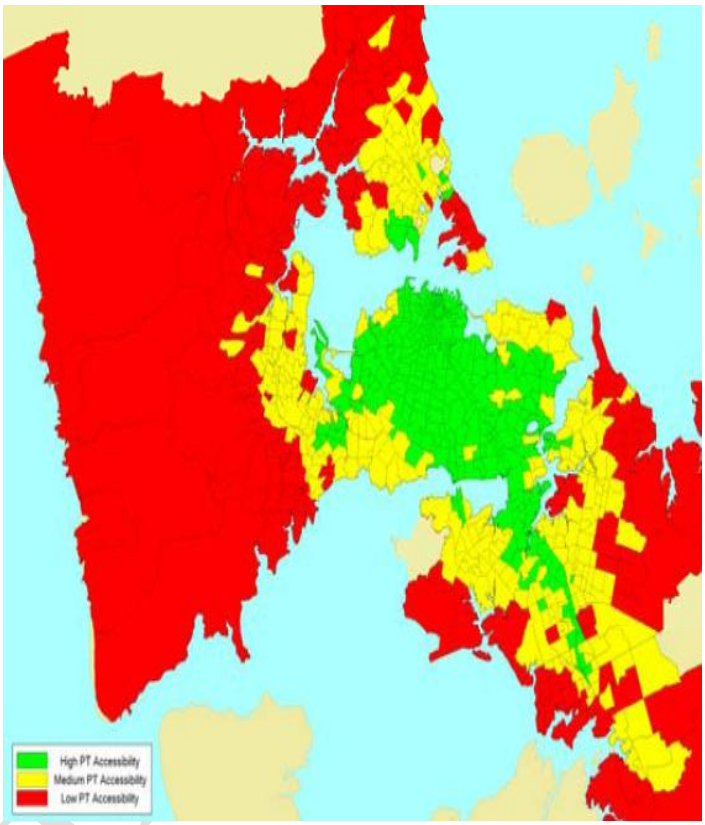


The southern corridor is dominated by land that is commercial and industrial in nature. Designating this corridor may have minor impacts on the social and environmental status quo in the short term. However over the longer term and particularly during the construction phase there are likely to be significant social and environmental impacts that will require mitigation at that time. Noting that the purpose of the corridor is to improve the performance of the overall transport system, reduce emissions through modal shift and congestion relief. As the project progresses and if this corridor is identified as one which will be taken into phase 2 then further investigation and evaluation is recommended for specific alignments along the corridor.

[9] The Coastal Protection Area is defined as areas that are of regional, national or international significance due to their ecological, landform or geological values. There are two types of CPAs which reflect the different values, size and the degree of vulnerability of the significant areas and sites (Auckland Regional Plan: Coastal (1995)).

5.3.5 Connectivity

Figure 10 Accessibility to public transport



The need for improved connectivity has been identified as a key issue across the study area. Most communities within the study area have developed as a response to increasing employment however the transport network does not reflect the desired movement.

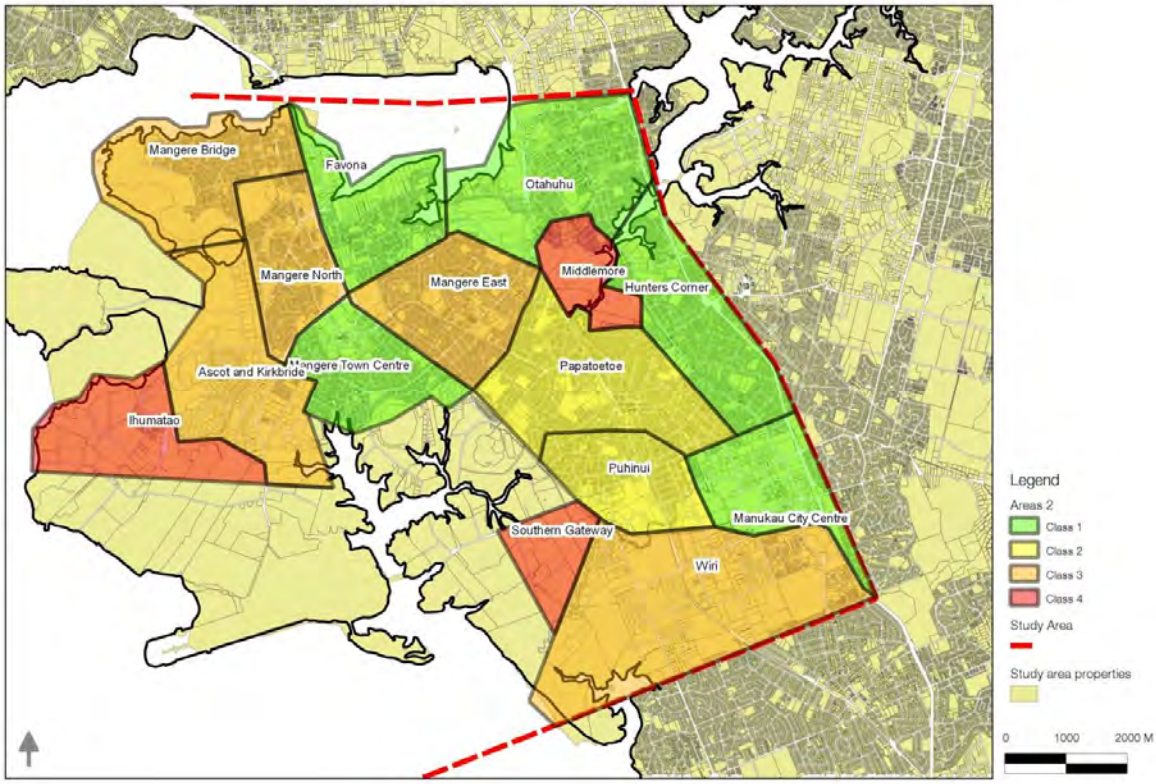
Significant infrastructure corridors (SH1, SH20, NIMT) have developed as a response to strategic north-south movements and this has resulted in severance for communities contained within.

Communities within the study area are not well connected and have relatively low access to public transport particularly to employment in and around the airport.

5.4 Opportunities for Transit Oriented Development

Within the study area there are varying constraints for TOD. Figure 11 summarises the outcome of a classification process undertaken by area in terms of their potential to support TSD. The scale of classification ranges from Class 1, which indicates areas where there are no major barriers for TOD, through to Class 4, which indicates fundamental difficulties to TOD. Appendix T discusses these opportunities in more detail. However in broad terms the central and eastern portion of the study area exhibits the greatest opportunities for TOD. Only three areas are considered fundamentally unsuited to TOD, namely Ihumatao, South Gateway, and Middlemore.

Figure 11 Opportunities for TOD



5.5 Demand considerations

A key input into the assessment of the options included modelling of the packages to determine their relative ability to meet demand and free up capacity within the existing network. To achieve this in the constrained timeframes of phase 1 existing base models were used. These were the Auckland Regional Transport Model (ART3) using the RLTS and NZTA input assumptions. These models have provided the evidence for the initial business case in Phase 1 of the project and supporting information for the development of the strategic transport packages and the Public Transport Progression Plan. Below is a summary of the need for providing the RTN and how each package meets that need. Further detail can be found in Appendix D and Appendix F.

5.5.1 The Need for travel

The expected demand for travel in the study area has been found to be as follows:

- Auckland airport is anticipated to attract 11,865 person trips during the 2-hour morning peak in 2041, of which 7,716 will be home-based work trips. The Airport is a significant regional employment and economic centre where the distribution of home-based work trips is such that 30% are trips from within the study area and 70% are external; 1 in 5 work trips to Auckland airport originated in Manukau South (which includes Papakura

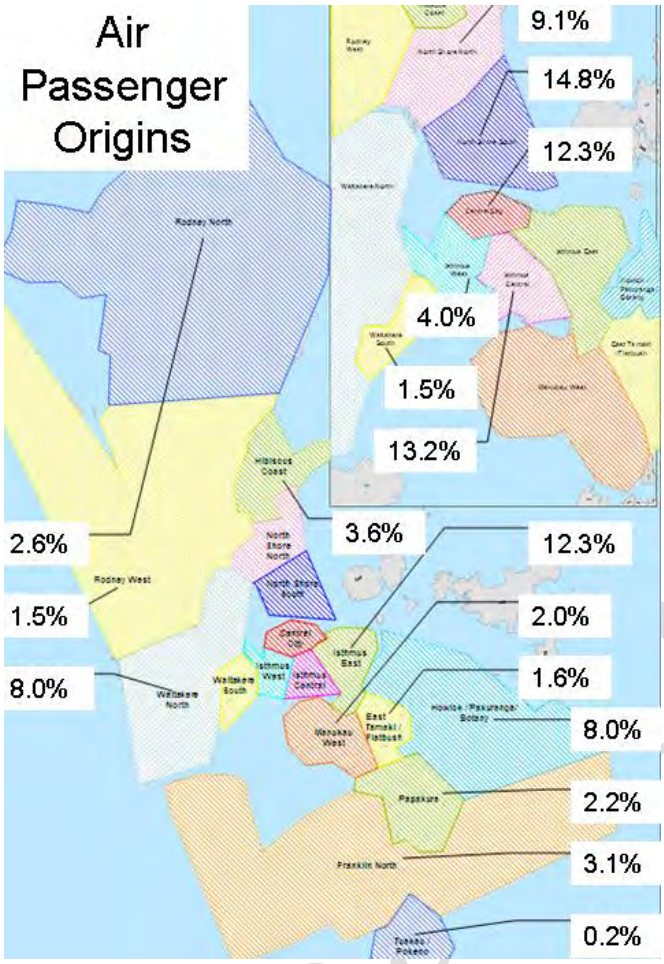
and Franklin), 13% originate in Manukau East and 12% are from Papatoetoe. In 2006, approximately 4% of trips in the Auckland region were by public transport. The model suggests that around 20% of trips to Auckland airport will be via public transport by 2026 and more than 40% by 2041.

Figure 12 Work trips

- The Auckland airport environs is expected to attract 3,418 person trips during the 2-hour morning peak in 2041, of which 2,043 will be home-based work trips. The distribution of home-based work trips is such that approximately 40% are internal and 60% are from outside the study area; 15% of work trips to the Auckland airport environs originate in Mangere town centre, 12% are from Papatoetoe and 12% are from Manukau South (including Papakura and Franklin). It has been forecast that there will be an increase in the public transport mode split to the airport environs to about 25% in 2026 and 35% in 2041.

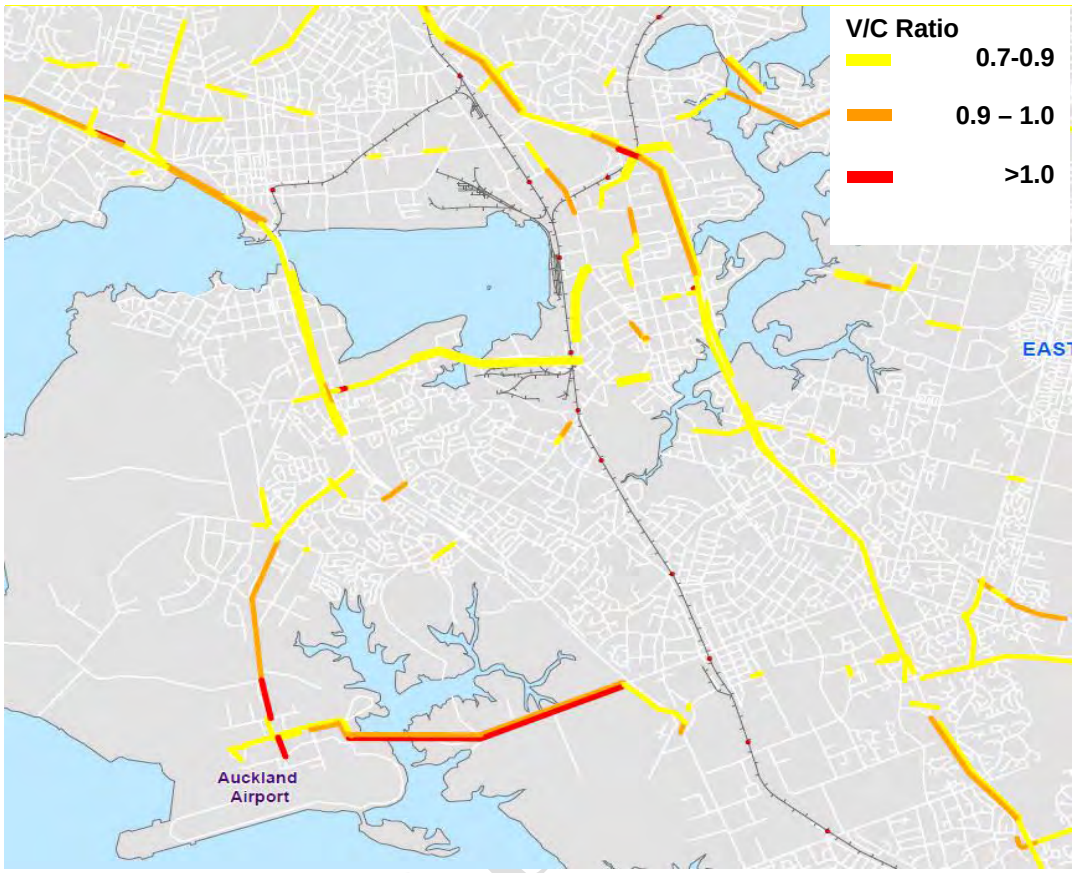
Figure 13 describes the split in origin for passengers travelling to the airport across the region. It highlights the large proportion of travellers coming from the isthmus area.

Figure 13 Passenger trips



- Other communities in the study area comprise of Mangere Bridge, Mangere Town Centre, Papatoetoe and Manukau Central. Papatoetoe accounts for the largest number of person trips in 2041 (25,056) but has little annual growth. Manukau central is the fastest growing community in terms of the increase in the number of person trips per annum (2.4% p.a). The majority of trips from these communities are miscellaneous trips, the exception being Mangere Bridge where the majority of trips are work-related. The Isthmus East and Auckland airport are significant employment sectors for these communities and represent a large number of the total work trips; 1 in 5 work trips from communities within the study area travel to the Isthmus East and between 8-17% of trips are to Auckland airport. There is also a significant expected increase in the percentage of trips by public transport.

Figure 14 Congestion forecasting 2041 in AM with RLTS assumptions



5.5.2 The availability of travel

To satisfy the demand for travel there needs to be an adequate transport network which is available and accessible. Currently, accessible travel within the study area is by bus, road or alternative services such as shuttles and taxis.

- There are three bus services which travel to Auckland airport; the airbus express, the Manukau Airporter 380 and the route 375 bus service. The airbus express does not have any stations in the study area and is therefore unavailable for local residents. The Manukau Airporter is a quality transit network (QTN) that provides fast, reliable and frequent transport to the airport from Manukau and Papatoetoe. The 375 bus service is a local connector network (LCN) that travels an indirect route through the study area to the airport. There is currently no bus that travels from Mangere Bridge to Auckland airport. The current bus services are inadequate to provide the forecast public transport mode share.
- SH20A and SH20B provide access to Auckland airport. The demand along SH20A currently reaches a peak of around 1400 vehicles per direction per hour between 4.00-5.00 pm. The demand along SH20B currently reaches a peak of around 600 vehicles per direction per hour between 2.00-4.00 pm. It is expected that these roads will reach capacity before 2026.

- There are numerous taxi and shuttle services available to Auckland airport which offer a more comfortable service than public transport for passengers and their luggage, although the cost of these services is high. The reliability of these services is dependent on the level of service of the road corridor.

5.5.3 The issues

The first stage assessment of the expected transport demand in 2041 has identified the following issues:

- There is insufficient capacity within the existing transport network to meet long term growth demands of the airport business district and its surrounds;
- Limited transport choices affect the ability of some communities to access the airport and the surrounding employment, leisure and commercial centres; and,
- Poor journey time reliability between the airport and main centres affects the efficiency of the markets which service it and vice versa.

5.5.4 Comparison of the packages

The packages meet the demand to varying degrees in terms of capacity, travel time, journey time reliability and impacts on the existing network. Details of how each package meets these needs is included in Appendix H along with the other criteria included in the evaluation criteria. Figure 15 below identifies two distinct areas / zones that were modelled using the ART3 model.

The Auckland Airport Business District covers the 165 businesses operating out of 268 operating units. Approximately 11,700 people currently work in the Auckland Airport Business District. The airport business district is represented by a single zone in the ART3 model.

The Airport environs is a major employment centre in the study area and there are currently several proposed land use plan changes that involve the development of the Ascot and Kirkbride area to the North of the airport into a large industrial and Business Park. In total, there are 510 permanent businesses which operate out of the Auckland Airport environs that collectively currently generate approximately 10,100 jobs. The airport environs is separate from the airport business district and includes the land to the north of the airport between the airport and Ascot.

Figure 15 Key markets within the study area

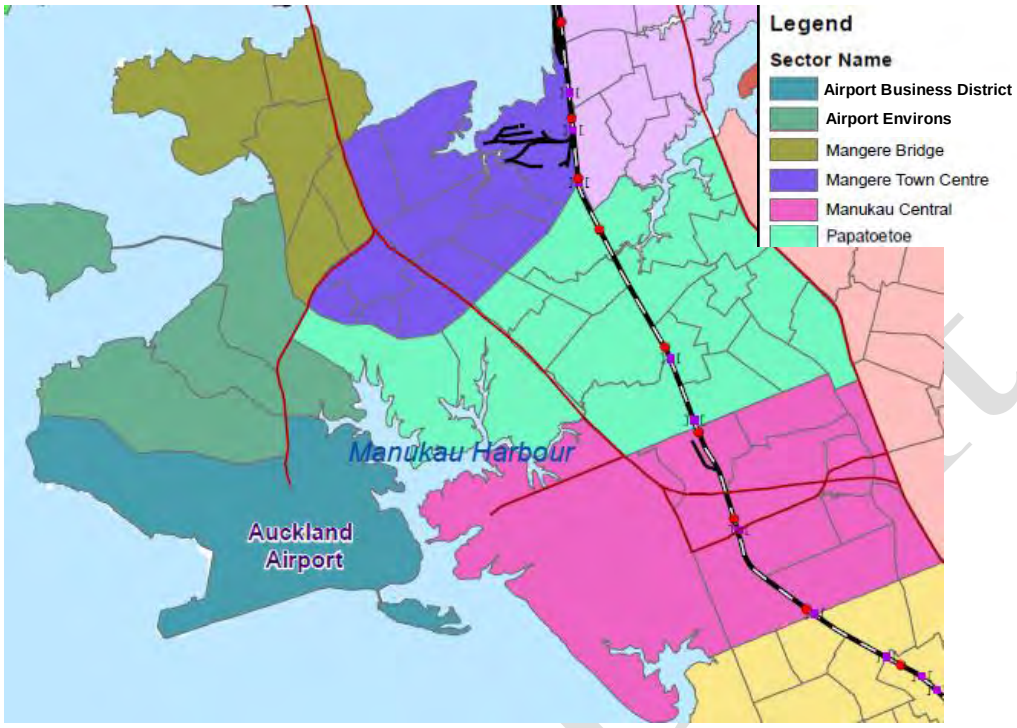


Table 11 below compares the daily PT mode share for air passengers for each package using both the RLTS and NZTA input assumptions. Whilst there is a difference between the RTLS and NZTA input assumptions there is very marginal difference between the various packages.

Table 11 Daily PT mode share to for Air Passengers in 2041

	Do-Minimum	Package 1	Package 2/3	Package 4	Package 5	Package 6	Package 7
RLTS	47%	50%	49%	50%	50%	48%	50%
NZTA	62%	66%	64%	65%	66%	62%	66%

Table 12 below compares the daily PT mode share to Auckland Airport Business District for each package using both the RLTS and NZTA input assumptions. Whilst the NZTA inputs forecast lower levels of PT patronage, both the RLTS and NZTA models recognise the ability of each RTN to improve the mode share to the airport. In both cases Package 1 is expected to result in the largest increase in mode share compared to the do-minimum network (between 13-17% increases). Package 4 is expected to increase the mode share by between 12-16% from the do-minimum.

The lowest increase in mode share is expected to come from Package 6, the bus lanes on motorway shoulders option. In general, the rail options are expected to increase the mode share to Auckland Airport by between 10-17% (7-13% for NZTA) and the bus-based options are expected to increase the mode share by between 4-10% (2-7% for NZTA).

The Rail loop is expected to have the largest impact on a modal shift towards public transport, which alleviates the reliance on private vehicles as a primary means of transport to Auckland Airport

Table 12 Daily PT mode share to Auckland Airport Business District in 2041

	Do-Minimum	Package 1	Package 2/3	Package 4	Package 5	Package 6	Package 7
RLTS	24%	41%	34%	40%	34%	28%	35%
NZTA	17%	30%	24%	29%	24%	19%	26%

Table 13 below compares the daily PT mode share to the Airport environs for each package for both the RLTS and NZTA input assumptions. As with the mode share to the airport the mode share to the airport environs package 1 is expected to result in the largest increase in mode share. The remaining packages all show increases of between 2 and 3%, with the exception of Package 4 which doesn't show any modelled increase in PT mode share to the Auckland airport environs as this package is the rail to the south option and therefore doesn't provide any improved public transport access to the airport environs to the north of the airport.

Table 13 Daily PT mode share to Auckland Environs in 2041

	Do-Minimum	Package 1	Package 2/3	Package 4	Package 5	Package 6	Package 7
RLTS	18%	25%	23%	18%	22%	21%	23%
NZTA	10%	15%	13%	10%	13%	12%	13%

Table 14 below summarises some of the key network performance statistics for each package using the RLTS input assumptions (and NZTA input assumptions brackets). In summary, the Rail loop results in the largest increase in public transport trips network wide, inducing an additional 12,000 daily trips by public transport. This increase gives an indication of the packages' ability to create a modal shift towards public transport and by providing a higher quality public transport service it decreases the dependence on private vehicles.

The Busway/LRT, Rail to the South and Rail to the East all showed similar increases in public transport trips; in the order of 8,000-9,000 additional PT trips daily. Bus lanes on motorway shoulders had the least effect on the number of daily public transport trips out of all the packages.

Table 14 Summary of Network Performance

	Do-Minimum	Package 1	Package 2/3	Package 4	Package 5	Package 6	Package 7

	Do-Minimum	Package 1	Package 2/3	Package 4	Package 5	Package 6	Package 7
Network Travel Time (hrs) [10]	952,305 (1,379,129)	-19,118 (-16,974)	-11,684 (-4,509)	-15,590 (-8,496)	-10,508 (-3,969)	-2,877 (+12,852)	-11,892 (-10,271)
Total PT trips	669,648 (456,904)	+12,117 (+9,794)	+8,807 (+4,623)	+8,369 (+5,558)	+6,744 (+3,275)	+4,758 (+2,212)	+8,974 (+6883)

5.5.5 Conclusion from preliminary traffic modelling

The preliminary modelling undertaken during phase 1 indicates that package 1 (rail loop) is expected to have the largest impact on a modal shift towards public transport, which alleviates the reliance on private vehicles as a primary means of transport to Auckland Airport and its environs. In doing so package 1 is also most successful in reducing congestion on the road network and improving general journey times. Package 1 is therefore expected to provide the greatest economic benefits resulting from a lower level of general congestion for general traffic and importantly freight.

The Rail loop is forecast to have the most significant impact on network travel time, reducing this by 19,118 hours daily. The wider economic benefits of this are far more than just improved public transport patronage and extend beyond the revenue that will be collected from fares. Rail to the south has the second highest reduction in network travel time (15,590 hours daily), followed by Busway/LRT (11,684 hours daily) and Rail to the East (11,892 hours daily).

5.6 Geometric and constructability considerations

5.6.1 Introduction

Figure 16 shows the three corridors within the study area that were assessed for their relative abilities to be utilised for several competing modes. A number of alternative geometric alignments were run along each corridor so as to determine the feasibility of several alternatives; to identify potential issues associated with each; and, to allow the development of a Feasibility Estimate (FE). This section provides a summary of issues found along each of the three corridors and discusses the constraints within each.

The preliminary geometric and constructability assessment was undertaken for each alignment using the following criteria:

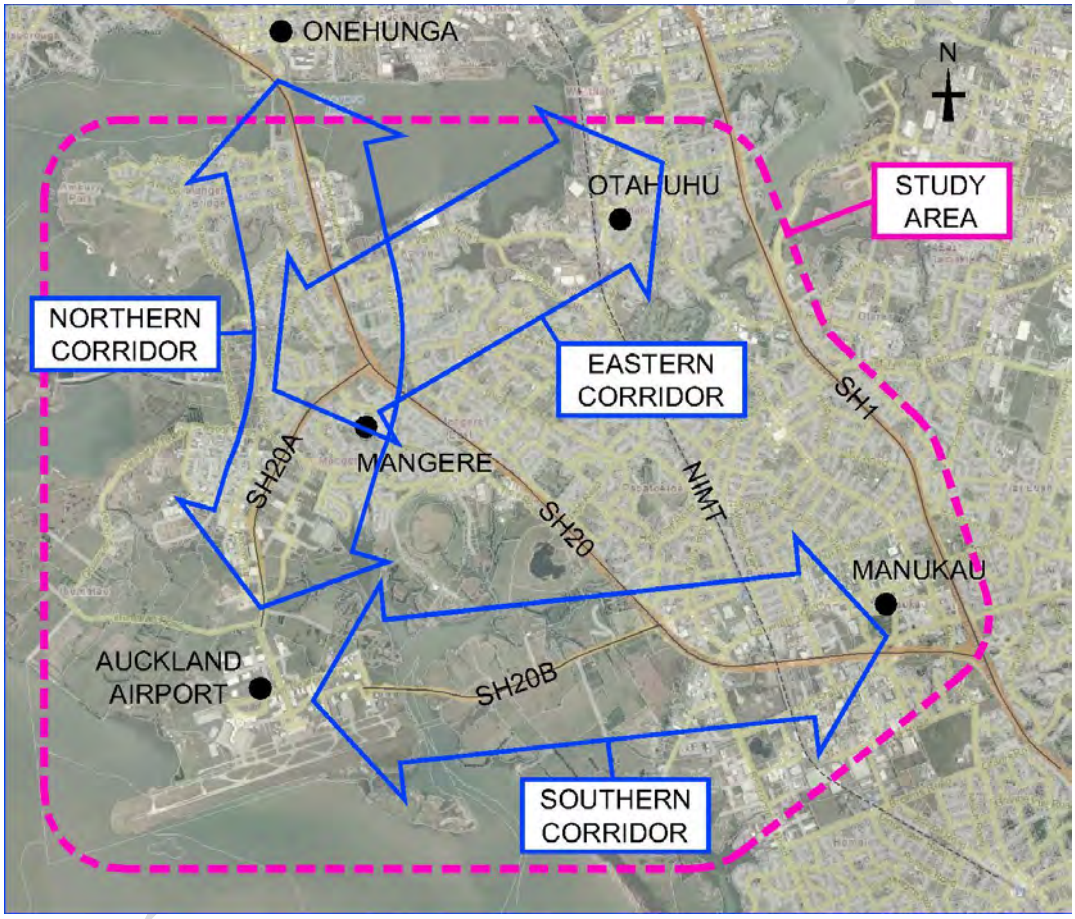
- Community connectivity – Assessed the relative degree to which community centres are connected to the RTN;
- Community severance – Assessed the relative degree to which an alignment severs communities;
- Constructability – Assessed the relative ease by which the alignment could be constructed; and,

[10] Where a + or – is shown, this indicates the relative increase or decrease with relevance to the do-minimum

- Suitability for heavy rail – Assessed the relative suitability of the alignment to accommodate a heavy rail line. If the alignment was suitable for heavy rail then it is assumed to be suitable geometrically for all other modes.

Following selection of the proposed way forward an alignment will be developed sufficient to allow designation of the corridor(s). It is expected that this alignment will be dictated by non geometric constraints and opportunities. However a more detailed review of constructability and construction sequencing is expected to be necessary during the next phase of the project.

Figure 16 Three corridors



5.6.2 Assumptions

In assessing the feasibility of various alignments along each corridor, the following key assumptions were made:

- Grades and geometrics initially based on heavy rail - As the preferred mode has not been confirmed at this stage, alignments were identified that allowed for heavy rail due to the more onerous grade and geometric requirements of this mode. Identifying a corridor suitable for heavy rail allows the flexibility to support any mode, and one in which any progression plan can be effectively applied;

- No at grade crossings - Where the corridor crosses major existing infrastructure, such as motorways and on/off-ramps, grade separation is anticipated. The nature of this separation depends on the infrastructure and topographical characteristics at that location;
- Station locations were considered conceptually - Critical station locations have been considered to conceptually only. During phase 2 alignments will be established to facilitate capturing land use benefits and to locate an appropriate designation; and,
- Alignment to be at grade where possible - The vertical alignment aims to follow the existing ground profile as appropriate, however exceptions to this may include:
  - Within the airport terminal precinct, where an elevated or underground alignment may to be required;
  - Locations where severance is a significant issue, such as town centres, an underground alignment may be recommended;
  - Grade separation over existing road/rail/motorway infrastructure.

5.6.3 Northern corridor

Figure 17 shows the four alternative alignments that were assessed along the northern corridor. Table 15 summarises the findings from the assessment. Appendix U provides further detail on specific issues identified during the assessment.

Figure 17 Northern corridor alignments assessed

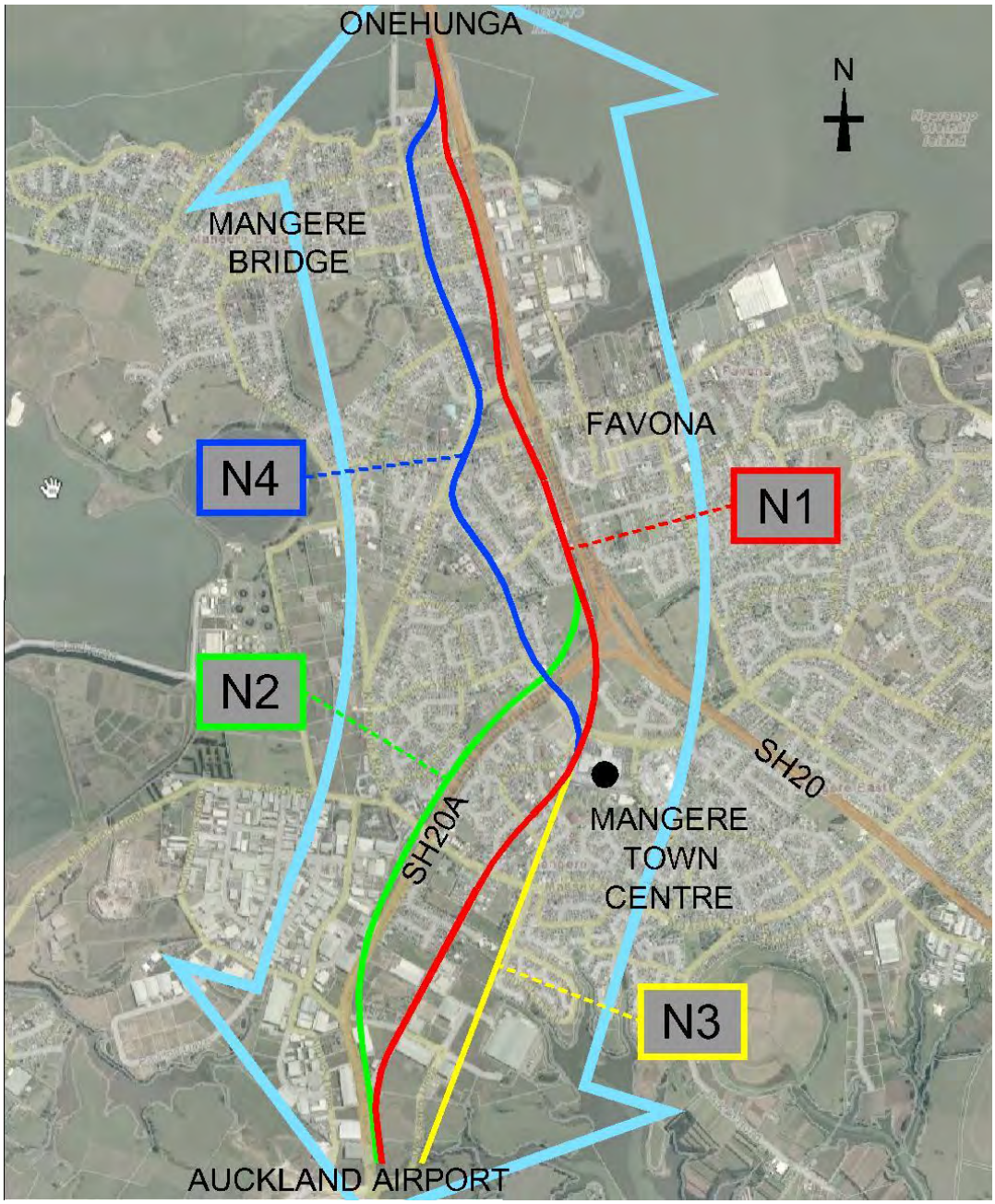


Table 15 Northern corridor geometric considerations

Specific Outcome & Success Criteria	N1	N2	N3	N4
Community connectivity	Neutral	Poor	Neutral	Good
Community severance	Moderate	Minor	Moderate	Significant
Constructability	Moderate	Easy	Moderate	Difficult

Specific Outcome & Success Criteria	N1	N2	N3	N4
Suitability for heavy rail	Good	Good	Good	Poor

5.6.4 Eastern corridor

Figure 18 shows the four alternative alignments that were assessed along the eastern corridor. Table 16 summarises the findings from the assessment. Appendix U provides further detail on specific issues identified during the assessment.

Figure 18 Eastern corridor alignments assessed

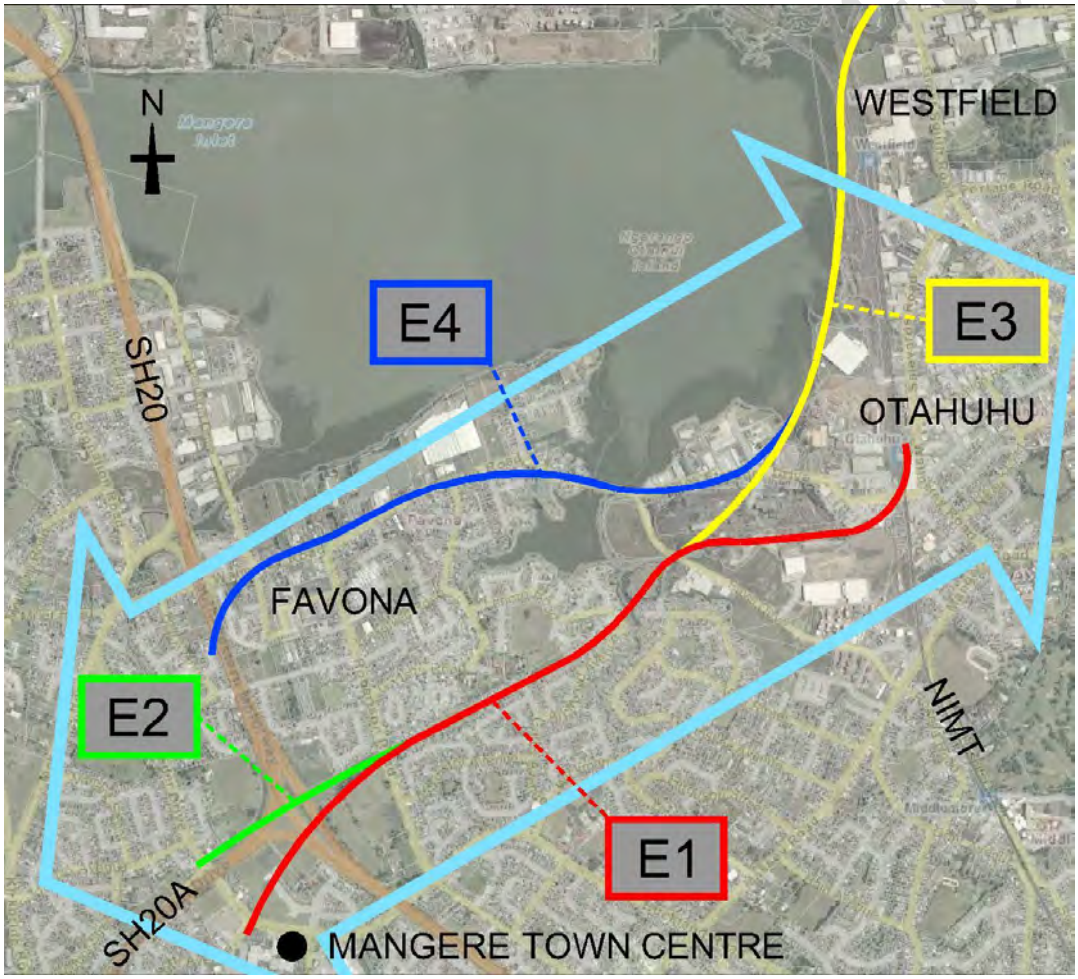


Table 16 Eastern corridor geometric considerations

Specific Outcome & Success Criteria	S1	S2	S3	S4
Community connectivity	Good	Poor	Neutral	Neutral
Community severance	Significant	Moderate	Moderate	Significant

Specific Outcome & Success Criteria	S1	S2	S3	S4
Constructability	Difficult	Difficult	Difficult	Difficult
Suitability for heavy rail	Good	Good	Good	Neutral

5.6.5 Southern corridor

Figure 19 shows the four alternative alignments that were assessed along the southern corridor. Table 17 summarises the findings from the assessment. Appendix U provides further detail on specific issues identified during the assessment.

Figure 19 Southern corridor alignments assessed

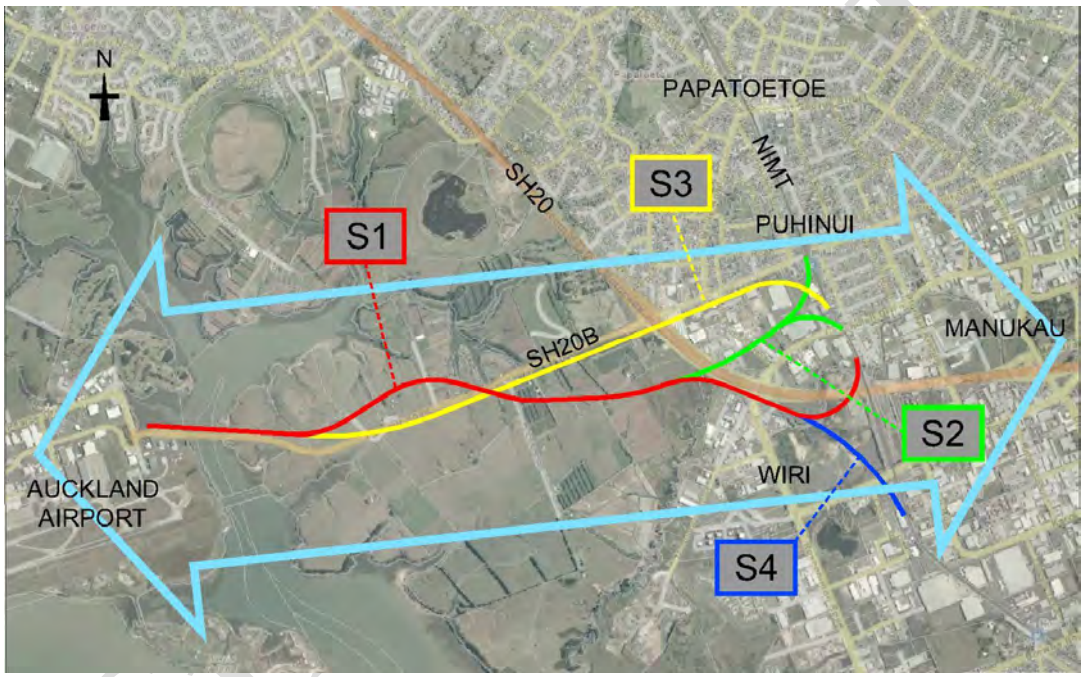


Table 17 Southern corridor geometric considerations

Specific Outcome & Success Criteria	S1	S2	S3	S4
Community connectivity	Good	Neutral	Neutral	Neutral
Community severance	Moderate	Moderate	Moderate	Moderate
Constructability	Easy	Easy	Difficult	Moderate
Suitability for heavy rail	Good	Good	Good	Good

5.6.6 Conclusion from geometric assessment

The various alignments assessed within the three corridors, together with the Airport precinct options, represents a number of feasible alignments within the study area.

Whilst there are pros and cons for each alternative, (some being significant), this assessment has found that from a geometric, and constructability viewpoint most of the options are viable and could be considered in Phase two.

This leads to the conclusion that constructability and geometrics will be a secondary consideration to determining the final alignment of the corridor, and that the primary determinant will be a combination of desired station locations, connectivity of the corridor to the surrounding communities and the mitigation of social and environmental issues.

However if the proposed way forward is rail based then careful consideration will be needed when connecting any rail RTN to the existing rail network from a physical, and operational standpoint.

It is recommended that during the next phase the ability to construct infrastructure at some point in the future is assessed against the need for maintaining existing capacity within the transport network during construction. In addition consideration is needed to be given to the ability to construct the infrastructure in a staged approach and determine if interim benefits can be realised or alternatively if major components of the proposed way forward need to be constructed before benefits can be realised.

5.7 Statutory & Policy considerations

The policy context within which the project sits is described in some detail in Appendix X. Figure 20 provides some content of the various pieces of legislation, regulation, policies and strategies that were considered during the first phase of this project.

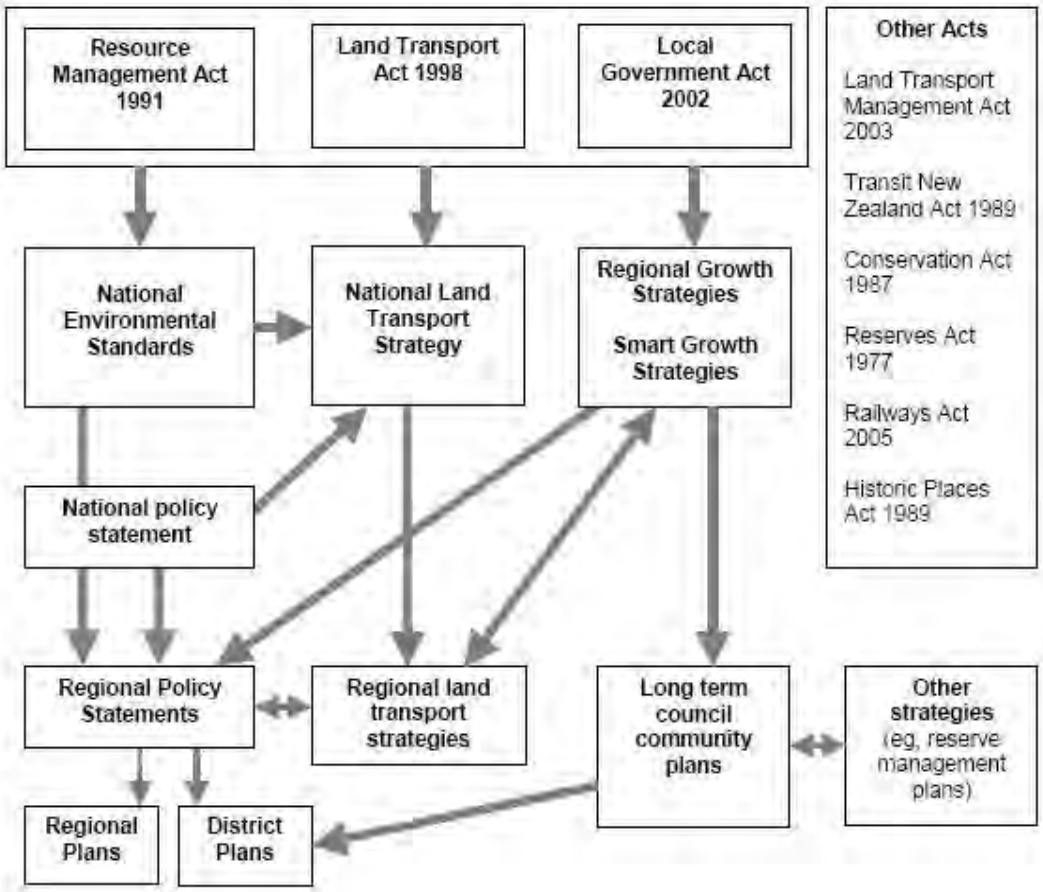
Table 18, Table 19 and Table 20 below include a summary assessment of how each package complies with the key objectives contained in three of these documents. Those documents being:

- The Land Transport Management Act (LTMA);
- The Government Policy Statement; and,
- The Regional Land Transport Strategy.

Although some of the packages have greater benefit than others insofar as they address the statutory or policy requirements more fully, each of the packages do meet the required objectives as set out in the LTMA, GPS and RLTS.

This leads to the conclusion that removal of any of the packages from further consideration due to their failure to meet LTMA, GPS or RLTS requirements is not warranted and that other considerations will determine the preferred package.

Figure 20 Legislative Framework



5.8 LTMA compliance

Each package was qualitatively assessed to see the degree to which it met LTMA requirements. The relative assessment is included in Table 18 below.

Table 18 Potential contribution to LTMA objectives [11]

LTMA Objective	Potential contribution	Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7
Assisting economic development	Improved access and choice to the Airport and adjacent business parks leading to less constrained economic development and decongestion on the state highway	High	Medium	Medium	Medium to High	Medium	Low	Medium to High
Assisting safety and personal security	Increased frequency in PT services and construction of high quality stations	High	Medium	Medium	Medium to High	Medium	Low to Medium	Medium to High
Improving access and mobility	Connectivity, both within the primary study area and with its associated markets, can be significantly improved	High	Medium	Medium	Medium	Medium	Low	High
Protects and Promotes Public Health	Reduced emissions and increased access to active modes is seen as part of the solution	Medium	Medium	Medium	Medium	Medium	Low to Medium	Medium
Ensuring environmental sustainability	Reduced congestion and travel time across the network will result in benefits in air/noise pollution and fuel consumption	Medium	Medium	Medium	Medium	Medium	Medium	Medium

[11] High indicates the package contributes very well to the LTMA objective while Low indicates that the package contributes but to a lesser degree to the LTMA objective

5.9 GPS compliance

Each package was qualitatively assessed to see the degree to which it met the GPS requirements. The relative assessment is included in Table 19 below.

Table 19 Contribution to Government Policy Statement [12]

GPS	Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7
Impacts that contribute to economic growth and productivity	High	Medium	Medium	Medium	Medium	Low	Medium
Improvements in journey time reliability	High	Medium	Medium	Medium to High	Medium	Low to Medium	Medium
Easing of severe congestion	High	Medium	Medium	Medium	Medium	Medium	Medium to High
More efficient freight supply chains	High	Medium	Medium	Medium	Medium	Low	Medium
Better use of existing transport capacity	Medium to High	Medium to High	Medium to High	Medium to High	Medium to High	Medium	Medium
Better access to markets, employment and areas that contribute to economic growth	Medium to High	Medium	Medium	Medium to High	Medium	Low	Medium to High
A secure and resilient transport network	High	Medium	Medium		Medium	Low	Medium to High
Reductions in deaths and serious injuries as a result of road crashes	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
More transport choices, particularly for those with limited access to a car where appropriate	Medium to High	Medium	Medium	Medium	Medium	Low	Medium to High

[12] High indicates the package contributes very well to the GPS while Low indicates that the package contributes but to a lesser degree to the GPS

GPS	Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7
Reductions in adverse environmental effects from land transport	Medium to High	Medium	Medium	Medium	Medium	Low to Medium	Medium
Contributions to positive health outcomes	Medium	Medium	Medium	Medium	Medium	Low to Medium	Medium

5.10 RLTS compliance

Each package was qualitatively assessed to see the degree to which it met the RLTS requirements. The relative assessment is included in Table 20 below

Table 20 RLTS objectives [13]

RLTS Objective	Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7
Improved regional and interregional freight efficiency	Low	Low	Low	Low	Low	Low	Low
Improved transport system safety	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral	Neutral
Improved public transport (PT) accessibility for all	High	Medium	Medium		Medium		Medium
Reduced exposure to the negative impacts of transport pollution on human health	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Increased walking and cycling	Medium	Medium	Medium	Medium to High	Medium	Low	Medium to High
Reduced greenhouse gas emissions from the transport network	Medium	Medium	Medium	Medium	Medium	Medium	Medium
Improved public transport links to and between identified higher density growth centres	Medium	Medium	Medium	Medium to High	Medium	Low	Medium to High
Improved value for money from transport investment	Medium	Medium	Medium	High	Medium	Medium	Medium

[13] High indicates the package contributes very well to the RLTS objectives while Low indicates that the package contributes but to a lesser degree to the RLTS objectives

5.11 Ranking of packages

After evaluating the packages a qualitative assessment was undertaken to determine the relative ranking of the packages as detailed in Appendix H. This is summarised in Table 21 and Table 22 below which represents an abridgment of the detailed evaluation included in the appendices. It is provided solely to differentiate the various packages and summarise the degree to which each package achieves specific project outcomes and success criteria as they relate to the strategic case. It is important to note that no weighting has been applied to this assessment and that the over all ranking is based on the opinion of the project team and is not intended to represent the combined view of the Project Partners.

Table 21 Assessment of the options [14]

Project outcomes and success criteria	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7
Increase in person capacity to meet demand for travel	5	4	4	5	5	4	5
Increased efficiency within transport network	5	4	4	4	4	3	4
Increased PT Travel time reliability	5	4	4	5	5	3	4
Increased travel time reliability particularly for freight and airport related traffic	5	3	3	4	4	4	4
Improved public transport links between key centres	5	4	4	4	4	4	3
Modal shift towards public transport.	5	4	4	4	4	4	4
Improved visual amenity of the route to and from the airport.	4	3	3	5	3	3	4
Improved quality (frequency, time and experience) of public transport services.	4	4	4	4	4	4	4
Public transport services connect safely and reliably with community facilities and centres of employment.	4	4	4	4	4	4	4
Local road and street network assists internal connectivity, manages traffic volumes and reduces accident rates	3	3	3	3	3	3	3
Increased walking and cycling opportunities	3	3	3	3	3	3	3
Development of higher density nodes supported by transport investment and modal choice.	5	4	3	4	4	3	4
Accommodates high levels of growth and development	5	4	4	4	4	3	4

[14] Rating is on a scale of 1 to 5 with 1 being very poor, 3 being adequate and 5 being very good

Project outcomes and success criteria	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7
Unlock the economic potential of the airport environs to increase contribution to regional and national GDP and employment generation	4	4	4	4	4	2	4
Improved access to employment opportunities	4	4	4	4	4	4	4
Improved access to social infrastructure	3	3	3	3	3	3	3
Indicative Ranking of Packages [15]	**1**	**5**	**6**	**2**	**3**	**7**	**3**

Table 22 Assessment summary [16]

Criteria	Pkg 1	Pkg 2	Pkg 3	Pkg 4	Pkg 5	Pkg 6	Pkg 7
Demand	Very Positive	Positive	Positive	Very Positive	Very Positive	Average	Positive
Quality	Very Positive	Positive	Positive	Positive	Positive	Average	Positive
Connectivity	Very Positive	Positive	Positive	Very Positive	Positive	Positive	Positive
Land use	Positive	Positive	Positive	Positive	Positive	Positive	Positive
Feasibility	Moderate	Easy	Difficult	Easy	Moderate	Easy	Moderate
Cost	High	High	High	Medium	High	Low	Medium
BCR	Low	Low	Low	Medium	Low	Low	Low
Indicative Ranking of Packages [17]	**1**	**5**	**6**	**2**	**3**	**7**	**4**

Key **Effectiveness** - Impact of option against problems and opportunities

Very positive	Positive	Average or Neutral	Negative	Very negative

Economic efficiency (BCR) Very low < 0.5; > 0.5 Low < 1; > 1 Medium < 2, > 2 High < 4; Very high > 4

[15 & 17] The indicative ranking is based on a relative assessment of its contribution to achieving the project outcomes and success criteria for of each package. No weighting has been applied and it should be recognised that this ranking has been used to identify a primary package only. It is recommended that the proposed way forward include components, where deemed appropriate, from other packages so as to provide a resilient network wide solution more capable and likely to address all of the criteria

[16] Rating is on a five point scale ranging from very positive to very negative

6. Economic Evaluation

6.1 Evaluation methodology

The economic evaluation has been carried out in accordance with NZTA's Economic Evaluation Manual (EEM) Volume 1, September 2008. Full details of the evaluations are available in the Indicative Business Case.

The economic evaluation was independently peer reviewed and accepted by NZTA. Further detailed evaluation will be necessary during the Scheme Assessment phase to confirm the viability of the project.

The economic evaluation, and cost estimates in particular, were completed assuming the proposed way forward as described in section 10 of this report.

6.2 Cost estimation

A feasibility cost estimate (FE) for each package was prepared based on the limited design information available at the time of undertaking the Scoping Report to obtain an order of magnitude estimate based on July 2010 prices. This corresponds to the Base Date on which benefit costs are currently evaluated. The estimates included in Appendix J have been prepared for the sole purpose of comparing packages and establishing Benefit Cost Ratios (BC's) based on core benefits of each package. The estimates are based on desk top data, notional alignments within the corridors and historical cost information. Given that the benefits are limited to the core benefits derived from the primary mode the costs have also been limited to those associated with providing the primary mode. It is recommended that no reliance be placed on these estimates other than for the sole purpose of relative comparison and order of magnitude assessment.

The Estimate consists of the following components and allowances that are deemed to be accurate to +/- 30%:

- Land purchase based on the assumption that where whole properties are purchased remanent land will be sold back and only allowance for land needed for the corridor is included;
- Physical works costs for the primary RTN;
- Allowance to address grade separation requirements or adjustments to the local network along the corridor;
- Connection of the northbound bus option (package 3) to a corridor starting at Dominion Road;
- Walking and cycling infrastructure along the full length of each corridor;
- Undergrounding within airport land to approximately 50% for the northern connection and 80% for the southern connection;

- Bi-directional travel for each package along the full length of the corridor (i.e. double-tracked rail and two-laned busway) – noting some areas outside the study area may not be such as the Manukau Harbour crossing;
- Stations along the corridor with one major terminus at the airport;
- 4-laning of SH20B including duplication of the bridge across Pukaki Creek; and,
- Allowance for mitigation of temporary and permanent environmental issues along the corridor.

The cost estimate is limited to the capital cost for the construction of the proposed way forward and includes property purchase, and professional fees for investigation, design and construction surveillance. Other costs and benefits such as social, environmental and economic benefits / effects, constructability (including access issues), operational and maintenance issues and costs of mitigation of adverse effects will be established and accounted for during the next phase of the project following further investigation and the development of a scheme design.

Specifically excluded from the estimates are costs associated with the provision of:

- Operational costs, rolling stock or additional buses;
- Improvement of local roads or public paths providing access to the rapid transit corridors;
- Upgrades to the state highway network;
- Complimentary public transport services within the study area;
- Upgrades to the local road network to provide a new district arterial linking Ascot to Favona;
- Major service relocations;
- Unusually difficult ground conditions - say excavation in solid rock or filling on deep compressible soils;
- Extraordinary costs associated with contaminated sites, or those with cultural historical environmental or community constraints; and,
- NZTA managed costs, including public consultation.

The provided cost estimates are an estimate only. Actual prices, costs and other variables may be different to those used to prepare the estimates. GHD does not represent, warrant or guarantee that the proposed alignment can or will be undertaken at a cost which is the same or less than the estimates shown.

Subject to the above, the opinions, conclusions and any recommendations in this Report may be relied upon until 2014, after which time GHD expressly disclaims responsibility for any error in, or omission from this Report arising from or in connection with those opinions, conclusions and any recommendations.

Table 23 Summary of package costs ($,000,000.00) [18]

	Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7
Land acquisition	$95	$74	$114	$20	$116	$0	$71
Public transport	0	$0	$0	$0	$0	$0	$0
RTN stations	$122.6	$98	$112	$80	$98	$57	$93
Transport infrastructure (Local roads, walking and cycling)	$116	$86	$126	$30	$86	$10	$90
Transport infrastructure (RTN)	$768	$408	$362	$244	$551	$114	$342
Transport infrastructure (State highways) Physical works & MSQA	$0	$0	$0	$0	$0	$0	$0
Service relocations & extra ordinary costs	$15	$9	$9	$6	$10	$5	$8
Other project costs (I&R, D&PD)	$165	$98	$99	$59	$121	$31	$87
Base Cost [19]	$1,282	$772	$821	$440	$981	$217	$692
Contingency	$261	$157	$168	$90	$200	$47	$143
Expected Estimate (FE)	$1,543	$929	$989	$530	$1,181	$264	$835
Funding Risk	$437	$271	$281	$160	$339	$86	$245
95th Percentile Estimate	$1,980	$1,200	$1,270	$690	$1,520	$350	$1,080

[18] Cost estimates established at this phase of the project should be considered as "Order of Magnitude Estimates". They are provided primarily to identify the relative quantum of each package. During phase 2 further work will be undertaken as part of the business case to establish an accuracy of better than ±30%

[19] Costs are either based on or indexed to July 2010 prices

6.3 Benefits

The benefits of the proposed way forward have been determined as part of developing the indicative business case. Combining these with the package costs results in benefit to cost ratios as included in Table 24 below.

Table 24 Summary of benefit cost ratios

Package 1	Package 2	Package 3	Package 4	Package 5	Package 6	Package 7
0.6	0.7	0.7	1.2	0.6	1.0	0.9

7. Risk

7.1 Approach to risk

The approach to risk has been to record risks and opportunities as the project has progressed. During the initial phase of the project these have predominantly related to study risks. However risks and opportunities associated with specific packages have been identified and assessed at a preliminary level. This has not however involved costing of the risks as this is deemed to be inappropriate at this stage given the limited investigation. During the next phase of the project the financial case will evolve along with the business case.

Table 25 below outlines the current qualitative assessment of key risks and opportunities as they relate to each of the packages. Given the timescale for fully implementing the proposed way forward, potential variation in demand modelling, technology changes and funding constraints then this approach is deemed appropriate.

The most significant risks identified for the project going forward are:

- The project is delayed or does not proceed as a result of insufficient funding being available. Noting that this risk is a long term risk and does not necessarily preclude taking the project forward to secure land through the designation process;
- The modelling assumptions are found to be overly optimistic or pessimistic leading to either project benefits not being achieved or demand for PT exceeds capacity. Noting that this risk is primarily one of timing of the construction of the RTN and does not necessarily preclude taking the project forward to secure land through the designation process;
- Public/stakeholders favour an option different from the study findings leads to pressure to amend the proposed way forward. It is expected that irrespective of the final way forward there will be some controversy as it is likely to involve considerable expenditure or not meet the needs of those seeking significantly greater investment in PT; and,
- Wider network constraints inhibit capacity / frequency and lead to erosion of benefits for the project. It is anticipated that unless existing constraints within the wider network are addressed that the benefit of investment in the study area will not be full realised.

Table 25 Project Risk Register

Risk / Opportunity	Consequence	Likelihood						
		Package 1	Package 2	Package 3	Package 3	Package 5	Package 6	Package 7
Project failure if sufficient funding not available	Project is delayed or does not proceed	Expected	Likely	Likely	Quite common	Quite common	Unlikely	Likely
Modelling assumptions are found to be too optimistic	Project benefits are not achieved	Expected	Unlikely	Unlikely	Unlikely	Unlikely	Unusual	Unlikely
Modelling assumptions are found to be too pessimistic	Demand for PT exceeds capacity	Unusual	Likely	Likely	Likely	Likely	Expected	Likely
Auckland Council requires the project to be fast tracked	Auckland Council share of the funding increases significantly	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common
Archaeological or cultural issues result in one or more corridors	Significant alignment changes required	Likely	Unlikely	Unlikely	Likely	Unlikely	Unusual	Unlikely
Cost estimates are found to be inadequate to cover the scope of the project	BC ratios are eroded and the project is delayed or does not proceed	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common
Affected parties not identified / consulted leading to fundamental amendments being required	Opposition leads to delayed designation	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Community severance issues are such that alternative alignments require investigation	Greater cost for increased mitigation measures	Likely	Quite common	Quite common	Unusual	Unlikely	Rare	Likely
Manukau Harbour Bridge is unable to carry the RTN	A new crossing is required	Quite common	Unlikely	Unusual	Rare	Quite common	Rare	Rare
Protected flora / fauna found	Alignment changes required	Likely	Unlikely	Unlikely	Likely	Unlikely	Unusual	Unlikely
Watercourse or groundwater issues	Alignment constrained and or additional mitigation measures	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common	Unusual
The designation is inadequate to cover the alignment requirements	Further designation required at time of detailed design or design amendments to work within designation	Quite common	Quite common	Quite common	Quite common	Quite common	Unlikely	Quite common
Change in policy or government	Project is accelerated, delayed or does not proceed	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common
Recommended package is unacceptable to one of the Project Partners	Other Project Partners shoulder more of the funding or project is delayed	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Package does not fit into the wider transport system	Modal interchange is required or difficult to integrate into network	Unlikely	Expected	Unusual	Unlikely	Unlikely	Unusual	Unlikely
Significant utility clashes	Additional costs for relocation of services	Likely	Likely	Likely	Unlikely	Likely	Unusual	Likely
Affected land owners or communities are uncooperative	Designation process delayed and design changes needed	Likely	Likely	Likely	Quite common	Likely	Unlikely	Likely
Global warming results in significant sea level rise	Greater cost for increased mitigation measures	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common
Project Partner relationships break down	Public disagreement project delayed and/or other Project Partners shoulder more of the funding	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common	Quite common
Public/stakeholders favour an option different from the study findings	Pressured to amend the proposed way forward	Likely	Likely	Likely	Likely	Likely	Likely	Likely
Desired land use changes do not occur	Benefits of the scheme are not realised	Quite common	Quite common	Quite common	Quite common	Quite common	Unlikely	Quite common
Wider network constraints inhibit capacity / frequency	Benefits of the scheme are not realised	Likely	Likely	Likely	Likely	Likely	Likely	Likely
Land use changes and development positively support RTN	Benefits of the scheme are realised	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely	Unlikely
Fragmented network development because of funding constraints or difficulties securing continuity of route designation before construction	Modal interchange is required or difficult to integrate into network	Unlikely	Unusual	Unusual	Unlikely	Unlikely	Rare	Unlikely

Table Key

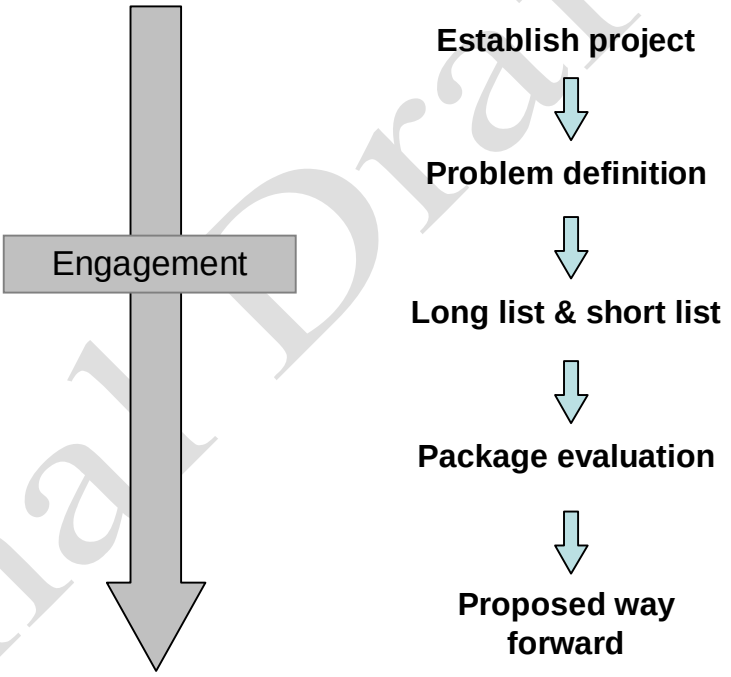
Likelihood	Rare	Unusual	Unlikely	Quite Common	Likely	Expected	Almost Certain
Probability of Consequence	<1%	1% to 10%	10% to 20%	20% to 50%	50% to 75%	75% to 90%	>90%

8. Stakeholder Relationship Management and Consultation

8.1 Approach

The approach to stakeholder relationship management and consultation has been to engage as broadly as practicable given the current stage of the project. This approach is described in detail within the Consultation and Communications Strategy Report included in Appendix V. In summary the approach included:

Figure 21 Engagement



- Identifying project "influencers" including the Stakeholder Steering Group, Implementation Executive Group, the Core Project Team and the stakeholders (including Technical Advisory Groups);
- Developing a framework of the consultation process, using technical advisory groups to maximise involvement across stakeholder organisations;
- Setting consultation and communication objectives, protocols and techniques, aimed at ensuring that team members took ownership of their component of the consultation and communication process, and a robust process for managing the inputs and outputs of that process; and,
- Creating a structure for identifying the decisions that need to be made during Phase 1, the questions that need to be asked of specific stakeholders, the means or method of consultation, and a summary of the outcomes of the consultation process.

The key missing component of the stakeholder engagement undertaken thus far has been the deliberate omission of general public consultation. The reason for this omission is that at this stage of the project only strategic level issues have been investigated and following on from confirming the following then broader consultation will be undertaken

- Confirmation that the project will proceed to phase 2;

- Confirmation of the proposed way forward and the number of corridors that the project partners wish to protect; and,
- Confirmation of specific options for specific alignments within the corridors that can then be discussed with specific communities and affected property owners.

8.2 Identified parties to include in phase 1 engagement

During Phase 1 the consultation and communication process was confined to the key project partners and a limited number of external parties. The stakeholders engaged with included:

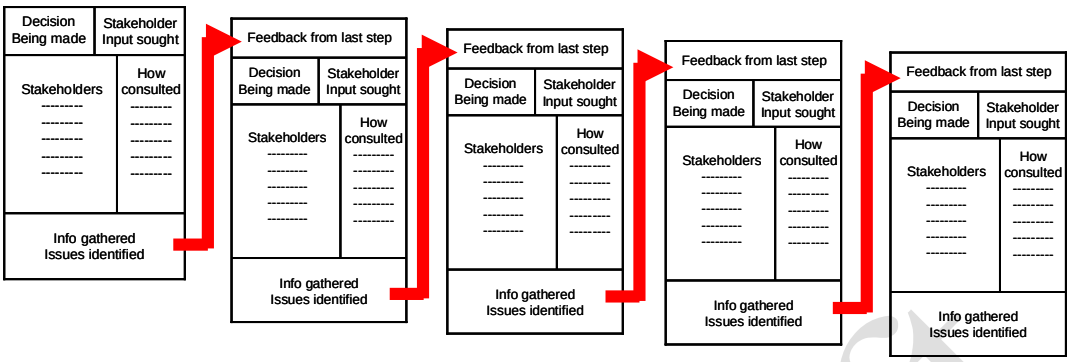
- Auckland Transport;
- New Zealand Transport Agency (NZTA);
- Auckland Council;
- Auckland International Airport Ltd, and,
- KiwiRail.

External parties with whom consultation occurred during Phase 1 included:

- The Local Boards of Mangere / Otahuhu and Otara / Papatoetoe;
- Iwi holding manawhenua over the study area. The key hapu were:
  - Ngati Te Ata; and,
  - Pukaki ki te Akitai.

  Other iwi / hapu organisations which claim manawhenua over the broad study area, and who were consulted include:
  - Kawerau a Maki;
  - Ngati Whatua O Orakei;
  - Ngati Tamaoho; and,
  - Ngai Tai ki Tamaki.
- The Ministry of Transport;
- Treasury (via MoT); and,
- Utility Service Providers.

Figure 22 Engagement consisted of a number of iterations



8.3 Techniques for engagement and consultation

The methods used to engage with stakeholders consisted of a combination of:

- Focused one-to-one meetings with specific individuals used to discuss specific issues, obtain feedback or provide a summary of where the project was headed;
- Focused meetings involving a small group of stakeholders used to discuss specific issues, obtain feedback or provide a summary of where the project was headed;
- Technical Advisory Group (TAG) meetings used to discuss technical issues related to a particular work stream and involving representatives from the project partners;
- Workshops with a broad cross section of stakeholders used to provide and update of findings as the study progressed and to seek feedback and identify issues and risks associated with findings and proposed solutions; and,
- Distribution of interim reports and sub deliverables used to provide an update on findings and proposed solutions and to seek specific feedback on these as the project progressed.

8.4 Outcomes from engagement and consultation

The outcomes from the engagement process is summarised in Appendix V. The feedback provided represented a key input into the development of the proposed way forward. Engagement was used to assist in establishing options that were robust and reviewed by a number of key stakeholders.

The engagement and consultation process allowed:

- Alignment of understanding and agreement on the project problem, opportunities, objectives, outcomes vision and packages that were needed to address these;
- Technical input from the project partners to critique packages as they were developed;
- The project team to demonstrate with confidence that Treasury's requirement for full and early consultation to be undertaken as expected by the 'Better Business Cases for Capital Proposals' guideline;

- The development of a sound appreciation of the Auckland Plan and how the project is likely to inform that plan and how the plan is likely to inform the project; and,
- The development of good principals for iwi engagement that can be taken forward as the project progresses;

9. Preliminary Design Philosophy Statement

9.1 Design approach

The preliminary design philosophy statement included in Appendix K outlines:

- Specific assumptions and background reasoning for those assumptions that may lead to deviations from standards or guidelines;
- Assumptions regarding the functional requirements of the study;
- Key parameters used in the consideration of options, corridors and modes within the study;
- The primary standards and guidelines that will be used in subsequent stages of the study; and
- Where further work could be focused that may result in a reduced capital cost, operation cost, improved safety or operational effectiveness.

At this phase of the project the design philosophy is necessarily flexible. The need for flexibility is driven by:

- The proposed package is identified but not confirmed;
- The mode choice and progression plan will be identified but not confirmed;
- Specific constraints and opportunities along the general corridor have been identified but not investigated to a level that justifies selecting a specific corridor;
- It would be inappropriate to produce a corridor that indicates a level of design and analysis that has not been completed; and,
- Key stakeholders have not been consulted and feedback may result in movement of the corridor within limits to realise a particular opportunity or mitigate a specific risk.

During the next phase of the project the corridor(s) will be refined to allow the identification of specific properties requiring purchase and an alignment that allows for the final selected solution. Broadly the corridor(s) will ultimately be expected to allow sufficient width to accommodate:

- The selected mode and its geometric requirements including sight lines, shoulders, central barriers, structures and the majority of cut and fill batters;
- Intersections and access locations where additional width may be necessary;
- The provision of utilities;
- Alternative modes including cycling and walking if deemed appropriate along part or all of the corridor(s);
- Maintenance activities and cater for reasonable foreseeable future growth without additional land take;
- Urban design elements in selected locations;

- Stormwater treatment and detention infrastructure in selected locations;
- Visual, vibration or noise shielding or separation for specific community facilities or residential areas;
- Structures and other infrastructure to minimise severance issues across the corridor(s); and,
- Stations and associated infrastructure and connectivity to other modes in selected locations.

10. Proposed Way Forward

10.1 Introduction

The expectation for this project, as defined in the request for tender, was that the project would determine future arrangements for the following:

- The Long Term State Highway footprint for SH20A and SH20B and connections to SH20 and a progression plan for infrastructure delivery;
- Rail rapid transit connections including station locations to the Airport, along SH20, SH20A and SH20B alignments and the interface between these connections and the Airport passenger terminals;
- A progression plan of public transport infrastructure and service provision over the next 30 years identifying progression from bus to rail based public transport;
- Long term corridor(s) cycle and walking routes and linkages; and,
- The approach to be taken identifying current and potential future integrated transport/ land use opportunities along the multimodal connections to the Airport including those that could utilise freight rail where rail is a rapid transit option.

The proposed way forward below recommends the proposed package to be taken forward to the Scheme Assessment Stage, an alternate package and a do minimum package.

10.2 Developing the proposed way forward

The proposed way forward has been determined through the development and assessment of the following multi-modal transport packages:

- Package 1 – Heavy Rail Loop
- Package 2 – Light Rail to the north
- Package 3 – Bus RTN to the north
- Package 4 – Heavy Rail to the North
- Package 5 – Heavy Rail to the South
- Package 6 – Bus Shoulders on the Motorway
- Package 7 – RTN connection to the east

Diagrams illustrating each package are included within Appendix E. Each of these packages recognises the need to respond on a number of corridors (i.e. if rail is provided along one corridor then bus (QTN or RTN) would need to be included on other corridors to provide a total network solution).

The packages were assessed to determine the key benefits of each package. As part of the assessment, extensive consultation was undertaken with key stakeholders so that their views and opinions could be taken into consideration. The packages were modelled using the ART3 model [20].

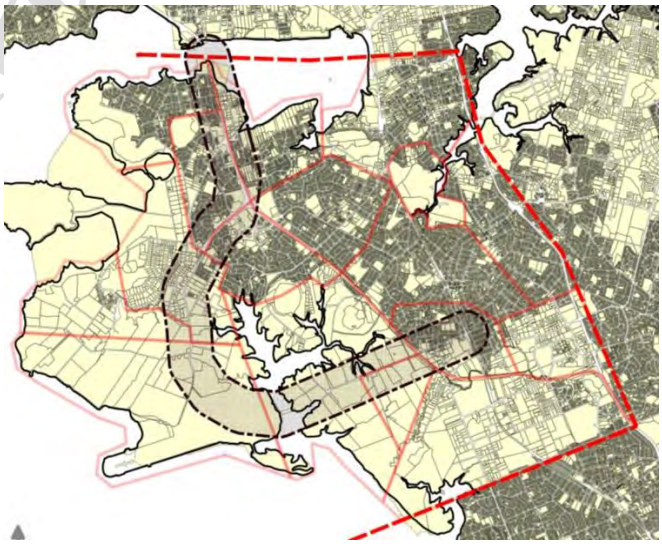
[20] The conclusions in this report are based on the preliminary modelling results and more detailed modelling is expected to be undertaken in Phase 2

The basis on which the proposed way forward, the alternate, and the do minimum options were indentified was though an assessment of the packages. A summary of this can be found in section 5. Further detail can be found in Appendix H where the evaluation of each package is tabulated in greater detail. Going forward into the scheme stage it is recommended to maintain some flexibility by inclusion of a bus based option along with the proposed way forward and do minimum options. The proposed way forward:

- Provides the most effective response to the 3 key problems by:
  - Reducing congestion within the existing network by removing trips from the roading system;
  - Providing a high level of capacity to sustain feasible frequency that meets demand and improves accessibility across the wider region; and,
  - Attracts the greatest number of PT passengers as a result of the quality of the service expected to be provided.
- Provides direct integration with the region wide rail network and leverages off the current substantial investment in electrification, new rolling stock, signalling improvements and station upgrades;
- Reduces interchange penalties for longer trips located across the rail network

10.3 The proposed way forward

The proposed way forward consists of the elements listed below and is described in Figure 23. Broadly it is package 1. It represents the final solution required to be investigated during phase 2 to allow designation of a corridor that can accommodate it. The proposed way forward in response to long term demand requirements consists of a primary RTN involving a heavy rail loop from Puhinui to Onehunga via the airport designed to run standard Electric Multiple Units (EMU's) as will be operating elsewhere on the Auckland network



The Expected Cost Estimate (FE) for the primary RTN component of the proposed way forward included in Appendix I is $1,543M million with a 95 percentile estimate of $1,980M which provides a Benefit Cost Ratio of 0.6. This confirms that the economics for this project are in the order of magnitude similar to other transformational projects and that at an indicative level the project should proceed to the next stage to allow further development of the business case and identification of an alignment.

10.4 Alternate option

In addition to the proposed way forward it is recommended that the next phase of the project include investigation and analysis of an alternate way forward consisting of a bus based RTN. This alternative option provides a well differentiated alternative for comparison that has some cost advantage and the ability to connect into bus based investment across the wider region.

The option consists of a busway running from the airport northwards to Onehunga and connecting either to a busway or bus priority network running into the CBD or a heavy rail station at Onehunga. To the south this would run from the airport to Puhinui or Papatoetoe and connecting either to a busway or bus priority network running to the east and AMETI and / or to a heavy rail station at Puhinui or Papatoetoe.

10.5 Do minimum option

In addition to the proposed way forward and alternate option it is recommended that the next phase of the project include investigation and analysis of a do minimum option that excludes the provision of a RTN. Rather buses would run on the motorway alongside general traffic without provision for bus lanes and connect to a heavy rail station at Onehunga in the north. To the south buses would run along SH20B alongside general traffic without provision for bus lanes and connect to a heavy rail station at either Puhinui or Papatoetoe.

10.6 Additional measures

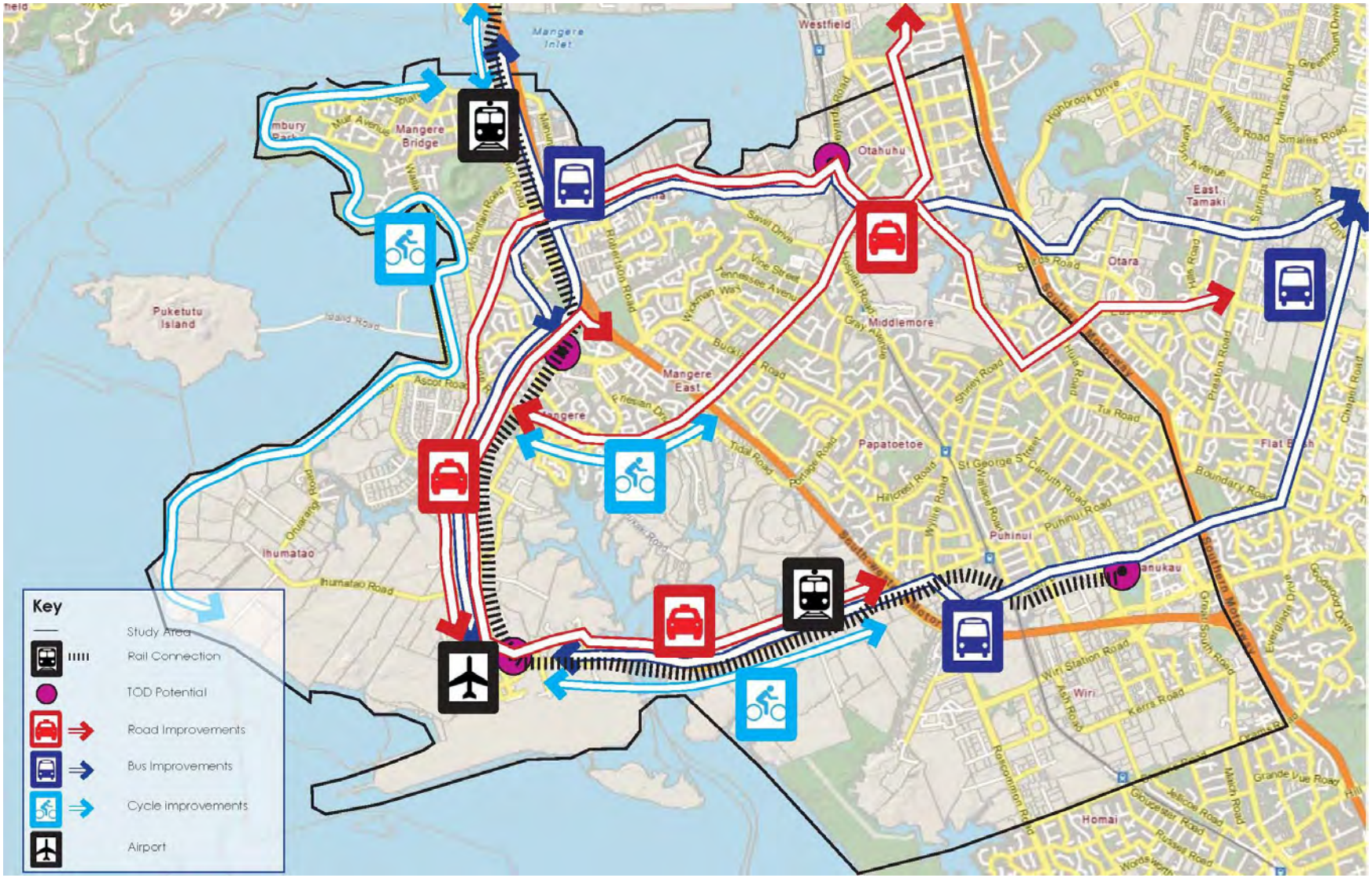
In addition to providing for a primary RTN corridor(s) it is also recommended that a number of other transport measures be put in place. These would be required for all options and would require more rapid instigation with the do minimum option.

The additional measures include:

- Upgrade of the state highway network involving:
  - Widening of SH20B to 4 lanes;
  - Connection of SH20A and SH20B;
  - Kirkbride grade separation; and,
  - A southbound connection of SH20A to SH20;
- Complimentary public transport services including:
  - Connecting the airport to Otahuhu and key centres in between. This would be a QTN in the short term with potential progression towards RTN; and,
  - Reconfiguring local bus routes to be more direct and frequent connecting key centres within the study area with the airport business district.
- Safe cycling connections for both commuting and recreational cyclists; and,
- Improving network resilience through a new district arterial road linking Ascot to Favona thereby providing an alternative to the only other route north (SH20A).

It should be noted that whilst there are a number of items included above that are not directly related to the primary corridor(s) those elements are recommended to be included in a network wide approach to addressing the overall project vision and associated objectives.

Figure 23 Proposed way forward



11. Scope and Limitations of this Report

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- may only be used for the purpose of informing the first phase of the contract 111/11/3/PA which is ultimately aimed at identifying the preferred alignment(s) and configuration of multi-modal transport connections to and from the Airport and agree the best manner in which the alignment(s) can be protected and provided for and must not be used for any other purpose; and,
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- Two pre-existing traffic models were used to assess future traffic flows and associated economic benefits for the packages and alternatives. There are a number of assumptions inherent in these models that have been adopted without review;
- Material provided by Auckland International Airport including future plans for growth and passenger forecasts have been adopted without review; and,

- GHD has prepared this Report on the basis of information which GHD has not independently verified or checked ("Unverified Information") beyond the agreed scope of work. GHD expressly disclaims responsibility in connection with the Unverified Information, including (but not limited to) errors in, or omissions from, the Report, which were caused or contributed to by errors in, or omissions from, the Unverified Information.

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GHD Limited

Level 16, ASB Bank Centre
135 Albert Street, Auckland
T: 64 9 307 7373 F: 64 9 307 7300 E: auckland_mail@ghd.co.nz

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