Business Case for Implementation

Detailed Business Case to proceed from Initiation to Implementation

Penlink

Type the document number here.

19 November 2013 – 0.18

Change History and Approval

As **Representative of the Executive Leadership Team (ELT)**, I confirm this Business Case addresses the problem or opportunity identified. An assessment of the benefits has been carried out and they are realistic and achievable.

ROLE:	NAME:	SIGNATURE / EMAIL	DATE
For ELT			

As **Senior Supplier**, I endorse this Business Case. I agree the proposal is aligned with existing policy, the resource implications are noted and the estimates on cost and time are realistic and achievable.

ROLE:	NAME:	SIGNATURE / EMAIL	DATE
Senior Supplier			

As **Project Sponsor**, I approve this Business Case. I confirm it is a fair and realistic representation of the opportunity, requirements and benefits. It accurately identifies resources, known risks and impacts that need to be taken into account in order to move to Project Execution phase.

ROLE:	NAME:	SIGNATURE / EMAIL	DATE
Project Sponsor			

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Glossary of Terms

Abbreviation	Term
AEE	Assessment of Environmental Effects
AP	Auckland Plan
ARGS	Auckland Regional Growth Strategy
ARPS	Auckland Regional Policy Statement
AT	Auckland Transport
ATMS	Advanced Traffic Management Systems
Beca	Beca Ltd
BCR	Benefit-Cost Ratio
CAPEX	Capital Expenditure
CBD	Central Business District
CCO	Council Controlled Organisation
CEO	Chief Executive Office
CLAN	Centre-Led Action Network
CMP	Corridor Management Plan
CPI	Consumer Price Index
EEM	Economic Evaluation Manual
ELT	Executive Leadership Team
dVAC	Decision Value Assurance Committee
FYRR	First Year Rate of Return
GPS	Government Policy Statement
HCV	Heavy Commercial Vehicle
LCV	Light Commercial Vehicle
LGA	Local Government Act
LGACA	Local Government (Auckland Council) Act
LOS	Level of Service
LTCCP	Long Term Council Community Plan
LTP	Long Term Plan
LTMA	Land Transport Management Act
MCV	Medium Commercial Vehicle
MSQA	Management, surveillance and quality assurance
NLTF	National Land Transport Fund

Abbreviation	Term
NLTP	National Land Transport Programme
NPC	Net Present Cost
NPV	Net Present Value
NoR	Notice of Requirement
NZTA (or the Agency)	The New Zealand Transport Agency
NZTS	New Zealand Transport Strategy
PBM	Proxy Bid Model
PCG	Project Control Group
PCM	Price-Cost Margins
PHR	Project Highlight Report
PID	Project Initiation Document
POSG	Programme Optimisation Steering Group
PP	Procurement Panel
PPP	Public Private Partnership
PSC	Public Sector Comparator
RAG	Red, Amber and Green
RDC	Rodney District Council
RLTP	Regional Land Transport Programme
RLTS	Regional Land Transport Strategy
RMA	Resource Management Act
RoNS	Roads of National Significance
RUB	Rural Urban Boundary
SAR	Scheme Assessment Report
SH(#)	State Highway (number)
SMT	Senior Management Team
T(#)	Tier (number)
TA	Territorial Authority
TGPPP	Transmission Gully Public Private Partnership
VoT	Value of Time
VPD	Vehicles Per Day
VTM	Variable Trip Matrix
WEBs	Wider Economic Benefits
WEIs	Wider Economic Impacts

1 Executive Summary

This Business Case for Implementation investigates the potential for Penlink to proceed to construction, including consideration of its economic efficiency and the procurement option that provides Auckland Transport the best value-for-money. The Business case concludes that the Project:

- Achieves the strategic objectives of improved travel times, improved network performance and the promotion of economic activity
- Is expected to commence construction in July 2016, with the facility assumed to be open in 2019. This is the earliest start Auckland Transport could achieve if it were not cash-constrained. Penlink is presently planned in the Long Term Plan to commence in 2018, largely due to lending constraints for such a large project
- The total physical works for the facility (the costs to construct the alignment) have been calculated to be $358.5 million
- Has a benefit cost ratio of 2.9, giving it a Medium efficiency rating in terms of the New Zealand Transport Agency's (NZTA's) funding profile
- Development of Penlink means future costs associated with further widening of Whangaparoa Road will not be necessary (cost avoidance of $20 - $26 million)
- Is a viable tolled project, enabling costs of investment from the existing national tolling system to be partially recovered
- Is a strong candidate for a public private partnership (PPP) as:
    - There is strong potential for the PPP approach to drive better value-for-money
    - A PPP financing mechanism, will not only allow this project to proceed, but will also act as an enabler in terms of Auckland Transport's total cashflows, resulting in the ability to accelerate other projects in the forward plan.

Introduction

Penlink is a key new road connection between Redvale and Whangaparaoa that will provide an alternative access route to the fast-growing Whangaparaoa Peninsula. The Project has a long history and the route has been designated in the District Plan since 2001. While the transport need for the Project was identified, funding constraints have delayed the commencement of construction. Since 2001, there has been on-going progress in developing the Project including land acquisitions, investigations to progress options for construction, delivery and tolling. The recently published Auckland Plan (AP) outlines a 30 year spatial framework for the growth and development of Auckland to become the world's most liveable city. Silverdale and Orewa have been identified in the AP as new growth areas for both future residential development and for employment growth. Intensification is also identified in Red Beach, Orewa and on the Whangaparaoa Peninsula. As a result of changes in growth areas outlined in the AP, a review of the Project has identified the need for Penlink to provide for greater capacity and improved connectivity to the west of State Highway 1 (SH1) at Dairy Flat.

The biggest constraint for the delivery of Penlink has been to obtain funding and the ability to prioritise projects within the available capital funding envelope. The prioritisation of funds to other projects has

limited available funding for Penlink and is the key reason why Penlink has not already been constructed.

Issues/Opportunities/Objectives

The Hibiscus Coast area has grown rapidly over the past 20 years. Analysis of the transport need confirmed a new access corridor to the Whangaparaoa Peninsula was required to support the transport and land-use needs of both the Peninsula and wider Hibiscus Coast. Three key constraints underpin the case for Penlink:

- Poor transport network performance negatively impacts economic activity and quality of life on the Whangaparaoa Peninsula and surrounding area. The Whangaparaoa Peninsula, Hibiscus Coast Highway and the Silverdale motorway interchange all currently experience regular congestion during weekday peak periods. Access between the eastern and western ends of the Peninsula are poor, as Whangaparaoa Road is largely a single lane road carrying approximately 30,000 vehicles per day. Traffic demand in the area is expected to increase with future planned growth in Silverdale.
- The Whangaparaoa Peninsula community is vulnerable to physical isolation due to current single road access. If an emergency closes or disrupts Whangaparaoa Road or the Hibiscus Coast Highway, there are limited alternatives for connectivity to Whangaparaoa. When considered with the existing congestion on this corridor, the residents and businesses of the Peninsula risk 'severance', effectively being isolated from the rest of the City.
- Limited capacity in the transport network is constraining planned urban growth in the area. There are a number of areas in and around Silverdale and the Whangaparaoa Peninsula that have been planned for growth over the last decade. Council's current District Plans[1] are restricting the growth of Silverdale North until improvements to the transport network are made[2]. The AP has also identified that expanding the growth area to include Wainui and Dairy Flat is a key element of the City's overall spatial plan.

Widening the western end of Whangaparaoa Road between Hibiscus Coast Highway and Red Beach is an identified project between 2013 and 2015 at a cost in the order of $20 - $26 million. This widening is identified as an immediate short-term solution to the network capacity issues, pending the construction of Penlink. Further delays to the construction of Penlink will increase pressure on Auckland Transport to widen Whangaparaoa Road, thereby diverting funds into short- to medium-term improvements, rather than Penlink, which will provide greater benefits over a longer period of time. Short-term improvements on Whangaparaoa Road will be costly and have little future value once Penlink is constructed.

The three key objectives for Penlink are to:

- improve travel times and journey reliability through the study area
- improve network performance in order to facilitate economic activity, planned growth and transport mode choice in Silverdale, the Whangaparaoa Peninsula and the surrounding area
- improve network resilience for the Whangaparaoa Peninsula community.

[1] Issue 12.8.19.3.14.
[2] See Objective 12.8.19.4.21.

Options considered

The notion of a bridge across the Weiti River or the 'Weiti Crossing' connecting Stillwater to Whangaparaoa was first identified during the 1980s. The Whangaparaoa Access Study[3] concluded that 'Penlink' was the best option to address both transport and land-use needs for the area. This was followed by scheme design and work to protect the land corridor for Penlink, and designation, construction and operational resource consents were obtained in February 2001.

A number of additional options to Penlink were considered including:

- do nothing
- improved bus and ferry provision
- widening Whangaparaoa Road
- improvements to the Hibiscus Coast Highway.

Updated analysis using the new land-use growth assumptions in the AP, has reconfirmed that Penlink is the preferred alternative to address the identified problems and achieve the desired outcomes. Penlink increases the resilience of the transport network on Whangaparaoa and reduces congestion, which will enable planned residential and commercial growth in Auckland's northern sector as well as facilitating a more reliable and efficient public transport network.

Given the funding constraints for Penlink, further work was progressed for widening of Whangaparaoa Road and a 1.8km stretch of the road was widened in 2004/05. Given the capacity constraints on the Hibiscus Coast Highway, widening of Whangaparaoa Road is no longer seen as an alternative transport option to Penlink. In early 2013, Auckland Transport undertook further investigations into Penlink and confirmed that bringing construction of Penlink forward would avoid the need for further Whangaparaoa Road widening (and therefore provided the opportunity to avoid incurring these costs which are in the order of $20 - $ 26 million).

Description of the recommended solution and the costs/benefits

The preferred option provides for a four lane arterial road (two lanes in each direction), from the Redvale interchange (connecting to SH1) through to the Whangaparaoa Road intersection. A two lane option is currently designated and has operational consents in place. This option is no longer considered to be effective, as it only partially enables planned urban growth through the provision of additional capacity in the transport network and does not provide sufficient network capacity for planned growth.

[3] Beca, Whangaparaoa Access Study, Technical Report 4, Traffic and Economic Analysis, July 1997.

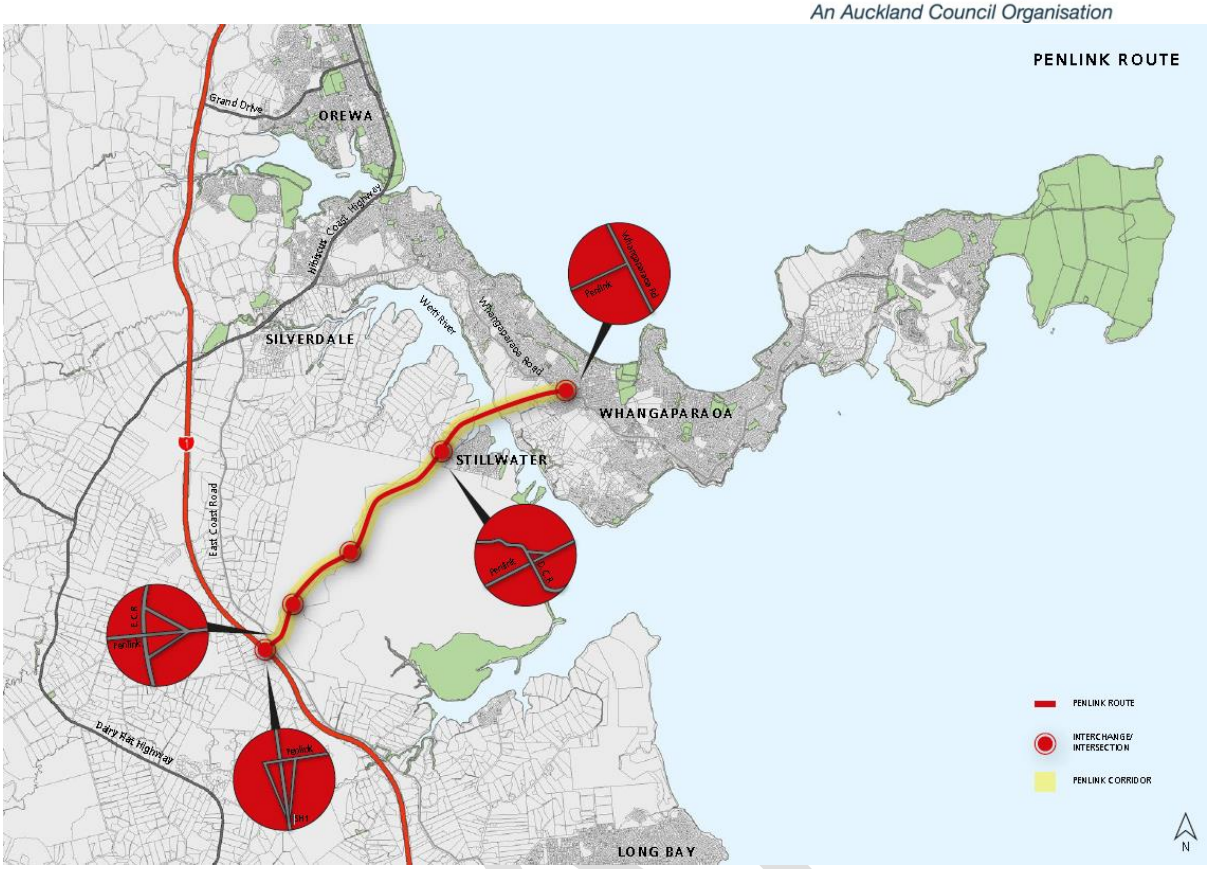


Figure 1-1: Penlink

Penlink in this configuration will meet the desired project outcomes for the following reasons:

- The removal of through traffic from Silverdale enables the full extent of planned urban growth of residential and business land in Silverdale to be realised.
- Better access to planned new development areas such as Weiti Station and Weiti Forest Park will be provided.
- Congestion along Whangaparaoa Road will be reduced significantly, which will improve the quality of life for residents while providing opportunities for economic activity.
- Improved accessibility and connectivity (reduced travel time) for traffic on Whangaparaoa Peninsula will provide for business and residential growth on the Peninsula.
- Community resilience will be enhanced by providing transport connectivity options to the Whangaparaoa Peninsula (no longer reliant on a single road access).
- Opportunities will be created for increased network capacity for other modes (passenger transport and pedestrian/cycle).
- Opportunities for streetscape and townscape improvements along the Whangaparaoa Road and Hibiscus Coast Highway.
- Increased capacity on existing networks will enable planned growth in the Silverdale area, including potential growth in Silverdale West.

Analysis supports the construction of Penlink as a toll road, both to partially offset the cost of the Project (with funding supplemented by NZTA and Auckland Council), and to efficiently manage demand and level of service. The recommended toll strategy is:

- A single toll collection point on or near the Weiti Bridge
- Free-flow electronic tolling using NZTA's National Toll System
- Fixed 24/7 toll tariff but the ability to consider time-variable tolling at a later date when the technology is available
- A light vehicle toll of $2.20 and a heavy vehicle toll of $4.40 (in $2013)
- No caps or discounts
- Tolls escalated regularly at the rate of inflation (Consumer Price Index (CPI)).

Detailed economic evaluation of Penlink was undertaken in accordance with NZTA's Economic Evaluation Manual (EEM). Both standard transport benefits and wider economic benefits were assessed and a benefit cost ratio (including wider economic benefits) of 2.9 was delivered.

Procurement

The form of procurement for Penlink is an important consideration not least because of the potential opportunity to employ an alternative to Auckland Transport's more traditional models, such as a PPP. [redacted] As such, Auckland Transport will be able to draw on intellectual property, learning's and experience from previous projects.

[redacted]

The work undertaken in this Business Case has identified that PPP could be considered as a feasible procurement model. A viable "full" PPP option (where the road is funded, developed, and operated by the private sector) principally depends on two critical features:

- a clear value-for-money benefit associated with the Project
- market appetite to undertake the Project as a PPP.

Value-for-money

Financial modelling has been undertaken to establish the potential value-for-money from a privately financed and operated project. This modelling establishes the cost of building via a traditional method, financed by Auckland Transport/NZTA, and then compares it against a proxy for a privately financed project. Typically in this modelling, the cost of public sector cost of finance means the "public project" is considerably cheaper. Accordingly, the next consideration is whether the benefits of innovation (construction/operations) and risks transferred to the private sector under a PPP model would result in an overall saving greater than the cost difference.

The financial modelling established that whole-of-life costs to develop Penlink as a PPP project were around [redacted] higher compared to being developed as a public project. Based on market observations

of private sector financing costs at the end of July 2013 and a static discount rate of [redacted], this would be considered an achievable gap to overcome.

The ability to generate superior value-for-money from a PPP depends critically on the ability to generate both construction and operating efficiencies. It is extremely likely that efficiencies would materialise under a PPP, because there is scope for innovation, particularly given features such as challenging terrain, multiple structures and challenging geotechnical conditions, as well as opportunity to reduce the construction timeframe and optimise structures.

No market sounding has been undertaken for Penlink at this stage, but given the high degree of interest in the Transmission Gully PPP, it is highly likely that there will be sufficient interest in the Project to generate a competitive process.

PPP is a complex and significant commitment. It has a number of important features that are quite different to the Auckland Transport's traditional procurement models. A PPP will involve a very long term contractual relationship with a private sector constructor, operator and, importantly, financiers. This brings a focus to risk allocation and financial and commercial issues that are not part of or not as transparent in Auckland Transport's more traditional procurement models.

The Business Case identifies that PPP is a feasible procurement model for Penlink. Key factors supporting the feasibility of PPP are:

- It is a viable procurement model in that the outcomes required from Penlink can be unambiguously captured in a performance based contract that provides the basis for private sector design, construction, financing, maintenance and operation.
- Incentives can be put in place to encourage the contractor to deliver innovative design and construction techniques, especially with regards to improving operations and maintenance efficiencies, lifecycle optimisation and road user safety. In addition, there will be opportunities for Auckland Transport, working in partnership with the contractor, to take the innovations and ideas delivered through Penlink with improved investment certainty and transfer them to the wider Auckland road network. By embracing the opportunities provided by this project, Auckland Transport can secure change in the effectiveness and efficiency of its approach to design, construction and operations.
- The private sector is likely to have strong interest in the Project, based on current interest in the Transmission Gully PPP procurement process.
- Auckland Transport has the ability to secure capability and resources to manage the PPP procurement process effectively.
- The financial analysis and the review of available evidence from overseas suggest that the level of net financial gains that a contractor would have to achieve for the whole-of-life cost of Penlink under a PPP to be at least equal to if not less than the whole-of-life cost if Auckland Transport were to construct, finance and operate using a traditional approach is achievable. Auckland Transport can validate if this is achievable in projects of this type and scale in New Zealand with RFP responses for the Transmission Gully PPP received in October 2013 and further validated with a preferred bidder identified in early 2014, indicating the bidders have beaten the PSC. The expectation, and requirement, is that a well run procurement process to deliver Penlink through a

PPP could produce bids that will "beat" the cost under traditional procurement and, at the same time:

- Bring whole-of-life innovations and improved investment certainty that would not necessarily be available under traditional procurement where there is a separation of design and construction, and operation and, importantly, the incentives on efficiency that will be driven by private sector financiers are not present.
- Transfer to the contractor a range of whole-of-life risks that the Auckland Transport would usually be responsible for under traditional procurement, but which can be better managed by other parties.
- The cashflows associated with the PPP for Penlink are such that Auckland Transport will be able to achieve more transport benefits across its network by bringing forward other projects in response to the funding headroom achieved by the structured financing element of the PPP procurement.

The procurement process for a PPP is complex and time consuming. This reflects, in part, that it involves a very long term contract (25 years or more) and that the returns to the private sector financiers will be spread over most of the contract terms. All parties have an interest in ensuring that the contract will be enduring and provides for appropriate management of their respective risks and interests. [redacted] Auckland Transport will also have the benefit of the Treasury's standard form contract that has been tested in the two PPPs that have been completed to date.

There will be specific features relevant to Penlink that will need to be factored into the procurement process. A particularly important issue that will need to be addressed before a final decision can be made on PPP procurement is the management of interest rate risk. Under the Treasury standard form contract, the risk of an element of interest rate changes will be borne, to a large extent, by Auckland Transport. Given that New Zealand has been at a low point in the interest rate cycle in recent times it is likely that interest rates will rise in the short to medium term. The allocation of risk will require further consideration.

PART A – THE CASE FOR THE PROJECT

2 Background

Penlink is a key new road connection between Redvale and Whangaparaoa that will provide an alternative access route to the Whangaparaoa Peninsula. Penlink is an important part of the region's development infrastructure in order to facilitate the urban (residential and business) growth in the north Auckland sector, particularly in the Silverdale area (Hibiscus Coast) and on the Whangaparaoa Peninsula itself. Whangaparaoa Road reached its 25,000 vehicle per day capacity in 2009. With 4.6% per annum transport growth since 2001 (based on the south facing ramps at the Silverdale interchange), and the future planned urban growth in the 'Northern Sector', there is a need for the transport network to provide increased capacity and to improve connectivity between development areas.

The Project has a long history and the route has been designated in the District Plan since 2001. Since 2001, considerable work has focused on the cost effective delivery of the Project, including options to toll the route. Most recently, a review of the Project in light of current land-use development plans, particularly the vision set out in the Auckland Plan (AP), has identified the need for Penlink to provide for greater capacity and improved connectivity to the west of State Highway 1 (SH1) (Dairy Flat).

2.1 Context

2.1.1 Historical Growth

The Hibiscus Coast (including Whangaparaoa and Orewa) was originally developed as a series of small beach towns (holiday destinations for Auckland residents). Over the past 20 years, the area has experienced rapid growth[4] and has increasingly become a dormitory suburb of Auckland. This growth has been further accelerated over the last decade, since SH1 was completed through to Puhoi. Over this period, there has been a lag in commercial growth, resulting in a high proportion of trips by residents out of the area to work, and for commercial services.

To support the Hibiscus Coast community, and enable its sustainable growth, Council (primarily the former Rodney District Council (RDC)) has undertaken significant planning for both infrastructure and for commercial/employment growth (particularly in the Silverdale area). As part of this planning, Penlink has long been identified as a critical element of infrastructure.

[4] The population increased by over 40% between 1996 and 2006 (from 27,000 to 38,500). 60% of this growth has been since 2001 (Statistics NZ). Further growth has continued since this time, but census data from 2013 has not yet been released.

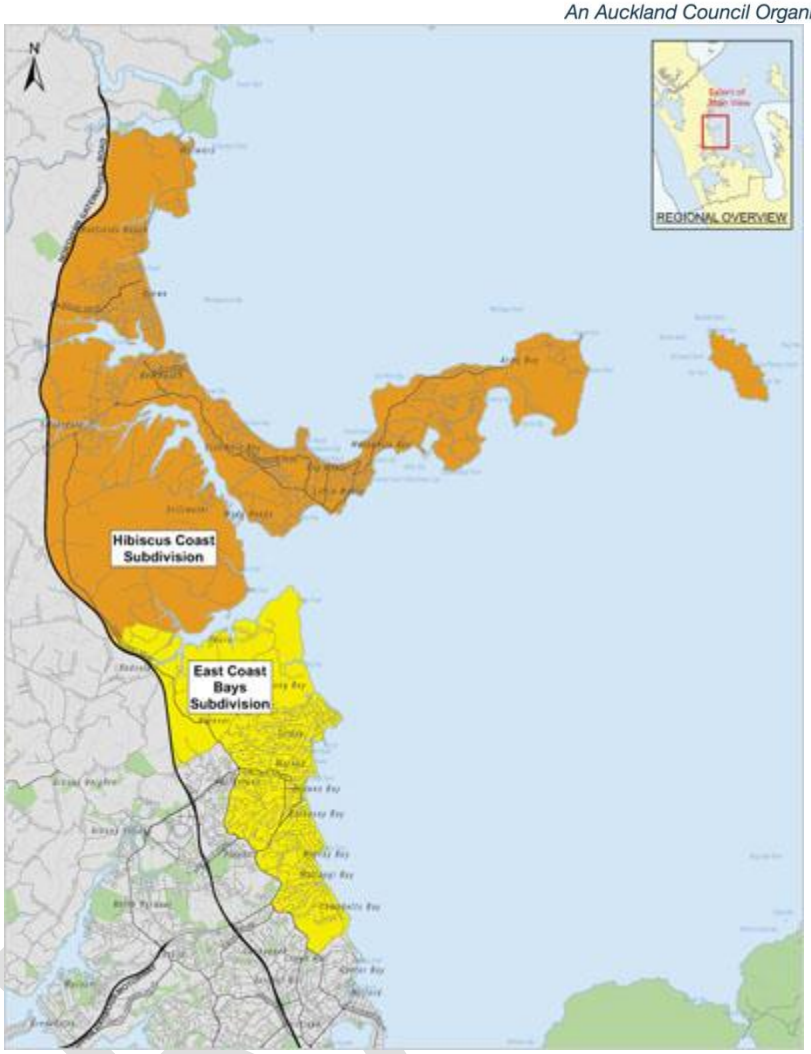


Figure 2-1: Hibiscus Coast and East Bays Area

The relationship of Penlink to the existing and planned urban areas of the Hibiscus Coast is provided on the following page in Figure 2-2:

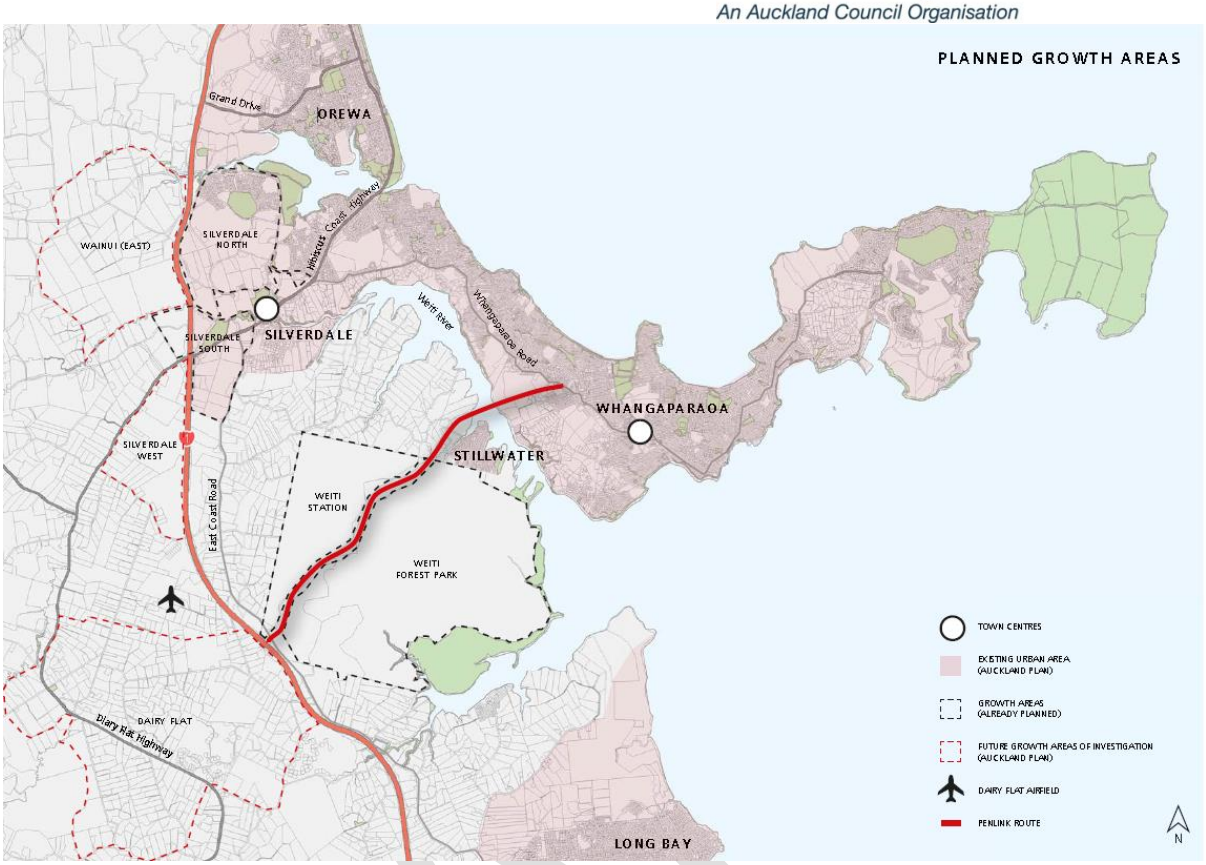


Figure 2-2: Relationship of Penlink to the Existing Area

2.1.2 Auckland Plan

Auckland is New Zealand's largest and fastest growing region and is predicted to grow by over one million people by 2040[5]. The AP sets out the 30 year spatial framework for the growth and development of Auckland to become the world's most liveable city. An additional 400,000 houses, as well as supporting infrastructure, business and services are required to support this growth. The AP acknowledges that the transport system is crucial to achieving this vision.

The AP provides for urban growth through a mix of intensification in existing urban areas and new 'greenfields' development (e.g. urban growth in areas that are currently predominantly rural and outside of the existing 'urban limits').

Within the existing urban area of Auckland, significant new growth and intensification is planned. Silverdale and Orewa have been identified as new growth areas for both future residential development and for employment growth. Employment growth is identified in areas such as the Silverdale North Knowledge Economy Business Park. Intensification growth is also identified in Red Beach, Orewa and on the Whangaparaoa Peninsula.

[5] Auckland Council, The Auckland Plan (2012).

The AP identifies a significant proportion of new greenfield growth in the north, titled the "Northern Growth Sector". The Northern Growth Sector (which is identified as an 'area of investigation'[6] for new greenfield growth) includes residential (e.g. Wainui East and Dairy Flat) as well as business/employment growth areas (e.g. Silverdale West and Dairy Flat). From the land-use forecasts provided by Auckland Transport the growth in households between 2011 and 2041 is forecast to be 17,800 dwellings, split across the following locations:

- 5,400 in Orewa
- 1,800 in Whangaparaoa
- 5,800 in the Silverdale area
- 4,800 in Dairy Flat.

Some of this growth (in the rural urban boundary (RUB) area to the west of SH1) has not been included in the modelling here due to uncertainties surrounding it. As a result, some of the growth assumptions used may be conservative.

From the land-use forecasts, the growth in jobs between 2011 and 2041 is forecast to be a total of 7,730, split across the following locations:

- 1,150 in Orewa
- 180 in Whangaparaoa
- 4,600 in Silverdale
- 1,800 in Dairy Flat.

Again, due to uncertainties in the forecasts, some of this growth (in the RUB area to the west of SH1) has not been included in the modelling undertaken for the Project.

2.1.3 Importance of Penlink within the Auckland Network / Land-Use Strategy

To support the substantial historical and planned growth in the Hibiscus Coast area (over 40% between 1996 and 2006), Council undertook detailed planning and analysis of the transport needs. Those studies[7], have confirmed that a new access corridor (Penlink) to the Whangaparaoa Peninsula is needed to support the transport and land-use needs of both the Peninsula and wider Hibiscus Coast area. Penlink will support the wider land-use strategy by providing capacity on the existing Hibiscus Coast Highway to facilitate development of planned growth such as the Silverdale North Knowledge Economic Business Park and provide new connectivity / accessibility between the Whangaparaoa Peninsula and these growth areas (e.g. Dairy Flat).

[6] At the time of preparing this Business Case, the Auckland Plan had identified those areas of the City where the opportunity for future greenfield growth needed further investigation. These areas were identified on the basis that they may be suitable to future urban development, subject to provision of infrastructure and addressing potential environmental issues with such growth.

[7] Beca, Whangaparaoa Access Study, Technical Report 4, Traffic and Economic Analysis, July 1997.
Market Economics, Silverdale North Economic Impact Assessment, November 2006
Beca, Penlink project – Review in terms of the New Zealand Transport Strategy and the Land Management Transport Act, January 2004.

2.2 Work Completed to Date

The need for an alternative route to the Hibiscus Coast Highway and for improved access to Whangaparaoa has a long history. The notion of a bridge across the Weiti River or the 'Weiti Crossing' connecting Stillwater to Whangaparaoa was first identified during the 1980s. In 1997, the Whangaparaoa Access Study[8] (prepared for RDC) considered a wide range of transport alternatives; ranging from investing in improved public transport, widening Whangaparaoa Road to improve the traffic capacity of the existing corridor, restricting growth, or providing a new access corridor.

From that assessment, it was concluded that a new access corridor from East Coast Road to the Whangaparaoa Peninsula was the best option to address both transport and land-use needs for the area and 'Penlink' was identified (the route for Penlink is indicated on the following page in Figure 2-3). This was followed by scheme design and work to protect the land corridor for Penlink (undertaken over the period 1997 through to 2001). Designation, construction and operational resource consents were approved in February 2001[9].

The designation allows for the construction and operation of Penlink and gave the requiring authority (then the RDC and now Auckland Council[10]) the ability to purchase land required for the Project.

While the transport need for the Project has been identified, funding constraints have delayed the commencement of construction. Since 2001, there has been on-going progress towards Penlink including land acquisitions, which were completed in 2007, and various investigations to progress options for both tolling revenue for construction/delivery of the Project.

Given the funding constraints for Penlink, further work was progressed for widening of Whangaparaoa Road (with proposals to four lane the road between Vipond Road and Ladies Mile). A 1.8km stretch of the road was widened in 2004/05 and more recently, a section of the road between the Hibiscus Coast Highway and Red Beach has been planned. However, given the capacity constraints on the Hibiscus Coast Highway, widening of Whangaparaoa Road is no longer seen as an alternative transport option to Penlink. In early 2013, Auckland Transport undertook further investigations into Penlink and confirmed that bringing construction of Penlink forward (from the planned 2018 construction date) would avoid the need for further Whangaparaoa Road widening (and therefore provided the opportunity to avoid incurring these costs).

[8] Beca, Whangaparaoa Access Study, Technical Report 4, Traffic and Economic Analysis, July 1997.

[9] The consents approved for Penlink in 2001 were for the construction of 2 lanes. The preferred option is now to construct 4 lanes and changes to consent and designation will be required.

[10] In October 2010, RDC and Auckland Regional Council were amalgamated with the six other territorial authorities in Auckland to become Auckland Council, a unitary authority with responsibility for both the District and Regional Council functions.

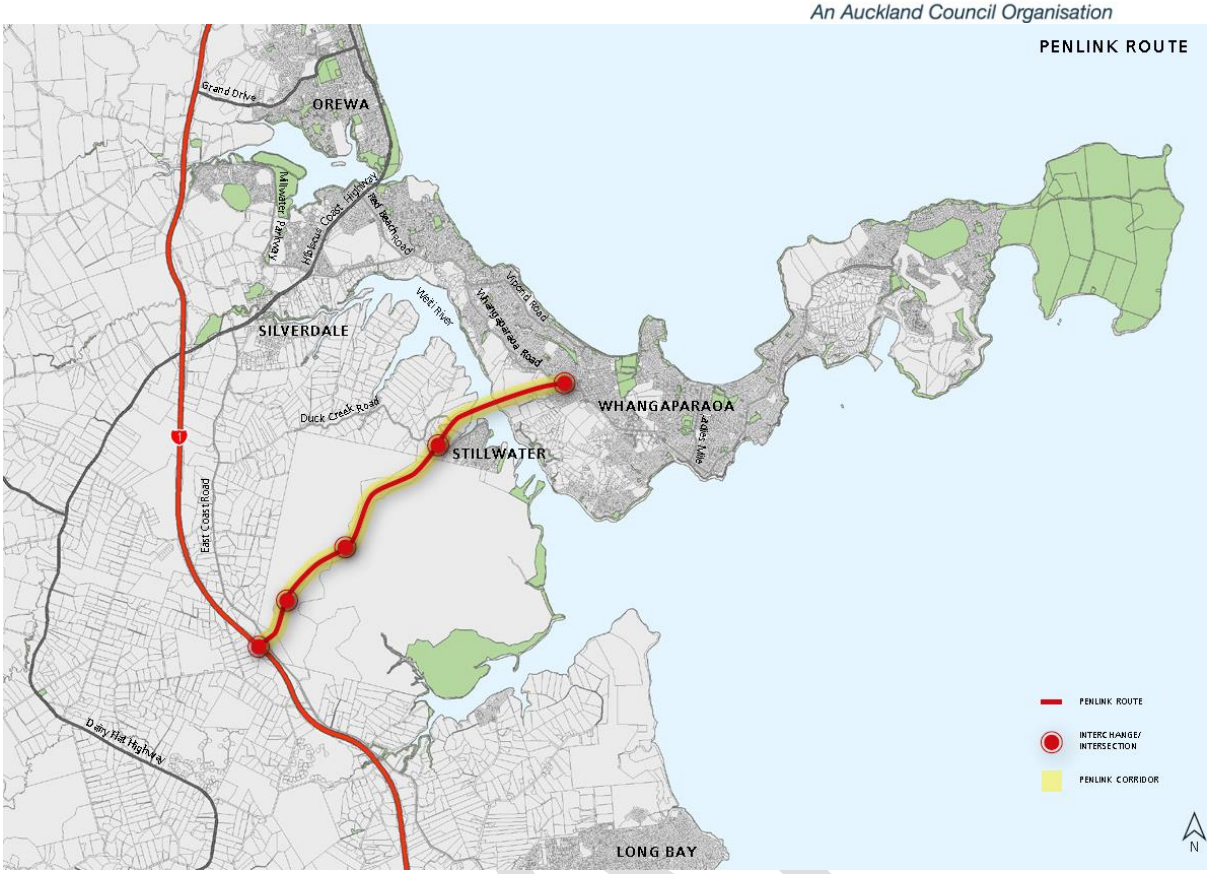


Figure 2-3: Penlink Alignment

2.3 Project Governance

2.3.1 Organisation structure

The organisational chart from the Scheme Assessment phase is included below in Figure 2.4:

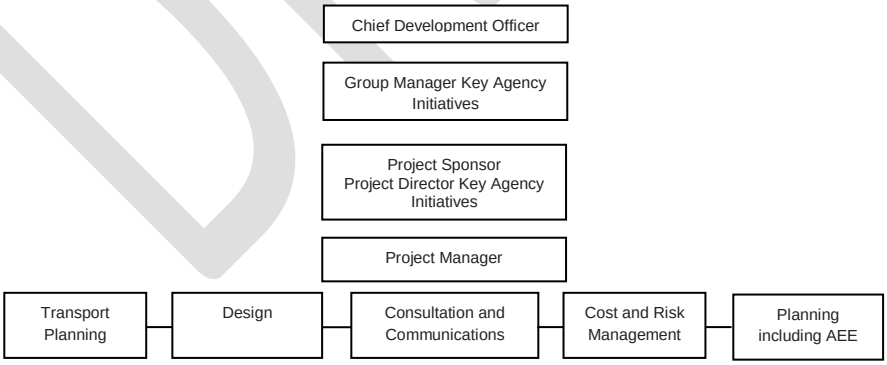


Figure 2-4: Organisational Structure for Penlink

2.3.2 Auckland Transport Board

Auckland Transport was established to operate on and from 1 November 2010 under the Local Government (Auckland Transport) Act 2009 as a Council Controlled Organisation (CCO) for the purposes of the Local Government Act 2002.

The purpose of Auckland Transport is "to contribute to an effective and efficient land transport system to support Auckland's social, economic, environmental, and cultural well-being." (Section 39 Local Government (Auckland Council) Act 2009).

Auckland Transport's activities are directed and guided at a strategic level by the Board of Directors:

- Five directors are appointed by the government to the board of Auckland Transport and serve a term of one to three years, with none serving longer than three years
- A further two directors are appointed by Auckland Council to serve on the board during the council term
- A representative from the NZTA serves as an advisor to the board.

Auckland Transport's Board of Directors has overall responsibility for delivering transport in Auckland; this includes management and controlling public transport and local roads, as well as preparing the Auckland Regional Land Transport Programme (RLTP).

All decisions relating to the operation of Auckland Transport are made by, or under, the authority of the Board in Accordance with the Local Government (Tamaki Makaurau Reorganisation) Amendment Act 2009, the Local Government (Auckland Council) Act 2009, and the Local Government (Auckland Transitional Provisions) Act 2010.

2.3.3 Decision Value Assurance Committee

The purpose of the decision Value Assurance Committee (dVAC) is to provide a formal forum where significant operational decisions of the Auckland Transport can be made with a focus on optimising whole-of-life value. The intention is to ensure significant decisions are made with an appropriate mix of strategic and technical input.

2.3.4 Tier 3 Department Manager and Tier 2 Divisional Manager

The Tier 3 Department Manager and the Tier 2 Divisional Manager have the responsibility to ensure a project aligns with strategic goals and is balanced within the wider programme of work.

- The Tier 3 Manager reviews and authorises the Business Case documentation on behalf of the Chief Development Officer, Capital Development Division and executive team.
- The Tier 3 Manager is accountable to the Tier 2 Manager. The Tier 3 Manager escalates project issues that are outside their delegated authority or Business Case tolerances.
- Other actions include authorising funds and resources (internal or external).
- Resolve issues escalated by the Project Sponsor.
- The Tier 2 Manager is accountable to the Chief Executive. Any issues which have escalated to Tier 2 level will be resolved here, or escalated to the Executive Leadership Team (ELT) which will be chaired by the Chief Executive. If further escalation is required, the issue will be escalated to the Auckland Transport Board.

2.3.5 Project Sponsor

The Sponsor at Auckland Transport generally is the Cost Centre Manager responsible for the project budget. The Project Sponsor is responsible for ensuring that the project or programme of change meets its objectives and delivers the projected benefits.

The Project Sponsor's key responsibilities:

- Remains in place for the duration of the programme or project.
- Recognised as the owner of the project throughout the organisation.
- Owner of overall business change.
- Responsible for the successful delivery of project.
- Ensures the project is technically and financially compliant.
- Ensures the project is identified in the organisation's Long-Term Plan and Integrated Transport Programme.
- Proactive in providing leadership and direction throughout life of the project.
- Provides approvals and decisions that affect project progress and delivery.

3 Problems, Opportunities and Constraints

By creating a new access corridor, Penlink addresses issues of existing limited accessibility (and therefore quality of life) for residents in Whangaparaoa and improvements to wider transport efficiency, reliability and reducing congestion. As well as improving network resilience (with the current network reliant on a single transport connection to the Whangaparaoa Peninsula), the new corridor removes the substantial through-traffic from the Hibiscus Coast Highway through Silverdale, which is creating congestion and poor integration with land-use in the Silverdale Centre. Penlink will also better enable the 'northern growth sector' areas identified in the AP to be realised, contributing to the overall vision of the spatial plan.

In response to the key transport issues identified for Penlink, a number of environmental constraints have been identified that have informed the Project alignment and design. These include responding to complex topography, geotechnical constraints, sensitive ecological areas and marine receiving environments.

The Hibiscus Coast area including Orewa, Whangaparaoa Peninsula, Silverdale and Stillwater has grown rapidly over the past 20 years. Between 2001 and 2013, the population increased by almost 13,000 people (approximately 40%). In the 2009 Long Term Plan (LTP), the RDC were predicting an increase of 11,000 residents in the Hibiscus Coast area over the 10 year period to 2019.

Following the opening of the motorway north of Orewa in 2009 there has been substantial new development demand created in the areas surrounding Whangaparaoa. This has resulted in and will lead to more pressure on the Hibiscus Coast Highway. Recent examples of urban growth in the area include:

- Silverdale North (3,500 homes plus commercial areas)
- Orewa West (600-700 homes)
- Peninsula Golf Course (proposed 650 homes)
- Weiti Forest Park (450 homes plus recreation and business)
- Weiti Station (225 homes)
- Silverdale mixed use commercial zone and service centre (includes The Warehouse, Northern Arena etc).

In addition to this growth, future new 'greenfield' areas are also identified (i.e. areas proposed for future urban development beyond the existing urban area). Both the existing growth areas identified above and future indicative growth areas were identified in Figure 2-2.

3.1 Problems and Opportunities

Three key problems/opportunities have been identified in the transport network at Whangaparaoa/ Silverdale. Each of these is discussed below.

Poor transport network performance negatively impacts economic activity and quality of life on the Whangaparaoa Peninsula and surrounding area

The Whangaparaoa Peninsula, Hibiscus Coast Highway and the Silverdale motorway interchange are all currently subject to regular congestion particularly during weekday peak periods. More severe congestion is experienced when incidents occur. Access between the eastern end of the Peninsula and the western end is currently poor, as Whangaparaoa Road is largely a single lane road (50kmph) with approximately 30,000 vehicles per day (VPD) using the route. Whangaparaoa Road was not designed to accommodate these volumes of traffic and therefore has a poor level of service (LOS)[11].

Furthermore, in order to travel south from the Whangaparaoa Peninsula (e.g. to the centres of Takapuna and the Auckland central business district (CBD)), traffic must travel along the Hibiscus Coast Highway and to the Silverdale motorway interchange (connecting onto SH1). Recent growth occurring in and around Silverdale has resulted in congestion being experienced on this section of the network. The current LOS (determined by travel time) for this section of the Hibiscus Coast Highway is also poor[12].

With further planned growth in Silverdale, including the Silverdale North Knowledge Economy Business Park, it is expected that there will be increased travel demand and time delays at the Silverdale interchange and along the Hibiscus Coast Highway. This results in congestion on both the Whangaparaoa Road and Hibiscus Coast Highway corridors. With increasing regularity, queues are impacting on the SH1 corridor at Silverdale. This is predicted to significantly increase congestion on Whangaparaoa Road and will extend to a much wider area than just Whangaparaoa and Silverdale.

For businesses, congestion and time delays result in additional costs, through inefficient use of resources. Costs associated with locating a business in an area subject to such congestion are deterrents to business growth, creating lost economic opportunities. The cost of time delays associated with the congestion on Whangaparaoa Peninsula and the wider Silverdale area is estimated at $20 million / year[13].

As a congested route with significant volumes of traffic, Whangaparaoa Road also currently faces safety issues for vehicle users, as well as cyclists and pedestrians. The reported five year crash history between 2008 and 2012 is below in Table 3-1. The crash rates, as measured on a vehicle–kilometre basis, is similar to other high-volume arterial roads in Auckland, however the high speed and high volume of traffic on the Hibiscus Coast Highway has been recognised as both a safety issue and a barrier to integrated land-use. The high traffic flows and lack of infrastructure capacity restricts the ability

[11] Level of Service: LOS is a quality measure describing the operational conditions of a highway in terms of speed and travel time, freedom to manoeuvre, traffic interruptions and comfort and convenience. LOS A represents the best highway operating conditions and LOS F the worst (stop-start traffic).
[12] The LOS for the whole corridor is F, especially in the evening peak where there is a high level of congestion on the northbound off-ramp at Silverdale, at the turning from the Hibiscus Coast Highway into Whangaparaoa Road and along Whangaparaoa Road between the Hibiscus Coast Highway and Vipond Road.
[13] This has been estimated by considering the congestion costs per vehicle km in the peak period compared to that of the interpeak, which is assumed to be uncongested.

to provide enhanced facilities for other modes of transport (e.g. bus, high occupancy vehicle lanes or cycle lane provisions).

There are also limited controlled crossing points for pedestrians. This creates safety issues for pedestrians using the corridor to access shops, schools or residences (e.g. from public transport).

Table 3-1 Five year Crash History 2008 – 2012

Road Section	Reported Crashes 2008 - 2012				Crash Rates per 100 million VKT		
	Fatal	Serious	Minor	Non-Injury	Fatal	All Injury	Akld All Injury
Whangaparaoa Road (Arklow to HBC Highway)	1	5	37	95	2.4	17.2	33
HBC Highway (SH1 to Whangaparaoa Road)	1	4	32	79	3.5	25.6	29
East Coast Road (HBC Highway to Redvale)	0	6	26	26	4.6	24.3	29
SH1 (Silverdale to Redvale)	0	3	21	62	0.4	3.4	14

Safety is a particular concern for vulnerable road users. Vulnerable road users include children and young people using the road network to access school and extra-curricular activities; elderly whose mobility has decreased and will face greater challenges with crossing roads; and cyclists. These road users can feel intimidated by high volumes of traffic, which affects the perceived safety and enjoyment of travel by these modes of transport.

Further delays to the construction of Penlink will increase pressure on Auckland Transport to deliver transport improvements along Whangaparaoa Road and the Hibiscus Coast Highway, thereby diverting funds into short- to medium-term improvements, rather than Penlink, which will provide greater benefits over a longer period of time. These short-term improvements will be costly and have little future value, once Penlink is constructed.

The Whangaparaoa Peninsula community is vulnerable to physical isolation due to current single road access

The existing transport connections for residents and businesses on the Whangaparaoa Peninsula are reliant on Whangaparaoa Road and connection to the Hibiscus Coast Highway from the Silverdale Interchange. In the event of an emergency that causes closure or disruption to Whangaparaoa Road or the Hibiscus Coast Highway, there are limited alternatives for land-based connectivity (means of entry or egress from Whangaparaoa). When considered with the existing congestion on this corridor, the residents and businesses of the Peninsula risk ‘severance’, effectively being isolated from the rest of the City.

Given the capacity limitations of Whangaparaoa Road, there is also little capacity to accommodate public transport, walking and cycling facilities resulting in limited mode choices for residents on the Whangaparaoa Peninsula, particularly for vulnerable users (who often have more limited access to private motor vehicles).

Until recently, the Hibiscus Coast Highway also provided the sole access into Silverdale North. A new access to Grand Drive to the north was opened in 1999, and a new motorway connection to SH1 at Wainui Road will be constructed prior to stage 3 of the Millwater subdivision in 2014/15. However, even with those additional access points, the Hibiscus Coast Highway will remain a key entry point to the Silverdale Village and surrounds. This access is constrained (e.g. it is currently only possible to turn right out of Silverdale North onto Hibiscus Coast Highway at the Millwater Parkway/Whangaparaoa Intersection).

To address this constraint, longer term access from Silverdale North (via a new access road connecting across the Weiti Stream to East Coast Road), has been identified. However, the current lack of capacity on the Hibiscus Coast Highway and SH1 interchange is restricting development of this new road connecting across Hibiscus Coast Highway (e.g. rules require staging of developments to protect the functioning of the Hibiscus Coast Highway and SH1 interchange require that Penlink is constructed prior to this new access being developed).

Limited capacity in the transport network is constraining planned urban growth in the area

Auckland is the fastest growing region in New Zealand. Key growth areas identified (refer to Figure 2-2) in the Auckland Plan (relevant to Penlink) include:

- Town Centre development and associated urban intensification around the Whangaparaoa 'Town Centre'[14].
- Growth in Silverdale for both new dwellings and new employment opportunities (particularly the Silverdale North Knowledge Park) by 2041[15]. This will significantly contribute to the overall growth plans of the AP.
- A business and residential growth area adjacent to the Dairy Flat airport[16].
- Western Orewa (Wainui) area identified for future urban residential development.

There are a number of areas in and around Silverdale and the Whangaparaoa Peninsula that have been planned for growth over the last decade. In particular, the former RDC has facilitated new urban growth areas in Silverdale North and Silverdale South. More recently, the opportunity for this growth area to be 'expanded' to the areas of Wainui / Dairy Flat has been signalled in the Auckland Plan as a key element of the City's overall spatial plan for growth.

[14] Hibiscus and Bays Area Plan (Draft, October 2012), Auckland Council.
[15] Auckland Council Silverdale RUB investigations, May 2013 (note that March 2013 documentation identified 12,000 new residential dwellings: Proposed North and West Rural Urban Boundary map – Silverdale, Auckland Council 2013). As of September 2013, Council has revised calculations, with capacity for between 4,700 and 6,100 dwellings; this has yet to go through the statutory process and therefore is likely to be altered through that process.
[16] Auckland Council has identified Dairy Flat as a growth area with capacity for 4,700 to 6,100 dwellings, though this figure may be revised through the Unitary Plan notification process.

There are currently three main traffic capacity constraints to enabling the identified growth. These are:

- The single-lane sections of Whangaparaoa Road (especially west of the town centre) having insufficient capacity
- The turning conflicts at intersections along the Hibiscus Coast Highway (such as the right turns at the Whangaparaoa and East Coast Road intersections)
- The Silverdale Interchange.

During peak periods (and especially the evening peak), these constraints interact resulting in variable queuing that regularly extends back through the Silverdale Interchange and even back for some distance on the SH1 main carriageway. Those queues and congestion are expected to become more severe and regular with continuing growth.

The relationship between transport infrastructure requirements and ability to deliver planned growth has been recognised by Council. For example, the Silverdale North Zone section of Council's District Plan[17], specifically recognises the issue of potential adverse effects of growth on the surrounding 'primary' (arterial) road network. In response to this issue, the Plan goes on to restrict growth of Silverdale North until improvements to this network are made[18]. This has resulted in staging rules on both residential and employment areas in Silverdale North being deferred until projects such as Penlink are constructed and has resulted in delays to delivery of growth in this area. It is acknowledged that the deferment of Penlink has resulted in those staging rules now being under pressure to be relaxed (as landowners seek to progress 'delayed' development).

In addition to the constraints on planned growth set out above, the AP also identifies significant further areas around Silverdale (Wainui) and Dairy Flat for future urban development. Penlink provides an opportunity to support these growth plans, by diverting traffic from the Silverdale Interchange. This increases the ability of the network to absorb traffic required to support these potential commercial and residential growth areas. The preferred design of the Redvale Interchange (Penlink) also maintains the opportunity for a future connection between Dairy Flat (to the west) and SH1, thereby providing an opportunity for this area to be supported by the existing transport infrastructure.

3.2 Constraints

There are four types of constraints for the Project, being economic, environmental, physical and social constraints. The specific constraints for each of these are discussed in the following sections. These are shown below in Figure 3-1:

[17] Issue 12.8.19.3.14.
[18] See Objective 12.8.19.4.21.

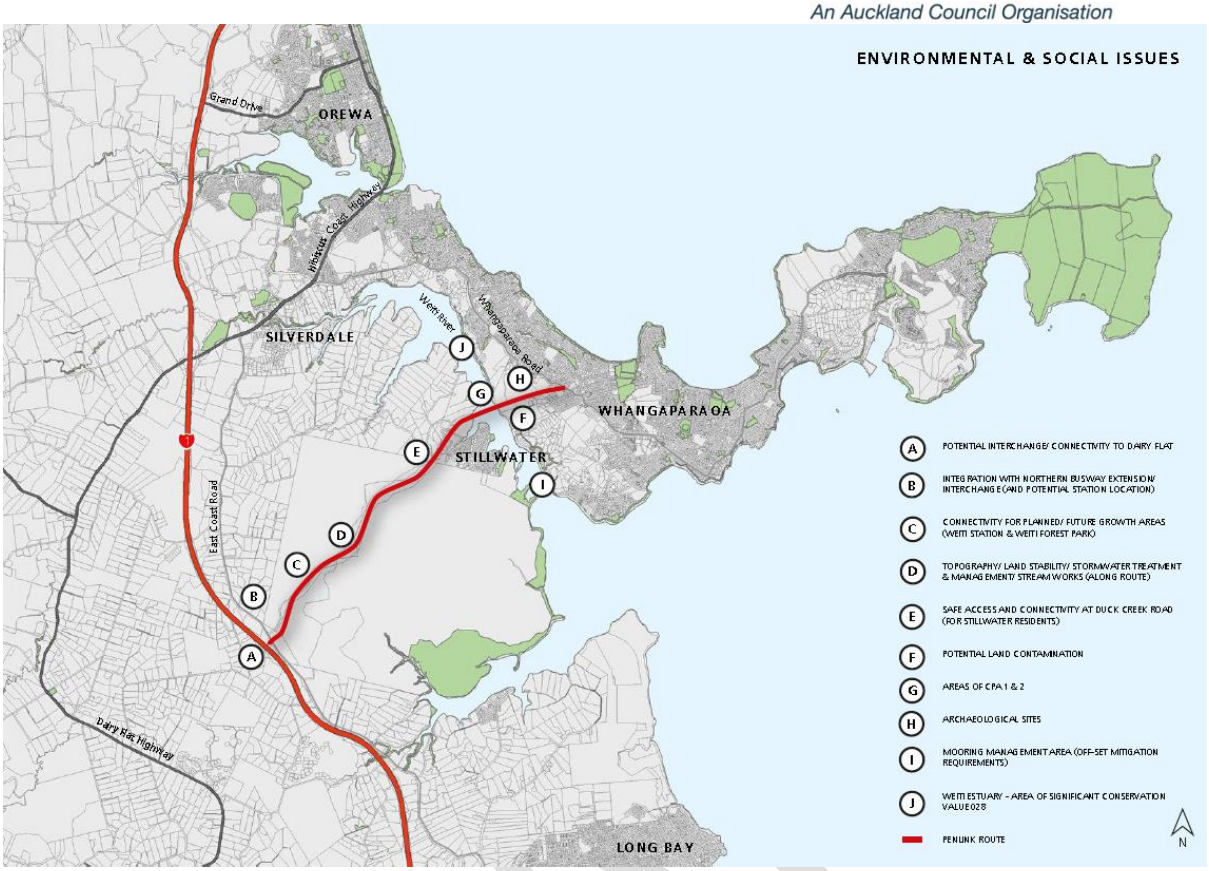


Figure 3-1: Environmental and Social Issues

3.2.1 Economic

The biggest constraint for the delivery of Penlink has been to obtain funding and the ability to program projects within the available capital funding envelope. The programming of funds to other projects limits available funding for Penlink and has been the key reason that Penlink has not already been constructed. Because Penlink is so large, it takes out a large part of the annual capital budget. As no other projects could be completed at the same time, it became difficult to achieve Penlink, even though it had a high priority. It was a cashflow (program) issue, not a prioritisation issue. The majority of development in Whangaparaoa has already occurred and therefore opportunities for traditional development funding for district infrastructure such as an arterial road (through development or financial contributions) is limited. From an economic perspective, the 'direct benefits[19], of the Project are attributed to the Whangaparaoa community (with wider indirect benefits for Silverdale, Red Beach, Redvale and potentially Dairy Flat / Wainui).

3.2.2 Environmental

Crossing the Weiti River requires the construction of a 540m bridge over the Weiti River. The river is a sensitive receiving environment, meaning it is at risk of degradation from development. Earthworks within the catchment will require appropriate erosion and sediment control to prevent sedimentation of

[19] Direct benefits are benefits to those who use Penlink. Indirect benefits are to those who don't use Penlink, but still experience benefits as a result of it being in place.

the river. As a sensitive receiving environment, works in the coastal marine area will need careful management.

The location of the proposed bridge crossing the Weiti River is part of the Coastal Marine Area. The entire Weiti Estuary is identified as a Coastal Protection Area, which is the most significant protection category and the most sensitive coastal environment. The western side of Weiti River where the bridge is proposed is identified as having notable vegetation[20]. The construction and design of the Project will need to be carefully managed to maintain the characteristics of significance in the Coastal Protection Area. While consents are in place for the occupation of the bridge over Weiti River, modification and new consents to construct are required as previous construction consents have lapsed.

On the Whangaparaoa Peninsula side of Weiti River, Penlink travels through a significant natural area with moderate significance as described by the Auckland Council District Plan: Rodney Section. This area is a known habitat of native lizards and therefore it is likely the removal of these will be required prior to commencement of earthworks. Again, these will be addressed at construction consenting.

3.2.3 Physical

The Project traverses some difficult terrain along the 6.8km of the route. Between Redvale and Stillwater the local topography rises and falls steeply and frequently then from Stillwater, the topography continues to fall to the Weiti River. At the point of crossing, the Weiti River is 270m across. However, due to the steep topography on both sides and the fact the bridge will maintain a 40m clearance above the water, the bridge needs to be 540m. Across the Weiti River, the land steeply rises before undulating down towards Whangaparaoa Road. The challenging topography results in economic implications for the Project, as significant cut and fill is required as well as a number of retaining walls or batter slopes[21]. These physical constraints are also 'compounded' by the extent of the existing designation which limits the width for construction of batter slopes.

3.2.4 Social

The Project alignment passes close to the existing Stillwater community. Stillwater is currently a small settlement of just over 2,000 residents with a quiet environment. There are high lifestyle and recreational values in this area. It is noted that there is planned residential growth around this settlement (e.g. Weiti Forest Park and Weiti Station, see Figure 2-2). Notwithstanding this, the potential of community opposition and the perception of change in the vicinity of Stillwater is an issue.

Since the Project was designated and consented, new noise standards have been implemented. As part of construction, Penlink will potentially require additional noise mitigation measures around sensitive communities.

There are approximately 10 heritage items identified along the alignment, particularly Maori Cultural Heritage sites flagged in the draft Unitary Plan within and adjacent to the alignment near Weiti River. This may affect construction works (for example a specific construction methodology around sites may

[20] Auckland Council, Auckland Council Regional Plan: Coastal (2004).
[21] Batter slopes protrude up or recede down from the road corridor at an angle and assist with stability of the ground.

be required or works may need to cease if any historic artefacts are unearthed) and require consultation with affected parties as well as consenting from the Historic Places Trust.

The potential impact of traffic flows and motorway access due to downstream capacity on SH1 and the need for Penlink to integrate with proposals for the planned future Northern Busway (parallel to SH1) will also need to be considered in the design of the Project.

3.3 Government Policies

This section briefly outlines the Government land-use and land transport policies and priorities related to Penlink. Figure 3-2 below shows the relationship between the documents under the three relevant pieces of legislation.

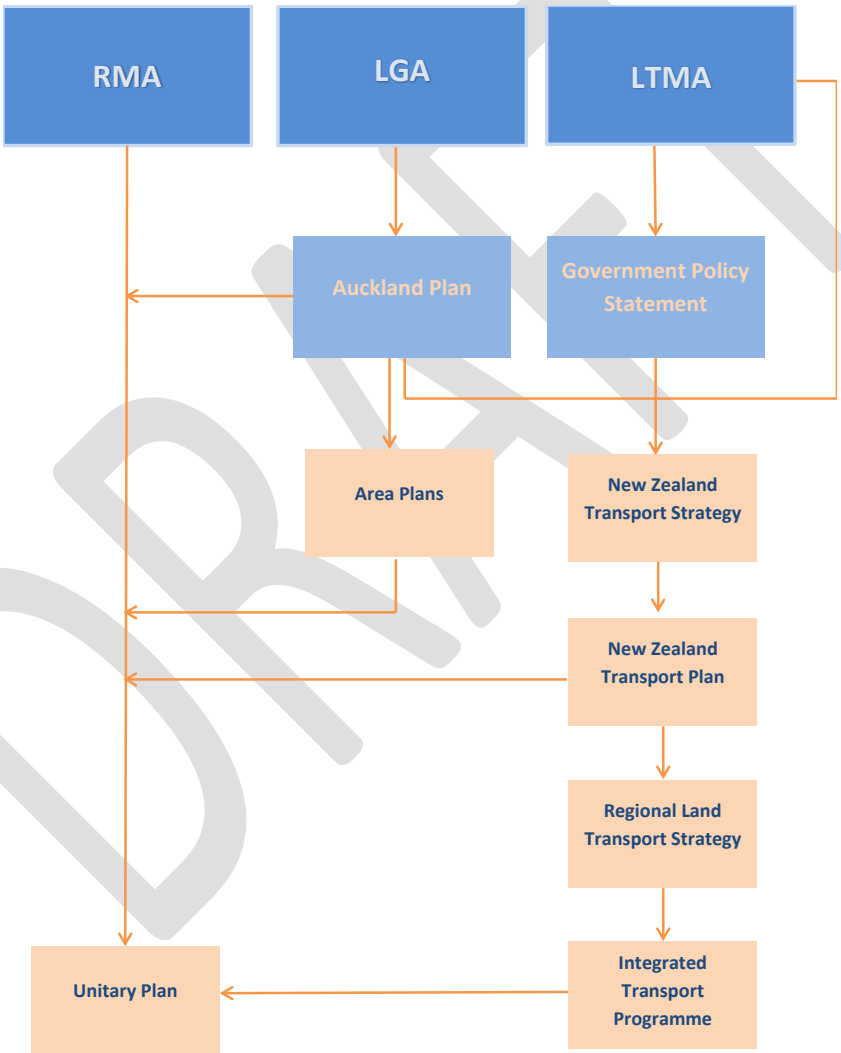


Figure 3-2: Conceptual Relationship of Relevant Documents

3.3.1 Contribution to LTMA Objectives

The Land Transport Management Act (LTMA) 2003 requires all potential projects to be assessed against the Government Policy Statement for Land Transport Funding (GPS), the relevant Regional Land Transport Strategy (RLTS) and the five New Zealand Transport Strategy (NZTS) objectives, which are:

- Assisting economic development
- Assisting safety and personal security
- Improving access and mobility
- Protecting and promoting public health
- Ensuring environmental sustainability.

The primary outcome of the Project is to improve access to, from and around Whangaparaoa. Access will be improved not only for private vehicles but also for pedestrians, cyclists, public transport operators and businesses.

Penlink provides an opportunity for economic development on the Whangaparaoa Peninsula, by improving travel times. Additionally, it will alleviate transport pressures in the vicinity of the existing Silverdale commercial and industrial areas which will assist in improving both access and mobility, and will also assist in economic development of this important northern employment area.

The provision of cycling and pedestrian facilities on Penlink will provide a safe alternative mode of transport for those connecting between Whangaparaoa, Stillwater and the North Shore. As part of the Whangaparaoa Road widening stage of the project, five pedestrian crossings will be installed to improve safety and personal security.

The reduction in traffic will provide opportunities for capacity on Whangaparaoa Road and Hibiscus Coast Highway to be made available for a wider range of transport modes. As a result of these opportunities as well as the more specific provision for cyclists and pedestrians on Penlink, there will be benefits to public health (via use of more active transport modes).

Air quality can affect public health and is significantly impacted by vehicle traffic. Congestion results in a higher concentration of emissions within a particular area. By creating an alternative road to facilitate growth, the total traffic journeys are likely to increase. However, the concentrations of emissions are likely to decrease, due to faster travelling speeds and the split of emissions across two separate roads. This will likely reduce the air quality impacts and increase the quality of life for the local Whangaparaoa community[22].

[22] No air quality assessment has yet been undertaken, though it is anticipated that fewer stationary vehicles and fewer vehicles along the route will result in improved air quality.

3.3.2 GPS and the National Land Transport Programme

The GPS was adopted in 2011 and sets out the government's priorities and outcomes for the land transport sector until 2022. The three priorities identified are:

- Economic growth and productivity
- Value-for-money
- Road safety.

Every three years, NZTA develops a National Land Transport Programme (NLTP) to give effect to the GPS. The focus of the 2012-2015 NLTP is aligned with the priorities of the GPS, being:

- Ensuring value-for-money
- Supporting economic growth and productivity
- Improving safety
- Providing a range of travel choices.

Penlink will contribute to meeting the priorities and objectives of the GPS and NLTP relating to improving the functioning of Auckland's transport system by improving the local road network. In particular, the addition of an alternative high speed route will foster both business and residential growth on the Peninsula and the wider areas of Silverdale and Dairy Flat. These will contribute to economic growth.

The NLTP predominantly concentrates on regional arterial roads and the Roads of National Significance (RoNS) as opposed to local roads. Whangaparaoa Road is identified as an existing regional arterial road and Penlink has been identified as a proposed regional arterial. To alleviate congestion, emphasis will be placed on a mode shift by delivering high quality pedestrian and cyclist networks. Penlink is beyond the current funding period of the NLTP (e.g. between 2012 and 2015)[23], meaning construction will not commence until after 2015. The construction of Penlink will provide for the strategies of the GPS and NLTP insomuch as it provides for a range of travel choices, including the provision of cycle and pedestrian facilities on the Project and improved opportunity for greater public transport provision along Whangaparaoa Road. The opportunities for economic development and productivity, discussed in respect of the LTMA are also considered relevant.

3.3.3 Auckland Regional Land Transport Strategy and Programme

The Auckland RLTS (2012-2015) sets the direction for the regional transport system for the next 30 years. The Auckland RLTP was approved by the Auckland Transport Board in June 2012. The RLTP sets out a three year programme of prioritised works for transport in Auckland which has been developed holistically to recognise transport's economic influences, enhancement of the city's liveability and the requirement of a co-ordinated approach.

[23] Current planning proposes construction of Penlink in 2018.

The four strategic priorities of the RLTS are identified as:

1. Support greater integration between land-use and transport
2. Improve the efficiency and effectiveness of the region's transport networks
3. Make best use of the existing transport system
4. Improve transport safety and reduce the adverse impacts from transport on the surrounding environment.

Penlink contributes to the first priority by creating transport capacity to support planned residential and commercial growth within the existing metropolitan urban limit. The efficiency and effectiveness of the existing network will be improved by the Project. Greater opportunity for achieving the fourth priority will arise from the construction of Penlink and reduced congestion on Whangaparaoa Road. With no priority for public transport or cycling along Whangaparaoa Road and high levels of congestion, implementing changes to the existing network, as per priority 3, will only be possible with significant changes and social effects.

Penlink is currently identified in the RLTP as a 4-10 year project with a 'MMM" (medium, medium, medium) level profile when ranked against strategic fit, effectiveness and economic efficiency[24] (it is noted that this assumes that the proposed Whangaparaoa widening is undertaken). Widening of the western end of Whangaparaoa Road between Hibiscus Coast Highway and Red Beach is an identified project between 2013 and 2015. This widening seeks to address the current capacity limits of Whangaparaoa Road and is identified as an immediate short-term solution pending the construction of Penlink. As noted previously, earlier construction of Penlink could avoid the need for the widening of Whangaparaoa Road.

3.3.4 Auckland Integrated Transport Programme

The 2012-2014 Integrated Transport Plan (ITP) for Auckland sets out a 30 year investment programme for meeting transport priorities. The ITP states the Auckland Plan set the overall strategic direction for transport. Key priorities are discussed in more detail in Section 4.1.

3.3.5 The Auckland Plan

The Local Government Act 2002 (LGA) and the Local Government (Auckland Council) Act 2009 (LGACA) set out the government structures for Council and the general powers, planning and accountability requirements for local government. Of particular relevance to Penlink, one of the key roles of the Auckland Council is to plan and provide for both existing and future communities. Council has responded to this requirement through the development of the AP.

[24] This rating has been updated as part of this study. Refer to Section 8 for the updated profile and details of the criteria and meaning of the ranking.

The AP provides a comprehensive long-term (20 to 30 year) strategy for Auckland's growth and development. The vision of the AP is for Auckland to become the world's most liveable city with a 'well-connected and accessible Auckland' identified as a key outcome. The vision of the AP is that Auckland's infrastructure is well planned and up-to-date, and meets the needs of its communities and the economy effectively. In this regard, the AP identifies the future connection from SH1 to Whangaparaoa on the Development Strategy Map as shown below in Figure 3-3:

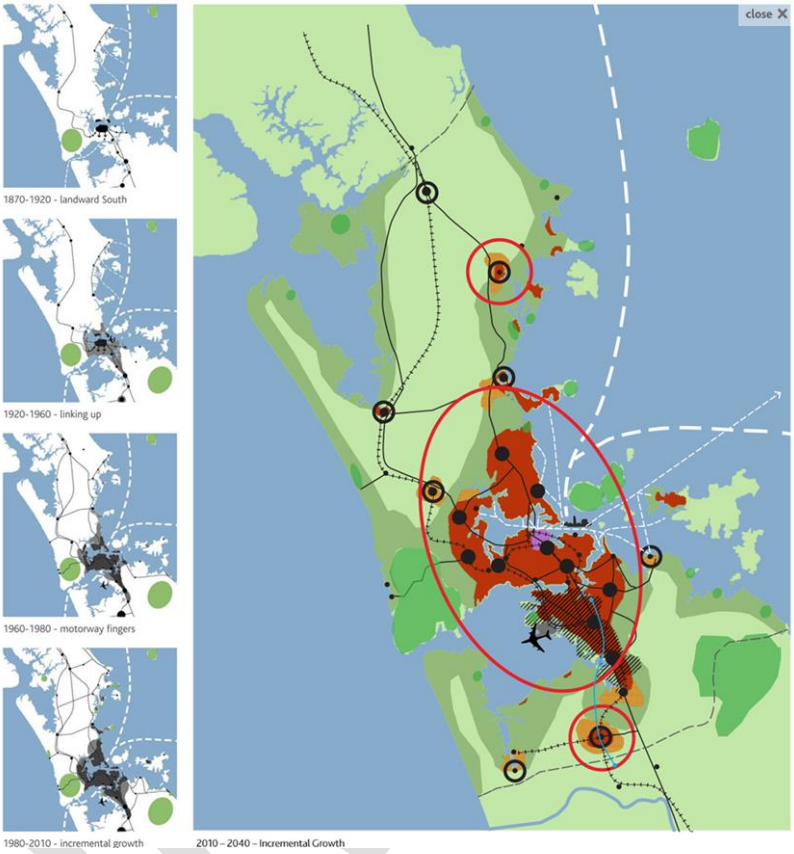


Figure 3-3: Auckland Plan Identified Growth

The transport objectives are derived from the AP as the overarching strategic direction for Auckland. The AP identifies the following outcomes that the transport network can help achieve.

- A fair, safe and healthy Auckland
- A green Auckland
- An Auckland of prosperity and opportunity
- A well connected and accessible Auckland
- A beautiful Auckland that is loved by its people.

Additional strategic directions are identified as a means of achieving the outcomes. Those of relevance to transport and the Project are:

- Create a stunning city centre, with well-connected quality towns, villages and neighbourhoods
- Create better connections and accessibility within Auckland, across New Zealand and to the world.

Penlink will enable potential growth and economic development on Whangaparaoa and in the Silverdale area. The construction of Penlink will increase accessibility to, from and within Whangaparaoa by providing additional benefits such as a cycleway along Penlink, pedestrian crossings on Whangaparaoa and enabling improved public transport provision.

3.3.6 Hibiscus and Bays Area Plan

Area plans are being prepared by Auckland Council to analyse local issues, challenges and opportunities. Guided by the AP and local aspirations, area plans provide a long-term (30-year) vision for 21 areas of the City. These plans look to implement the AP and at a local level, including the identification of infrastructure needs and the timing for delivery of infrastructure to meet the needs of local areas.

The Hibiscus and Bays Area Plan was drafted in October 2012. While, at the time of preparing this report, the Area Plan was still a Draft, this Plan identifies Penlink as a key priority project to improve transport connections in the area; one of the six key moves to support transformational shifts in the area. The Plan identifies that Penlink will be completed in 2018, and will enable planned growth in Silverdale and Orewa, by alleviating current traffic limitations.

4 Outcomes

The three key objectives for Penlink are to improve travel times and journey reliability through the study area; improve network performance in order to facilitate economic activity, planned growth and transport mode choice in Silverdale, the Whangaparaoa Peninsula and the surrounding area; and improve network resilience for the Whangaparaoa Peninsula community.

These objectives have been derived from and contribute to Auckland Transport's strategic objectives which relate to the transport network across Auckland.

4.1 Strategic Objectives

Auckland Transport's purpose is set out under Section 39 of the LGACA. This section states that the purpose of Auckland Transport is *"to contribute to an effective and efficient land transport system to support Auckland's social, economic, environmental and cultural well-being"*[25]. Auckland Council has defined the social, economic, environmental and cultural well-being of the Auckland community both now and in the future through the AP. The AP identifies a vision, outcomes and strategic directions for Auckland.

AT contributes to the same vision as Auckland Council[26]. The 2012-2014 ITP for Auckland sets out a 30 year investment programme for meeting transport priorities. The ITP states the AP set the overall strategic direction for transport. There are four key priorities identified through the Auckland Plan for transport. These strategic priorities are:

- A single system transport network approach that manages current congestion problems and accommodates future business and population growth to:
  - Improve and complete the existing road and rail network
  - Encourage a shift toward public transport
  - Support environmental and health objectives through walking and cycling.
- Integrate transport planning and investment with land-use investment to:
  - Incorporate the transformational shifts and land-use directives of the AP
  - Align transport investment and services, especially public transport and regional arterial roads, with future growth and development
  - Give particular emphasis to freight movement and other related business travel on international, national and Auckland-wide transport corridors.

[25] As a Council Controlled Organisation (CCO), the purpose of local government under Section 20 of the LGA 2002 is also relevant. This section states that the purpose of local government is 'to promote the social, economic, environmental and cultural well-being of communities in the present and for the future'.
[26] As it is a Council Controlled Organisation (CCO).

- Prioritise and optimise investment across transport modes to:
    - Enable several critical transport projects for Auckland to cope with population growth
    - Manage $25 billion worth of assets in the transport system to get best value from existing investment. This includes maintenance programmes, traffic optimisation and safety programmes
    - Manage demand for transport to ease congestion and potentially alleviate the need for expensive additional capacity, through school travel plans, possible time-related pricing mechanisms, smarter parking policies and other initiatives.
- Implement new transport funding mechanisms that:
    - Enable critical infrastructure projects such as the City Rail Link and an additional Waitemata Harbour Crossing
    - Consider new funding mechanisms to help finance the approximately $10 billion to $15 billion funding shortfall for transport projects
    - Support Auckland Council and central government in jointly considering new funding mechanisms.

4.2 Project Objectives

Reflecting on Auckland Transport's priorities and the wider objectives of the AP, three project specific objectives have been identified for Penlink. These are:

1. To improve travel times and journey reliability through the 'Study Area'[27] (being the land areas east of SH1 in the vicinity of the Hibiscus Coast Highway and Whangaparaoa Road: Silverdale, Millwater, Weiti, Stillwater and the Whangaparaoa Peninsula)
2. To improve network performance so as to facilitate economic activity, planned growth and transport mode choice in Silverdale and the Whangaparaoa Peninsula and the surrounding area
3. To improve network resilience for the Whangaparaoa Peninsula community.

The Project contributes to meeting the strategic objectives of AT, project objectives and wider objectives of relevant documents. Penlink will:

- Meet the key requirements of the LTMA.
- Facilitate economic development and growth (residential and business) by significantly improving the infrastructure servicing for the Silverdale and Whangaparaoa areas (both identified for growth in the AP).
- Improve the quality of urban living for residents on the Whangaparaoa Peninsula.
- Create an alternative secure transport connection for residents and to enhance the ability of safety services (e.g. ambulance and the fire services) to be able to provide essential services in the

[27] See Figure 2-1 for a map of the Study Area.

event of an emergency, especially during peak travel periods as well as improve safety for all modes (vehicles, cyclists and pedestrians).

- Decrease travel times, distances and trip reliability (from the Whangaparaoa Peninsula), alleviating traffic congestion pressure at the Silverdale Interchange and the Hibiscus Coast Highway. This results in reduced vehicle operating costs due to less engine idling time for the people electing to use Penlink.
- As a result of the reduction in travel distances and traffic congestion, lessening air pollution (with lower CO2 emissions and other pollutants due to less engine idling time).
- Lessening (by varying degrees) the noise pollution experienced by residents living on or near Whangaparaoa Road west of the Weiti Toll Road junction, through a reduction of vehicle volumes using the existing road.
- Enable an improved bus services to be implemented, with direct access onto Penlink from public transport facilities on the Whangaparaoa Peninsula. Penlink will also free up capacity on Whangaparaoa Road and reduce congestion and travel times in the surrounding area, making public transport a more attractive option when and if more matching public transport capacity is provided.
- Avoid or mitigate the environmental and cultural effects of the route through Project design, consultation and construction management.
- Provide opportunities to implement a public private partnership to deliver the Project using an alternative funding mechanism.

Key Transport Outcomes

The direct benefits of Penlink relate to those who would use the new facility between Whangaparaoa and Redvale and those remaining on the existing routes where significant volumes of traffic are expected to be removed.

The level of service on Penlink is expected to be high with high travel speeds, extensive passing opportunities and high safety performance through the divided carriageway and grade separation at Duck Creek and East Coast Roads.

Relative to the 2016 Do-Minimum scenario, the models suggest that the opening year travel times would be some 5 minutes quicker for those continuing to use the Hibiscus Coast Highway route between Whangaparaoa and Redvale and between 13 and 20 minutes for those using the tolled Penlink. Without Penlink, the peak direction travel times between Whangaparaoa and Redvale are predicted to increase from the current 20 minutes to over 55 minutes by 2041. With Penlink, these 2041 travel times are forecast to reduce by between 38 and 50 minutes, depending on the route taken.

For those using Penlink, the travel time would be some 5.8km shorter and 8 minutes faster than using the free alternative route.

With Penlink in place, the traffic flows are forecast to reduce (relative to the equivalent future Do-Minimum scenarios) by up to 9,400 VPD (22%) on Whangaparaoa Road, up to 6,500 VPD (15%) on the Hibiscus Coast Highway through Silverdale, and up to 15,700 VPD (17%) on SH1 between Redvale and Silverdale. Increases in traffic flow are forecast on SH1 south of Redvale of up to 4,300 VPD (5%) and on Whangaparaoa Road east of Penlink of up to 3,900 VPD (15%). More critically, the peak-hour traffic flows on key sections such as the Silverdale interchange and on Whangaparaoa Road are forecast to reduce by over 500 vehicles per hour (20%-30%), bringing them below the capacity of those sections.

AT is separately investigating widening of the section of Whangaparaoa Road between the Hibiscus Coast Highway and Red Beach Road. This analysis of Penlink excluded any such widening, although it was considered in the sensitivity testing. This modelling and testing indicated the following:

- The forecast reduction in peak-period traffic flow on this section of Whangaparaoa Road is such that widening of that section is unlikely to be required if Penlink is constructed
- Including such widening in the analysis showed an improvement in network performance in the No-Penlink scenario, but only minor changes if Penlink was in place.

This means that widening is not predicted to make any material change in the traffic flow (and hence revenue) on Penlink, but would reduce the economic efficiency of the Project as measured against the No-Penlink scenario.

Secondary benefits (although equally as important), would also accrue as the traffic constraints currently limiting the residential and business land development in this area is removed.

4.3 Consequences of Not Meeting Objectives

Converse to the above, if the objectives of the Project are not met, there will be a number of consequences, including:

- Intensified congestion on Whangaparaoa limiting potential development along the peninsula
- Compounded traffic problems along Hibiscus Coast Highway and at the Silverdale interchange due to the significant growth proposed in Silverdale
- Pressure to invest in less enduring, localised capacity upgrades such as widening sections of Whangaparaoa Road (discussed in more detail in Section 6 of this report)
- Vulnerability in the network in emergency situations. For example on 1 August 2013 a significant incident occurred on Hibiscus Coast Highway. Traffic was diverted through Orewa resulting in 90 minute delays to access the Peninsula
- Inability to meet growth targets and accommodate planned growth, such as that at Gulf Harbour
- Limited safe crossing points for pedestrians and safe routes for cyclists to travel
- Limited opportunity to prioritise public transport and/or high occupancy vehicles

- Limited economic growth continuing the need for long commutes for residents to access employment hubs.

5 Stakeholders

Extensive on-going consultation has been undertaken for Penlink since 1986. Consultation has included a wide range of methods and connected with a large number of stakeholders. Feedback received shows significant support for the Project, support for tolling of the road and support for construction through a public private partnership (PPP).

All consultation undertaken has been around the designated design, being a two lane road with width for a third lane if required. No consultation has been undertaken on the proposed four lane design.

5.1 Consultation and Communication Approach

5.1.1 Communications to Date

Specific consultation on Penlink has been undertaken between 1986 and 2007. No specific consultation has been undertaken since 2007[28].

Significant consultation was undertaken in the 1990s and early 2000s as part of the consenting process for the 'Weiti Crossing' project[29]. The Weiti Crossing was the original name for Penlink and the concept of providing a road connecting East Coast Road in the west with Whangaparaoa Road in the east. Public and stakeholder consultation included surveys, focus groups, public submissions and hearings, meetings with directly affected parties, telephone interviews with affected parties, negotiation and mediation. Key stakeholders (including the Stillwater Residents & Ratepayers Association) and local Iwi groups were consulted via letters, meetings and site visits. In addition, Council held three open days.

Since confirmation of the designation, Council has used its website as a tool to update the community and directly affected property occupiers of the status of Penlink[30]. In December 2010, Auckland Transport released an updated website providing answers to frequently asked questions.

Consultation has also been undertaken for the Project in respect of tolling. In 2006, a door-to-door survey and individual interviews of nearly 700 residents and workers was conducted to identify how these residents would be affected by proposals to toll Penlink. Also in 2006, the Council sought feedback on the proposed Tolling Strategy. Of the 1,400 responses received, 90% supported Penlink being tolled.

In 2007, the Council (then Rodney District Council) consulted with the community for the development of their Long Term Plan. In this consultation, more than half of all submissions related to Penlink. Of these, 92% indicated support for the Project.

[28] Since 2007, comments regarding the project have been received through public consultation on strategic and planning documents.
[29] 'Weiti Crossing' refers to the Penlink project as consented and designated in 2001.
[30] This engagement is a condition of the designation (Condition 10.1).

Since 2007, the former and current Councils have continued to receive public support for the Project, through wider engagement processes, such as the annual plan, local board plan, the Auckland Plan and the Hibiscus and Bays Area Plan (in 2011). For example, in 2011, nearly 80% of the 2,500 submissions on the Hibiscus and Bays Local Board Plan related to Penlink and less than 1% of those submissions were in opposition.

It is noted that consultation has not been undertaken as part of the Penlink review including the alignment design developed which is further discussed in Section 6 below (e.g. as a four lane road with grade separated intersections). This consultation will be required to support consenting and alterations to the designation.

5.1.2 Next steps

It has been a number of years since direct consultation on Penlink was undertaken. Consultation is required on the revised design discussed in Section 6.

It is proposed that consultation will be undertaken with landowners adjoining the Project and other major stakeholders including:

- Iwi groups
- NZTA
- Auckland Council
- Hibiscus and Bays Local Board
- New Zealand Historic Places Trust
- Stillwater and Whangaparaoa Residents and Ratepayers
- Silverdale Business Community.

6 Alternative and Option Assessment

Extensive investigations of alternative options for alleviating traffic congestion on Whangaparaoa Peninsula have been undertaken over the past 15 years. Alternatives analysed include do nothing, a crossing over Weiti River, public transport improvements (bus and ferry), widening of Whangaparaoa Road and widening of Hibiscus Coast Highway.

Penlink (a new crossing of the Weiti River) is the recommended alternative as it will best meet the objectives of the Project. A number of options for Penlink have been analysed including a 2-lane option, 4-lane option, grade separation at both East Coast Road and SH1 and options for the Duck Creek Road intersection. The preferred option is a 4-lane arterial road with a grade separated intersection at SH1 / East Coast Road and for the Duck Creek Road intersection.

6.1 Alternatives Analysed

This section gives a brief outline of the various alternatives analysed for improving the efficiency of the transport network and addressing the identified constraints on recent and future growth. This analysis draws from work undertaken in 1997 (Access Study) and review of the project objectives (2013).

6.1.1 Status quo

The existing transport situation along Whangaparaoa Road has been documented and researched over the past twenty years. The status quo ('do nothing') is not considered to meet Auckland Transport objectives nor the objectives of the AP (for the northern growth sector) for the following reasons:

- Poor transport network performance is adversely affecting the economic activity and quality of life for residents and businesses on the Whangaparaoa Peninsula and surrounding area
- Current limited network capacity is constraining urban land-use growth and planned growth in the area
- The Whangaparaoa Peninsula community is vulnerable to physical isolation in the event of natural disaster or other network disruption, with only a single road access
- Constrained network capacity and poor network performance are limiting transport choices, particularly mode choices on Whangaparaoa Road (including pedestrian and cycle safety and limited opportunities for bus provision)
- Traffic volumes on the Hibiscus Coast Highway are constraining opportunities for land-use and transport integration, as identified in the Hibiscus Coast Highway Corridor Management Plan (CMP).

6.1.2 Penlink (Weiti Crossing)

This option includes the provision of a new arterial road connecting Whangaparaoa Road, to the west of Whangaparaoa township, with SH1 in Redvale. The road would pass to the north of Stillwater and would include a 500m bridge across the Weiti River. This option diverts traffic from the western half of Whangaparaoa Road and Silverdale providing an alternative connection to the south. The designation for the "Weiti Crossing" was obtained in 2001 and the required land purchases were completed in 2007.

This option increases the resilience of the transport network on Whangaparaoa and will alleviate pressures through Silverdale and along Whangaparaoa Road by diverting traffic travelling through to the city thereby reducing congestion. The removal of congestion from Whangaparaoa Road will enable planned residential and commercial growth in Auckland's' northern sector. Historical consultation shows significant support for this option.

6.1.3 Improved Bus Provision

This option includes provisions to increase the quality of the bus service into, out of and around the Whangaparaoa Peninsula, including the frequency and number of buses.

According to 2006 census data for Auckland[31], approximately two to four percent of commuters on Whangaparaoa and in Silverdale travelled to work by bus. Increased provision of bus transport will contribute to a reduction in work trips by private motor cars. The option of providing improved public transport will help to alleviate some congestion.

However, the option is limited because the buses need to share the limited road space with other road users. The modal shift from cars to bus passenger transport, even in the best case, will not be enough to significantly solve the transport corridor capacity problems.

Therefore, while this option will alleviate some congestion on Whangaparaoa Road, this option does not, in itself, provide a long-term solution to the congestion problems that are forecast to occur on Whangaparaoa Road and the Hibiscus Coast Highway[32].

6.1.4 Improved Ferry Services

There is a current ferry service operating from Gulf Harbour to the Auckland CBD, operated by 360 Discovery Cruises. There are currently 4-6 sailings on week days with two in each peak period. Ferry services represent a small portion of the work trips from the Peninsula. The option of providing improved ferry services will help to alleviate some congestion on Whangaparaoa Road and Hibiscus Coast Highway by increasing the proportion of the resident population using this transport mode. However, additional ferry crossings are considered unlikely to significantly increase patronage levels or reduce work time traffic volumes[33].

In addition, wider infrastructure investment means that the key ferry destination is only the Auckland CBD. A significant number of travellers on the Whangaparaoa Peninsula journey to other employment and town centre destinations. Additionally, an increase in ferry capacity and usage will not create a resilient network to provide land based access to the peninsula in event of an emergency and it lacks suitability for businesses and freight. For these reasons it is not seen as a viable option for alleviating pressures on the transportation network.

[31] Detailed Census data, including travel to work data, will be available on 3 December 2013.
[32] It is further noted that the development of Penlink is likely to create opportunities to enhance service levels for public buses by enabling services to take up the capacity provided on Whangaparaoa Road.
[33] Auckland Regional Transport Authority Priorities and Programmes from 2005-06 to 2014-15.

6.1.5 Widen Whangaparaoa Road

Whangaparaoa Road has already been widened to four lanes between Red Beach and Vipond Road (2004/05). Auckland Transport has also recently investigated widening the section from Hibiscus Coast Highway to Red Beach Road (2010) and further widening has been investigated so that Whangaparaoa Road would be four lanes over its entire length from the Hibiscus Coast Highway to Ladies Mile. This option will provide improved capacity on Whangaparaoa Road (alleviating congestion and travel time delays on this section of the network). Improved capacity may also increase modal shift to public transport if the widening of Whangaparaoa road results in designated bus lanes which prove a realistic alternative to car travel, as discussed in section 6.1.3 Improved Bus Provision.

However, this option is not preferred for the following reasons:

- This option would have significant environmental and community impacts. For example it would directly or indirectly affect around 780 properties (compares to the estimated 340 properties affected by Penlink[34]). It is likely this would result in time delays for delivery.
- Overall travel time savings for many trips are estimated to be minimal as long delays are still likely to be encountered at Hibiscus Coast Highway and the Silverdale Interchange (e.g. for traffic travelling from the Whangaparaoa Peninsula onto SH1).
- Four lanes along Whangaparaoa Road will not provide a strategic alternative route to the Peninsula in the event of an emergency or congestion delays.
- As was experienced during the previous small section of four-laning, there may be significant delays during construction, which would have adverse effects on economic activity and social well-being for residents during the period of construction.
- It does not remove the through traffic on Hibiscus Coast Highway (and in fact is likely to induce higher traffic levels there). This would therefore not resolve the existing conflicts and constraints in that section of corridor. As such, it is concluded that this option would not facilitate the planned growth in Silverdale North or the wider northern growth sector areas, nor would it allow for the integration of land use at Silverdale (e.g. on either side of the Hibiscus Coast Highway) as sought in the Hibiscus Coast Highway CMP.
- The original options assessments (Whangaparaoa Access Study, 2007) found this option was substantially more expensive than Penlink. There is no evidence to consider the proportionality of costs would have changed, except that it is noted that land costs over this period have increased.

Widening the full length of Whangaparaoa Road is not a viable long-term solution for the current transport problems. It will not alleviate pressure on the Hibiscus Coast Highway and Silverdale Interchange entirely, nor will it provide a resilient network. In addition, it will have a higher environmental and social impact by affecting about 780 properties, as opposed to the 340 properties projected to be impacted by Penlink.

AT is separately investigating widening of the section of Whangaparaoa Road between the Hibiscus Coast Highway and Red Beach Road. The cost of such work is understood to be of the order of

[34] Noting that substantial property purchase for Penlink has already been undertaken and completed in 2007.

$20 - $26 million. Auckland Transport instructed Beca that this analysis of Penlink should exclude any such widening, although it was considered in the sensitivity testing.

This modelling and testing indicated the following:

- The forecast reduction in peak-period traffic flow on this section of Whangaparaoa Road is such that widening of that section is unlikely to be required if Penlink is constructed.
- Including such widening in the analysis showed an improvement in network performance in the No-Penlink scenario, but only minor changes if Penlink was in place. This means that that widening is not predicted to make any material change in the traffic flow (and hence revenue) on Penlink, but would reduce the economic efficiency of the project as measured against the No-Penlink scenario (see further details below).

It is likely that if Penlink was delayed then Auckland Transport would need to widen that section of Whangaparaoa Road. Therefore the early completion of Penlink should avoid the need for that $20 - $26 million of expenditure.

6.1.6 Improvements to the Hibiscus Coast Highway

This option is supplementary to Whangaparaoa Road widening, to address the specific limitations and issues of increased traffic on Hibiscus Coast Highway. Improvements to the Hibiscus Coast Highway could be undertaken between Whangaparaoa Road and the Silverdale Interchange, such as grade separation of intersections and localised widening. This option would require additional land take along Hibiscus Coast Highway and due to land-use and topographical constraints it is considered it would be a high cost option due to the need for extensive new structures.

Hibiscus Coast Highway is already a four lane road carrying large volumes of traffic. Widening of Hibiscus Coast Highway would not alleviate pressures at the Silverdale Intersection and would still result in significant volumes of traffic on Whangaparaoa Road. Traffic travelling to Whangaparaoa from SH1 would still be constrained by the width of Whangaparaoa Road (unless this option was undertaken in conjunction with the earlier Whangaparaoa Road widening, which would further increase costs). For these reasons it is considered the planned growth of Silverdale and Whangaparaoa will be constrained by this option. This option will not increase the resilience of Whangaparaoa in an emergency.

As for widening Whangaparaoa Road, this option does not remove the through traffic from the Hibiscus Coast Highway and therefore would not allow for the integration of land-use at the Silverdale Town Centre (e.g. on either side of the Hibiscus Coast Highway) as sought in the Hibiscus Coast Highway CMP.

6.1.7 Evaluation Framework

Alternatives were compared against criteria for investment objectives, NZTA Investment and Revenue Strategy Criteria and identified critical success factors. The evaluation was qualitative against a five point scoring system as detailed in Appendix B.

6.2 Recommended Package of Alternatives

This updated analysis, undertaken in the context of new land-use growth planning based on confirmed resource consents and envisaged in the Auckland Plan, has reconfirmed that Penlink is the preferred alternative to address the identified problems and achieve the desired outcomes. Therefore, it is recommended the Penlink (the Weiti Crossing) alternative be further analysed. This option increases the resilience of the transport network on Whangaparaoa and will alleviate pressures through Silverdale and along Whangaparaoa Road by diverting through traffic thereby reducing congestion. The removal of congestion from Whangaparaoa Road and the Hibiscus Coast Highway will enable planned residential and commercial growth in Auckland's northern sector as well as facilitating more reliable and efficient public transport network.

Penlink has been designated and land has been purchased. This option will likely have shorter consenting times and avoid significant social effects which may arise through other options, particularly the widening of Whangaparaoa Road.

6.3 Options Analysed

The following section discusses the options considered for the development of Penlink. The general alignment of the Project has not been reviewed as it will utilise the existing designation.

6.3.1 Two Lanes

The 2-lane option is considered to be the "base case" as per the designation lodged in 2001. This option consists of a new two lane arterial, 6.8km long between SH1 and Whangaparaoa Road. The western extent of the Project begins with a directional (south facing) ramp to SH1 at Redvale, an at-grade (roundabout) connection with East Coast Road, and terminates at its eastern extents with a roundabout on Whangaparaoa Road. Some widening of Whangaparaoa Road is also allowed for as part of this two lane arterial.

The design speed is to be 100km/hr from SH1 for the first 4km and 80km/hr from there to the eastern extent of the Project. The cross section of the road comprises of 3.5m lanes and 1.5m shoulders. Batters have been used to slope the land from the edge of the road to the existing ground. However where designation constraints exist, retaining walls can be used to reduce the overall footprint. Local road connections for four side roads have been allowed, including Duck Creek Road. Access across Penlink via Duck Creek Road was via two staggered 'T' intersections.

A concrete balanced cantilever box girder bridge has been allowed for the crossing of Weiti River. A 3-lane cross-section was used to allow for a future tidal-flow operation.

This option has been designated and has operational consents in place. This option partially enables planned urban growth through the provision of additional capacity in the transport network. However, this option does not 'future proof' the transport network capacity (particularly in light of the current planned growth as discussed in Section 2) and therefore is not considered to be as effective as other options discussed below.

6.3.2 Four Lanes

This option provides for two lanes in each direction, from the East Coast Road connection to the Whangaparaoa intersection. As such, it provides an additional 3.5m wide lane in each direction and a 3.0m wide central median and widened 2.5m shoulders. The design of local road connections is as described above for the 2-lane option.

This option requires a wider bridge and potential alterations to the designation to accommodate the wider footprint and required batter slopes. This may be mitigated by targeted design and detailing of retaining walls and batter slopes. However this will introduce some additional cost to the Project.

New consents are required as design standards have been updated since the Project was originally consented and design of the Project has changed. This option provides capacity for the predicted demand over the next 30 years.

This option would provide both a safer road (due to the central median) as well as an improved level of service for vehicles travelling on Penlink. This option also provides sufficient capacity to accommodate the higher traffic flows expected in the future, particularly in light of the current levels of growth planned both on the Whangaparaoa Peninsula and in the surrounding areas of Silverdale and Dairy Flat (see Figure 2-2 for a summary of these growth areas), and the fact that the tolls will eventually be removed (as required under current legislation).

6.3.3 East Coast Road Grade Separation

This option comprises of grade separation of East Coast Road, with a northbound off ramp and southbound on ramp at the SH1 motorway. This grade separation accommodates an eastbound on ramp and west bound off ramp to/from East Coast Road. This design avoids the need for major alteration of the East Coast Road alignment.

The grade separation will improve traffic flows travelling along Penlink and East Coast Road. Additionally, grade separation will avoid approximately 1km of realignment along East Coast Road which would be required by an at grade intersection. The design provides greater opportunity for future proofing (Dairy Flat and Northern Busway Extension and interchange). It removes direct access from East Coast Road to SH1 which would also simplify the tolling system (the toll strategy adopted by RDC included tolls on the ramps to manage local traffic from East Coast Road accessing the motorway in preference to Penlink traffic).

6.3.4 Duck Creek Road

A number of options have been considered around Duck Creek Road and the access to Stillwater. Options have included split ‘T’ intersections approximately 400m apart, at grade controlled intersections and grade separation.

The current option comprises grade separation over Penlink with on / off ramps in both directions. This design prevents segregation of the Stillwater community and better facilitates safe pedestrian and cyclist access along Duck Creek Road and across Penlink. This option reduces the realignment length required for Duck Creek Road and reduces retaining wall quantities required and their associated risks.

6.3.5 Tolling

The Project is set to be constructed as a toll road. The recommended toll strategy is:

- A single toll collection point on or near the Weiti Bridge
- Free-flow electronic tolling using NZTA's National Toll System
- Fixed 24/7 toll tariff but the ability to consider time-variable tolling at a later date when the technology is available
- A light vehicle toll of $2.20 and a heavy vehicle toll of $4.40 (in $2013)
- No caps or discounts
- Tolls escalated regularly at the rate of inflation (Consumer Price Index (CPI)).

6.4 Recommended Option

The preferred option is the four lane option with grade separation at both East Coast Road and Duck Creek Road and is discussed in more detail in Section 7.

7 Recommended Project Option

The recommended option for Penlink comprises a four lane arterial road with grade separated interchange to SH1 and at Duck Creek Road (local access). This option is preferred as it is considered to best meet the Project objectives, providing sufficient capacity for traffic in the longer term and maintaining opportunities for connectivity with planned growth in the Dairy Flat area (to the west of SH1). This option also provides for safe local road access at Duck Creek Road (Stillwater) reducing potential social / community impacts of the Project. Provision for pedestrians and cyclists will be provided at Weiti Bridge (providing connection to Duck Creek Road / Stillwater). In addition, there is opportunity to deliver improved community outcomes by providing an extended cycle facility along the whole Project.

7.1 Description

The preferred option provides for a four lane arterial road (two lanes in each direction), from the Redvale interchange (connecting to SH1) through to the Whangaparaoa Road intersection. The carriageway also provides for a 3.0m wide central median and 2.5m shoulders along the length of the Project.

The western connection to SH1 is provided as a grade separated interchange, with proposals for south facing ramp connections onto and off SH1. The Project does not provide (but does not preclude) the potential for north facing ramps in the future (e.g. for traffic accessing Penlink from the north or exiting Penlink to travel towards Orewa on SH1).

Local road connections are identified for the existing consented connections to Weiti Station and Weiti Forest Park (two separate subdivision proposals to the north and south of Penlink).

The preferred option proposes that Duck Creek Road passes over Penlink in a bridge, with connections to Penlink via grade separated ramps. This option is preferred as it is considered to mitigate the potential severance and safety issues for the local Stillwater community; reducing the need for traffic travelling along Duck Creek Road (e.g. to the school and other services in Stillwater) to turn onto and across the four lanes of arterial traffic on Penlink. This option also maintains provision for a pedestrian / cycle connection on Duck Creek Road which will serve both as a local connection (within the Stillwater community) and provide for a connection from the Weiti Bridge (linking the Stillwater community to the Whangaparaoa town centre).

Cycle facilities are proposed throughout the route. This includes provision for cyclists within the shoulders of Penlink from SH1 through to Duck Creek Road. From Duck Creek Road a separate shared path is proposed on Weiti Bridge.

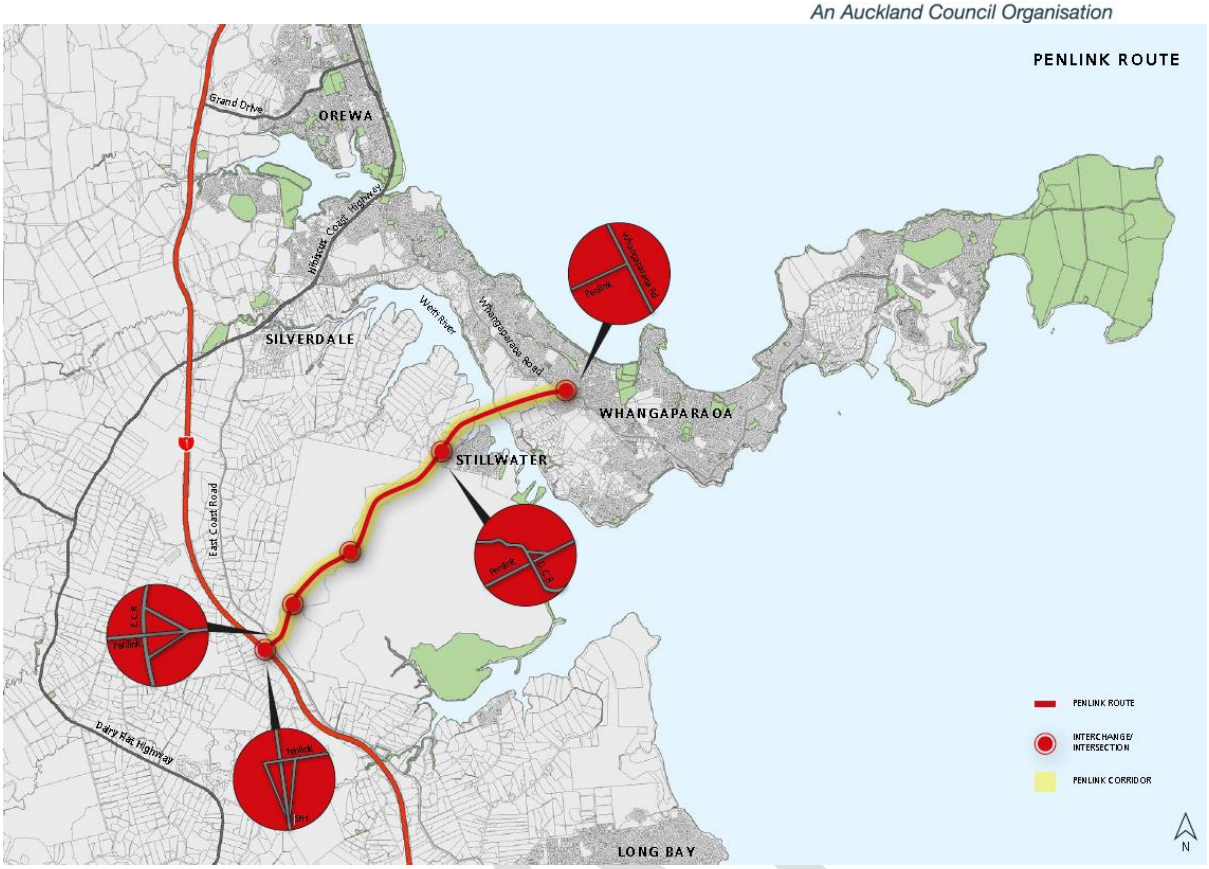


Figure 7-1: Penlink Connections

7.2 Scope

The Project is required to address three main problems, being:

- The poor transport network performance which is negatively impacting economic activity and quality of life on Whangaparaoa Peninsula and the surrounding area
- The vulnerability of the Whangaparaoa Peninsula community to physical isolation due to the situation of a current single road access
- The limited capacity of the transport network which is constraining planned urban growth in the area.

As a minimum requirement, it is expected Penlink will contribute to the project objectives by improving network performance, improving network resilience and enabling accessibility for planned urban growth. In order to deliver this, the minimum expected from the Project is the construction of an arterial road and bridge connection over Weiti River, with connections to current consented subdivision/development areas (e.g. at Weiti Station and Weiti Forest Park).

In addition to this, the preferred option (four lanes) is considered to better respond to the problems / issues of the Project (compared to options with less capacity such as a two lane road) as it will provide a better level of service to a wider audience. Specifically, the capacity of Penlink will provide reduced

traffic flow through the Silverdale Town Centre (on Hibiscus Coast Highway), which will create opportunities for land-use development.

This option has requirements that would add value and bring about additional beneficial outcomes including:

- Cycle lanes are provided along the entire length of the route to maximise potential users, cyclist safety and encourage cycling for journeys between North Shore and Whangaparaoa.
- Potential for grade separation at the future intersections of Weiti Station and Weiti Forest Park developments to reduce travel times along the length of Penlink and improve safety at Duck Creek Road for Silverdale residents.

The next phase required to progress the Project is consenting and consultation. This includes an alteration to the designation, new resource consents and six Historic Places Trust Authorities under the Historic Places Act. Details of the consenting phase can be found in Section 7.6 below.

7.2.1 Excluded from Scope

Whilst facilitating and providing opportunities for improved public transport is part of the Project, the provision of public transport services and prioritised bus lanes on Whangaparaoa Road is not part of the Project.

7.3 Outcomes

Penlink will meet the desired project outcomes for the following reasons:

- The removal of through traffic from Silverdale enables the full extent of planned urban growth of residential and business land (including the development of the Silverdale Town Centre) in Silverdale to be realised.
- The provision of better access to planned new development areas such as Weiti Station and Weiti Forest Park will be provided.
- Congestion along Whangaparaoa Road will be reduced by up to 7,300 vehicles a day in 2016 and 11,900 vehicles per day in 2041 at West End, between Red Beach at Vipond Road it will reduce by 8,200 vehicles per day in 2016 to 12,800 in 2041 and east of Vipond Road it will reduce by 5,800 vehicles in 2016 and 8,800 in 2041, which will improve travel times and the quality of life for residents whilst providing opportunities for economic activity.
- Improved accessibility and connectivity (reduced travel time) for traffic on Whangaparaoa Peninsula will provide for business and residential growth on the Peninsula as identified in the AP.
- Community resilience will be enhanced by providing transport connectivity options to the Whangaparaoa Peninsula (no longer reliant on a single road access).
- Penlink provides additional capacity on Whangaparaoa Road enabling it to be better utilised by pedestrians, cyclists, public transport operators and for local vehicle trips.

- Opportunities for streetscape and townscape improvements, important aspects of transport development as identified in the AP, will be created along the Whangaparaoa Road and Hibiscus Coast Highway (particularly at the town centre) through the reduced traffic volumes on these roads (as traffic is diverted to Penlink).
- Increased capacity on existing networks (particularly Hibiscus Coast Highway and the interchange of Hibiscus Coast Highway and SH1) will enable planned growth in the Silverdale area, including potential growth in Silverdale West.
- Scheme design will maintain opportunities for access between future growth areas and SH1, as identified in the AP and Unitary Plan (e.g. Dairy Flat) to the west of Penlink.

7.4 Implementability

An initial assessment of the ability to implement Penlink was undertaken in the earlier designation and consenting of the Project. Further assessment of implementability of the preferred option will be carried out as part of the Scheme Assessment in late 2013. Given the earlier consenting and investigation, the Project is considered to be implementable.

At this stage, it is envisaged that Penlink will be constructed in one stage as it is an 'off-line' connection (in other words there are no existing road connections between East Coast Road and Whangaparaoa Road that could be used to provide a staged development with any transport benefits).

7.5 Operations Review

An operations review has not been done and is expected to be undertaken during subsequent detailed design development.

This Project is intended to operate as a toll road. Over the period that the toll is in place, toll operations will be the responsibility of AT.

7.6 Statutory Requirements

The Penlink route already has a motorway designation in place and the land within the designation has been purchased by Auckland Council for the Project. However, in order to construct the preferred option the following statutory approvals are required:

- Alterations to the designation – including extension of the footprint at SH1 and amendments to conditions of the designation for the preferred scheme design
- Resource consents for construction (including permits for discharges to land and water and water permits)
- Resource consents for operation (particularly for discharges to land and water and occupation of the coastal marine area)

- Authority from the New Zealand Historic Places Trust (NZHPT), in accordance with the Historic Places Act, 1993 (HPA), for works relating to any historic sites or items

- Potential approvals and permits under the Wildlife Act 1953 (potentially this could include approvals in respect of protected flora and fauna (e.g. lizards) and / or Fresh Water Fisheries Regulation approvals for stream crossings and/or culvert effects on fish passage.

7.6.1 Designations

Much of the Penlink corridor is already designated (as a two lane road). However, alterations to the designation will be required (for additional land and to amend the conditions of the designation for the preferred option). To alter the Penlink designation, Auckland Transport must prepare a Notice of Requirement (NoR). The NoR is submitted to Auckland Council, who can then recommend that Auckland Transport confirm, modify or withdraw the requirements. Auckland Transport then accepts or rejects Auckland Council's recommendation in whole or in part.

In particular, the following elements are noted for the alteration to designation:

- In order to accommodate the preferred option, additional land will be required for the Project (e.g. to enable construction and operation of the interchange with SH1 (Redvale interchange))[35].

- There is potential that further land acquisition of additional private property will enable the Project to be constructed more efficiently (reduced construction costs) (e.g. by reducing the need for retaining wall structures). The opportunities will be explored in consultation with land owners before alterations to designation are confirmed.

- Alterations to conditions will be required to allow for tolling.

- Amendments to conditions of the designation will be required to reflect modified scheme designs for the preferred (four lane) road option.

A number of technical investigations will be required to support the amendment to designation, including visual, landscape, ecological, noise, social, transport and land-use assessments. This work will be undertaken during the next phase of design development.

7.6.2 Resource Consents

In addition to the designation, a number of resource consents have been obtained for construction and operation of the Project. Since the consents were granted in 2001 a number have lapsed (particularly construction consents). New construction consents will need to be applied for at the same time as alterations to the designation.

New resource consents are required under the current Auckland Council Regional Plans for the construction of the Project. These relate to earthworks, vegetation clearance, stormwater, air quality, works in the coastal marine area and contaminated land. Further technical investigations (i.e.

[35] It is noted that land around the proposed Redvale interchange is either road, or owned by either Auckland Council.

geotechnical, air quality and water quality) will be required to support future resource consent applications for the Project, which will be undertaken during the next phase of design development.

There are Archaeological sites within the existing designation. Application will need to be made to the Historic Places Trust for the modification of these sites, in accordance with Section 11 of the Historic Places Act.

Alterations to operation consents are also required (e.g. to provide for the increased width of the Project as a four lane road). Further technical investigations (i.e. visual and coastal impact assessments) will be required to support these changes. This work will be undertaken during the next phase of design development.

Approximately 18 months are required to obtain the alteration to designation and required resource consents. Key consenting risks include:

- Delay to consenting
- Appeals on decisions to the Environment Court (extending the consenting period)
- Conditions could lead to increased costs
- Private land opportunities could lead to increased time and costs.

7.7 Property Impacts

Property constraints have had a minor impact on the Project design. Penlink has been signalled for many years and the designation included on the District Plan since 2001. The property purchase within the designation was completed in 2007 and property owners are aware of the Project.

In addition, there are a number of properties adjacent to the existing designations (SH1 and Penlink) that are owned by either NZTA or AT. Whilst some of these parcels or additional parcels may be required for the proposed option, requirements will be significantly lower than other alternatives considered (such as Whangaparaoa Road widening). There is also the potential for some further private land to be affected as a result of the increased width of the Project (from two to four lanes). The next stage of design development and land owner consultation will identify opportunities to reduce construction costs of the Project through the acquisition of additional land.

7.8 Environmental Impact

Along the length of the Project, the route selection process and preliminary design of the proposed alignment has sought to avoid and remedy potential environmental effects. These processes have been informed by a range of technical studies, environmental investigations and community feedback on preliminary concepts and project values.

As a result, the Project alignment and design seeks to avoid or remedy impacts on communities and sensitive receiving environments. There are only a few locations along the proposed alignment where direct effects on communities or sensitive environments have not able been able to be fully avoided or remedied (this includes impacts on the Stillwater residential area and the bridge crossing of the Weiti River). In such instances, measures have been proposed (through the existing designation) to mitigate

the potential effects of the alignment. The sufficiency of this mitigation will need to be reviewed in light of the amendments to the Project (i.e. the increase from two to four lanes) as part of the next stages of design development.

Adverse effects of the Project include noise, visual, landscape and amenity, and ecological effects, as well as impacts on the coastal and estuarine environment (noting that the Weiti River in particular is identified as a sensitive receiving environment), freshwater heritage and social (community) generated during both the construction and operation phases. The Project also results in a number of positive effects at a local, regional and national level (particularly in respect of travel times and congestion relief). The following issues will require a full assessment of impacts at the next stage of design development:

- Earthworks within the catchment will require appropriate erosion and sediment control to prevent sedimentation of the river.
- At the western side of Weiti River, at the proposed bridge abutments there is an area identified as having notable terrestrial vegetation adjacent to the best manuka-kanuka shrubland on hills in the district[36].
- Works in watercourses and review of the stormwater management proposals will need to be considered, particularly as the preferred option will result in an increased volume of stormwater being discharged from the Project.
- On the Whangaparaoa Peninsula side of Weiti River, Penlink travels through a significant natural area with moderate significance (as opposed to high or outstanding). This area is a known habitat of native lizards and therefore it is likely the removal of these will be required prior to commencement of earthworks.

In addition, since consenting works were undertaken for the earlier 'Weiti Crossing' new national standards in respect of contaminated land have come into effect. The Project area will need undertake an assessment of potential land contamination and if necessary obtain consents for under the National Environment Standard requirements.

7.9 Social Impact

7.9.1 Potential Negative Effects

Adverse social effects during construction primarily relate to the physical works, such as the movement of materials, goods, services and people to and from the construction site. Such effects may be experienced by people in the Stillwater and surrounding rural locations. In particular, these impacts include:

- Ability for residents and landowners to cross the proposed alignment during construction, particularly at Duck Creek Road
- Disturbance from construction activities for those properties that adjoin the proposed alignment or are close to the Project but not directly adjoining it (e.g. those with line-of-sight to the Project)
- Residents on East Coast Road who may be affected by construction-related traffic.

[36] Auckland Council, Auckland Council Regional Plan: Coastal (2004).

7.9.2 Potential Positive Effects

The construction phase could result in positive impacts for the local community in terms of increased job opportunities associated with the construction and increased spending by construction personnel (however, at this stage this is not anticipated to be a significant positive effect).

The principal benefits of the new connections in terms of improved accessibility, safer travel and shorter journey times. From a social perspective, the outcomes of improved travel include improved 'quality of life' contributing to how people live, work and play (in both Whangaparaoa and for surrounding areas such as Silverdale). Other benefits from improved connectivity for Whangaparaoa residents include:

- Improved accessibility to community facilities (such as education and health care services)
- Connectivity for families and other community groups
- Opportunities for improvements to other transport modes (particularly cycling and walking)
- Opportunities to improve the health and wellbeing of residents.

These social effects will be assessed (drawing from updated traffic effects assessments). Social effects and traffic effects assessments will be undertaken in the next stage of design development.

Other potential positive social effects relate to the opportunities created by the reduction in traffic on the Hibiscus Coast Highway and the SH1/Hibiscus Coast Highway intersection. Such benefits include enabling development of town centre proposals for Silverdale and providing capacity in the road network to accommodate planned urban growth in the Silverdale area.

7.10 Physical Impact

The Project traverses some difficult terrain across the 6.8km word missing here?. Between Redvale and Stillwater the local topography rises and falls steeply and frequently. From Stillwater, the topography continues to fall to the Weiti River. At the point of crossing, the Weiti River is 270m across. Across the Weiti River the land steeply rises before undulating down towards Whangaparaoa Road. The challenging topography results in a balancing of economic implications and potential land impacts, as significant cut and fill or retaining is required. These physical constraints are also compounded by the extent of the existing designation and further detailed assessment will need to be undertaken in this area to confirm the extent of works and opportunities to undertake minor widening to the designation footprint.

7.11 Asset Management

The Project will involve the construction of a new four lane road and bridge over the Weiti River. Auckland Transport will own and operate this new piece of infrastructure. The existing Whangaparaoa Road will also remain under Auckland Transport's control.

No asset management review has been formally completed. The following general comments are noted:

- Maintenance costs would typically be low as a result of it being a new piece of road. However, there would be inspection and maintenance costs associated with bridges, structures, side protection, stormwater plus landscape and ecological mitigation planting.

- Pavement maintenance costs (reseal/rehabilitation) are variable over time as opposed to a fixed annual cost, and the timing for these works represent a value-for-money opportunity.

7.12 Joint Working

AT will be required to work with NZTA in regard to funding and where Penlink connects to SH1. This is normal practice for AT.

Opportunities exist to work with AC and NZTA in terms of developing the details of this Project with complementary AC/NZTA initiatives to deliver wider network benefits. Examples of these are set out in the following sections.

7.12.1 Northern Busway Extension

There is an opportunity to work with internal Auckland Transport staff and NZTA around the design of the Northern Busway Extension to make sure that neither Project is disadvantaged by the other. In addition, the design development will look to maintain opportunities for a future bus interchange to be located in the vicinity of the Redvale Interchange (this work will be undertaken in tandem with work on the Dairy Flat urban growth area discussed below).

7.12.2 Redvale Interchange

The design of the Redvale interchange will require involvement of AC and Auckland Transport in regards to the design and construction where the Project connects with SH1 and potentially with the future Dairy Flat development to the west. The next stages of design development will also consider opportunities for north-facing ramps at this interchange in the future.

7.12.3 Dairy Flat Growth Area

The Auckland Plan identifies areas beyond the existing urban boundaries of Auckland for future greenfield urban growth. In the Northern Sector (the northern part of Auckland) these areas are identified as Wainui, Silverdale West and Dairy Flat. The opportunity for the Project to be designed in such a way as to accommodate future infrastructure requirements, including transport access for the Dairy Flat growth area (in particular) will be progressed with Auckland Council, NZTA and AT. For example, the issue of whether north-facing ramps may be required (in the future) at the Redvale Interchange will need to be considered and design for Penlink (which only provides for south-facing ramps) will need to appropriately respond to the outcomes of this.

7.13 Do-Minimum Option

The do-minimum option has been retained for evaluation purposes. This option does not assist in achieving the project objectives or addressing the problems identified (see Section 3 of this report).

8 Recommended Option - Economic Analysis

A detailed economic evaluation of the Project was undertaken in accordance with NZTA's Economic Evaluation Manual (EEM). This analysis considered capital, operating and maintenance costs, including toll transaction costs. Both standard transport benefits and Wider Economic Benefits (WEBs) were assessed and both National and Government Benefit Cost Ratios (BCRs) were assessed, which differ in their treatment of toll revenues. This analysis found that the Government BCR (including all WEBs) was 2.9, giving it a Medium efficiency rating in terms of the NZTA's funding profile. Extensive sensitivity testing found that under the majority of scenarios considered, the rating remained as Medium with BCRs between 2.0 and 4.0. Only one of the 16 scenarios tested indicated a Low rating while a further one showed a potential High rating.

Assessment Profile

The Project was assessed using the latest NZTA Investment and Revenue Strategy profiles. An assessment profile of HHM has been determined for the Project using the NZTA's funding allocation process as detailed below:

Strategic fit of the problem, issue or opportunity that is being addressed: High

The Assessment Framework introduces the strategic fit criteria as follows:

A strategic fit assessment considers how an identified problem, issue or opportunity aligns with the NZTA's strategic investment direction. Strategic fit ensures that the activities the NZTA approves for funding address the issues that are significant from a national perspective.

A road improvement project can only be given a high strategic fit rating if it meets one or more of the following:

- Local roads and/or services identified by the NZTA as critical to the operation of a RoNS
- Potential for a nationally significant contribution to economic growth and productivity using a local road classification system which identifies:
    - Key freight routes including designated routes for High Productivity Motor Vehicles (HPMV), or
    - Key tourism routes, or
    - Key routes critical for maximising access to significant markets, areas of employment or economic growth.

through significant improvements in one or more of:

- Journey time reliability
- Easing of severe congestion in major urban areas
- Relieving capacity constraints
- More efficient freight supply chains
- A secure and resilient transport network.

- Potential to significantly reduce the actual crash risk involving deaths and serious injuries in line with the Safer Journeys strategy.

Penlink has a significant impact on access to areas of significant employment or economic growth. The Project contributes to meeting the strategic objectives of AT, project objectives and wider objectives of relevant documents by facilitating economic development and growth (residential and business) through significantly improving the infrastructure servicing the Silverdale and Whangaparaoa areas (both identified for growth in the Auckland Plan). There will be a resultant decrease in travel times, distances and trip reliability (from the Whangaparaoa Peninsula), alleviating traffic congestion pressure at the Silverdale Interchange and the Hibiscus Coast Highway.

Therefore, the Strategic Fit is considered to be **HIGH**.

Effectiveness of the proposed solution: High

The Assessment Framework introduces the effectiveness criteria as follows:

The effectiveness assessment factor considers the contribution that the proposed solution makes to achieving the potential identified in the strategic fit assessment, and to the purpose and objectives of the Land Transport Management Act 2003.

Higher ratings are provided for those proposals that provide long-term, integrated and enduring solutions.

In addition, transport related activities which mitigate or reduce vulnerabilities of essential transport networks, known as Lifelines, will enable Approved Organisations and the NZTA (state highways) to justify an improved effectiveness rating if local and regional network plans are supported by the NZTA.

The framework also requires that:

At the time of funding approval of individual projects, the strategy must have been supported by the NZTA in order to meet the relevant medium and high criteria.

The framework for effectiveness provides threshold criteria for low, medium and high ratings. The Project needs to meet all criteria for a low rating before being considered for Medium, and similar all Medium criteria must be met before being considered against the High criteria.

The assessment identifies a rating of **HIGH** effectiveness, contingent on the following items being demonstrated:

- A viable funding plan
- An appropriate monitoring and review framework
- Endorsement of Penlink being a key part of an NZTA-supported strategy, package programme or plan.

The Penlink Project meets all of the low and medium effectiveness criteria. It also meets the criteria for a high rating:

- Is part of a whole of network approach
- Improves integration within and between transport modes, where appropriate to the activity
- Supports networks from a national perspective, where appropriate to the activity
- Provides a strategic approach that makes a significant contribution to multiple GPS impacts, where appropriate to the activity
- Adopts a collaborative approach to the development of studies, strategies and plans
- Is a key component of an NZTA-supported strategy, endorsed package, programme or plan (for inclusion to the NLTP a completed strategy that will be presented to the NZTA for support in the near future may be considered sufficient) (contingent on the endorsement of this package by NZTA).

Economic efficiency of the proposed solution: **Medium**

The BCR is the primary indicator for assessing the economic efficiency of projects such as Penlink. The rating thresholds are as follows:

BCR between 1.0 and 2.0:	Low rating
BCR between 2.0 and 4.0:	Medium rating
BCR greater than 4.0:	High rating

The previous Business Case (2008 update) indicated a National BCR[37] of 2.1 with agglomeration and a Government BCR with agglomeration of 2.4. The current update of the Business Case indicates a Government BCR for the preferred option of 2.8 (including agglomeration, 2.4 excluding agglomeration).

With previous and current BCRs consistently in the range between 2 and 4 means that it would have a **MEDIUM** efficiency rating.

[37] The National BCR is a measure of economic efficiency from a national perspective. The Government BCR indicates the monetised benefits obtained for government expenditure (value-for-money from a central and local government perspective).

8.1 Framework and Assumptions

The economic evaluation has been undertaken in accordance with the NZTA Economic Evaluation Manual (EEM), as updated in 2012. The key aspects of this evaluation include:

- The economic evaluation is based on models for three weekday peak periods (AM, inter and PM peaks), for the years 2016, 2021, 2031 and 2041.
- The models have 14-separate vehicle classes, based on trip purpose, vehicle type and the user Value of Time (VoT) assessed for the class in the toll response model.
- Induced traffic effects have been accounted for using a Variable Trip Matrix (VTM) methodology.
- Vehicle travel time and vehicle operating cost benefits have been assessed for each of the 14-classes in the models. The travel time benefits use the local user VoT, however the final aggregate benefits were factored to match the national equity value in the EEM.
- Reliability benefits have been estimated as 5% of the base travel time benefits.
- Cycle benefits have been estimated at $1.4/km of new facility and the new facility has been split into two sections, Whangaparoa to Stilllwater, which is assumed to be 1.9km in length and is expected to grow from 20 cyclists/day in 2016 to 100 cyclists/day in 2041. The second segment is 4.9km from Stillwater to East Coast Road. The patronage of that section is forecast to grow from 10 cyclists in 2016 to 50 cyclists in 2041.
- The time zero date has been assumed to be 1 July 2015 and the base date is 1 July 2013.
- Construction costs have been spread over three years, commencing in July 2016, with the facility assumed to be open in 2019.
- Update factors have been applied to EEM values to bring to $2012.
- The evaluation has used a 40-year analysis period and a 6% discount rate.
- Toll transaction costs are assumed to reduce from 60c/vehicle in 2016 to 50c/vehicle in 2041.
- Crash benefits have been calculated on Penlink itself based on crash prediction models for a 4-lane divided facility while the crash costs for the rest of the model area have been calculated by applying a rate of 5c/km.
- The National BCR has been calculated as the transport benefits (excluding the toll costs) divided by the total Project costs (excluding the toll revenue but including the toll transaction costs).
- The Government BCR has been calculated as the transport benefits (including the toll costs as a dis-benefit) divided by the net Project costs (including the toll revenue). That is, the Government BCR is assessed by subtracting the toll revenue from both the benefits and the costs.
- Property costs have been assumed to be accrued in the year before construction, irrespective of when the property was purchased.

- Both annual and periodic maintenance costs have been included for Penlink.

8.2 Do-Minimum

The Do-Minimum scenario includes the following key assumptions:

- The Silverdale Park and Ride (Stage 2) in place by 2016
- The North Shore Busway extended to Silverdale by 2031
- The Curley Avenue/East Coast Road extensions in Silverdale in place by 2021
- No widening of Whangaparaoa Road
- Inclusion of the Wainui Road south-facing ramps to SH1 by 2016
- A new roundabout on East Coast Road (near Weiti Station Road) to accommodate the consented development from the Weiti Station and Weiti Forest areas[38]
- Inclusion of traffic signals at the Hibiscus Coast Highway/Jack Hawkin Lane intersection, to precinct 11 of Silverdale North Special 19 Zone[39].

These assumptions were included in both the Do-Minimum and Option scenarios and hence are cost neutral.

8.3 Economic Summary of Recommended Project Option

Table 8-1 displays the economic summary for the recommended project option:

Table 8-1: Economic Summary Table

Timing	
Earliest Implementation Start Date	July 2015
Expected Duration of Implementation	3 years of construction
Economic Efficiency	
Time Zero	1 July 2015
Base date for Costs and Benefits	1 July 2013
Present Value of Total Project Cost of Do-Minimum	$0m
Present Value net Total Project Cost of Recommended Option	$387.8m
Present Value net Benefit of Recommended Option (exc. WEBs)	$743.3m

[38] This roundabout is not formally proposed as these developments propose to connect directly to Penlink. However, for the purposes of this assessment a similar-standard connection to East Coast Road was assumed.
[39] Agreement was reached between the land owners and AT for such an intersection, following consent of the land owners' development plans by Auckland Council.

Present Value net Benefit of Agglomeration of Recommended Option	$105.3m
Present Value net Benefit of other WEBs of Recommended Option	$46.8m
National BCR excluding agglomeration	2.1
National BCR including agglomeration	2.5
National BCR including agglomeration and other WEBS	2.5
Government BCR excluding agglomeration	2.4
Government BCR including agglomeration	2.9
Government BCR including agglomeration and other WEBS	3.1
First Year Rate of Return (FYRR)	8%

P50 Costs

			Present Value	
	Do-Min	**Recommended Option**	**Do-Min**	**Recommended Option**
Detailed Design	$0m	$20.37m	$0m	$18.15m
Investigation and Statutory Applications	$0m	$5.82m	$0m	$5.19m
Property	$0m	$26.35m	$0m	$24.86m
Construction/Implementation	$0m	$358.5m	$0m	$279.31m
External Impact Mitigation	$0m	$0m	$0m	$0m
Other Capital (e.g. insurances)	$0m	$0m	$0m	$0m
Capital Risk Management	$0m	$0m	$0m	$0m
TOTAL IMPLEMENTATION COST	**$0m**	**$387.8m**	**$0m**	**$327.50m**
Maintenance	$0m	$0m	$0m	$23.56m
Renewal	$0m	$0m	$0m	$5.93m
Operating	$0m	$0m	$0m	$0m
Other Ongoing Costs (e.g. Toll Collection)	$0m	$0m	$0m	$30.41m
Post Project Evaluation	$0m	$0m	$0m	$0m
ONGOING COST	**$0m**	**$0m**	**$0m**	**$59.94m**
Project Contingency (included above)	$0m	$0m	$0m	$0m

TOTAL P50 PROJECT COSTS	**$0m**	**$0m**	**$0m**	**$387.44m**
BENEFITS				
			Present Value	
			Do Min	**Recommended Option**
Base Travel Time Benefits			$0m	$500.3m
Congestion Travel Time Benefits			$0m	$97.3m
Trip Reliability Time Benefits			$0m	$25.0m
Vehicle Operating Cost Benefits			$0m	$94.4m
Accident Cost			$0m	$21.9m
Pedestrian/Cyclist Benefits			$0m	$1.6m
Carbon Dioxide			$0m	$3.8m
	PV total net benefits		**$0m**	**$743.4m**

8.4 Comparison with Earlier Stages

The previous BCR was undertaken in September 2010 as part of the Auckland Regional Transport Authority (ARTA) independent review of the Project. That analysis was undertaken using the version of the EEM applicable at that time, with key differences to today being the use of an 8% discount rate (now 6%) and a 30-year analysis period (now 40 years). For this comparison, the previous analysis was updated to a 6% discount rate and 40-year analysis period but with no other changes. During the ARTA review there was also disagreement between RDC and ARTA about the treatment of toll revenue in the BCR. For comparative purposes, toll revenues have been removed from the costs to Government in both assessments.

Table 8-2: Economic History Summary Table

Timing		
	Previous Estimate	**Current Estimate**
Earliest Implementation Start Date	July 2010	July 2016
Expected Duration of Implementation	3 years	3 years

Economic Efficiency			
	Previous Estimate	**Previous Estimate Updated**	**Current Estimate**
Base date for Costs and Benefits	1 July 2010		1 July 2013
Time Zero date for Costs and Benefits	1 July 2010		1 July 2015
Total Implementation Cost, including property	$172m	$0m	$387.8m
Present Value of Total Ongoing Cost, including toll transactions	$66.6m	$0m	$60m
Present Value of Total Project Cost	$218.3m	$0m	$387.8m
Present Value net Benefit of Recommended Option (Exc. WEBS)	$740m		$743m
Present Value net Benefit of WEBS of Recommended Option	$37m (assumed to be 5%)		$144m (calculated)
Present Value of Gross Toll Revenue	$96m		$113.1m
National BCR (Exc. WEBS)	3.4		2.4
Government BCR (Exc. WEBS)	5.3		2.3
Government BCR (Inc. WEBS)	5.5		3.1

8.5 Sensitivity Analysis

A number of sensitivity tests have been undertaken. These are described in Table 8-3 with the resultant BCRs (this is the government BCR including agglomeration only).

Table 8-3: Sensitivity Analysis

Sensitivity Testing			
No	**Description**	**Method**	**BCR_G with Agglomeration**
0	Base	As assessed	2.9
A	NETWORKS		
	Whangaparaoa Road Widening (Hibiscus Coast Highway to Red Beach) added to Do-Minimum Only	Add widening to Do-Minimum network only (model 2016 and 2031) with indicative cost of $26 million dollars added only to Do-Minimum	2.5
	Whangaparaoa Road Widening (Hibiscus Coast Highway to Red Beach) added to Both Do-Minimum and Penlink options	Add widening to both Do-Minimum and Option scenarios (hence cost neutral)	2.3
	Bring forward Curley Avenue/East Coast Road extension from 2041 to 2031	Include these links in 2031 models of both Do-Minimum and Option	2.7
	Widen SH1 (Oteha Valley Road to Silverdale) to 6-lanes	Include this widening in 2031 models of both Do-Minimum and Option	2.3
	Reduce speed on Hibiscus Coast Highway	Reduce speed limit on Hibiscus Coast Highway through Silverdale from 70kmph to 60kmph, to reflect Corridor Management Plan intentions	2.9
B	Land-Use and Growth		
	Add growth in extended RUB area	Include approximately 1/3rd of the estimated 20,000 dwellings and 5000 jobs proposed west of SH1 in the extended RUB area (Wainui east, Silverdale West and Dairy Flat). This was included in 2031 models of both Do-Minimum and Option scenarios	4.1
	Add Weiti Development expansion	Include requests for further growth beyond that consented in Weiti Forest (another 1000 dwellings) and Weiti Station (another 750 dwellings)	3.6
	Slower growth rate	Slow benefit growth by delaying modelled results (e.g. 2016 benefits applied in 2026, 2026 benefits applied in 2031 etc)	1.8

Sensitivity Testing			
No	**Description**	**Method**	**BCR_G with Agglomeration**
	Faster growth rate	Speed benefit growth by bringing forward modelled results (e.g. 2031 benefits applied in 2026 etc)	3.9
C	Travel Behaviour Parameters		
	Lower Willingness to Pay	Reduce WTP by 30%	2.6
	Higher Willingness to Pay	Increase WTP by 30%	3.0
	Increase vehicle operating costs	Increase vehicle operating costs in both distribution and assignment models (2031 only)	2.9
	Higher diversion to Public Transport	Increase 'diversion rate' from 1.0 to 2.0 in 2031 (to match 2041)	2.7
	Lower diversion to Public Transport	Reduce 'diversion rate' from 1.0 to 0.5 in 2031 (to match 2026)	3.0
D	Evaluation Framework and Assumptions		
	4% discount rate	Reduce discount rate from 6% to 4%	4.5
	8% discount rate	Increase discount rate from 6% to 8%	2.0

8.6 Wider Economic Benefits

As part of the Penlink scheme assessment, WEBs have been examined in more detail. This section discusses the updated methodology used to define the WEBs likely to be generated by the Project.

Traditional benefit cost analysis aims to assess the direct economic, social and environmental impacts of an initiative. In a transport context, such as the proposed Penlink Project, this typically includes capital and O&M costs, travel time, vehicle operating costs, safety impacts and environmental externalities (such as greenhouse gases and air pollution).

Increasingly, there is greater acknowledgement that traditional benefit cost analysis does not adequately take into account the indirect impact that an investment in transport infrastructure is likely to have on the wider economy. As such, the WEBs that may be derived from Penlink can be estimated to capture the impacts that may not be captured due to imperfect competition. Additionally, changes in the operations of transport networks may have implications for employment and productivity within an economy.

The application of the WEBs framework in New Zealand has relied heavily on the UK Department for Transport (DfT) guidelines. Moreover, the NZTA EEM[40] specifically outlines guidelines for measuring

[40] The EEM methodology addresses agglomeration impacts only.

agglomeration benefits. This assessment of the WEBs uses the NZTA EEM to sum the following four impacts over the project lifecycle:

- **WEB1 Agglomeration Impacts** – improvements in transport can increase the accessibility of an area to a larger number of firms and works. This generates an increase in 'effective density' which is likely to result in positive agglomeration economies. WEB1 values the increase in productivity to all existing CBD or cluster jobs[41] resulting from the increase in employment density arising from a transport improvement.
- **WEB2 Increased Competition** – estimates any potential increase in production or output in the goods or service markets that use transport as a result of reduced transport costs.
- **WEB3 Output Change in Imperfectly Competitive Markets (Imperfect Competition)** – measures the efficiency benefits to firms from reduced transport costs, where those benefits are not passed on to customers due to lack of competition.
- **WEB4 Increased Labour Supply** – estimates the additional tax revenue arising from increased supply of new workers, existing employees working longer hours and work relocating to more productive jobs as a result of improvements of time savings from a transport project.

Each of the WEBs components have been estimated for the Project and calculated for the 40 year project period (i.e. 2013 to 2052) at the standard discount rate of 6%. Table 8-4 summarises the WEBs associated with provision of Penlink. Sensitivity tests and a discussion of the underlying analysis is provided in Appendix J.

Table 8-4: Summary of WEBs

WEB	Penlink ($M NPV)
Agglomeration benefits[42]	$97.1
Imperfect Competition benefits	$24.3
Labour Supply benefits	$22.5
TOTAL WEB	**$143.9**

[41] Cluster jobs: A group of similar places of employment or jobs close together.

[42] Guidance from NZTA based on future changes to the EEM guidance. Included in conventional benefits.

9 Financial Case

This financial assessment of Penlink (the Project) involved developing a PSC to calculate the whole-of-life cost of the Project if Auckland Transport were to design, construct, finance, operate and maintain the Project over a 25 year operations period. The PSC includes a risk adjustment to allow for those risks that are likely to be transferred to the private sector partner under a PPP contract and an adjustment for corporate taxation. The PSC provides a basis for establishing the affordability envelope for the Project.

The construction and O&M cost inputs in the PSC are used as a basis for developing a PBM to estimate the cost of private sector procurement of the Project. This is effectively the PSC with the addition of private sector debt and equity finance costs.

At a P85[43] level for risk and uncertainties, there is a [redacted] million [redacted] difference between the PSC and the PBM, which is primarily the additional cost of private sector finance. In order to provide Auckland Transport with value-for-money and meet the affordability threshold, the private sector will need to identify total savings in construction, operating and risk costs of at least [redacted] million (net present cost). These savings may arise as a result of efficiency or innovation during the design and construction process and are brought about by additional rigour and due diligence present under PPP procurement.

9.1 Project Delivery Costs

This section outlines the key cost assumptions that have been made in the development of the project cost estimates, which are provided in Appendix C. A risk analysis has been undertaken, with the calculated contingency used to determine the P50 estimate. This cost estimate has been used in the economic analysis that has been undertaken for the Project, discussed previously in Section 8.

- Construction has been assumed to start in 2015/16 and take three years, with the facility opening in 2018. Maintenance therefore is assumed to start in 2018.
- [redacted]
- Investigation and reporting costs have been calculated as 2% of the total physical works value, with design and project documentation calculated as 4% of the total physical works value. These both include consultancy fees, Statutory Application Costs (including alterations to the designation, resource consent applications and statutory processes), and Auckland Transport managed costs (including insurances etc).
- Management, surveillance and quality assurance fees (MSQA) have been assumed to be 3% of the total physical works value. This includes consultancy fees, NZTA managed costs and consent monitoring fees.

[43] P85 can be interpreted as an 85% probability that costs will be less than or equal to the P85 number.

- The total physical works for the facility (the costs to construct the alignment) have been calculated to be $243 million with the expected estimate (P50) for the Project (including supervision, Auckland Transport costs etc) calculated to be [redacted]

9.2 [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

9.3 Purpose of this Section

This paper includes the following:

- The reference project: this section identifies the capital expenditure and operating assumptions used in the PSC to define the reference project
- Competitive neutrality: this section describes a tax adjustment made to the PSC to facilitate a like-with-like comparison between the PSC and PBM
- Transferred risk quantification: this section identifies the quantification of risks that would be borne by Auckland Transport under traditional procurement but would be transferred to the private sector contractor under a PPP
- Calculation of the PSC: this section brings together the components of the PSC and presents the PSC results

- Proxy Bid Model: introduces and quantifies the PBM and presents discussion on the potential financial benefits that could be provided by procuring the Project through a PPP
- Reconciliation to the scheme estimate for the Project: this section provides a reconciliation between the PSC and the scheme estimate for the Project
- Tolling: this section discusses the potential revenue if the decision is made to toll Penlink
- Accounting treatment: this section illustrates the accounting implications for Auckland Transport of PPP procurement
- Base interest rate risk: the effect on the PBM of changes in the base interest rates.

The whole-of-life cost of the Project using traditional procurement is presented as the PSC. The PSC is compared to the estimated cost of the Project under a PPP procurement model (presented as the PBM) to examine if it is possible for the private sector to equal or better the PSC through construction and operating cost efficiencies, or better risk management practices.

The calculation of the PSC uses a different methodology to the traditional Auckland Transport scheme estimate. For example, the PSC includes allowances for inflation and is a net present cost (NPC) number, whereas the Auckland Transport scheme estimate is a real number (excludes inflation and discounting). A reconciliation of the PSC and the Auckland Transport scheme estimate is included in this section along with an explanation of the differences.

9.4 Definition of the PSC

The PSC is an estimate of the risk adjusted cost of the Project if it were to be designed, built, financed and operated by Auckland Transport using traditional procurement methods. It has been developed taking into account:

- The current scheme estimate for the Project
- The risks retained by Auckland Transport under traditional procurement that would be transferred to the private sector under a PPP.

The PSC provides an estimate of the cost of the Project if it were to be built and operated by Auckland Transport to deliver the outcomes Auckland Transport requires from the Project. This has been used to provide a benchmark against which to compare the PBM (representing the cost to Auckland Transport of the Project if it were procured through a PPP). If a decision is taken to procure the Project through a PPP, the PSC will be used as an input to determining the “affordability threshold”. The affordability threshold will be the upper limit of the amount Auckland Transport is prepared to pay for delivery of the Project via a PPP (and may lock in a small proportion of quantitative value-for-money up front).

9.5 Components of the PSC

The PSC is comprised of three components:

- The “raw PSC” based on the “Reference Project”:

  The Reference Project provides a baseline costing assuming the Project is built and operated by AT. This includes all capital costs (the base estimate) and operating costs associated with designing, building, maintaining and operating the Project over the same period as the assumed term of the PPP Contract and to performance standards consistent with the outcomes for the Project and excludes risk events and contingency. The timing of cash flows included in the PSC calculation reflects when the cash flows are incurred by AT. It is assumed the construction cost will be incurred evenly over the three year construction timetable.

- Pricing and quantity (P&Q) uncertainties:

  A probability distribution around the base estimate to recognise that the prices and quantities are subject to uncertainty. This replaces the contingency component of the scheme estimate.

- Transferred risk:

  One of the important features of a PPP is the transfer of certain risks to the contractor. Risks that the contractor will have to manage will include such things as completing the building of the Project within the cost estimate, achieving the required operational quality requirements etc. The value of transferred risks is included in the PSC to allow a like-with-like comparison with the PBM. Retained risk is the same under both scenarios so does not need to be considered in the analysis.

- Competitive neutrality adjustments:

  A tax adjustment made to the PSC to allow a fair and equitable comparison between the PSC and the PBM. Tax is ultimately neutralised on a whole-of-government basis in any event, so this adjustment takes this into account.

The inclusion of the P&Q uncertainties and transferred risk as probability distributions enables the PSC to be expressed as a distribution, not a point estimate. Where point estimates are provided in this section, they are at the P85 level for risks and uncertainties.

The following figure summarises the components of the PSC:

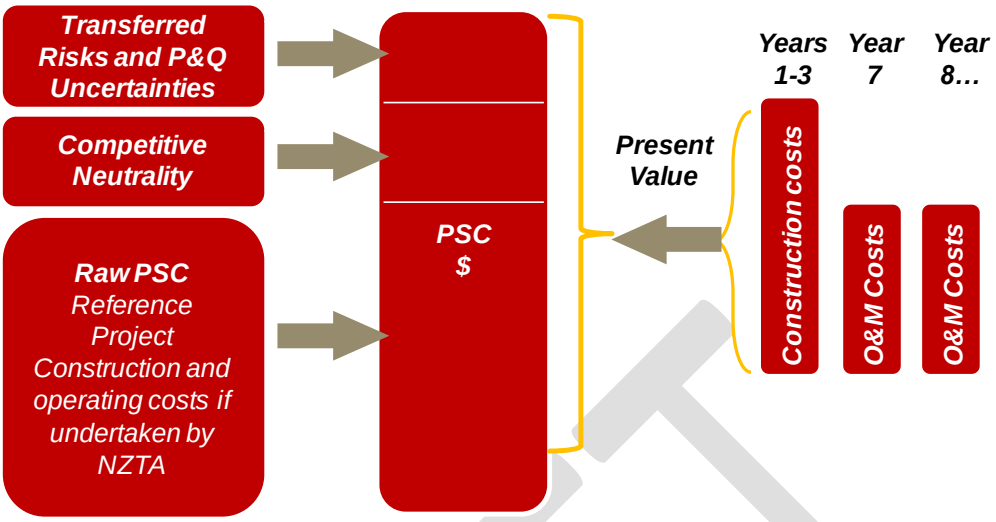


Figure 9-1: PSC Components

9.6 D&C assumptions

The design and associated construction costs for the Project are based on the most recent scheme estimate and programme for the Project. For a full breakdown of the scheme estimate see Appendix C. The table below summarises the key features of the D&C assumptions used in the PSC:

Table 9-1: Design and Construction Assumptions

Category	Value
Construction start (Financial Close)	1 July 2016
Construction completion	30 June 2019
Construction duration	3.0 years
Total construction cost included in the PSC (excl. land purchases and contingency, real as at Q2 2013)	[redacted]
Escalation on construction cost	[redacted]
Total escalated construction cost	[redacted]

The Project base estimate excludes risk events and contingencies associated with cost and quantity estimates. Risk events and contingencies have been excluded from the base Project estimate as the risk allowance (incorporating transferred risk and P&Q uncertainties) is added as a separate, specific adjustment to the PSC.

The PSC calculation assumes that Investigation and Reporting, Design and Project Documentation and MSQA are all costs that would be included within the unitary payment under a PPP. If some of these costs

would remain with Auckland Transport regardless of procurement method they would need to be excluded.

9.7 O&M assumptions

O&M costs (including lifecycle maintenance costs) have been developed for the Project. It has been determined that the O&M costs for the preferred option will not be materially difference from the base case option. Therefore, the same O&M costs have been used. These costs are included over a 25 year operations period. For a further breakdown of the costs see Appendix D. The key operating and lifecycle maintenance assumptions are included in the following table:

Table 9-2: Operating and Lifecycle Maintenance Assumptions

Category	Average Value (real as at Q2 2013)	Frequency
Operations and Maintenance	**$000**	
General O&M	[redacted]	Annual
Concrete bridges maintenance	[redacted]	Annual
Retaining walls maintenance	[redacted]	
Steel pedestrian bridges maintenance	[redacted]	Every 15 years
Lifecycle maintenance		
General resurfacing cost	[redacted]	In years 8, 16 and 24
Resurfacing cost for residual life	[redacted]	In year 25
Other		
Tolling equipment replacement	[redacted]	Every 10 years

9.8 Competitive Neutrality

Competitive neutrality does not include differences in performance or efficiencies that arise in a competitive market. It does not include differences in cost levels between the public and private sectors. The only competitive neutrality adjustment is for corporate tax. This adjustment has a NPC of [redacted] million and a nominal value of [redacted] million.

9.9 Risk Transfer

The Project will involve a range of risks (such as unforeseen ground conditions, delays, cost overruns etc). These risks are not captured in the construction or operating costs for the Reference Project included in the PSC. These risks may or may not crystallise into actual costs.

Under traditional procurement, a large number, but not all, of the project risks will be retained by AT. Under PPP procurement the risks will be allocated between AT and the private sector contractor depending on which party is best able to effectively manage the potential for the risk to occur and best able to mitigate the cost if it does occur. This requires an optimal rather than maximum transfer of risk.

Neither Auckland Transport nor the private sector contractor will be best placed to manage all of the risks. However, all things being equal, the intent under a PPP is to pass as much responsibility as possible to the private sector contractor to manage construction and operation of the Project.

Transferring risk to the private sector contractor will come at a cost. The price the contractor will charge to deliver the Project will include some allowance for the risks it is required to manage. The risk quantification exercise is an attempt to identify and quantify all of the material project risks. These risks will include risks to be retained by the Auckland Transport and risks to be transferred to the contractor. The transferred risks are added to the PBM and also the PSC for comparative purposes. Retained risk is the same under both scenarios so does not need to be considered in the analysis.

Where a risk is classified as a "Transferred Risk", the contractor should be given a substantial degree of flexibility to determine the best method of control over the costs associated with that risk. This creates a powerful incentive for the contractor to manage the risk in the overall interests of the Project, while delivering value-for-money to AT. An efficient allocation of risks will allow Auckland Transport to obtain greatest value-for-money by harnessing the respective skills of all parties. However, if too much risk or the wrong risks are transferred to the contract, Auckland Transport may pay more than if they were retained, as the private sector may require a risk premium over and above the estimated cost of Auckland Transport retaining the risk.

9.10 Transferred Risk and Pricing & Quantity Uncertainty Quantification

There are two components of the transferred risk and P&Q uncertainty adjustment made to the PSC:

- Transferred risks (discussed above) are included in the risk matrix and a curve of possible cost outcomes has been modelled and included in the PSC distribution.
- P&Q uncertainties are included in the uncertainties matrix. The uncertainties are modelled as a range of possible outcomes for prices and volumes and included in the PSC. This replaces the contingency in the scheme estimate.

Careful consideration was given to ensure that all relevant risks were covered under either the uncertainties matrix or the risk matrix and that there was no double-counting of risks between the two matrices.

A detailed analysis of risk for the Project has been undertaken during July 2013. The probability of each risk occurring and the financial impact of occurrence have been used as inputs into a risk model that simulates potential outcomes.

The table below summarises the overall results of the risk assessment process (including P&Q uncertainties). The table provides a total estimated risk cost (including construction and operating phases) for the 85th percentile observation.

Table 9-3: Transferred Risk and Uncertainties

	$m (NPC)	$m (nominal)
Transferred construction risk and P&Q uncertainties	[redacted]	[redacted]
Transferred operating risk	[redacted]	[redacted]
Total transferred risk and P&Q uncertainties	[redacted]	[redacted]

9.11 PSC Summary Results

The probability distributions of the NPC and nominal costs of the PSC are presented in Figure 9-2 and Figure 9-3. The NPC[44] is the present value of the costs as at 1 July 2016[45], calculated using a discount rate of 8.0%. The nominal costs are the total (undiscounted and escalated[46]) costs over the entire PPP Contract term.

Figure 9-2: PSC NPC Probability Distribution

[44] The present value of forecast costs.
[45] The discount date of 1 July 2016 has been used as it is the anticipated date for financial close (project start).
[46] All costs have been inflated at 3% per annum.

Figure 9-2: PSC nominal costs probability distribution

A breakdown of the PSC at the P85 level for transferred risks and P&Q uncertainties is presented in the following table:

Table 9-4: PSC Summary

	$m (NPC)	$m (nominal)
Operating costs	[redacted]	[redacted]
Construction costs	[redacted]	[redacted]
Raw PSC	[redacted]	[redacted]
Competitive neutrality	[redacted]	[redacted]
Non risk adjusted PSC	[redacted]	[redacted]
Transferred risk and pricing uncertainties (P85)	[redacted]	[redacted]
Total PSC	[redacted]	[redacted]

9.12 PBM

The PBM provides an indication of the possible cost of the Project if it were to be delivered through a PPP. The PBM is calculated by adding the following to the PSC:

- Private sector financing costs[47]. The financing costs used in the PBM are based on observations from recent New Zealand and Australian market transactions. The cost of debt used to derive the interest costs was based on market interest rate data current as at late July 2013. Interest rates in recent times have been relatively low and it is likely that interest rates will rise in the short to medium term. An increase in interest rates will potentially increase the PBM, although this will depend on how the discount rate used to calculate the net present costs is adjusted for the change in interest rates.
- Costs that the private sector contractor will incur in managing its operations and its obligations under the PPP contract.

The PBM does not include any allowance for efficiency gains. Please refer below for the discussion on how efficiency gains might be achieved by the private sector and further testing of the impact on potential efficiency gains on the NPV of the PBM below.

Probability distributions have been produced for the PBM. The probability distributions of the NPC and nominal costs of the PBM are presented in Figure 9-4 and Figure 9-5:

[47] The PBM uses the construction and operating costs and related information from the PSC. Private sector financing parameters are added to the model and tax is calculated. The model is solved to generate a sufficient level of Unitary Payment annually to cover operating and maintenance costs, taxation, debt servicing and provide equity returns to shareholders while maintaining banking covenants.

Figure 9-3: PBM NPC probability distribution

Figure 9-4: PBM nominal costs probability distribution

9.13 Comparison of PSC and PBM

Table 9-5 presents the NPC of the PBM and the difference between the NPC of the PSC and the PBM at the P85 level for transferred risks and P&Q uncertainties.

Table 9-5: Financial Benefits Comparison

Category	Value
NPC base date	1 July 2016
NPC of the PSC	[redacted]
NPC of the PBM	[redacted]
Difference	[redacted]
Difference as a percentage of the NPC of the PBM	[redacted]

The difference between the PBM and the PSC is primarily a function of the difference between the private sector and public sector cost of finance. It reflects that the local government, given its credit rating and access to different financial markets, will be able to finance the Project at a lower cost than the private sector.

The difference between public sector and private sector financing costs is effectively reflected in the difference between the discount rate used to calculate the NPC of both the PSC and PBM ([redacted]) and the private sector interest rates and cost of equity used to quantify the finance costs in the PBM.

As noted earlier, the PBM will change (increase) if interest rates change (increase). But the discount rate should also change to reflect changes in underlying interest rates[48]. Consequently, the difference between the PSC and the PBM will change as interest rates change, although the extent of the change will depend on the relationship between the interest rates and the discount rate.

In order to provide a cost effective solution to AT, private sector contractors bidding for the PPP contract will need to bridge the gap between the PBM and the PSC through construction and operating cost efficiencies, or more efficient management of risk. By testing the cost structure and risk assumptions used to calculate the PBM, the implicit cost efficiencies and savings from more efficient management of risk that the private sector will need to achieve to provide value-for-money to Auckland Transport have been identified.

The following presents an assessment of the combination of construction cost savings and risk cost savings that would be required to reduce the PBM to a level that coincides with the PSC. This does not include O&M cost savings because O&M is a relatively small component of the PBM.

The following figure shows:

- The PSC distribution
- The PBM distribution
- Two PBM distribution scenarios incorporating reductions in construction costs of [redacted] (saving of [redacted] million, Q2 2013 dollars) and [redacted] (saving of [redacted] million, Q2 2013 dollars).

[48] As both the public and private sectors are experiencing an increase in borrowing costs.

Figure 9-5: PBM "Efficiencies"

The figure above shows that there is cross-over of the PSC and PBM, as well as the PSC with a PBM including [redacted] of construction cost savings and a PBM including [redacted] of construction cost savings. This substantial cross-over occurs due to the wide range of uncertainty still present in the PSC estimate (there is approximately [redacted] million between the PSC at P10 and P90).

Specific cross over points are noted in the following table (for example the PSC at the P85 value and the PBM (with [redacted] D&C savings) at the [redacted] have an equivalent NPC [redacted]million.

Table 9-6: PSC and PBM cross over points

9.14 The cost of the Project under traditional procurement

The funding requirement under a traditional procurement approach is significantly different to that of a PPP contract. A comparison of the two approaches to procurement is shown in the figure below for the construction period and entire operations period:

Figure 9-6: Annual (nominal) payments under Traditional and PPP procurement methods

Figure 9-7 illustrates that while the cumulative nominal average annual payment under PPP procurement is higher, there are no payments made until operations begin.

While the PPP project costs are greater, having private sector capital at risk in a non-recourse manner within the PPP brings benefits in incentivising the contractor to deliver optimal whole-of-life performance and innovation. These benefits may potentially outweigh the added nominal costs of the PPP.

9.15 Reconciliation of the PSC to Auckland Transport cost estimates

The Project base estimate for the Project of [redacted] million (excluding risk and contingencies) has been used as a cost input into the PSC.

A reconciliation between the scheme estimate and the PSC is provided in Appendix I. In general, the difference between the scheme estimate and the PSC is a result of the calculation methods used for the PSC, the inclusion of operating costs, competitive neutrality adjustments and escalation which are not included in the scheme estimate.

9.16 Tolling

Penlink has been identified as a potential toll road. Initial toll revenue forecasts produced based on traffic modelling work undertaken by Beca. The full details of that forecasting, including the scope, assumptions, methodology, disclaimers and limitations are documented in the separate Beca technical report which should be read in conjunction with this report.

Tolled traffic forecasts were prepared for the years 2016, 2021, 2031 and 2041. A range of sensitivity tests were undertaken on the input assumptions and model parameters, to which Monte-Carlo simulation was applied to provide probability-based forecasts at the 5th, 50th and 95th percentile levels. The resulting risk profiles are indicated in Figure 9.8. These show that in 2016 the expected (50%ile) value is below the modelled value (factor less than 1), which is due to the risks being skewed to down-side risks (primarily due to the effect of a possible lower WTP). These become skewed to the upside in later years (with probability based values higher than the modelled forecasts) due to the opportunities for higher land use growth in areas such as Weiti and west of SH1.

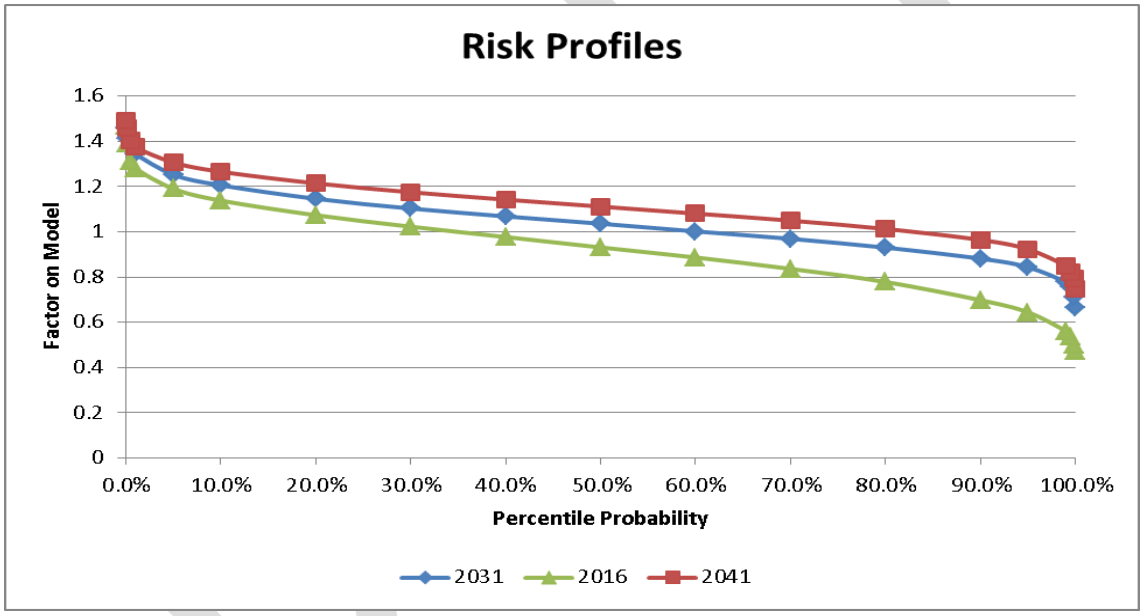


Figure 9-8: Risk Profiles on Patronage Predictions

Figure 9- 9-9 shows the key contributors to the risk profile in the year 2031, where it can be seen that the growth rates and WTP parameters contribute most to the uncertainty.

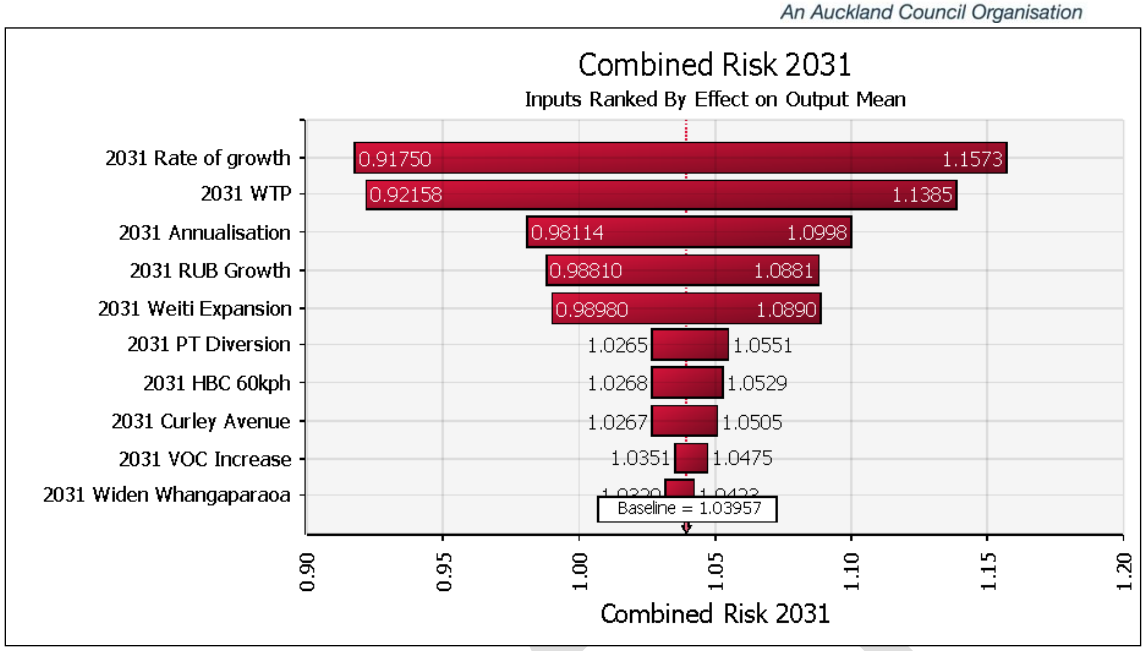


Figure 9-9: Key Contributors to Patronage Risks

The forecast AADT values with their probability ranges are summarised in Table 9-7 and graphed in Figure 9-10:

Table 9-7: Traffic and Revenue Forecasts

Year	AADT Flows at Penlink Toll Gantry				Gross Daily Toll Revenue, $2013			
	Model	5%ile	50%ile	95%ile	Model	5%ile	50%ile	95%ile
2016	10,700	6,900	10,000	12,700	$24,400	$15,700	$22,700	$29,100
2021	12,600	9,800	12,600	15,500	$28,600	$22,200	$28,600	$35,200
2031	13,300	11,200	13,800	16,700	$30,100	$25,400	$31,200	$37,800
2041	14,500	13,400	16,100	18,900	$33,000	$30,500	$36,700	$43,100

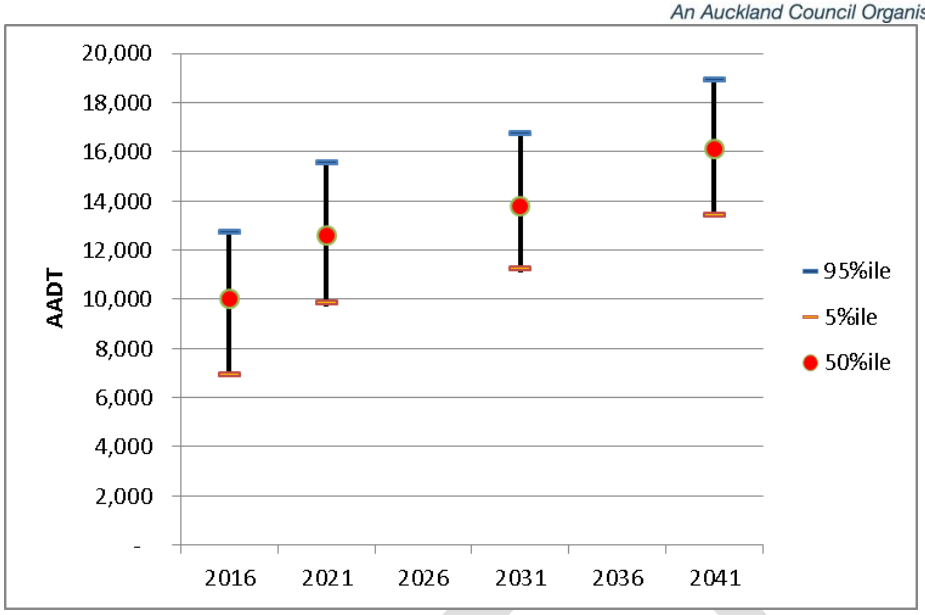


Figure 9-10: AADT Values and probability Ranges

The current patronage forecasts on Penlink were also compared to the patronage forecasts developed for the RDC in 2007. Direct comparisons are not possible because the previous forecasts used different land use forecasts, a different option (2-lane with at-grade connections), different network assumptions, a different (2-gantry) toll strategy and used a different toll model.

Not-withstanding those differences (in fact considering the changes in inputs and assumptions is in itself useful to understanding the uncertainties in the forecasts), the new forecasts show patronage levels noticeably higher than those previously forecast (between 9% and 70% depending on which of the previous toll strategies is considered).

This analysis found 50th percentile annual gross revenues increasing from some $8.2 million if opened in 2016 to $13.4 million in 2041 (these estimates do not allow for ramp-up effects in the early periods of operation as motorists become familiar with the new facility nor any revenue leakage due to non-payment of tolls).

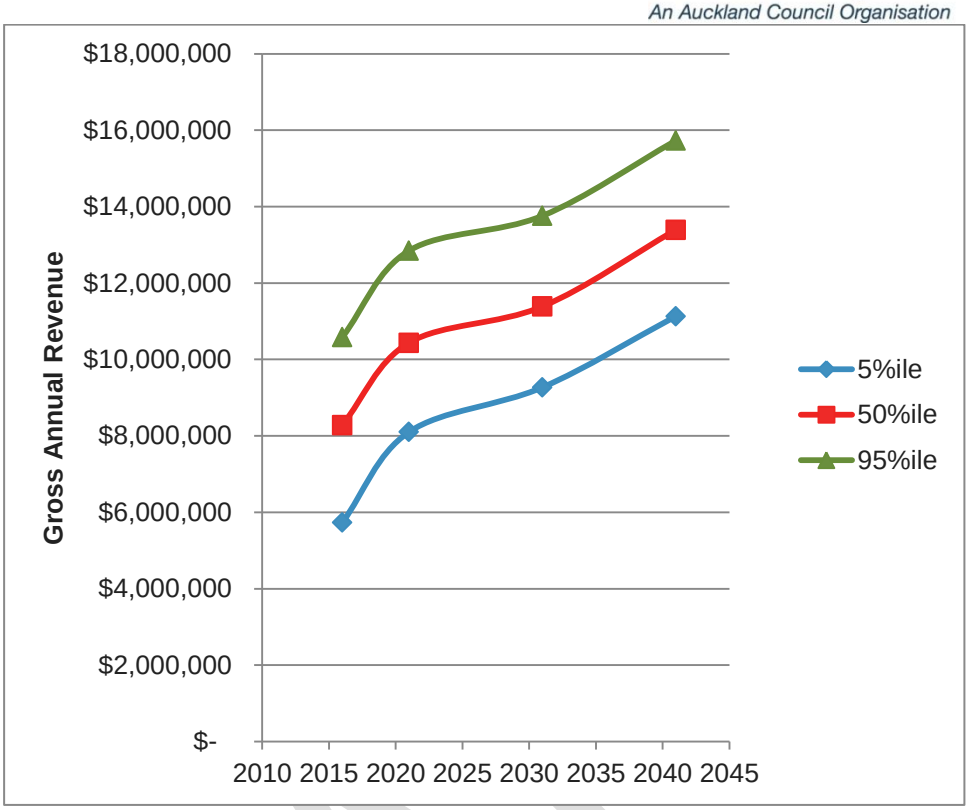


Figure 9-11: Annual tolling gross revenue

If the decision is made to undertake tolling on Penlink, Auckland Transport may need to undertake further analysis of the key uncertainties in the forecasts, such as the rate of general land use growth, specific development opportunities, market research into motorists' willingness-to-pay, limiting diversion, leakage and toll infrastructure needs.

For the purposes of the Economic Evaluation, the NPV of the gross toll revenue is estimated at $123 million (using the unadjusted modelled forecasts, 6% discount rate and a 40-year analysis period) This includes $10 million capital expenditure required for the installation of the single toll gantry and required integration with the NZTA's National Toll System.

AT will retain responsibility for the tolling operations and for collection of the tolling revenue irrespective of the method of procurement. Under PPP, the contractor will not be required to take demand risk for tolling. It will have to provide Auckland Transport with any access required to facilitate the tolling programme.

9.17 Funding requirement

The purpose of this section is to identify the estimated annual cash costs to Auckland Transport of procuring the Project using a PPP procurement model. These costs are compared to the annual cash costs of traditional procurement over the first ten years of the Project.

Another alternative for funding the Project is to utilise Auckland Transport borrowing. The costs of this option have been quantified and are discussed in this section.

Revenue received from tolling is not discussed in the section as the financial impact of tolling is the same under a PPP procurement model and traditional procurement, as AT will undertake any tolling activities itself.

9.17.1 Cost of the Project to AT

The cash costs of the Project to Auckland Transport under PPP procurement will consist of:

- Payments made to the contractor (the Unitary Payment) over the term of the contract
- Costs that Auckland Transport will incur itself in relation to the PPP contract, in addition to the Unitary Payment.

The Unitary Payment

The Unitary Payment is likely to be a fixed real amount, a component of which will be subject to indexation to allow for inflation. For the purposes of this Business Case for Implementation, the inflation allowance has been applied to a proportion of the Unitary Payment to reflect that the costs that the Contractor will incur in providing operating services will be subject to inflation. Costs relating to debt and equity repayment and servicing are not subject to inflation and are not indexed.

An allowance for lifecycle maintenance costs, primarily consisting of resurfacing and pavement rehabilitation has been included in the cash flows when this cost is expected to be incurred.

The annual Unitary Payment has been estimated for the Project using the PBM, adjusted to incorporate the level of efficiencies required to equate the PBM to the PSC. This is presented in the following figure, which shows the real Unitary Payment and the inflation component:

Figure 9-7: Total Unitary Payment

The Unitary Payment has been calculated to provide sufficient revenue to the contractor to allow the infrastructure to be operated and maintained and to cover forecast debt and equity servicing requirements over the term of the PPP contract. A breakdown of the different components of the Unitary Payment for the first ten years of operations is provided in the following table:

Table 9-7: Unitary Payment Breakdown

Table 9-8 demonstrates that the majority of the cash costs relate to servicing debt and equity over the operations period. Return on equity payments remains fairly constant during the initial ten year period. Interest costs begin to reduce as principal payments reduce the outstanding debt balance. The initial spike in debt repayments reflects the impact of working capital and establishment of reserve accounts[49], which occurs in the first year of operations of the Project.

Costs incurred by AT

Preliminary estimates suggest that Auckland Transport could spend up to [redacted] million in total of additional costs in relation to project management, commercial, financial and legal advisers, under PPP procurement. This amount is additional to the cost of traditional procurement and is likely to be incurred during the periods prior to financial close.

9.18 Base interest rate risk

The costs above are an estimate of the cash costs that may be incurred under a PPP contract. The actual costs may be different from those observed for a number of reasons, including different cost of capital and capital structures utilised by the contractor and different base interest rates.

[49] The debt funders will require the contractor to establish reserve accounts to, among other thing, reserve cash for debt servicing.

Under Treasury's standard form PPP contract, base interest rate risk will be a risk borne by the contracting agency (in this instance AT). Interest rates have been at or close to historical lows and have, in the past few months, begun to rise. The base interest rates utilised in the cost estimates reflect market rates in late July 2013. It is reasonable to assume that base interest rates will rise but it is not feasible to forecast accurately the timing and magnitude of future increases. Should base interest rates increase from those used in the above estimates, the total Unitary Payment will increase. This will affect both the PPP procurement process and the total cost of the Project to AT.

- If base interest rates increase prior to a signed PPP contract, this increase in the Unitary Payment could make it more difficult for the private sector to 'bridge the gap' to the affordability threshold depending on how the discount rate is changed for the increase in interest rates. Auckland Transport will need to monitor the impact of changes in base interest rates on the affordability threshold.
- If base interest rates increase after a PPP contract is signed, the increase in the Unitary Payment will be passed on to AT, who will face a higher cost. Conversely, if base interest rates fall, this decrease in interest costs will be a benefit to Auckland Transport through a reduction in the Unitary Payment.

The table below shows the impact on the total value of the PBM from changes in base interest rates assuming no change in the discount rate:

Table 9-9: Impact to the PBM of changes in base interest rates

Category	Scenario 1	Scenario 2	Scenario 3
Movement in interest rates (bps)	[redacted]	[redacted]	[redacted]
NPC of the PBM ($m)	[redacted]	[redacted]	[redacted]
Change in the PBM ($m)	[redacted]	[redacted]	[redacted]
Change in the PBM (%)	[redacted]	[redacted]	[redacted]

9.19 The cost of the Project under traditional procurement

The funding requirement under a traditional procurement approach (D&C) is significantly different to that of a PPP contract. A comparison of the two approaches to procurement is shown in the figure below for the construction period and entire operations period:

Figure 9-13: Annual payments under Traditional and PPP procurement models

Figure 9-13 illustrates that the total payments over the term of the PPP project agreement are higher than the total payments under traditional procurement. The PPP payments include the cost of private sector finance. The traditional procurement cash flows do not include the cost of the public sector financing.

9.20 Financial forecasts

The figures below show the hypothetical cash flows of traditional procurement versus PPP procurement. Both figures assume that the NPC of the Project ([redacted]) is available at the start of the Project and under both procurement options this funding would be reduced to zero at the end of the Project. The figures both show the following:

- The annual cash cost (red bars)
- The notional interest earned against the funding balance (blue bars)
- The change in the initial funding amount over the life of the Project (black line).

These figures are illustrative only and show that, given an equal upfront funding, the funding would reduce to zero under both procurement options however the profile of the cash outflows would differ.

Figure 9-14: Traditional procurement

Figure 9-15: PPP procurement

9.21 Accounting Treatment

International Public Sector Accounting Standard (IPSAS) 32 Service Concession Arrangements: Grantor prescribes the accounting for service concession arrangements. The guidance in this standard is directly relevant to the accounting for PPP arrangements under the Treasury's PPP Standard Contract.

The accounting treatment of a PPP contract has two distinct phases, being Construction and Operations. During the Construction phase, as the contractor is building the asset, Auckland Transport will recognise both a Service Concession Asset (split between the road and fixtures and fittings) and a financial liability on a work-in-progress basis. During the operating phase:

- The service concession asset will be accounted for in accordance with Auckland Transport's depreciation and revaluation policies.
- AT will need to separate the unitary payment made to the Contractor into its component parts. There will be at least three components:
    - Cost of service (charge to the income statement)
    - Finance cost (charge to the income statement)
    - Financial liability (reduction in the financial liability).

The implications for Auckland Transport of the accounting guidance are demonstrated in the following table:

Table 9-10: Summary of Accounting Treatment Implications

Balance Sheet	***Assets*** Land (retained on balance sheet) Roading and related assets ***Liabilities*** Financial liability (written down during the service concession period)
Income Statement	***Income*** Nil ***Expenditure*** Cost of service provision by the contractor (recognised as the services are provided) Depreciation of service concession assets Loss on disposal of service concession assets (being fit-out periodically replaced by the contractor over the service concession period) Finance costs
Cash Flow Statement	***Operating Outflows*** That part of the unitary payment that relates to the services delivered. ***Investing Outflows*** That part of the unitary payment that relates to the lifecycle maintenance expenditure. ***Financing Outflows*** That part of the unitary payment that relates to the finance costs and the reduction in

	the financial liability.

PART B – READINESS AND ASSURANCE

10 Commercial Analysis

Work undertaken to date on the commercial case for Penlink suggests there is nothing to indicate that PPP is not a workable and effective procurement model although Auckland Transport needs to be fully aware of the interest rate risk it would bear under the current version of the Treasury standard form contract. Further work is needed to confirm PPP as the recommended procurement model, including further investigation of geotechnical issues, market testing of these issues, undertaking a market sounding for the Project as a PPP and a position reached on interest rate risk.

PPP is a viable procurement model in that the outcomes required from Penlink can be unambiguously captured in a performance based contract that provides the basis for private sector design, construction, financing and O&M.

Incentives can be put in place to encourage the contractor to deliver innovative design and construction techniques, especially with regard to improving O&M efficiencies, innovative design for structures, lifecycle optimisation and road user safety. Additionally, there will be opportunities for AT, working in partnership with a contractor, to take the innovations and ideas delivered through Penlink and transfer them to the wider local road network. By embracing the opportunities provided by this Project, Auckland Transport can secure change in the effectiveness and efficiency of its approach to design, construction and operations.

Although the Transmission Gully Public Private Partnership (TGPPP) procurement process is demonstrating that there is a strong interest in PPPs in New Zealand, TGPPP is of a significantly different scale than Penlink which may negatively impact the level of market interest. This will need to be tested through a market sounding for Penlink.

AT has the ability to secure the capability and resources to manage the PPP procurement process effectively.

The expectation, and requirement, is that a well-run procurement process to deliver Penlink through a PPP could produce bids that will “beat” the PSC. The experience to date with PPPs in New Zealand suggests this is achievable.

10.1 Introduction

AT is responsible for over $1.5 billion of expenditure on O&M and capital improvement of the local road network in Auckland each year. This represents a considerable investment in roading infrastructure, which is vital to our national economy’s support and development.

The aim of Auckland Transport Procurement is “to achieve sustainable ‘value for money’ through collaborative relationships that encourage and foster fair competition and innovation in the delivery of Auckland Transport’s objectives to the satisfaction of its customers”. The principle guiding all Auckland Transport procurement activities is: “Sustainable ‘value for money’ through the ‘whole of life’ of an asset or service” by:

- Being customer and output focused
- Supporting sustainable supplier markets
- Where applicable, supporting innovative and collaborative relationships
- Acting with integrity in an open, fair and transparent manner
- Minimising transaction costs.

10.2 PPP Procurement of Penlink

There are a number of advantages that the PPP procurement model can provide, however, the benefits of PPP procurement to Auckland Transport do not of themselves argue for or against Penlink as a specific candidate for procurement through a PPP.

Penlink is a viable candidate for PPP procurement. It has a number of the features that would enable the private sector to deliver value-for-money by bundling design, construction, financing and operation into a single, performance based contract such as:

- Penlink is of reasonable scale. Based on interest in the TGPPP procurement process, Penlink may be attractive to potential private sector participants. It may also be able to absorb the reasonably significant transaction costs that are part of a PPP transaction.
- Material risks inherent in Penlink can be adequately defined and allocated appropriately between Auckland Transport and the private sector contractor. An initial high-level risk allocation is included in Appendix E.
- There is scope for innovation, particularly given features such as challenging terrain, multiple structures and challenging geotechnical conditions, as well as opportunity to reduce the construction timeframe and minimise structures.
- It is feasible to express and quantify the outcomes Auckland Transport requires from Penlink so they can be incorporated into a mechanism for measuring the performance of the private sector contractor and setting the amounts it is paid for delivering the services.
- It is feasible to bundle the on-going management and maintenance of Penlink with the construction and financing into a long-term (25 year) contract.

10.3 Quantitative Analysis: Financial Modelling

A financial model has been developed to compare the cost of Auckland Transport constructing, financing and operating Penlink itself (PSC), using a traditional D&C procurement approach, to the cost if it were designed, constructed, financed and operated by the private sector (the proxy bid model (PBM)). The financial modelling is included in Section 9.

The construction and operating costs in the base PBM do not include any efficiencies or cost reductions that the private sector might be able to achieve. Consequently, the PBM is higher than the PSC, reflecting that the private sector financing costs are higher than the public sector financing costs. This is to be expected.

The expectation, and requirement, is that the private sector will be able to equal or "beat" the PSC by providing construction, risk management and operating costs savings to at least offset the difference in financing costs between the public and private sectors.

The provisional estimates and analysis in Section 9 demonstrate that construction, and risk cost savings driven by private sector efficiencies can assist in overcoming the difference between the PBM and the PSC. Other factors may also come into play for the private sector to beat the PSC, such as different finance structures or costs and construction timeframes. These are not included in the analysis in Section 12.

10.4 Market Sounding

Through observations and discussion with the NZTA, Auckland Transport has been able to get an understanding of the current market appetite for projects of this nature from recent market soundings for TGP and the Huntly Bypass and current engagement with the market for the TGPPP procurement. Although the TGPPP procurement process is demonstrating that there is a strong interest in PPPs in New Zealand, TGPPP is of a significantly different scale than Penlink, which may negatively impact the level of market interest. This will need to be tested through a market sounding for Penlink.

There are some specific technical issues associated with Penlink that will need to be tested with the market when more specific detailed information on these issues is available. Without this information, further interaction with the market was deemed unnecessary at this stage.

10.5 Required Outcomes and Payment Mechanisms

The outcomes required from Penlink under a PPP would be linked to Auckland Transport's high level outcome measures. As part of the current TGPPP procurement process, the NZTA has developed a payment mechanism and performance regime that reflects the outcomes that the NZTA requires from TGPPP. Auckland Transport should be able to leverage off the payment mechanism and performance regime developed for the TGPPP and tailor this to Penlink. This payment mechanism and performance regime for the TGPPP are currently being tested with the market as part of the RFP process and may form the precedent for any future roading PPPs procured in New Zealand.

10.6 PPP Contract

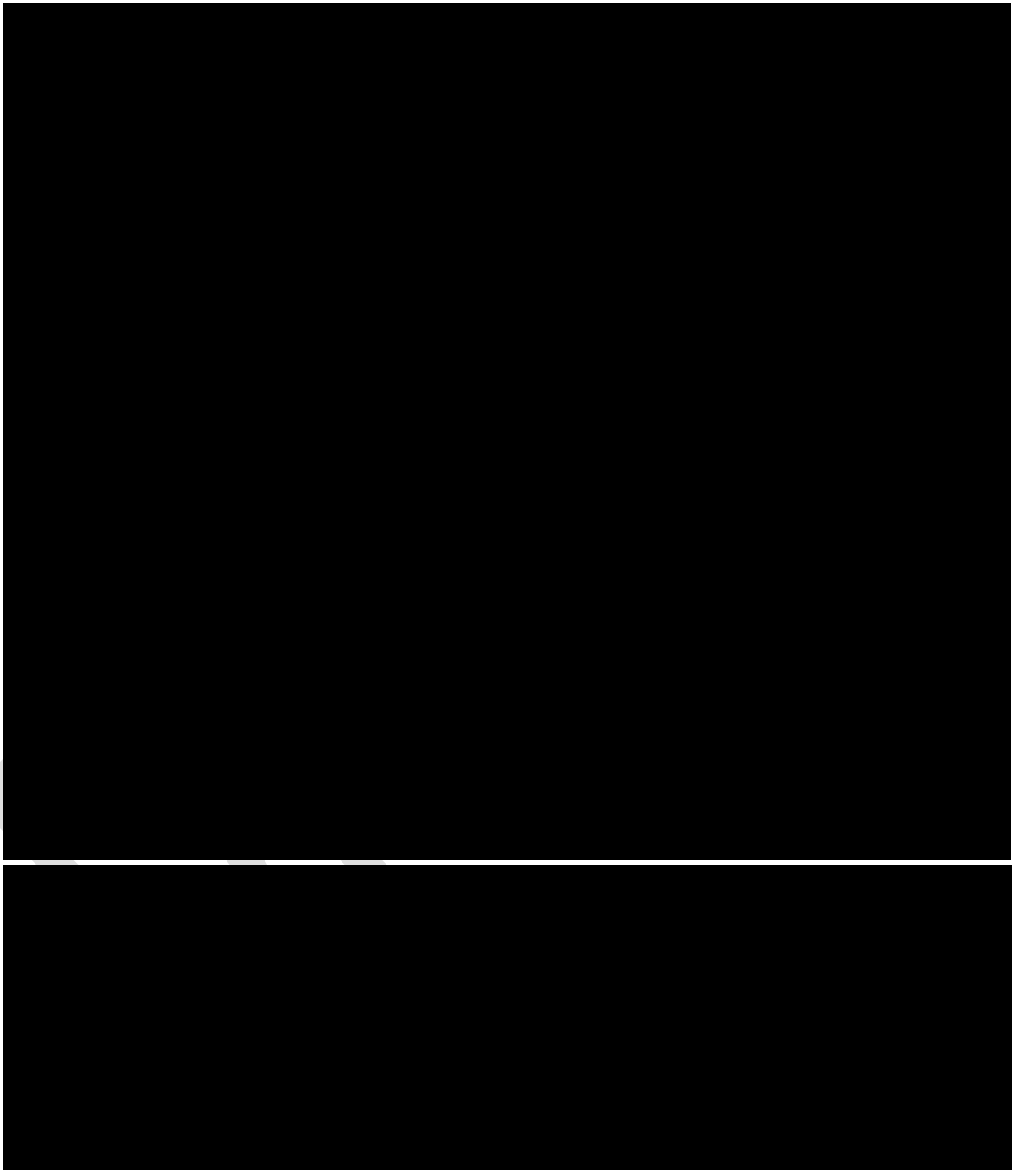
The PPP Contract for Penlink will have the benefit of:

- Treasury's Standard Form PPP Contract[50] as the basis of the contract, adapted and used for both Hobsonville Schools PPP and the Prison at Wiri PPP

[50] http://www.infrastructure.govt.nz/publications/draftpppstandardcontract.

- The contract and learnings from the TGPPP procurement.

AT will be able to use The Treasury Standard Form Contract for Penlink. Bell Gully has reviewed the application of the Standard Form Contract for Penlink. Their findings are set out in the supplementary paper to this Business Case. In summary, Bell Gully has concluded that:



AT will benefit from the exposure the Standard Form Contract has had to the market through the two transactions completed to date, as well as further adaptation for the TGPPP. The PPP market participants have an understanding of the position taken in the Standard Form Contract on a range of commercial and risk allocation issues of greater or lesser importance (although they may not agree with all of the positions taken).

One critical point leading to some differences between the PPP market participants' expectations about contractual terms and conditions and the Treasury's requirements has been the "New Zealand specific" nature of the contract. The PPP market participants' expectations were based on Australian precedents (and, to a lesser extent, UK precedents). These were not always consistent with the focus of the New Zealand requirement for a well specified contract to support a focus on delivering outcomes.

No doubt the positions of the market and Auckland Transport would be retested in the procurement of Penlink, particularly given offshore market participants' familiarity with roading PPPs. However, Auckland Transport will have a sound position to negotiate from. The precedent for many of these issues will be set by the TGPPP procurement process.

11 Risk Analysis

The risk process involved a qualitative and quantitative risk assessment and analysis process which has been maintained throughout the Project. The risk analysis for the retained, operational and maintenance, and transferred risks were included in the scheme estimate for the Project.

Following the risk analysis the contingencies included in the estimate for the P50 and P95 estimates were [redacted] and [redacted] of the base estimate respectively.

11.1 Risk Analysis Process

This section overviews the risk analysis process undertaken. This will include:

- The risk register from the previous stages of the Project was used as a starting point and comprehensively reviewed and updated.
- A qualitative assessment considering reputational, stakeholder and environmental, as well as the cost and programme risks (and consideration of opportunities) which were then incorporated in to the risk adjusted cost estimate and programme.
- A parallel but integrated qualitative and quantitative risk assessment and analysis process which has been maintained throughout the Project. A monte-carlo analysis was undertaken for the preparation of this Business Case.
- A further risk workshop was undertaken, at which the retained and operational and maintenance risks were identified and a risk analysis undertake. The transferred risks were subject to a separate risk analysis.
- The risk analysis for the retained, operational and maintenance and transferred risks were included in the scheme estimate for the Project.

11.2 Key Project Risks

The top five key project risks (threats) as assessed and analysed in the quantitative analysis (cost and programme threats) are as follows:

- The current design does not meet current standards
- Weiti Bridge constructability
- Earthworks quantities and cost allowances
- Stormwater treatment and detention allowances
- Geotechnical – slope stability, retaining walls.

11.3 Risk Quantification

A quantitative risk analysis was undertaken at a Quantitative Risk Workshop held on 16 July 2013. The objective of the quantitative risk analysis for the stages was to determine the:

- Expected estimate
- 95th percentile estimate.

The risk process was broken into two components: the uncertainty associated with the quantity and rate of items included in the schedule and discrete risks identified by the Project team.

11.3.1 Quantity and Rate Risk

Based on discussions and consensus in the risk workshop, utilising the team's experience and knowledge of the project design and construction risk profile, each section of the estimate (e.g. earthworks, drainage) was rated with a confidence limit for the variation in the costs.

Risk simulations were run using @RISK software based on this register for each stage.

11.3.2 Discrete Risks

A discrete risk analysis was undertaken using the following procedure:

- A collated register of construction risks was developed from information supplied by various team members
- This discrete risk register was then quantified in the risk workshop based on the team's knowledge and experience
- Each item was then rated for both consequence (in terms of dollars) and likelihood (in terms of a percentage probability)
- Risk simulations were run using @RISK software based on this register for each of the five stages.

The results of the risk simulations are detailed in the table below.

Table 11-1: Contingencies Adopted in Estimates

Option	Expected Estimate as Percentage of Base	95th Percentile Estimate as Percentage of Base
Penlink Preferred Option	[redacted]	[redacted]

11.4 Commercial and Financial Risk

There will be a number of commercial and financial risks that Auckland Transport would bear under a PPP procurement that it would not face under a D&C procurement. Also, there will be a number of risks that are inherent in traditional procurement that would be more transparent and explicit under a PPP.

One of the critical factors that will affect risk under a PPP is the financing of the construction of Penlink with private sector debt and equity. There is also the added complexity with a PPP of the presence of private sector banks and equity investors. This is one of the advantages of a PPP (private sector capital places pressure on the contractor to perform efficiently) but the private sector financiers will also be particularly focused on the comprehensive identification and allocation of risks.

Some of the key commercial and financial risks will include:

- Procurement risks:
  - [redacted]
  - [redacted]
  - [redacted]
- Financing risks will distinguish a PPP procurement from traditional procurement:
  - [redacted]
  - [redacted]
- There will be operating risks that will be similar between PPP and traditional procurement. For example, Auckland Transport will probably bear the costs of inflationary increases in the contractor's operating costs under a PPP. This is unlikely to be significantly different to traditional procurement.

Under a PPP, operating costs will tend to fixed in real terms, with the exception of certain costs which the contractor will want to be reviewed periodically. [redacted]

As with traditional procurement, effective contractor management is a primary (but not the only) means of mitigating risk under a PPP. Auckland Transport will have the benefit of the precedent set by the NZTA with the TGPPP as well as the Treasury's Standard Form Contract and the "testing" it has had on the two PPP deals signed to date. However, it is likely there will be a need to adapt the contract to reflect Auckland Transport's status as a Council Controlled Organisation. Unlike traditional procurement, a PPP contract will be for a very long period, possibly 25 years. The contract must be able to stand the test of time and provide protection to Auckland Transport for a range of eventualities, not all of which can be foreseen now.

If Penlink is procured via a PPP, it will be Auckland Transport's first PPP project. Auckland Transport will benefit from drawing on the experience of NZTA and their experience with TGPPP. Auckland Transport will also need to create a partnership with Treasury to assist them during the procurement process. This will enable them to utilise Treasury's experience and expertise in the development of the structural design of the necessary contracts.

12 Summary of Procurement Analysis

12.1 Introduction

The choice of a procurement approach for Penlink is a significant decision for a range of reasons, not least because of the opportunity to use an alternative to Auckland Transport's more traditional approaches.

Sections 9, 10 and 11 of this business case contain a qualitative and quantitative analysis of procurement options, with a particular focus on the application of a PPP procurement model. The analysis undertaken during the Scheme Assessment used D&C under a traditional procurement approach. When alternative procurement approaches, such as PPP, were considered, it was found that PPP was the favoured approach because it could provide:

- Qualitatively, great whole-of-life benefits to Auckland Transport than traditional procurement
- Quantitatively, greater cost savings than traditional procurement
- The potential to advance Penlink and therefore earlier delivery of economic benefits.

12.2 Features of a PPP

A PPP for Penlink would have the following high-level features:

- It would involve an entity contracting with Auckland Transport to design, construct, finance, operate and maintain Penlink. All of these activities would be bundled into and governed by a single contract.
- The term of the contact would be for the construction period plus a long operating period, in the order of 25 years. Both of the PPP contracts completed in New Zealand to date have a 25 year operating period, as does the proposed TGPPP.
- AT would specify its requirements for Penlink in terms of the outcomes it wants to achieve from the Project, not in terms of inputs. This would provide the contractor with flexibility and opportunity to innovate and make value-for-money choices and trade–offs without being overly constrained in the way it must construct, operate and maintain the infrastructure.
- Specifying requirements in terms of outcomes also provides a basis for a performance based mechanism for determining payments to be made to the contractor. A single periodic payment (e.g. quarterly) would be made to the contractor over the operating term of the PPP contract (i.e. the payments commence once the asset is commissioned and operating). This payment would incorporate repayment of the financing of the asset and operating costs. This allows capital and operating repayments to be linked to operational performance.

- The payment mechanism would be based on the principles of only paying for service delivered. Service delivered would be judged against a range of standards and performance measures. These standards would be related to Auckland Transport's outcomes for Penlink, the availability of the infrastructure for safe and timely journeys. The payment would be reduced (abated) where the services delivered are below the required performance standards. This would incentivise the contractor to deliver services in accordance with Auckland Transport's desired outcomes. Penlink may be able to benefit from the development of the performance regime for the TGPPP, which is being tested with the market and a final position will be reached early in 2014 with a preferred bidder. Auckland Transport may be able to gleam knowledge from NZTA's experience and the precedent set by the TGPP may be used as the based for the Penlink performance regime.
- Construction, operating and financing risk will be transferred from Auckland Transport to the contractor where it makes commercial and financial sense to do so. The starting premise will be that the contractor will be better placed to manage risks unless it is demonstrably more cost effective for Auckland Transport to do so. Risk transfer is a major feature of a PPP.

12.3 Benefits of a PPP

Bundling design, construction, operations and maintenance into a single, long-term contract, having private sector financiers exposed to the operating performance of the contractor for up to 25 years and having a well designed performance regime can deliver a range of benefits:

- AT will be presented with a range of solutions through the procurement process. It will be able to select a solution that provides it with the most appropriate combination of service quality, innovation and cost on a whole-of-life basis.
- AT will only commence payments to the contractor once Penlink has been completed to the required standards. Any cost increases due to delay will be the contractors' risk. This would provide considerable incentive for the completion of Penlink in time to ensure it is available for use in accordance with the required timetable.
- AT will only pay the contractor for what it achieves relative to the required outcomes. This provides a strong incentive for the contractor to deliver at the required level of performance.
- The payment mechanism can also be designed to incorporate strong incentives for the contractor to deliver continuous and long-term innovative solutions. Penlink will benefit from TGPPPs market-tested payment mechanism that may be able to be utilised for Penlink.
- The combination of design, build, finance with a 25 year maintenance and operating contract period provides incentives for the contract to deliver whole-of-life solutions in a cost effective manner.
- There will be some risks associated with Penlink that will be retained by AT. However, the nature of a PPP, with design, construction, financing and operations in a single contract provides significant scope for the transfer of risk to the contractor. A PPP will provide significantly more scope for whole-of-life risk transfer than is achievable under Auckland Transport's traditional procurement models.

- Linking of capital repayment and operating payments to operational performance will impose on the contract the need for rigour upfront in project delivery.
- Having private sector capital at risk (as a consequence of funding the construction costs) provides a powerful incentive for the contractor to deliver in all aspects and will incentivise the debt and equity providers in the consortium to maintain a high level of ongoing review and control compared with the other procurement models. This places additional pressure on the contractor to deliver services at the prescribed quality and quantity over the entire operating period.
- The PPP arrangement will provide financiers with the ability to replace the operator and Auckland Transport with the ability to step-in in the event of a major default. This will provide confidence in service delivery throughout the term of the PPP contract.
- The private sector partner will be expected to bring a fresh perspective to the delivery of the services that is constrained by local government processes and procedures and a focus on service delivery and achieving the required outcomes in the most efficient and effective way. The expectation is that Auckland Transport will be able to apply some of these ideas and processes to other parts of its roading network and other projects.

12.4 Penlink as a PPP

A qualitative assessment has been undertaken of the appropriateness of Penlink as a specific candidate for PPP procurement. The analysis found that the following features of Penlink are consistent with the attributes for a PPP project:

- Penlink is of a reasonable scale. It may be attractive to a range of potential private sector participants and it may be able to absorb the transaction costs that are part of a PPP transaction. A market sounding should be undertaken to test these issues with the market, particularly given the smaller scale of Penlink compared with TGPPP.
- Material risks inherent in Penlink can be adequately defined and allocated appropriately between Auckland Transport and the private sector contractor (e.g. ground conditions).
- There is scope for innovation, particularly given features such as some challenging terrain, bridge structures and challenging geotechnical conditions, as well as the opportunity to reduce the construction timeframe and optimise structures.
- It is feasible to express and quantify the outcomes that Auckland Transport requires from Penlink so they can be incorporated into a mechanism for measuring the performance for the private sector contractor and setting the amounts it is paid for delivering the services. TGPPP has the same outcome focused approach; with KPIs set against the NZTAs required outcomes and associated financial abatements for non-performance. Penlink may be able to leverage this precedent.
- It is feasible to bundle the ongoing management and maintenance of Penlink with the construction and financing into a long-term (25 year) contract.

- There may be market interest in delivering Penlink through a PPP, based on the market sounding for the TGP and the Huntly Bypass and market interest to date in the TGPPP procurement process. Although the TGPPP procurement process is demonstrating that there is a strong interest in PPPs in New Zealand, TGPPP is of a significantly different scale than Penlink which may negatively impact the level of market interest. Actual interest will depend on the details and specifics of the Project, Market experiences with NZTA through the TGPPP procurement process may also impact the interest in delivering Penlink as a PPP for AT.

12.5 Financial Analysis

Financial analysis has been undertaken to compare the costs of Auckland Transport constructing, financing and operating Penlink itself (the PSC) using a traditional D&C procurement approach, to the cost if it were designed, constructed, financed and operated by the private sector (the PBM). The financial model is included in Section 9.

The construction and operating costs in the PBM do not include any efficiencies or cost reductions that the private sector might be able to achieve. Consequently, the PBM is higher that the PSC, reflecting that the private sector financing costs are higher than the public sector financing costs. This is to be expected.

The results of the financial analysis are presented in the following table. These are presented in NPC terms at the P85 level for transferred risks and P&Q uncertainties:

Table 12-1: Summary of Financial Results

Category	Value
NPC base date	1 July 2016
NPC of the PSC	[redacted]
NPC of the PBM	[redacted]
Difference	[redacted]
Difference as a percentage of the NPC of the PBM	[redacted]

The analysis of the value for money gap has been estimated using the discount rate set by Treasury for public sector PPP procurement. That rate has not been updated on a frequent basis to reflect changes in underlying interest rates. This will mean that there can be a disconnect between the discount rate and the interest rates used in the proxy bid model. This is an increasingly important issue as interest rates rise. The Treasury are currently considering the most appropriate way of addressing this issue.

The expectation, and requirement, is that the private sector will be able to equal or “beat” the PSC by providing construction, risk management and operating cost savings to at least offset the difference in financing costs between the public and private sectors. See Section 9 for discussion on how the gap may be eliminated. Also note that the extent of the gap is subject to the relationship between interest rates and the discount rate,

The current procurement of TGPPP provides a 'real-world' comparator to see if this degree of cost efficient can be generated by the private sector. However, TGPPP is a project of significantly larger scale compared to Penlink, but it is expected that the procurement process will provide evidence of the private sector's ability to produce the required efficiencies on a transport PPP project. In October 2013, the NZTA will have two RFP responses that demonstrate if the private sector has the ability to 'bridge-the-gap' to the affordability threshold for TGPPP. While not assessed as part of this Business Case, market sounding would need to be carried out to test whether the market has similar expectations if being able to bridge the affordability threshold gap for a project of lesser scale.

12.6 Conclusion

Work undertaken during the scheme assessment phase used D&C as the procurement option for Penlink. The work undertaken in this Business Case for Implementation has identified that PPP could also be considered as a feasible procurement model.

This assessment has taken into account that a PPP is a complex and significant commitment. It has a number of important features that are quite different to Auckland Transport's traditional procurement models. A PPP will involve a very long-term contractual relationship with a private sector contract, operator and, importantly, financiers. This brings a focus to risk allocation and financial and commercial issues that are not part of, or not as transparent in, Auckland Transport's more traditional procurement models.

The assessment in this business case indicates that PPP is a feasible procurement model for Penlink. Key factors supporting the feasibility of PPP are:

- It is a viable procurement model in that the outcomes required from Penlink can be unambiguously captured in a performance based contract that provides the basis for private sectors design, construction, financing, maintenance and operation.
- Incentives can be put in place to encourage the contractor to deliver innovated design and construction of techniques, especially with regards to improving operations and maintenance efficiencies, lifecycle optimisation and road user safety.
- The private sector may be interested in the Project, given the interest to date in the TGPPP; however the smaller scale of Penlink should be testing through a market sounding.
- AT has the capability and the resources to manage the PPP procurement process effectively.

  The financial analysis and the review of available evidence from overseas suggests that the level of net financial gains that contractors would have to achieve to at least equal to the PSC is possible. A well-run procurement process to delivering Penlink through a PPP could produce bids that will equal or "beat" the PSC.
- The PPP can be designed to:
  - Bring whole-of-life innovations and improved investment certainty that would not necessarily be available under traditional procurement where there is a separation of D&C and

operation and, importantly, the incentives on efficiency that will be driven by the private sector financiers are not present.

- Transfer to the contract a range of whole-of-life risks that Auckland Transport would usually be responsible for under traditional procurement but which can be better managed by other parties.

The procurement process for a PPP is complex and time consuming. This reflects, in part, that it involves a very long-term contract (25 years or more) and that the returns to the private sector financiers will be spread over most of the contract term. All parties have an interest in ensuring that the contract will be enduring and provides for appropriate management of their respective risks and interests. Auckland Transport may have the benefit of the precedent set by the NZTA in the TGPPP as well as the Treasury's Standard Form Contract and the "testing' it has had on the two PPP deals signed to date.

A PPP has a number of risks for AT. It is a major undertaking based on a fairly complex contract. The price that Auckland Transport will pay for the services provided by the contractor will not be fully fixed at the commencement of the contract. For example under the current version of the Treasury standard form PPP contract, Auckland Transport will bear the risk of interest rate increases and changes in the consumer price index. These matters will require careful management by AT. More particularly Auckland Transport will need to consider whether it can reallocate some or all of the interest rate risk and how it should best manage any interest rate risk.

13 Management Case

13.1 Project Roles

The Project Team will comprise of:

Table 13-1: Project Roles

Role	Name
Project Sponsor (AT)	Theunis van Schalkwyk (Project Director Key Agency Initiatives)
Senior Supplier	John Schermbrucker (Manager Investigation and Design)
Senior User	Andrew Allen (Manager Road Corridor Operations)
Project Manager	Kimdon Nguyen (Senior Engineer – Investigation and Design)
Team leader	Aimee Barwick (Planning Integration Manager)
Team leader	James Hunt (Risk Framework Manager)

13.2 Governance Structure

Auckland Transport's governance structure ensures a single point of accountability for the success of a project. The governance structure below illustrates the line of accountability for this Project.

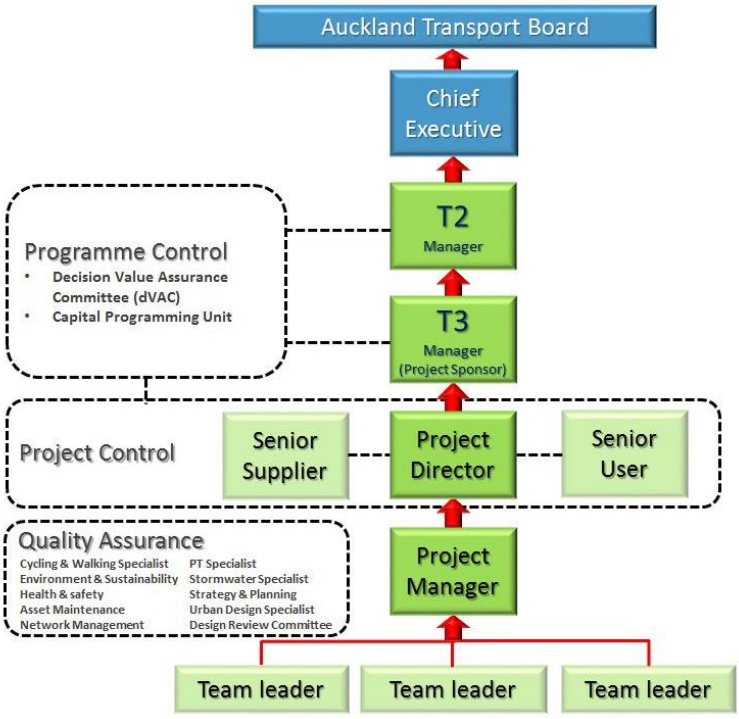


Figure 13-1: Auckland Transport Governance Structure

Roles and responsibilities of the project sponsor, project control group, project manager and the tier 2/tier 3 (T2/T3) divisional managers are discussed below.

Project Sponsor

The Sponsor provides the financial resources, in cash or in kind for the Project. At Auckland Transport, generally it is the Cost Centre Manager responsible for the project budget. The Project Sponsor is responsible for ensuring that the Project meets its objectives and delivers the projected benefits.

The Project Sponsor has the following key responsibilities:

- Remains in place for the duration of the project
- Recognised as the owner of the project throughout the organisation
- Owner of overall business change
- Responsible for the successful delivery of the project
- Ensures the project is technically and financially compliant
- Ensures the project is identified in the organisation's LTP and Integrated Transport Programme
- Proactive in providing leadership and direction throughout life of project
- Provides approvals and decisions that affect project progress and delivery
- Chair the Project Control Group (PCG) meetings
- Escalates issues beyond the delegated authority of the PCG to the SMT.

Project Control Group (PCG)

For this Project, Auckland Transport will appoint a full PCG. The PCG will assist the Project Sponsor in making sure the right activities are taking place, they are being done correctly and align with strategic goals. The PCG ensures appropriate input into the development process and maintain a high level of communication with all stakeholders.

The PCG includes:

- The Project Sponsor.
- A Senior User: The Senior User (also referred to as the client) represents the end users and promotes their concerns and interests.
- A Senior Supplier: The Senior Supplier represents the interests of those designing, developing, facilitating, procuring and implementing the project outcomes. The Senior Supplier often supplies the procurement element at the time.

PCG meetings will be held monthly. PCG members are expected to contribute to:

- The appointment of a Project Manager to organise and control the project and make sure that it meets its objectives
- The approval of project objectives, scope, the Project Initiation Document (PID) and Business Case prior to any expenditure

- Communicating information about the project to the organisation and stakeholder groups
- Be responsible for the authorisation of subsequent budget expenditure agreed by the appropriate forum, in line with the Project Plan, Phase Boundaries, and Financial Forecasts
- Briefing Council members and chief officers on the progress of projects
- Recommendations and authorisation of future actions on a project, including premature closure or extensions on deadlines or budget
- Sign off any changes in the:
    - Project plan
    - Business case
    - Budget.
- Monitoring quality control
- Managing any risks owned by the PCG that are highlighted in the:
    - Risk log
    - Issues log.
- Monitoring sign off for 'Phase End' and authorising 'Next Phase'
- Approval and sending of the Closure Notice on the project.

The key responsibilities of the PCG include:

- Ensure that the input from both the PCG and other User Groups in the development process is effectively achieved and, when required, that any issues of dispute between relevant parties are resolved.
- Provide a discussion forum with the authority to respond to requests for decisions or recommendations received from the Project Sponsor.
- Assist the Project Sponsor in the development of service plans, master plans, business cases, facility plans and contract documentation.
- Receive and endorse monthly project reports prepared by the Project Sponsor.
- Ensure the development of resources, schedules and associated costing.
- Ensure that the organisational and/or work practice changes from the agreed Business Cases are identified and achieved.
- Provide direction and guidance to themselves about objectives and strategies.
- Report progress to the SMT or a project steering group (if applicable) on a monthly basis.
- Establish Project User Groups to provide user requirements and input into the project development process.

- Meet monthly at a regular time convenient to all members or as the project timetable dictates.
- The PCG or its Chair may co-opt temporary members onto the PCG as required. The Secretary to the PCG will be in attendance and the PCG may invite others to attend meetings where necessary.
- The PCG is responsible to the SMT or a project steering group, where applicable.

Project Manager

The Project Manager is responsible for delivering the Project. The Project Manager leads and manages the Project team with the authority and responsibility to manage a project on a day-to-day basis.

The Project Manager will:

- Build and manage the relationship with the client
- Negotiate with the client and agree how the requirements and objectives will be achieved
- Prepare a Project Plan, detailing all activities required to deliver the project to agreed time, cost and quality standards
- Negotiate and agree the delivery of the project with internal support staff
- Monitor progress against plans, initiate remedial action and resolve problems to ensure delivery
- Identify and manage risks
- Carry out a detailed Stakeholder Analysis
- Produce a Stakeholder Engagement and Communication Plan
- Manage the project finances together with the departmental finance officer
- Prepare expenditure forecasts and actuals as required
- Provide regular reports to the PCG on project progress and maintain the project history for audit purposes
- Escalate issues/problems where appropriate.

T3 Department Manager and T2 Divisional Manager

The next two approval levels are the T3 Department Manager (T3 Manager) and T2 Divisional Manager (T2 Manager). It is their responsibility to ensure the Project aligns with strategic goals and is balanced within the wider programme of work.

- The T3 Manager reviews and authorises the Business Case documentation on behalf of the Chief Development Officer, Capital Development Division and executive team.
- The T3 Manager is accountable to the T2 Manager. T3 Manager escalates project issues that are outside their delegated authority or Business Case tolerances.
- Other actions include authorising funds and resources (internal or external).
- Resolve issues escalated by the Project Sponsor/PCG.
- The T3 Manager may sit on the PCG.
- The T2 Manager is accountable to the Chief Executive. Any issues which have escalated to T2 level will be resolved here, or escalated to the Executive Leadership Team (ELT) which will be chaired by the Chief Executive Officer (CEO). If further escalation is required, the issue will be escalated to the Auckland Transport Board.

13.3 Assurance and Acceptance

This Project will be reviewed by the following groups:

Capital Programming Unit

The Capital Programming Unit leads the capital programming function for Auckland Transport and is responsible in ensuring that the capital works and renewal activities are programmed to maximise the efficient use of Auckland Transport resources. With the dynamic nature of the capital programme, the Capital Programming Unit coordinates the activities to be brought forward from future years that will replace projects delayed in this financial year to ensure delivery of the LTP and that requirements from external agencies are met.

Responsibilities include capital programming to achieve the LTP/Annual Plan, progress monitoring and reporting and risk analysis of the programme. The team also coordinates and manages the 10 year LTP for Auckland Transport capital activities.

Decision Value Assurance Committee (dVAC)

The purpose of the dVAC is to provide a formal forum where significant operational decisions of the Capital Development Division can be made with a focus on optimising whole-of-life value. The intention is to ensure significant decisions are made with an appropriate mix of strategic and technical input.

Programme Optimisation Steering Group (POSG)

The POSG makes the capital development decisions needed for the management of Auckland Transport's Capital Works Programme to meet the objectives and outcomes agreed with Auckland Council and the NZTA. Decisions requiring approval from a higher financial delegation to that of the POSG are escalated to the Chief Executive or Auckland Transport Board as appropriate.

Design Review Committee

The Design Review Committee ensures consistent quality design outcomes for all Capital Development projects.

The objectives of the Design Review Committee are:

- To review scheme, preliminary and detail design drawings against Auckland Transport's approved standards and Industry best practice
- To provide feedback to Project Managers/Consultants where required, before being approved by the relevant Engineer/Manager
- To act as a forum to share knowledge and encourage learning among participants in this process.

Input is particularly critical during the delivery phases (scheme design, preliminary design and detail design) where all aspects of the design will be reviewed to ensure a high level of consistency and quality in the final product. In addition, the Design Review Committee is to promote a culture of collaborative thinking and the sharing of knowledge amongst participants.

Decision Points

At the end of each phase, management review progress and recommendations for the Project, then make a decision on whether to proceed to the next phase or not.

The Project will not advance into the next phase without an approved Business Case. Each Business Case document requires a standard set of approvals at each decision point.

The following approvals are mandatory for each Business Case document:

- Project Sponsor (for overall project control)
- Senior User (or Client) (for overview of the scope)
- Senior Supplier (for delivery resources)
- Finance Business Support (for budgets)
- Property (land acquisition)
- T3 Departmental Manager (resource allocation)
- Programme Manager (for capital works) and the (LTP programme)
- Asset Management (final owner of the asset)
- RLTP Team for NZTA funding.

At the Investigation, Design and Construction phases an additional approval is required from:

- Project Engineer (technical expertise)
- Asset maintenance and operations (operation of final product/service).

Sign-off by these parties signals acknowledgement of the information contained in the Business Case, and agreement with its recommendations. The process ensures all relevant project components are

considered and the right people participate in project planning. It gives greater confidence in the quality and accuracy of information.

Below is a summary for a typical Auckland Transport project, by phase.

Table 13-2: Project Phases

PHASE	Objectives & Priorities	Coordination & Participation	Budget & Funding	Forward Plan	Approvals to proceed
Initiation	Issues/ opportunities identified Strategic fit and objectives clarified Priority rating Technical requirements	Internal stakeholders: Investigation & Design, Strategy & Planning, Operations, Public Transport etc. External stakeholders: AC, NZTA, Iwi, Community Groups, Business etc.	Identified in LTP, RLTP, NLTP Funding availability Auckland Council versus NZTA subsidy Other funding structures available Firm estimates for undertaking feasibility phase	Resource allocation Detailed work schedule for feasibility phase	Sponsor User Supplier Finance Property T3 Manager Programme Manager RLTP Team Asset Management Additional approvals via: Programme Control Group, dVAC, POSG T2 Manager Chief Executive AT Board
Feasibility	Alternatives and options analysed Strategic fit assessments Priority ratings Technical and	Internal participation Effective external stakeholder participation	Updated whole of life estimates for LTP, RLTP, NLTP Funding availability Auckland Council versus NZTA subsidy (secure	Resource allocation Detailed work schedule for Investigation phase including: Land acquisition	Sponsor User Supplier Finance

PHASE	Objectives & Priorities	Coordination & Participation	Budget & Funding	Forward Plan	Approvals to proceed
	environmental impact assessments Economic analysis Value-for-money		where possible) Identify third party contributions or confirm alternative funding structures Firm estimates for undertaking Investigation phase	Consents	Property T3 Manager Programme Manager RLTP Team Asset Management Additional approvals via: Programme Control Group, dVAC, POSG T2 Manager Chief Executive AT Board
Investigation	Options analysed Preferred option Strategic fit assessment Priority ratings Technical and environmental impact assessments Economic analysis Value-for-money	Internal participation Effective external stakeholder participation	Preliminary estimate for whole of life updated to LTP, RLTP, NLTP Funding availability Auckland Council versus NZTA subsidy (secure where possible) Firm estimate for undertaking design phase	Resource allocation Detailed work schedule for design phase including: Land acquisition Consents Procurement	Sponsor User Supplier Project Engineer Maintenance & Operations Finance Property T3 Manager Programme Manager RLTP Team Asset Management

PHASE	Objectives & Priorities	Coordination & Participation	Budget & Funding	Forward Plan	Approvals to proceed
					Additional approvals via: Programme Control Group, dVAC, POSG T2 Manager Chief Executive AT Board
Design	Detailed design Design and peer reviews Strategic fit assessment Priority ratings Identified savings Economic analysis Value-for-money	Internal participation: Delivery and asset maintenance and operations teams Effective external stakeholder management	Firm estimate for whole of life updated to LTP, RLTP, NLTP Funding availability Auckland Council versus NZTA subsidy (secure where possible) Tendered prices for undertaking construction phase	Resource allocation Construction planning Procurement and contract management Detailed work schedule for construction phase	Sponsor User Supplier Project Engineer Maintenance & Operations Finance Property T3 Manager Programme Manager RLTP Team Asset Management Additional approvals via: Programme Control Group, dVAC, POSG T2 Manager

PHASE	Objectives & Priorities	Coordination & Participation	Budget & Funding	Forward Plan	Approvals to proceed
					Chief Executive AT Board
Construction	Assess deliverables against original strategic objectives Value-for-money	Internal participation: Delivery, asset maintenance and operations teams External stakeholder management	Remaining financial and contractual obligations	Scope of defects liability period Next steps for project review Practical completion and asset capitalisation	Sponsor User Supplier Project Engineer Maintenance & Operations Finance Property T3 Manager Programme Manager RLTP Team Additional approvals via: Programme Control Group, dVAC, POSG T2 Manager Chief Executive AT Board
Closure	Post implementation review Benefits	Internal participation External stakeholder management	Asset maintenance and operational needs confirmed	Implementation plan Records management	Sponsor User Supplier

PHASE	Objectives & Priorities	Coordination & Participation	Budget & Funding	Forward Plan	Approvals to proceed
	Lessons learned				Maintenance & Operations Finance Property T3 Manager Programme Manager Asset Management RLTP Team Additional approvals via: Programme Control Group, dVAC, POSG T2 Manager Chief Executive AT Board

13.4 Change Control

AT has established an approval process to track change/s whether they receive approval or not.

The Project Manager briefs anyone who is involved in completing a Work Package as part of the Project on the Change Process. Levels of change authorisation are established at the outset of each phase.

Any Change Request must include a detailed description of the proposed change and its impact on the Project as a whole, in respect to time, cost and quality. Some changes could have significant impact and these would require PCG/Project Sponsor approval. It is for the Project Manager to determine the level of authorisation required based on the tolerances agreed in the Business Case document. Once approved, the Work Packages are updated and reissued.

Auckland Transport has formally documented the Change Control Process (PPGN 002 Guide to Project Change Management).

13.5 Cost Management

AT has a robust monthly financial reporting system for tracking and managing actual project costs against project budget. This process reports the actual spend for the month and year to date and compares that with the anticipated spend. Any variances are investigated and reported separately.

AT also uses a monthly project reporting system that tracks project spend to date and forecasts the whole-of-life expenditure. Any expected variance greater the $500,000 needs to be authorised within the financial delegations before any increased spending can be committed.

It is the responsibility of the Project Manager to track expenditure on the Project. Financial tracking on a project is a forecast of expenditure against the plan. Departmental finance officers submit returns to Central Finance on expenditure for consolidation. The accuracy of these returns is the joint responsibility of the Project Manager and the Finance Officer for the Project.

Tracking Sheets have been developed by the Programme Implementation Group to assist both the Financial Officers and Project Managers to track expenditure on projects. All Project Managers are required to:

- Forecast expenditure for the financial year.
- Forecast the expenditure for the complete project life cycle.
- Track the project expenditure to date.
- Produce a detailed up-to-date commentary on a monthly basis. This includes information on the forecast and expenditure sheet linked to the project highlight report (PHR) (discussed in more detail below).

13.6 Issues Management

AT has standardised a procedure to recording issues and track their progress through to conclusion[51].

As with the Risk Log and Lessons Learned Log, a unique number must be allocated to each issue. It may also be necessary to allocate ownership to one or more individuals. It includes reference to who raised the issue as well as the type of issue.

It may not be possible to resolve all issues during the life cycle of the Project but the Issues Log provides a vehicle for managing them and assessing their impact.

The Issues Log are frequently reviewed and updated by the Project Managers and used at formal project meetings where the status and progression of outstanding and new issues are discussed.

The PHR is also submitted to the Project Sponsor on a monthly basis on a date scheduled in advance. This report is intended to be an overview for the Project Sponsor, and a copy is available to the Programme Team to enable the capital programme to be monitored for current and forecast expenditure against budget. It also highlights the progress and any associated high-impact risks or issues.

The Red, Amber and Green (RAG) indication against progress, cost and risk provides a visual indication of how the Project Manager rates the current situation in these areas.

[51] Auckland Transport Document – PPM 010 Project Issues Log.

14 Lessons Learned and Post Implementation Monitoring

14.1 Lessons Learned

The Lessons Learned Report is generated for the PCG/Project Sponsor at the closing down phase of the Project. Auckland Transport has developed a template for this report to be used on its projects[52].

The lessons learnt from this Project will be fed back into Auckland Transport's project development and delivery lifecycle through various mechanisms and levels of project and corporate management. These include the project management office, project management training workshops, Lessons Learnt Review and Contract Management Review process.

Given the magnitude and public and political exposure of the Project, it is expected that the full project management process, including gateway reviews, would be undertaken, particularly if the Project was funded by way of a PPP. The funding for project management and gateway reviews has been included in the project budget.

Project Managers will maintain a Lessons Learned Log[53] throughout the project life cycle. All staff involved in the Project will be encouraged to share lessons learned so that they can be added to the Lessons Learned Log.

These experiences will provide valuable reference information for similar projects in the future.

14.2 Post Implementation Monitoring – Approach and Schedule

Project Closure Report

The Project Closure Report allows the business to assess deliverables against original objectives. The Project Closure Report summarises:

- Project deliverables and performance
- Effects of changes on the Project
- Impact of changes on the Project
- Next steps for reviewing the Project.

Identified project benefits will be monitored as the Project progresses through detailed design, construction and operation.

The Auckland Transport benefits management process is outlined in Figure 14-1 below. Accountability for benefits management sits at Project Control Group level in the project hierarchy:

[52] Auckland Transport Document – PPM 020 Lessons Learned Report.
[53] Auckland Transport Document – PPM 012 Project Lessons Learned Log.

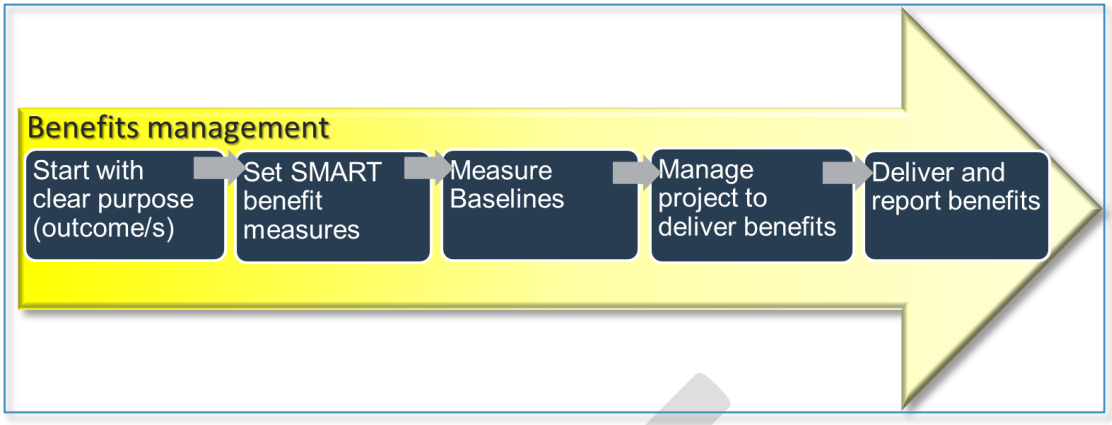


Figure 14-1: Auckland Transport Benefits Management Process

Post Implementation Review

A post construction monitoring regime will be developed and costed to assess whether the outcomes envisaged have been delivered. This benefits realisation assessment will then allow lessons learnt and mitigation plans to be developed and fed back into AT.

The post implementation review document[54] includes:

- An assessment of how the Project performed against benefits, objectives, scope, deliverables, schedule, expense and resource targets in project planning documentation
- A rating of conformance against each of the project processes, including time, cost, quality, change, risk, issue, procurement, communications and acceptance management
- A list of project achievements
- Lessons learned and recommendations for future projects.

The Project Manager will schedule an internal Project Closure Meeting a few weeks after the Project has been completed.

Financial completion may follow some time later and there is further requirement to ensure that all contracts are closed. This report includes an overall performance review and any further lessons learned.

The Post Implementation Review requires approval through the project and programme governance structure (which includes Programme level reviews by the SMTs dVAC).

[54] Auckland Transport Document – PPM 022 Post Implementation Review.

Benefits Realisation

The Benefits Review Plan is used to define how and when a regiment of the realisation of the project benefits can be made. The Benefits Review Plan:

- Clearly lay out exactly what benefits are to be measured
- Identifies who is accountable for the expected benefits
- Clarifies exactly how each benefit will be measured and when they can be measured
- Covers the period over which the benefits will be realised
- Details a baseline for reference
- Documents how the performance of the project product will be reviewed.

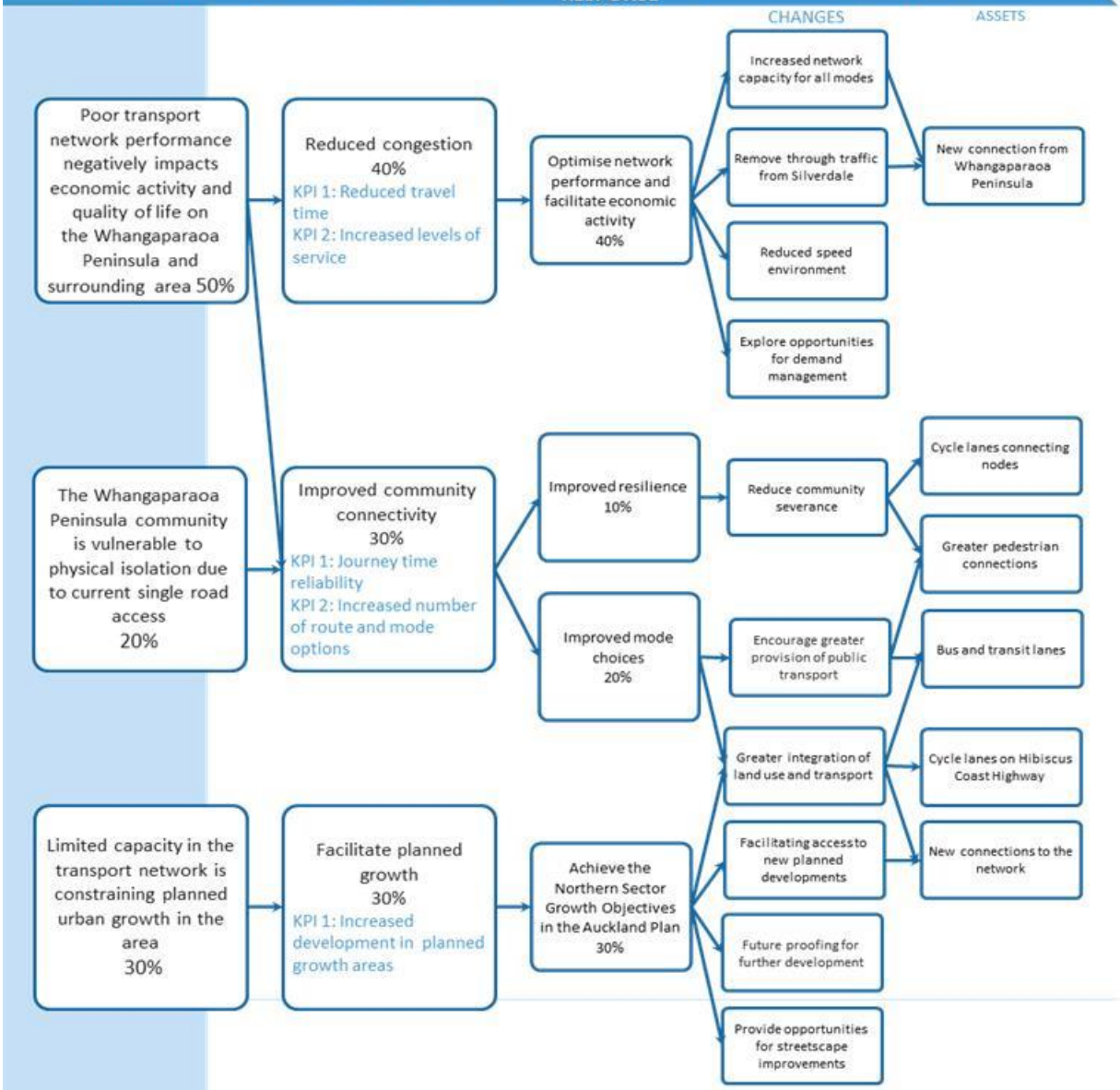
The Benefits Review Plan ownership should be passed on by the project board, and corporate/programme management will ensure that the individuals that held the Senior User roles are held to account.

Appendix A – Investment Logic Map

AUCKLAND TRANSPORT

Penlink

INVESTMENT LOGIC MAP
Initiative



Investor: Kevin Doherty
Facilitator: Lauren Jewell
Accredited Facilitator: No

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Initial Workshop: 25/07/2013
Last modified by: Lauren Jewell 30/07/2013
Template version: 5.0

Appendix B – Alternatives Assessment Summary

	Scoping Options									Service Delivery Options		Implementation Options	
Reference to	**SCO1**	**SCO2**	**SCO3**	**SC04**	**SC05**	**SCO6**	**SCO7**	**SC08**	**SC09**	**SDO1**	**SDO2**	**IMP1**	**IMP2**
Description of Option	**Do Nothing**	**Additional lanes on Whangaparaoa Road**	**Ferry Services to Peninsula**	**Bus PT**	**Widen Hibiscus Coast Highway +SC02**	**Penlink Two Lane Option**	**Penlink Two Lane +Passing Lane(s)**	**Penlink Two Lane + East Coast Road Grade Separation**	**Penlink Four Lane Option**	**Auckland Transport**	**New Zealand Transport Agency**	**Standalone**	**With Puhoi to Warkworth**
Investment Objective													
Poor transport network performance negatively impacts economic activity and quality of life on the Whangaparaoa Peninsula and surrounding area	No (0-2)	Partial (4-6)	No (2-4)	No (2-4)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Yes (8-10)				
The Whangaparaoa Peninsula community is vulnerable to physical isolation due to current single road access	No (0-2)	No (0-2)	Partial (4-6)	No (0-2)	No (0-2)	Yes (8-10)	Yes (8-10)	Yes (8-10)	Yes (8-10)				
Limited capacity in the transport network is constraining planned urban growth in the area	No (0-2)	Partial (4-6)	No (0-2)	No (2-4)	Yes (6-8)	Partial (4-6)	Partial (4-6)	Yes (6-8)	Yes (8-10)	Partial (4-6)	No (0-2)	Yes (6-8)	Yes (8-10)
NZTA Investment and Revenue Strategy Criteria													
Strategic Fit	No (0-2)	No (2-4)	No (0-2)	No (0-2)	Partial (4-6)	Yes (6-8)	Yes (6-8)	Yes (8-10)	Yes (8-10)				
Effectiveness	No (0-2)	No (2-4)	No (2-4)	No (2-4)	Partial (4-6)	Partial (4-6)	Partial (4-6)	Yes (8-10)	Yes (8-10)	No (2-4)	No (0-2)	Yes (6-8)	Yes (6-8)
Efficiency	No (0-2)	No (2-4)	No (0-2)	Partial (4-6)	No (2-4)	Yes (8-10)	Yes (8-10)	Yes (8-10)	Yes (6-8)				
Critical Success Factors													
Business Needs	No (0-2)	No (0-2)	No (0-2)	No (2-4)	No (2-4)	Yes (6-8)	Yes (6-8)	Yes (8-10)	Yes (8-10)				
Benefits Optimisation	No (0-2)	No (2-4)	No (2-4)	Partial (4-6)	No (2-4)	Yes (6-8)	Yes (6-8)	Yes (8-10)	Yes (8-10)				
Potential Achievability	Yes (8-10)	Partial (4-6)	Partial (4-6)	Partial (4-6)	Partial (4-6)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Partial (4-6)	No (0-2)	Yes (6-8)	Yes (6-8)
Supply side capability	Yes (8-10)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Yes (8-10)	Yes (8-10)	Yes (8-10)	Yes (8-10)				
Affordability	Yes (8-10)	No (0-2)	Yes (6-8)	Yes (6-8)	No (0-2)	Yes (6-8)	Yes (6-8)	Yes (6-8)	Partial (4-6)				
Summary	Continued for VFM	Discounted	Discounted	Discounted	Discounted	Possible	Possible	Possible	Preferred	Possible	Discounted	Possible	Possible

- [1] As all of the CSFs are important, any options that scored no have been discounted.
- Business needs and strategic fit - how well the option meets the agreed investment objectives, related business needs and service requirement, and integrates with other strategies, programmes and projects
- Potential value for money - how well the option maximises value for money from both the perspective of the organisation and society, and minimises associated risks
- Potential achievability - how well the option is likely to be delivered given the organisation's ability to respond to the changes required, and matches the level of available skills required for successful delivery
- Service provider capacity and capability - how well the option matches the ability of potential service providers to deliver, and appeals to providers
- Potential affordability - how well the option can be met from likely available funding, and matches other funding constraints.
- The ‘strategic fit’ criteria in the IRS help us to select the right activities under the GPS that have the greatest potential to support a thriving New Zealand and safe land transport system. The strategic fit criterion also ensures that our investment decisions are aligned with the directions and priorities in the GPS 2012.
- The ‘effectiveness criteria’ in the IRS help us select the activities most likely to succeed in achieving the desired GPS impacts and the ones that are ready to proceed in terms of both planning and funding availability.
- The ‘efficiency criteria’ in the IRS help us select those activities providing the greatest benefit for the least cost, and use best practice procurement models. Essentially, the efficiency criteria ensure that activities are delivered for the best possible price.
- http://www.nzta.govt.nz/planning/programming/docs/nltp-2012-15-irs.pdf.

Appendix C – Capital Cost Estimates

Table C-1: Scheme Estimate

	Project Estimate - Form B **Project Name : PENLINK PREFERRED OPTION** **SUMMARY OF ALL RELEVANT OPTIONS**			**SE** **20/09/2013** **Scheme Estimate**
Item	**Description**	**Base Estimate**	**P50 Contingency**	**P95 / Funding Risk**
A	**Net Project Property Cost**	[redacted]	**0**	**0**
	Investigation and Reporting			
	- Consultancy Fees	included		
	- Auckland Transport Managed Costs	included		
B	**Total Investigation and Reporting**	**4,850,000**	**970,000**	**632,000**
	Design and Project Documentation			
	- Consultancy Fees	included		
	- Auckland Transport Managed Costs	included		
C	**Total Design and Project Documentation**	**16,975,000**	**3,395,000**	**2,202,000**
	Construction			
1	**MSQA**			
	- Consultancy Fees	included		
	- Auckland Transport Managed Costs	included		
	- Consent Monitoring Fees	included		
	- Toll Gantry Back Office Costs	8,100,000		
	Sub Total Base MSQA	**22,650,000**	**4,531,000**	**2,939,000**
	Physical Works			
2	Environmental Compliance	8,113,300		
3	Earthworks	55,280,754		
4	Reclamation	0		
5	Ground Improvements	4,037,370		
6	Drainage	6,411,150		
7	Pavement & Surfacing	15,560,284		
8	Bridges (2 No pedestrian overbridges)	67,386,757		
9	Retaining Walls	28,655,650		
10	Traffic Services	6,176,725		
11	Service Relocations	1,844,000		
12	Landscaping & Urban Design	853,010		
13	Traffic Management Temporary works	2,425,000		
14	Preliminary and General Costs	45,754,470		
15	Rounding	6,830		
	Sub Total Base Physical Works	**242,506,000**		
D	**Total Construction**	[redacted]	**62,600,000**	**39,250,000**

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Project Estimate - Form B Project Name : PENLINK PREFERRED OPTION SUMMARY OF ALL RELEVANT OPTIONS				SE 20/09/2013 Scheme Estimate
Item	**Description**	**Base Estimate**	**P50 Contingency**	**P95 / Funding Risk**
E	**Project Base Estimate (P0) (A+B+C+D)**	**313,340,000**		
F	**Contingency** (Analysed)		**71,500,000**	
G	**Project Expected Estimate (P50)**	**(E+F)**	[redacted]	
H	**Funding Risk** (Analysed)			**45,023,000**
I	**95th percentile Project Estimate (P95)**	**(G+H)**		[redacted]

Date of Estimate: 23 July 2013	**Cost Index (2nd Qtr/2013)**
Estimate prepared by Carl Viljoen (Beca)	**Signed: 20/09/13**
Estimate internal peer review by Brian Lonergan/ Warren Perkins	**Signed: 20/09/13**
Estimate external peer review by	**Signed**
Estimate accepted by AT	**Signed**

These estimates are exclusive of the following:

- GST, escalation, operating costs and finance costs.
- Contingency on property as this is already purchased.
- Property interest and holding costs.
- Rental surpluses and property sales.
- NZTA subsidies.

The following potential additional scope items have been identified through the risk but no allowance for it have been made in the above estimate:

- Grade separation of side roads
- East Coast Road realignment for future busway
- Ramp signals to East Coast Road interchange
- Traffic signals and auxiliary lane to roundabouts in East Coast Road
- Cycleway.

NOTE: This Preferred Option Summary consists of the following sections:

- Penlink Base Summary
- 4-Lane Option
- East Coast Road Grade Separation Option
- Grade Separation of Duck Creek Road Option
- Extra Lane on Bridge over SH1 Option

Appendix D – Maintenance Cost Estimates

The O&M costs (real, Q2 2013) are shown in the table below:

Appendix E – Risks included in the PSC

Table E-1: Risks Included in the PSC

Risk #	Risk category	Risk Description	Risk Allocation	
			Contractor	Shared
Design and Construction risks				
DC1	Environmental	New flora/Fauna sites found	✓	
DC2	Environmental	Changing sea levels result in the need for the design to cater for higher sea levels	✓	
DC3	Environmental	Extra work required beyond base estimate to comply with environmental consents	✓	
DC4	Iwi/Heritage Issues	New archaeological/historic sites found	✓	
DC5	Iwi/Heritage Issues	Breakdown in relationship with Iwi	✓	
DC6	Resource Management Act Consents	Noise - Increase in requirements at development locations over and above current allowance	✓	
DC7	Consents	Noise - levels during construction not met (10 year consent) or noise levels met but not acceptable to local communities	✓	
DC8	Consents	Consents impose requirements for further approvals during construction	✓	
DC11	Site/Ground Conditions	Ancillary land is required (e.g. equipment, materials storage) over and above designation	✓	

Risk #	Risk category	Risk Description	Risk Allocation	
			Contractor	Shared
DC12	Site/Ground Conditions	Carbon offsets required following removal of trees (re-planting will reduce this requirement, this captures the residual risk)	✓	
DC13	Site/Ground Conditions	Unexpected liquefaction (poor) ground conditions encountered	✓	
DC15	Site/Ground Conditions	Known fault line under bridge may coincide with bridge pier locations	✓	
DC16	Site/Ground Conditions	DTM found to be inaccurate. DTM is based on LIDAR	✓	
DC17	Site/Ground Conditions	Unforeseen hazardous / contaminated materials encountered particularly Hugh Greens property / army training ground (including unforeseen unexploded ordinance)	✓	
DC18	Construction Risks	Contractor's workload affects construction schedule (shortage of machinery and labour)	✓	
DC19	Construction Risks	Scope / design creep - intended to cover instances where the current base estimate may not meet the performance requirements of the road (i.e. pavement design is not sufficient to meet the required outcomes)	✓	
DC20	Construction Risks	Health and Safety/industrial relations/public demonstrations issues arise during construction	✓	
DC21	Construction Risks	D & C contractor/sub-contractors becomes insolvent	✓	
DC22	Construction Risks	Adverse weather impacts on contractor's programme and production	✓	
DC23	Construction Risks	Road safety audit at the end of construction identifies deficiencies	✓	

Risk #	Risk category	Risk Description	Risk Allocation	
			Contractor	Shared
DC24	Construction Risks	Unforeseen utilities requirements and existing	✓	
DC25	Natural Events	Force majeure (i.e. earthquake, landslide, flood, tidal wave and other disasters or emergencies not insured which constitute a specified MAE)		✓
DC26	Design Issues	Additional stormwater treatment devices / capacity required due to increased pavement area.	✓	
O&M risks				
OM1	Maintenance	Ineffective operation of tolling system, delays in repairs, failure of tolling system due to equipment breakdown, failure due to lack of performance of supplier e.g. electricity	✓	
OM2	Maintenance	Operational costs (this risk effectively covers the uncertainty around O&M costs as there is no explicit uncertainty modelled as there is for D&C)	✓	
OM3	Maintenance	Force Majeure events during operations	✓	✓
OM4	Maintenance	Stability of slope and erosion is not adequately designed for, which increases operating costs (small slip, e.g. 1 in 4 year event)	✓	
OM5	Maintenance	Stability of slope and erosion is not adequately designed for, which increases operating costs. Known risks with landscape for blowing out bridges and culverts. (larger slip that causes damage, e.g. 1 in 10 year event)	✓	

OM6	Maintenance	Failure of mitigation (planting). Achieving certain targets part of consent conditions	✓	
Risk #	**Risk category**	**Risk Description**	**Risk Allocation**	
			Contractor	**Shared**
OM7	Lifecycle	Poor pavement design and construction results in increased maintenance costs	✓	
OM8	Lifecycle	Poor structure design and construction results in increased maintenance costs	✓	
OM9	Lifecycle	Ongoing settlement, post defects and liabilities warranty period. Slips		✓

Appendix F – Reviews and Audits

Peer Review

Peer reviews have not been undertaken at this stage as there is some uncertainty around whether Penlink will be brought forward. A decision from the Auckland Transport Board to bring budgets forward for Penlink is expected at the end of November 2013. Once this is confirmed, work will be progressed to undertake the appropriate peer reviews to support the updated design in preparation for PPP procurement.

Peer reviews of the following are planned:

- Beca – Traffic and Economic Analysis (2 October 2013 – Draft version)
- Beca – Cost Estimate (July 2013 – Refinements to estimate needed following design refinement as part of Planning Strategy).

A peer review of the design (including structures, stormwater, etc) will be carried out as part of the PPP design.

Safety Audits

Safety audits of the amended four lane design for Penlink have not been undertaken at this time. The current design is schematic and only proposes to demonstrate that the required cross section/outcomes can be constructed within the existing designation boundary to satisfy the requirements prior to the procurement of the PPP. It is anticipated that all necessary safety audits will be carried out as part of the PPP design phase when further detail will be available to assist with the assessment.

Appendix G – Consenting Strategy

[redacted]

[redacted]

[redacted]The scope of the Planning Strategy includes:

- A review/gap analysis of the existing designation and consents to confirm the required planning work needed for Penlink.
- Finalisation of the Planning Strategy outlining the proposed forward plan, programme, risks and methodology.
- Refinement of the specimen design to better inform the AEE based on the gap analysis.
- Engagement, co-ordination and management of specialists and their inputs needed to prepare the AEE.
- Preparation of the NoR and consent documentation.
- Assistance with consultation with the public, key stakeholders and affected parties.
- Liaison with Auckland Council consent teams.
- Lodgement of the consents.
- Preparation, attendance and presentations for relevant hearings.
- Collaborative engagement with legal services with regards to hearings and appeals.

Appendix H – Property Strategy

[redacted]

[redacted]

[redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]
  - [redacted]
  - [redacted]

[redacted]

Appendix I – Reconciliation of the PSC to the Auckland Transport Scheme Estimate

The following table provides a reconciliation from the PSC to the Auckland Transport estimate and an explanation of the each of the items.

The following adjustments are required to the PSC in order to reconcile back to the Auckland Transport scheme estimate:

i. The PSC is has been subject to both escalation to reflect inflation and discounting to reflect the time value of money. The first step in reconciling to the Auckland Transport scheme estimate is to remove the impact of discounting, by presenting the PSC as a nominal value.

ii. Operating costs are included in the PSC to calculate the whole-of-life cost of the Project over a 25 year operating period. These costs are not included in the Auckland Transport scheme estimate and therefore they are required to be removed.

iii. Competitive neutrality adjustments are specific to the PSC and are not included in the Auckland Transport scheme estimate. Therefore they have been removed as part of the reconciliation.

iv. The risk adjustments included in the PSC are not included in the Auckland Transport scheme estimate however contingencies are. Therefore, the risk adjustments they have been removed as part of the reconciliation.

v. Escalation to reflect inflation is added to all costs inputs in the PSC (construction, risk and operating cost inputs) at the rate of [redacted] per annum. The Auckland Transport scheme estimate does not include inflation and therefore it has been removed.

vi. Property costs are not included in the PSC as they are a cost to AT. There are no property costs in the scheme estimate.

Appendix J – WEBs Modelling – Assumptions Paper

Approach to valuing WEBs

Our approach to valuing WEBs is based on NZTAs EEM, which provides a framework for evaluating the comprehensive and robust wider economic impacts (WEIs) of transport investments. The EEM approach is in turn based on New Zealand-specific work conducted for NZTA in 2011 by Kernohan and Rognlien[55]. We have referred to Kernohan and Rognlien (2011) for key parameters and calculations.

WEBs arise as a result of market imperfections such as price-cost margins (PCM), taxes on labour supply that lead to additional impacts to the conventional benefits, and productivity spillovers that cannot be internalised by firms.

In line with EEM guidance, we have valued three broader monetisable benefits:

- Agglomeration benefits
- Imperfect competition benefits
- Tax wedge on increased labour supply.

Table J-1 provides a brief summary of the types of benefits expected, and the relationship between benefits measured in the EEM and WEIs.

Table J-1: Relationship between standard benefits and WEIs

Standard benefits		Wider Economic Impacts
Reduced generalised costs of travel for:	⇨	Agglomeration benefits (increased effective job density)
• Business travel	⇨	Imperfect competition benefits
• Commuter trips	⇨	Tax wedge on increased labour supply
• Other trip purposes		
Reduced negative externalities / increased positive externalities:		
• Reduced vehicle emissions		

[55] Kernohan and Rognlien (2011), "Wider economic impacts of transport investments in New Zealand", NZTA research report 448.

Three main relationships are worth noting:

1. Reduced costs for business travel result in wider economic impacts due to imperfect competition, which results in a wedge between hourly labour costs (which are valued under the EEM procedures) and the market value of output. WEI procedures are intended to capture the value of this "wedge".
2. Reduced costs for commuters lower the cost of working and hence encourage inactive workers to enter the labour supply. The direct benefits to those workers (and their employers) are valued by the EEM procedures as they are expected to be equivalent to travel time savings. However, taxes on labour result in an externality in the form of a "tax wedge" on labour income.
3. Transport improvements increase effective job density and hence result in agglomeration benefits by facilitating access between existing jobs. The EEM specifies procedures for valuing these benefits.

The value of the three WEBs, calculated over a 40-year evaluation period using a 6% discount rate, is summarised in Table J-2:

Table J-2: Summary of WEBs

Category	Value	Derivation
Agglomeration benefits	$97.1M	EEM procedures
Imperfect competition benefits	$24.3M	Calculations and parameters from Kernohan and Rognlien (2011)
Labour supply benefits	$22.5M	Calculations and parameters from Kernohan and Rognlien (2011)

Source: PwC Calculations

Imperfect competition benefits

These benefits arise as a result of a market imperfection in the form of price-cost margins (PCM). PCM is the "mark-up" that firms charge over and above their marginal cost of production. In a perfectly competitive market, PCM is expected to be zero as no firm will have enough market power to charge above marginal cost.

Imperfect competition benefits are expected to be proportional to the reduction in the generalised cost of travel for business travel only. Based on an estimated PCM of 20% for all New Zealand industries and the estimated elasticity of aggregate demand, Kernohan and Rognlien (2011) estimate imperfect competition benefits to be equivalent to 10.7% of the reduction in generalised cost of travel for business purposes. The source of this estimate is summarised below.

Table J-3: Recommended Parameter Values for Imperfect Competition Benefits

Parameter	Description	Value
εad	Aggregate demand elasticity	-0.6
Pcm	Price cost margin	20%
T	Ratio of imperfect competition benefits to user benefits	0.107

The transport modelling conducted for Penlink, and hence the calculation of the conventional economic benefits of the Project, has not distinguished between business trip purposes and other trips purposes. As a result, it has been necessary to estimate the share of overall demand and transport benefits associated with business travel.

We estimated the share of conventional benefits accruing to business trip purposes using values from EEM Tables A2.3 and A2.4, which report average traffic composition, by vehicle type, and average occupancy and trip purpose, by vehicle type, for urban arterial roads. Based on this information, we estimated that approximately 30% of total benefits were related to business travel. The values from the EEM used to derive this figure are summarised in the table below.

Table J-4: EEM Table A2.3, Table A2.4

Table A2.3				Table A2.4			
Road type Time Period		Vehicle Class	Traffic Composition	Average Occupancy	Trip Purpose		
					Work	Commute	Other
Urban Arterial	AM peak	Car	85%	1.4	10%	50%	40%
		LCV	10%	1.4	65%	20%	15%
		MCV	2%		90%	5%	5%
		HCVI	1%	1.2	90%	5%	5%
		HCVII	2%		90%	5%	5%
	Interpeak	Car	84%	1.3	30%	10%	60%
		LCV	11%	1.4	65%	5%	30%
		MCV	2%	1.2	90%	0%	10%
		HCVI	1%	1.2	90%	0%	10%
		HCVII	2%	1.2	90%	0%	10%
	PM Peak	Car	84%	1.4	10%	30%	60%
		LCV	11%	1.4	65%	15%	20%
		MCV	2%	1.2	90%	5%	5%
		HCVI	1%	1.2	90%	5%	5%
		HCVII	2%	1.2	90%	5%	5%

NZTA classifies vehicles into six vehicle classes for the purpose of estimating traffic composition and value of time. These vehicle classes, which are summarised above in Table J-4, are:

- Passenger cars (cars and station wagons with a wheelbase of less than 3.2 metres)
- Light commercial vehicles (LCVs) (vans and light trucks up to 3.5 tonnes gross laden weight
- Medium commercial vehicles (MCVs) (two-axle heavy trucks without a trailer, over 3.5 tonnes gross laden weight)
- Heavy commercial vehicle I (HCVI) (trucks with or without a trailer, with three or four axles)
- Heavy commercial vehicle II (HCVII) (trucks and trailers and articulated vehicles with five or more axles)

- Buses (excluding minibuses).

Tax wedge on increased labour supply

Reduced time and cost of commuting can enable easier access to work. A reduction in the perceived cost of working through a transport service improvement is likely to induce more people to work than would otherwise be the case. This may result from encouraging previously inactive people to join the labour market or by reducing the likelihood that workers leave the labour market. Alternatively, it may be the case that a proportion of commuting time savings will be allocated to productive work activities.

As described above, the benefits of increased user supply to the workers that enter the labour market and the firms that employ them are already captured in the reduction in generalised costs for commuters. The WEB related to increased labour supply is the "tax wedge" collected on the additional labour income[56].

The value of the increased labour supply WEB is expected to be proportional to the reduction in the cost of commuting and the elasticity of labour participation with respect to wages. This is represented in the following formula:

$$Wider\ economic\ impact = \frac{commuting\ time\ saving}{(average\ earnings) * (1 - average\ tax\ rate)} * (elasticity\ of\ labour\ supply) * (value\ added\ per\ worker) * (tax\ rate\ on\ new\ labour\ supply)$$

Kernohan and Rognlien (2011) provide New Zealand-specific estimates of the parameters for this equation. The approach expects to use these parameters, which are summarised in the table below, to calculate the benefit of the tax wedge on increased labour force participation.

Table J-5: Recommended parameter values for labour market impacts

Parameter	Description	Values
T^L	Indirect tax parameter (to convert gross to net earnings)	32%
ε^{ls}	The elasticity of labour participation with respect to wages	0.4
T^{ls}	The tax take on increased labour supply	26%

As discussed above, the transport modelling conducted for Penlink, and hence the calculation of the conventional economic benefits of the Project, has not distinguished between commuter trips purposes and other trips purposes (i.e. trips to and from external zones, some of which are commute trips). As a result, it has been necessary to estimate the share of overall demand and transport benefits associated with commuter trips.

[56] This approach is consistent with previous work on the tax wedge for the CRL, which was based on Venables (2007), "Evaluating urban transport improvements – cost-benefit analysis in the presence of agglomeration and income taxation", *Journal of Transport Economics and Policy 41*.

We estimated the share of conventional benefits accruing to commuter trips using values from EEM Tables A2.3 and A2.4, which report average traffic composition, by vehicle type, and average occupancy and trip purpose, by vehicle type, for urban arterial roads. Based on this information, we estimated that approximately 19% of total benefits were related to business travel. The values from the EEM used to derive this figure are summarised in the table in the previous section.

Defining agglomeration procedures

Our approach to valuing the agglomeration impacts of the Project is based on procedures defined in the EEM. EEM volume 1, Appendix A10 ("National Strategic Factors") defines these procedures.

The rationale for valuing agglomeration impacts is as follows:

- Firms derive productive advantages from close spatial concentration of economic activity. These include intra-industry localisation economies (which spillovers between firms operating in the same industry) and extra-industry urbanisation economies (which are related to the proximity of large markets for inputs and outputs).
- Transport costs are an important determinant of the amount of economic activity that firms can access from any given position. Reducing travel time and travel costs can increase the "effective density" of an area by making it more accessible from surrounding regions.

In order to value agglomeration impacts, we implemented the seven steps defined in Appendix A10 of the EEM. However, we note that it was necessary to deviate slightly from the procedures in some areas due to data availability issues. We have sensitivity tested the impact of the assumptions that were made in the process on the NPV of agglomeration impacts.

Step 1: Define the spatial area of analysis and the evaluation period

The study area is currently defined as the area covered by the Hibiscus Coast (HBC) Traffic model owned by Auckland Transport. The HBC model covers the parts of the former Rodney District Council from Puhoi in the north to Oteha Valley Road in the south and SH17 in the west. This model is broken into 130 zones, including ten external zones that serve as a proxy for travel to areas outside the study area.

In line with EEM guidance, we used a 40-year project evaluation period running from 2013 (the current year) to 2052. Agglomeration impacts were modelled using HBC model outputs for the follow years:

- 2016 [two years ahead of Penlink's intended opening date of 2018]
- 2021
- 2031
- 2041.

Step 2: Gather economic data

Step 2 in the EEM requires us gather a range of transport model outputs and economic data for all modelled years. This includes:

- Employment (full-time-equivalent employees) data, by zone, for all future years being modelled
- Estimates of gross domestic product (GDP) by model zone. These are obtained by distributing regional GDP to individual zones in proportion to employment by zone, plus any adjustments for differences in industry structure or ex ante productivity as needed
- Estimated agglomeration elasticities by zone. These are calculated on the basis of industry-level agglomeration elasticities and data on base year employment by industry in model zones
- Transport model outputs on demand and generalised costs for all modelled transport modes, trip purposes, and time periods, for the Do-Minimum and the Option.

Table J-6 defines the economic data that we gathered in order to carry out these calculations. However, we note that issues with data availability required us to vary these procedures in several areas. We describe these variations below.

Table J-6: Required information for agglomeration procedures

Required information	Output format	Source
Agglomeration elasticities by ANZSIC industry	N/A	EEM volume 1, Table A10.1
Total employment (employee counts), for: • Retail • Non-retail	By model zone and for zones outside model	Input to HBC model
2012 (base year) employment by industry	By model zone and for zones outside model	Sourced from Statistics NZ employment tables
Estimated GDP and labour productivity within study area	Total across study area	Calculated by PwC on the basis of Statistics NZ employment and National Accounts tables
Total number of trips, broken down by trip purpose: • Home-based work (commuters) • Non- home-based trips • Home-based shopping • Home-based education (schools) • Home-based other • Light commercial vehicles	Origin-destination matrices, including 130 model zones and external zones	HBC model outputs

Required information	Output format	Source
• Heavy commercial vehicles • External-to-external trips And time period: • AM peak • Interpeak • PM peak		
Total generalised cost of travel, broken down by trip purpose: • Home-based work (commuters) • Non- home-based trips • Home-based shopping • Home-based education (schools) • Home-based other • Light commercial vehicles • Heavy commercial vehicles • External-to-external trips And time period: • AM peak • Interpeak • PM peak	Origin-destination matrices, including 130 model zones and external zones	HBC model outputs
Concordance matrix between HBC model zones and Statistics NZ geographic areas	Table matching HBC zones to Statistics NZ geographic areas (meshblocks, area units)	Comprehensive concordance matrix not available (see below)

Variations from Step 2 of EEM agglomeration procedures

There were three main factors that required us to deviate from the EEM agglomeration evaluation procedures.

First, the limited coverage of the HBC model, which does not model transport outcomes beyond Puhoi (in the north), Oteha Valley Road (in the south), and SH17 (in the west), has required us to make some assumptions about agglomeration outcomes for travel to or from external zones.

The relatively limited size of the study area means that it is not possible to estimate the overall effects of reduced cost of travel for trips that begin or end outside the HBC model area as the costs of travelling outside the study area are not modelled. However, we expect Penlink to result in an increase in accessibility from the Whangaparoa Peninsula to employment areas south of Albany. This is likely to result in some benefits due to potential reductions in travel time and large concentrations of economic activity to the south.

A lack of information about travel times outside of model zones will constrain our ability to implement agglomeration procedures for the whole of Auckland. Rather than estimating agglomeration benefits only within the study area, which is not likely to provide a comprehensive view on agglomeration impacts, we have chosen an approach that will result in a conservative but defensible estimate of the agglomeration of trips to external zones.

In this approach, we have assumed that all trips to or from external zones will begin or end in the nearest large concentration of employment. We have defined these areas quite tightly based on employment data from Statistics New Zealand's Business Demography tables. For example:

- We have assumed that trips to or from areas south of the study area are destined for (or originated from) the nearest businesses in the Albany area unit
- We have assumed that trips to or from areas north of the study area are destined for (or originated from) the nearest businesses in the Warkworth area unit.

Second, the lack of a comprehensive concordance matrix between model zones and the Statistics New Zealand geographic area boundaries required us to take an alternative approach to gathering economic data on employment in the study area.

The concordance matrix made available to us was not sufficient to allow us to gather data on employment by industry for all model zones. Of the 130 zones in the HBC model, only 78 were matched to Statistics New Zealand geographic areas (meshblocks, area units). However, the concordance matrix did provide sufficient contextual information to allow us to match the study area as a whole to Statistics New Zealand area units. As a result, we were able to:

- Gather information on 2012 employment by industry for the study area as a whole
- Estimate 2012 GDP and labour productivity for the study area as a whole based on Statistics New Zealand employment and National Accounts tables.

However, it was necessary to take an alternative approach to calculating agglomeration elasticities for the HBC model zones, albeit one that is likely to produce reliable results. We calculated agglomeration elasticities for each model zone, in each future year, as follows:

- First, we used Table A10.1 from EEM volume 1 and data on 2012 employment by industry for the study area to calculate agglomeration elasticities for the Retail and Non-Retail industries
- Second, we gathered the employment inputs to the HBC model, which break down employment by zone into Retail and Non-Retail employment for modelled years
- Third, we used HBC employment input data and agglomeration elasticities to estimate weighted average agglomeration elasticities for each model zone.

Third, the lack of GDP growth forecasts for the study area required us to make some high-level assumptions about how GDP would grow in light of modelled employment growth. These assumptions are material for the overall estimate of the agglomeration impacts of Penlink, as we discuss below in the sensitivity testing. This is due to the fact that agglomeration impacts are calculated by multiplying the percentage increase in effective density resulting from a transport improvement against the GDP in the study area – in other words, higher forecast GDP leads to a higher agglomeration impact.

We estimated the GDP in each model zone in modelled years as follows:

- First, we calculated 2012 labour productivity, defined as GDP per employee, for Retail and Non-Retail industries the study area as a whole based on Statistics NZ employment and National Accounts tables
- Second, we gathered the employment inputs to the HBC model, which break down employment by zone into Retail and Non-Retail employment for modelled years
- Third, we projected growth in GDP per employee over the evaluation period based on the assumption that labour productivity would grow at an average rate of 1% per annum for both Retail and Non-Retail industries
- Fourth, we calculated the GDP in each model zone by multiplying together projected GDP per employee and employment in Retail and Non-Retail industries for each modelled year.

Finally, as the assumptions that we have made with respect to the economic characteristics of the study area in order to carry out Step 2 are likely to have an impact on our estimate of agglomeration impacts, we sensitivity tested them in order to determine which assumptions were likely to be material.

Step 3: Calculate weighted average generalised costs

In Step 3, we calculated the weighted average generalised cost of travelling between zones for all modelled years (2016, 2021, 2031, and 2041) for the Do-Minimum and the Option. We used HBC model outputs for demand and generalised cost of travel to calculate an average generalised cost of travel between all model zones, across:

- All time periods
- All trip purposes.

The outputs from this calculation are origin-destination matrices reporting the average cost of travel between all model zones.

As the data available from the HBC model is sufficient to carry out this step, it was not necessary to deviate from the EEM procedures.

Step 4: Calculate effective density, by zone, for each scenario

In Step 4, we calculated the effective density of each zone for all modelled years (2016, 2021, 2031, and 2041) for the Do-Minimum and the Option. In order to do so, we carried out the following two steps:

- For each origin-destination pair, we divided the projected employment in the destination zone by the average generalised cost of travel from the origin to the destination (as calculated in Step 3) to obtain the ease of accessing jobs in the destination zone from the origin zone
- For each zone, we summed up the ease of accessing jobs across all relevant origin-destination pairs to obtain the effective density of that model zone.

The outputs from this calculation are arrays containing the effective density of each model zone.

Step 5: Calculate productivity gains by zone

In Step 5, we calculate the expected impact of the increase in zones' effective density between the Do-Minimum and the Option on GDP in the model zone, for all modelled years (2016, 2021, 2031, and 2041). In order to do so, we carried out the following three calculations:

- First, we calculated each zone's percentage difference in effective density, as calculated in Step 4, between the Do-Minimum and the Option
- Second, we multiplied each zone's percentage difference in effective density by its agglomeration elasticity estimated in Step 2 to obtain an estimate of the likely percentage increase in productivity in that zone
- Third, we multiplied each zone's likely percentage increase in productivity resulting from increased effective density by its GDP, as estimated in Step 2, to obtain an estimate of the absolute change in GDP in that zone.

The outputs from this calculation are arrays showing the absolute change in GDP, relative to the Do-Minimum, for each model zones.

Step 6: Sum output increases across all zones in the study area

In Step 6, we summed up the increase in GDP in each zone, as calculated in Step 5, in order to obtain the total increase in GDP for the entire study area in each modelled year.

Step 7: Calculate net present value of benefits

In Step 7, we calculated the net present value (NPV) of agglomeration impacts in the study area. In order to do so, we implemented the following steps:

- First, we used straight-line interpolation to estimate agglomeration impacts in the years that were not modelled over the 2013-2052 evaluation period
- Second, because Penlink is intended to open in 2018, we used outcomes for the 2016 model year to estimate outcomes for 2018-2020 but did not include any impacts in 2016 or 2017
- Third, we discounted agglomeration impacts to 2013 values using a discount rate of 6%, in line with EEM guidance, plus sensitivity tests of 4% and 8%.

Main results

Table J-7 reports the estimated agglomeration impacts of the Project, with sensitivity tests for different discount rates and lengths of evaluation period. We note that:

- The agglomeration impact at the standard 6% discount rate and 40 year evaluation period is $97.1 million
- The agglomeration impact at the 8% discount rate and 30 year evaluation period previously used for transport evaluations is $56.0 million.

Table J-7: Net present value of agglomeration impacts

Evaluation Period	Discount Rate		
	4%	6%	8%
30 years	$104.4M	$75.6M	$56.0M
40 years	$145.8M	$97.1M	$67.4M

Source: PwC Analysis

The agglomeration impact results from the cumulative effect of:

- A relatively small decrease in the average generalised cost of a trip in or through the study area
- Resulting in a small percentage increase in the overall GDP of the study area, which is estimated to be in excess of $2 billion.

The magnitude of these effects are reported in Table J-8:

Table J-8: Modelled reduction in generalised cost of travel, increase in study area GDP

Year	Average GC of travel, all origins and destinations		% reduction in average GC	% increase in study area GDP
	Do-Minimum	Option		
2016	17.9	17.5	-2.0%	0.1%
2021	20.7	20.1	-2.8%	0.2%
2031	23.5	22.6	-3.8%	0.3%
2041	35.4	33.8	-4.5%	0.3%

Source: HBC model, PwC calculations

Caveats and challenges

We emphasise that it is necessary to use caution when using these estimates of the agglomeration impacts of Penlink. First, the assumptions underlying these calculations have been validated where possible, and generally represent a conservative and hence more robust position, but they are still potentially subject to questions.

Second, we emphasise that it is also desirable to think carefully about whether the arguments about agglomeration impacts of transport projects are likely to apply in the study area. The localisation economies (EEM: "efficiency gains that arise from the increased scale of a particular industry operating in close proximity") and urbanisation economies (EEM: "productive advantages that accrue to firms through location in large population centres such as cities") fundamental to agglomeration may not necessarily apply in practice.

Some characteristics of the Penlink study area may reduce the scope for productivity gains for agglomeration.

For example:

- Existing employment densities within the study area are low, and not forecast to increase to a significant degree, which may limit the scope for agglomeration within the area
- Distances to significant concentrations of employment outside the study area remain relatively large, limiting the scope for large-scale economic interaction between businesses relative to a more concentrated centre of employment such as a city centre
- Firms in the study area may be less likely to benefit from agglomeration economies – as evidenced by the fact that they have chosen a low-density location in the first place.

Sensitivity tests of economic assumptions

As discussed above, there were three factors that required us to deviate from the EEM agglomeration evaluation procedures:

- The limited coverage of the HBC model, which does not model transport outcomes beyond Puhoi (in the north), Oteha Valley Road (in the south), and SH17 (in the west), which has required us to make some assumptions about agglomeration outcomes for travel to or from external zones
- The lack of a comprehensive concordance matrix between model zones and the Statistics New Zealand geographic area boundaries, which required us to take an alternative approach to gathering the economic data required for Step 2
- The lack of GDP growth forecasts for the study area, which required us to make some high-level assumptions about how GDP would grow in light of modelled employment growth.

We have sensitivity tested these assumptions to understand their likely impact on the agglomeration impacts of the Project.

First, we sensitivity tested different assumptions about employment in the external zones. Table J-9 reports the results of sensitivity tests for starting (2012) employment in the external zones – i.e. the size of the employment areas that are accessed by travel beyond the study area's borders. We note that using a higher, less conservative assumption will increase the NPV (at 6%) from $97.1 million to $128.8 million – suggesting that this assumption is material.

Table J-9: Sensitivity tests for 2012 employment in external zones

Employment in external zones	Discount Rate		
	4%	6%	8%
Base case assumption	$145.8M	$97.1M	$67.4M
High assumption	$194.6M	$128.8M	$88.9M

Source: HBC model, PwC calculations

Table J-10 reports the results of sensitivity testing for different employment growth rates in the external zones. While this assumption has a smaller effect than the assumptions reported in Table J-9, it does have a considerable impact on the estimate of agglomeration impact.

Table J-10: Sensitivity tests for projected employment growth in external zones

Employment growth rate in external zones	Discount Rate		
	4%	6%	8%
0% (low scenario)	$134.2M	$90.0M	$62.9M
1% (base case)	$145.8M	$97.1M	$67.4M
3% (high scenario)	$176.5M	$115.7M	$79.0M

Source: HBC model, PwC calculations

Second, we performed sensitivity testing on our assumption about the agglomeration elasticity for Non-Retail industries that we applied across all model zones. Table J-11 reports the results of a high-level sensitivity test in which we reduced or increased agglomeration elasticities across the board – i.e. testing the outcomes had we systematically under- or over-estimated elasticities, which is unlikely. This sensitivity test suggests that our choice of agglomeration elasticity is less material – a systematic over- or under-estimate would reduce or increase the NPV (at 6%) by roughly $6 million.

Table J-11: Sensitivity tests for agglomeration elasticities

Agglomeration elasticity estimate	Discount Rate		
	4%	6%	8%
Base case (2012 study area industry average)	$145.8M	$97.1M	$67.4M
Low estimate	$136.9M	$91.0M	$63.1M
High estimate	$154.7M	$103.1M	$71.7M

Source: HBC model, PwC calculations

Third, we performed sensitivity tests on our assumption that labour productivity, or GDP per employee, would grow at an average rate of 1% over the evaluation period. This assumption proved to be highly material for our estimate of agglomeration impacts:

- A lower labour productivity growth rate of 0% reduces the NPV (at 6%) from $97.1 million to $78.9 million
- A higher labour productivity growth rate of 2% increases the NPV (at 6%) from $97.1 million to $120.2 million.

Table J-12: Sensitivity tests for GDP per employee growth rates

Labour productivity growth rate	Discount Rate		
	4%	6%	8%
0% (low scenario)	$116.5M	$78.9M	$55.6M
1% (base case)	$145.8M	$97.1M	$67.4M
3% (high scenario)	$183.2M	$120.2M	$82.2M

Source: HBC model, PwC calculations

Model validation

Our model of Penlink's agglomeration impacts has been reviewed and validated internally.