Appendix F

Integrated Transport Assessment prepared by Bloxam Burnett & Olliver

Waikato Regional Airport Ltd and Titanium Park Limited
Hamilton Airport Central and Southern Development Precincts

Integrated Transport Assessment
April 2018

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Waikato Regional Airport Ltd and Titanium Park Limited
Hamilton Airport Central and Southern Development Precincts

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1.0 EXECUTIVE SUMMARY

Waikato Regional Airport Ltd (WRAL) and Titanium Park Limited (TPL) has undertaken a review of the original development masterplan and structure plan for the Central and Southern Precincts of the Titanium Park Business Park (Titanium Park), and concluded that some fundamental changes to the access strategy are needed to ensure the masterplan reflects WRAL's core focus, being the Airport and terminal operations.

This Integrated Transport Assessment presents the proposed changes and addresses the transport effects.

Central Precinct Access

- WRAL wish to shift the position of the future SH 21 roundabout access to ensure it serves the objectives of the Airport first and foremost, while providing appropriate access to the business park.
- Section 5.1 identifies the proposed new location for the future roundabout, being approximately 100m to the north of the existing Airport access intersection.
- A roundabout with geometric design in accordance with Austroad standards and an overall diameter of 60m is achievable in this location.
- The position of the roundabout achieves a separation distance of 560m to Mystery Creek Road, which complies with the NZTA Planning Policy Manual requirements.
- Lochiel Road intersection with SH 21 will remain in its present form as a stop controlled 'T' intersection. Lochiel Road has very low daily flows with compliant sightlines looking to the north from the stop limit line, but non-compliant sight distance to the south by 98m. The lack of crash history suggests that this is not a significant impediment to the safe function of this intersection. The resulting effects of Lochiel Road / SH 21 remaining as a 'T' intersection are considered to be minor and acceptable.
- The 'Ashton Block' of land was not rezoned for industrial land use and there is no formal requirement to provide access via the roundabout for such landuse. So there are no transport effects to be considered.

Southern Precinct Access

- TPL consider that the significant disruption and cost to the Airport operations to build the internal road between the Central and Southern Precinct is not viable. In addition, the focus for TPL is the Airport operation and it would be beneficial to avoid having heavy vehicles mixing with airport traffic across the front of the Terminal building and public parking areas. To address this, BBO have identified at a high level, a proposed concept design for a new intersection on SH 21 to provide access to the Southern Precinct.
- Two potential options are identified, with Option 2 being the preferred in principle by WRAL, NZTA and Waipa District Council. The Option 2 intersection separation distance to Mystery Creek Road is 500m, and to the SH 3 roundabout, 965m. This complies with the NZTA Planning Policy Manual minimum separation distance of 500m between intersections.

- A separation distance of 200m is provided to the existing right turn bay intersection access for the John Roberts Contracting site, on the opposite side of SH 21. This separation distance complies with the NZTA Planning Policy Manual minimum of 200m.
- The existing property access at #108 Airport Road (Numax Industries) will require relocation northwards for safety reasons. Land owner agreement has been obtained for this.
- The preferred intersection design for the Southern Precinct also involves extending the existing deceleration lane on the opposite side of the road northwards approximately 50 metres, and remarking this lane with hatched chevron markings to form a wide shoulder. Heavy vehicles turning right out of the Southern Precinct can then make efficient use of the wide shoulder for southbound acceleration.
- The internal road connection across the gully between the Southern and Central precincts is proposed to be deleted from the Structure Plan. However, a path providing walking and cycling connectivity between the Southern and Central precincts will remain. The path avoids any need for walking or cycling trips on SH 21 between the two precincts.

Intersection Performance and Timing

- The WRTM identifies that SH 21 traffic volumes are predicted to increase by 2500 vpd in 2021 due to the Hamilton Section of the Waikato Expressway.
- Similarly, the Southern Links SH 3 section is predicted to reduce volumes on SH21 between Mystery Creek Road and SH 3 by 45-50%.
- TPL now intend to develop the total 18.4ha area previously identified as office/research and development, as light industrial. On this basis the total combined light industrial area in the Central and Southern Precincts will be 23.35 ha. The reduction in trip generation is 55% in the PM Peak and 60% in the AM Peak.
- The existing Right Turn Bay Airport intersection is now predicted to reach the MoA "construction" trigger of 45s/veh (LOS E) delay for building the SH 21 roundabout in about 2027 with 95% of the Central Precinct developed. This is on the basis of SH 21 volumes increasing with the opening of the Hamilton Section of the Waikato Expressway in 2021.
- The proposed SH 21 / Airport access roundabout performs well with LOS A on SH 21 and LOS B (10s average delay) on the Airport access road through to 2041, with full development of the Central Precinct as predominantly industrial land use. With Southern Links SH 3 section built by 2038 the roundabout performance improves to LOS A for all movements.
- The recent successful application to the central government Infrastructure Fund to enable development of the Peacocke Residential Growth Cell, may be a catalyst that brings forward construction of portions of Southern Links.
- The proposed SH 21 / Southern Precinct intersection performs well for 15 years (up to LOS D) with 100% development traffic added. The performance worsens to LOS E (45s/veh average delay) after 20 years, at 2037-38.
- On the basis that the SH3 section of Southern Links is under construction from 2033 and completed by 2038 the right turn out delay at the Southern Precinct intersection is unlikely to reach 45 s/veh, and instead will be performing much better with an average

delay of 10 s/veh (LOS B). This demonstrates that the intersection has sufficient capacity to perform satisfactorily for 20 years until Southern Links provides an alternative to SH21.

Overall, this assessment demonstrates that the revised access strategy for the Central and Southern Precincts of Titanium Park is practical and safe, with effects that are either less than minor or acceptable for the long term until Southern Links transport corridors provide an alternative to SH 21 as a strategic link between SH 3 and SH 21.

The revised access strategy also aligns with the draft GPS2018, and Regional and District land transport strategies which all have transport safety, economic development and increased walking and cycling as key objectives. The proposed roundabout and separate intersection access for the Southern Precinct, together with the walking and cycling path between the two Precincts meet these objectives

Accordingly, the following recommendations are made in support of the revised access strategy for Titanium Park Central and Southern Precincts:

- That the revised roundabout location for the Central Precinct together with the Option 2 Southern Precinct intersection concept, as described in this ITA, be advanced with the NZ Transport Agency for written approval;

- That, upon agreement with the NZ Transport Agency and Waipa District Council, the revised access arrangements are confirmed in the District Plan with an amended Airport Business Structure Plan that shows:
    - The future SH 21 roundabout position in general accordance with Drawing 144380/01/P/0101_A
    - The proposed Southern Precinct access intersection in general accordance with Drawing 144380/01/P/0221_A

- That the Airport Business Zone Structure Plan is amended to delete the internal road connection presently shown between the Southern Precinct and Central Precinct, and only a shared walking and cycling path be provided.

- That the existing designation for the roundabout at Lochiel Road, and for the Lochiel Road realignment be uplifted.

- That the existing vehicle access to #108 Airport Road (Numax Industries) is permanently closed and replaced by a new access to the same standard approximately 85m north of the existing access location, subject to NZ Transport Agency approval.

2.0 INTRODUCTION

2.1 REPORT PURPOSE

This report is an Integrated Transport Assessment in accordance with Appendix 5C of the NZTA Planning Policy Manual and Table 21.2.16.2 of the Waipa District Plan. The report assesses the transportation effects of Waikato Regional Airport Ltd (WRAL) and Titanium Park Ltd (TPL) proposed changes to the development masterplan for the Central and Southern development precincts of the Titanium Park Business Park that is located at the Hamilton Airport. The Central and Southern development precincts are located on the eastern side of the main runway, and are accessed from SH 21.

2.2 BACKGROUND OVERVIEW

Hamilton Airport is a critical hub in the Waikato Regions transport infrastructure. The Airport was established at its current site at Rukuhia off SH 21 in 1935. During World War 2 it was taken over by the Royal New Zealand Airforce. In 1946 the air force operation officially ended, and the Waikato Aero Club began flying from the airport.

Since then, the Airport has developed into a regional airport with scheduled domestic passenger services, and in the mid-1990s and 2000s operated as an international airport through the introduction of scheduled flights to Australia. These have since discontinued.

WRAL is the owner and certified operator of Hamilton Airport. During 2004, WRAL undertook a comprehensive review of their land holdings, with a view to planning development of the Airport and its surrounds. As a result, they identified 173ha of land for their long term operational needs including runways, runway extensions, safety areas, taxiways, navigation aids and the passenger terminal. They also identified approximately 117ha of land not needed for the direct operational requirements of the Airport, which became the 'Titanium Park Business Park'.

To bring the development potential into fruition a WRAL entered into a Joint Venture with McConnell Property, called the Titanium Park Joint Venture (TPJV).

In 2007 the Joint Venture lodged plan change to rezone land from Rural to Airport Business. (Plan Change 57). As part of this plan change application a transportation assessment was completed that addressed the transportation effects and access options to the airport and Titanium Park. This process resulted in the land being rezoned Airport Business in the Waipa District Plan (in 2010) and included a Structure Plan for the area. A copy of the Structure Plan is attached in Appendix A.

The Structure Plan defined that transport access to the Central and Southern development precincts would initially be from the existing airport terminal intersection on SH 21 for up to 8ha of business park land use, and after that or should adverse effects require it earlier, a new multi-lane roundabout intersection would be constructed at a location near Lochiel Road, and the existing airport intersection and Lochiel Road intersection with SH 21 would be permanently closed.

This work also culminated in the signing of a Memorandum of Agreement (MoA) between the NZ Transport Agency and WRAL. The MoA defined the future intersection configurations and a series of effects based triggers and monitoring requirements to determine when the new roundabout was to be planned, designed and constructed, and the existing right turn bay intersection closed.

In 2016, the TPJV was dissolved and TPL now takes responsibility for managing and developing the Central and Southern Precincts of Titanium Park and overseeing the wider WRAL land holdings.

Figure 1, on the following page, illustrates the site locality and approximate locations of the Central and Southern development precincts relative to the airport terminal.

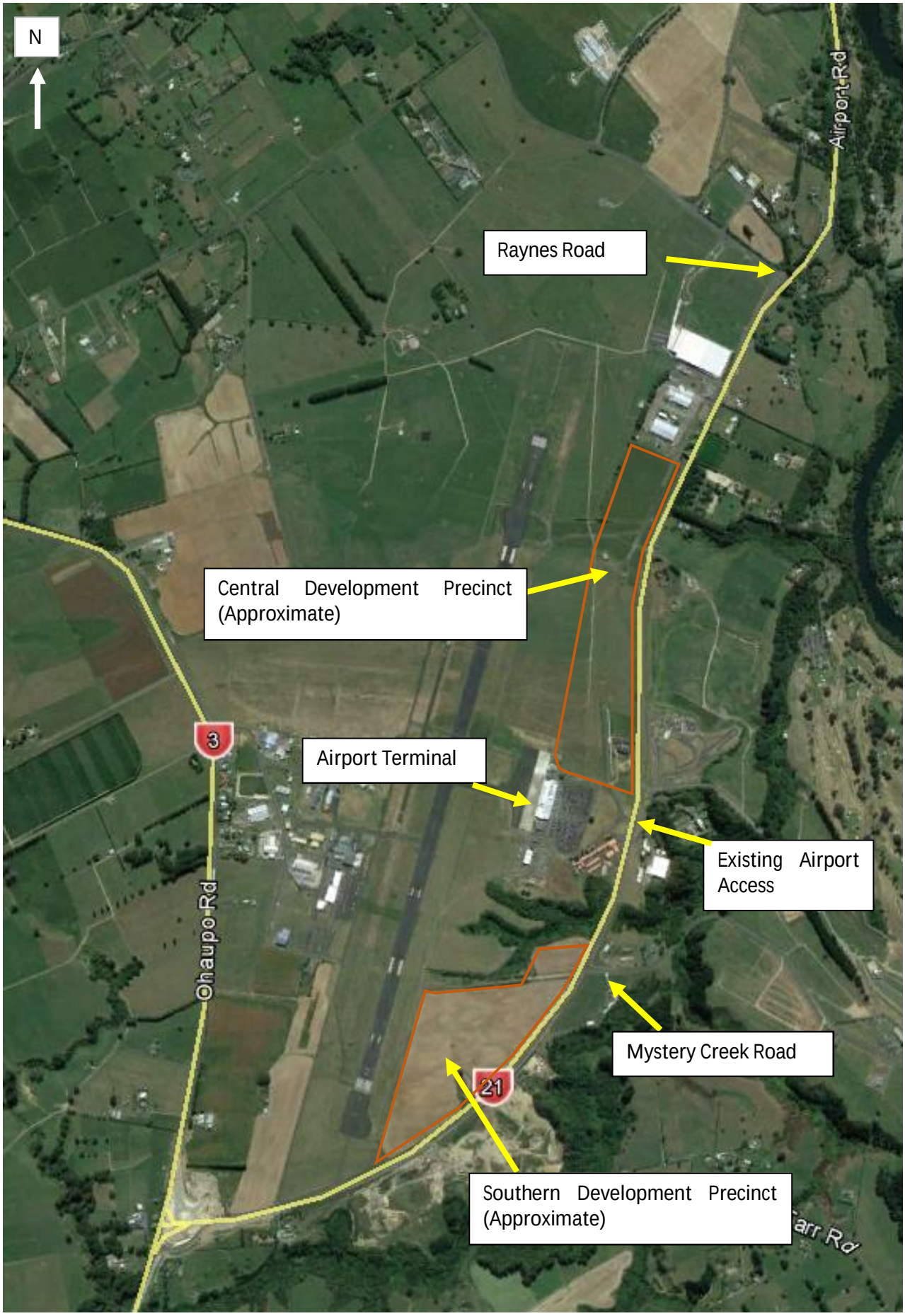


Figure 1: Site Location

2.3 CURRENT PROPOSAL OVERVIEW

Following the dissolution of the TPJV partnership with McConnell Property in 2016, Titanium Park Limited (TPL) took over ownership and development of the Central and Southern Precinct areas of Titanium Park.

WRAL and TPL has undertaken a review of the original development masterplan and structure plan, and concluded that some fundamental changes are needed to ensure the masterplan reflects WRAL's core focus being the Airport and terminal operations, with the business park development and operations secondary to that.

On this basis, the proposed key amendments include:

- Ensuring the airport terminal is the prominent focal point upon entry from SH 21, as it currently is.
- Revise the future SH 21 roundabout access position to achieve the above objective, while also serving appropriate access to the business park.
- Developing the Airport Business Zone Central and Southern Precincts predominantly as industrial land use rather than separate offices with research and development activities as allowed for under current District Plan rules. However, the small allowance of retail (5,300sq.m GFA) activity in the District Plan rules is be retained.
- Develop the Southern Precinct separately from the Central Precinct. No vehicle connectivity between the two areas due to the significant topographical constraint (deep gully) and existing and future airport operations constraints (fuel storage, water reservoir, car parking, terminal traffic circulation). However, walking and cycling connectivity between the two precincts is to remain.
- Access the Southern Precinct through a separate intersection to SH 21.

The original ITA for the plan change (Plan Change 57) assessed the transport effects based on the following land use activities and associated development areas. These relate to the Morris Bray Architects Master Plan Issue K for Titanium Park which was the basis of the plan change assessment of environmental effects.

Central Precinct

- Area J — 14.0 ha of Airport Terminal (including runway apron)
- Area G — 3.6 ha of terminal support (commercial)
- Area H — 0.53 ha GFA of retail
- Areas E,D — 4.95 ha of light industrial
- Areas K,I — 2.66 ha or airport hotel
- Area H — 3.50 ha of office/research and development

Southern Precinct

- Area M — 14.9 ha of office/research and development

The Central and Southern Precincts of the Master Plan are shown below in Figure 2. The letters in each colour coded area are referred to above and again in Section 6.

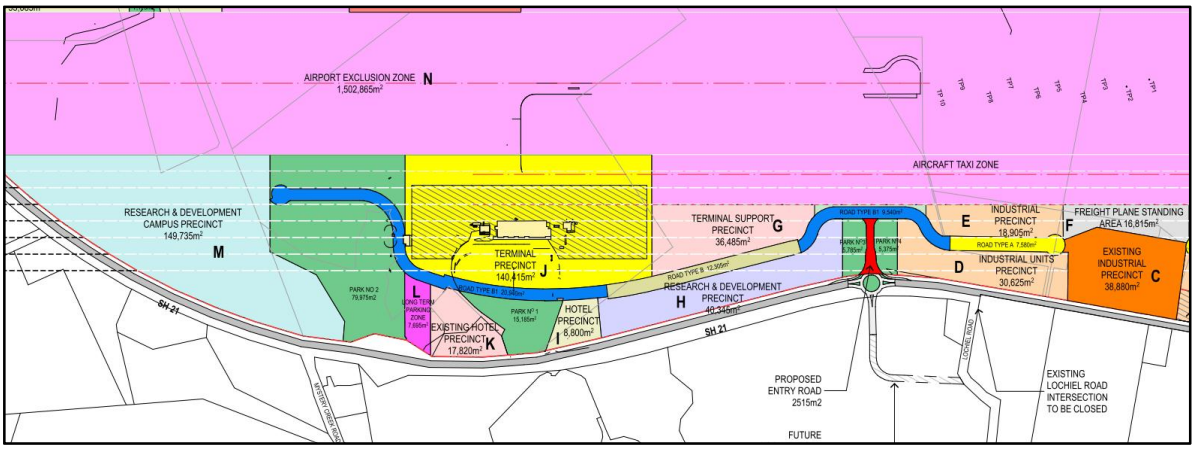


Figure 2: Airport Business Zone Master Plan – Central and Southern Precincts

Over the last 12 months the uptake of industrial land within the Central Precinct has increased to a level whereby approximately 5.7 ha of land (excluding land for roading) will be allocated[1] for industrial development.

There has also been increased interest for larger industrial sites, such as that purchased by Visy in the Western Precinct. TPL have earmarked the Southern Precinct (Area M) for similar large lot industrial development with the potential that this land is serviced by a single intersection on to SH21 and with no connection between the Southern Precinct and the Central precinct/terminal.

There has been very little interest in land at Titanium Park for office/research and development activities. Instead, TPL now primarily intend to develop the total 18.4 ha area identified for office/research and development, as light industrial, and with the small allowance for retail. On this basis, the total combined area for light industrial activities in the Central and Southern Precincts will be 23.35 ha.

These changes in land use together with the airport and terminal operations being WRAL's core business give rise to the need for a re-evaluation of the transport effects and site access strategy.

[1] Allocated means where titles have been created or subdivision consent has been granted.

3.0 TRANSPORTATION STRATEGIES AND POLICY

3.1 NATIONAL STRATEGIES

Government Policy Statement on Land Transport 2018/19 - 2027/28 (Draft)

The draft Government Policy Statement (GPS2018) outlines this Government's priorities for expenditure from the National Land Transport Fund over the next 10 years. It also provides guidance to decision-makers about where the Government will focus resources, consistent with the purpose of the Land Transport Management Act, which is:

"To contribute to an effective, efficient, and safe land transport system in the public interest."

The land transport GPS2018 identifies new strategic priorities and amended objectives to the previous GPS, with themes focussed on safety, mode neutrality, liveable cities, regional economic development, protecting the environment, and delivering the best possible value for money.

Accordingly, the key strategic priorities of the GPS2018 are defined as Safety and Access, with supporting strategic priorities of Value for Money and Environment protection. These are defined further as follows:

- *Safety: A safe system, free of death and serious injury;*
- *Access: Provides increased access to economic and social opportunities, enables transport choice and is resilient;*
- *Value for Money: Delivers the right infrastructure and services to the right level, at the best cost;*
- *Reduces the adverse effects on the climate, local environment and public health;*

Further explanation of the Themes in the GPS2018 to assist with delivering the strategic priorities are:

- *Addresses current and future demand for access to economic and social opportunities;*
- *Provide appropriate transport choices;*
- *Is resilient;*
- *Is a safe system, increasingly free of death and serious injury;*
- *Mitigates the effects of land transport on the environment; and*
- *Delivers the right infrastructure and services to the right level at the best cost.*

National Land Transport Programme 2015-2018

The National Land Transport Programme provides an overview of the investment expected between 2015 and 2018 and what this spending will be focused on achieving. The National Land Transport Fund's investment is aimed squarely at improving economic growth and productivity, safety, and value for money. This

reflects the strategic direction set by the 2015 Government Policy Statement on land transport as stated above.

The Transport Outlook 2017

The Transport Outlook 2017 provides an overview of what we can expect by way of traffic movements in the future. The population of New Zealand is expected to grow consistently over the next 50 years which will create additional demand on New Zealand's transport networks. Of particular relevance to this proposal is the projected increase in freight movements and general traffic movements on Waikato's Transport network.

Connecting New Zealand (2012)

Connecting New Zealand (2012) was prepared by the Transport Agency to provide an overview of the government's broad policy direction for the transport sector from 2012 to 2022. The overall objective for transport is as follows:

"The government is seeking an effective, efficient, safe, secure, accessible and resilient transport system that supports the growth of our country's economy, in order to deliver greater prosperity, security and opportunities for all New Zealanders."

New Zealand Transport Agency Long Term Strategic View

The Long Term Strategic View captures the pressure points and key economic, environmental, and population factors that will shape the transport system we need for the future. Of most relevance to this proposal is the Hamilton section, which describes Hamilton as being the third fastest growing urban area in New Zealand.
More specifically, this section recognises Titanium Park as an area which "will house commercial, industrial, manufacturing and aviation enterprises and provide a range of purchase options catering to businesses of all sizes".

This document sets out a number of objectives for the Hamilton area (including Titanium Park) which are as follows:

- *Managing the staging, impact and affordability of growth (Hamilton being a high growth area) including timely delivery of transport services and infrastructure. Strategic policy is to provide for 50% of future demand through urban intensification and the balance in green field areas being Rototuna, Peacocke, Rotokauri and Ruakura with existing capacity for 30 years supply. These are all growth areas identified in the FutureProof Strategy and Hamilton Urban Growth Strategy.*
- *Addressing urban safety within Hamilton due to a poor safety record resulting in a high social and personal cost.*
- *The preference for private car travel. The existing transport network supports high personal transport usage with projections for continued high car use. Continued high vehicle usage means increased pressure on the transport network. The city has recognised and anticipates future capacity constraints and congestion.*
- *Supporting and optimising the strategic national function of the Waikato Expressway.*

- *Ensuring social wellbeing and protecting the local environment.*

New Zealand Transport Agency Statement of Intent 2017-2021

This statement of intent presents a new direction for the Transport Agency. Over the next three to five years the Transport Agency aims to deliver three big changes that form the foundation of this new direction:

- *One connected transport system: Transform the performance of the land transport system by integrating digital technology with physical infrastructure to create a safe, connected system that works for everyone.*
- *People-centred services: Simplify our customers' lives and our partners' work with innovative services and experiences that make it easy for them to do what they need to.*
- *Partnerships for prosperity: Unlock social and economic opportunities for customers, businesses and communities through targeted partnerships.*

Comment: The proposed new access arrangements for the Central and Southern Precincts of the Airport Business Zone are considered to be safe and efficient access solutions. The proposed access arrangements will provide the appropriate capacity to enable the Airport and business park to deliver regional economic growth while providing safe and efficient accessibility to the airport, both business park precincts and the surrounding transport network at an appropriate cost. The revised Central and Southern Precinct access strategy directly supports increased economic growth for the Waikato region and a roundabout provides a very safe State Highway access to the Airport where tourists and visitors to the region come together. The proposed change in access arrangements will provide for the social wellbeing of its users by providing safe and efficient access to places of employment within the airport and both precincts.

The proposed development will come at no cost to the government given it is developer led by TPL. TPL have consulted with the Transport Agency as part of this proposal, and the Agency is in support of the new access arrangements.

As such, it is considered that the proposed change in access arrangements for the Airport and Central and Southern business park precincts is consistent with the documents referenced above.

3.2 REGIONAL STRATEGIES

Waikato Plan 2017

The Waikato Plan was created as a collaborative effort between the Waikato Councils, the Central Government and other private and public agencies. The Plan provides an overview of the important issues that affect the region now and are likely to affect the region over the next 30 years. The plan provides strategic guidance and advocacy to multiple agencies across the Waikato Region. Of particular relevance in this instance is priority two which is:

"Connecting our communities through targeted investment - To maximise our resources and access what we need, we must be able to connect with others quickly, safely and efficiently.

Whether by road, rail, air or via new technology, the Waikato Plan will ensure we have the right infrastructure in the right place, at the right time so our people and economy can succeed and prosper."

Waikato Regional Policy Statement

The purpose of the Regional Policy Statement is to achieve the purpose of the RMA by providing an overview of the resource management issues of the Waikato region, and policies and methods to achieve integrated management of its natural and physical resources. The issue, and corresponding objectives/policies, of particular relevance in this instance is the management of the built environment (Section 6). The issue and the corresponding objectives are as follows:

Issue 1.4 – Managing the Built Environment

> *Development of the built environment including infrastructure has the potential to positively or negatively impact on our ability to sustainably manage natural and physical resources and provide for our wellbeing.*

Objective 3.12 – Built Environment

> *Development of the built environment (including transport and other infrastructure) and associated land use occurs in an integrated, sustainable and planned manner which enables positive environmental, social, cultural and economic outcomes, including by:*
>
> > *c) integrating land use and infrastructure planning, including by ensuring that development of the built environment does not compromise the safe, efficient and effective operation of infrastructure corridors*
> >
> > *e) recognising and protecting the value and long-term benefits of regionally significant infrastructure;*
> >
> > *g) minimising land use conflicts, including minimising potential for reverse sensitivity;*
> >
> > *k) providing for a range of commercial development to support the social and economic wellbeing of the region.*

Waikato Regional Land Transport Plan 2015 -2045

The Waikato Regional Land Transport Plan 2015-2045 sets out the strategic direction for land transport in the Waikato region over the next 30 years. The Plan sets out nine priorities for land transport in the Waikato Region. The priorities relevant in this instance are as follows:

- *Optimising and growing public transport within Hamilton and between Hamilton and satellite towns.*
- *Improving safety, particularly reducing risk and addressing speed management.*
- *Maximising efficiencies and optimisation across the transport system.*
- *Ensuring route security and resilience.*

Waikato Regional Public Transport Plan 2015 – 2025

The Waikato Regional Public Transport Plan is a strategic document that sets the objectives and policies for public transport in the region, and contains details of the public transport network and development plans between 2015 and 2025. The plan

builds on the strategic direction for transport established through the Waikato Regional Land Transport Plan 2015-2045 (detailed above), and aims to deliver an effective, efficient and integrated public transport system for the people of Waikato. The overall goal in this plan is as follows:

"A growing and affordable public transport system that contributes to the economic, social and environmental vitality of the region."

Comment: The proposed access arrangements will provide improved access to the airport and the Central and Southern Precincts which will comprise a number of industrial activities in the near future. Both intersections have been assessed in Section 8 of this report and found to perform with sufficient capacity, and the locations can accommodate the appropriate design standards to maximise safety for road users. The new access arrangements will provide better access to the airport and the future industrial activities within these Precincts for employees and freight contributing to the success and prosperity of those individuals and the companies established there. They have been designed to fit with the existing development in the area including the Hamilton Airport and other activities occurring along SH21. Furthermore, the proposed intersection configurations have been assessed to perform well with the traffic increases expected within the area.

Although this proposal does not directly create public transport services to and from the Airport area, the improved access will support more efficient bus movements to these areas if services are commenced by the Waikato Regional Council in future.

As such, the proposed changes to the future access arrangements for Central and Southern Precincts are considered to be consistent with the regional strategy documents listed above.

3.3 DISTRICT STRATEGIES

Waipa Integrated Transport Strategy

The Waipa Integrated Transport Strategy sets out the direction for our transport system over the next 30 years. It has a vision that: *"People and freight in Waipa have access to an affordable, integrated, safe, responsive and sustainable transport system that supports community aspirations."*

The main objectives of the strategy are as follows:

- *Provide the strategic direction for delivery of transport actions consistent with the district's aspirations and future growth patterns.*
- *Contribute to achieving the objectives of the New Zealand Transport Strategy and the Government Policy Statement on Land Transport Funding.*
- *Provide a detailed implementation plan to inform and support the vision of the Waikato Regional Land Transport Strategy (RLTS), Future Proof, Waipa 2050, the Long-Term Council Community Plan (LTCCP) and district strategies and plans.*
- *Satisfy the NZ Transport Agency planning and funding requirements by providing evidence of strategic context for applications for financial assistance and submissions to future Regional Land Transport Programmes.*

Comment: The proposed access arrangements will contribute positively to the transport system within the Waipa District by providing safe and efficient access for "people and freight" to the Central and Southern Precincts which will be key industrial areas in the future. Additionally, the proposed access arrangements will improve access for people and freight to the Hamilton Airport. As has been assessed above, the proposal is consistent with the New Zealand Transport Strategy, Government Policy Statement on Land Transport Funding and the Regional Land and Transport Strategy. As such, it is considered that the proposal is consistent with the purpose and objectives of the Waipa Integrated Transport Strategy.

5.0 BASELINE CONDITIONS

5.1 EXISTING ROAD NETWORK

The Airport and adjacent Airport Business Zone land is bounded by SH 3 to the west and SH 21 to the south and east. SH 21 provides access to the Airport car park and terminal, and the central development precinct of Titanium Park. SH 21 is a two-lane two-way roads with 3.5m lane widths and variable shoulder widths near the application site. It has a posted speed limit of 100 km/h.

The main airport access is shown in Figure 3 below. The intersection has a left turn in deceleration lane, as well as a right turn bay on State Highway 21.

Figure 3: Existing Airport Access Intersection

The SH 21 Annual Average Daily Traffic (AADT) volume in 2016, measured near the existing access to the airport by the NZ Transport Agency, is 5767 vehicles per day (vpd) with 5.3% Heavy vehicle content. The daily traffic volume has grown at 3.5% pa since 2012. The SH 21 AADT volume measured nearer to SH 3 is a little lower at 5243 vpd and 5.9% heavy vehicles. This section has consistently (since initial studies in 2004) had slightly lower traffic volumes than that travelling past the airport entrance, and it is thought due to commuter traffic from Cambridge and surrounding areas using Mystery Creek Road and Raynes Road to access Hamilton.

Traffic counts were undertaken at the Airport access intersection on 28/02/2017 from 7-9am and 4-6pm to determine the number of vehicles entering and exiting the Airport. This was correlated with passenger numbers provided by WRAL so that future trip generation of the airport could be predicted based on passenger-number growth projections. In addition, hourly SH 21 traffic volumes were obtained on either side of the Airport access intersection.

Other key intersections in the vicinity of the Airport access is the SH 21 / Mystery Creek Road intersection and the SH 3/SH 21 intersection. The SH 3 / SH 21 intersection has recently been upgraded from a rural 'T' to a dual lane roundabout. The dual lane roundabout provides access to Titanium Park western precinct and will in future become part of the planned Southern Links grade separated interchange to be built at that location.

The SH 21 / Mystery Creek Road intersection is illustrated in context with the Hamilton Airport access intersection in Figure 4 below.

Figure 4: SH 21 / Mystery Creek Road intersection

5.2 BASELINE LAND USE AND TRIP GENERATION – AIRPORT BUSINESS ZONE

The Western Precinct of the Airport Business Zone (on the west side of the main runway) is being developed by Titanium Park Developments Limited (TPDL) while the Central and Southern Precincts of the Airport Business Zone (on the east side of the main runway) is being developed by TPL. The Raynes Precinct accessed from Raynes Road was sold and is now being developed by others.

All four precincts are still in the early stages of subdivision and development. Less than 50% of the total rezoned area is developed (contains buildings) to date. However, the land uses that have established are predominantly industrial manufacturing or warehousing, which is consistent with the District Plan rules. The Raynes Precinct presently has one large warehouse operated by Torpedo7 and other associated buildings.

Section 2.3 outlines the specific land use activities and associated development areas assigned to the Central and Southern Precincts in the masterplan for Plan Change 57.

The total traffic generation predicted for full development of the central and Southern Precinct land uses was calculated for Plan Change 57 as 1733 vph in the AM peak hour and 1852 vph in the PM peak hour. This included an airport patronage growth per annum of 5%, which was on the basis of forecast projections for international services at the time.

As at April 2018, approximately 6.2 ha (excluding roading) of land in the Central Precinct is subdivided or consented for subdivision, but just 1.0 ha is developed and occupied. The Airport terminal has not been extended or developed further than at the time of the Plan Change. The Southern Precinct area has not been developed at all, and continues to be used for rural activity.

5.3 BASELINE ACCESS STRATEGY – AIRPORT BUSINESS ZONE

As outlined in Section 2.2, the existing MoA between TPJV and the NZ Transport Agency identifies that a new roundabout intersection is to be constructed on SH 21 to provide access to the Central and Southern development precincts of Titanium Park once pre-defined traffic performance and land area development criteria are triggered. The location for the roundabout was agreed with the NZ Transport Agency and defined in the Structure Plan at a point approximately 160m south of Lochiel Road. Lochiel Road is to be realigned to connect into the roundabout as shown in Figure 5 below (noted as "Proposed Access #1), which is taken from the Morris Bray Architects Master Plan Issue K.

Upon construction of the roundabout, the existing SH 21 / Airport intersection and SH 21 / Lochiel Road intersection would be permanently closed.

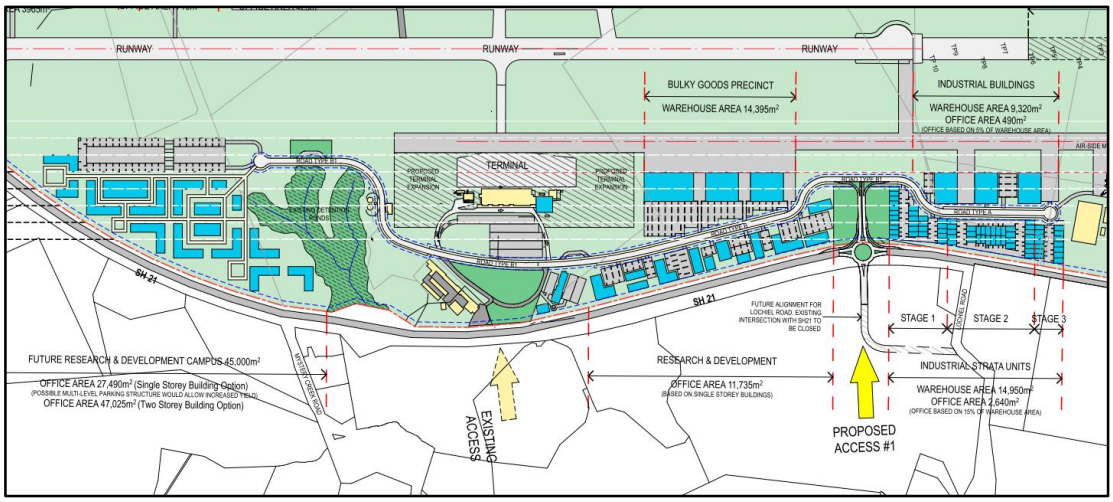


Figure 5: Baseline Airport Business Zone SH 21 Access Strategy

5.4 PUBLIC TRANSPORT

Public transport options at Hamilton Airport consist of taxis and Airport to CBD mini-vans. There are no scheduled public bus services operating from Hamilton or other

Waikato centres at this time, but future public transport services are not precluded in the development masterplan.

5.5 PEDESTRIAN AND CYCLIST FACILITIES

There are no existing or planned walking and cycling facilities on SH 21 due to the rural locality.

Internally within the central development precinct, Ossie James Drive has been constructed for a length of 250m with the formation consistent with the typical cross-section shown below in Figure 6. This includes a 2.5m wide shared walking and cycling path on one side. In the future a 1.5m wide footpath on the other side of the road will be added when the adjoining land is subdivided.

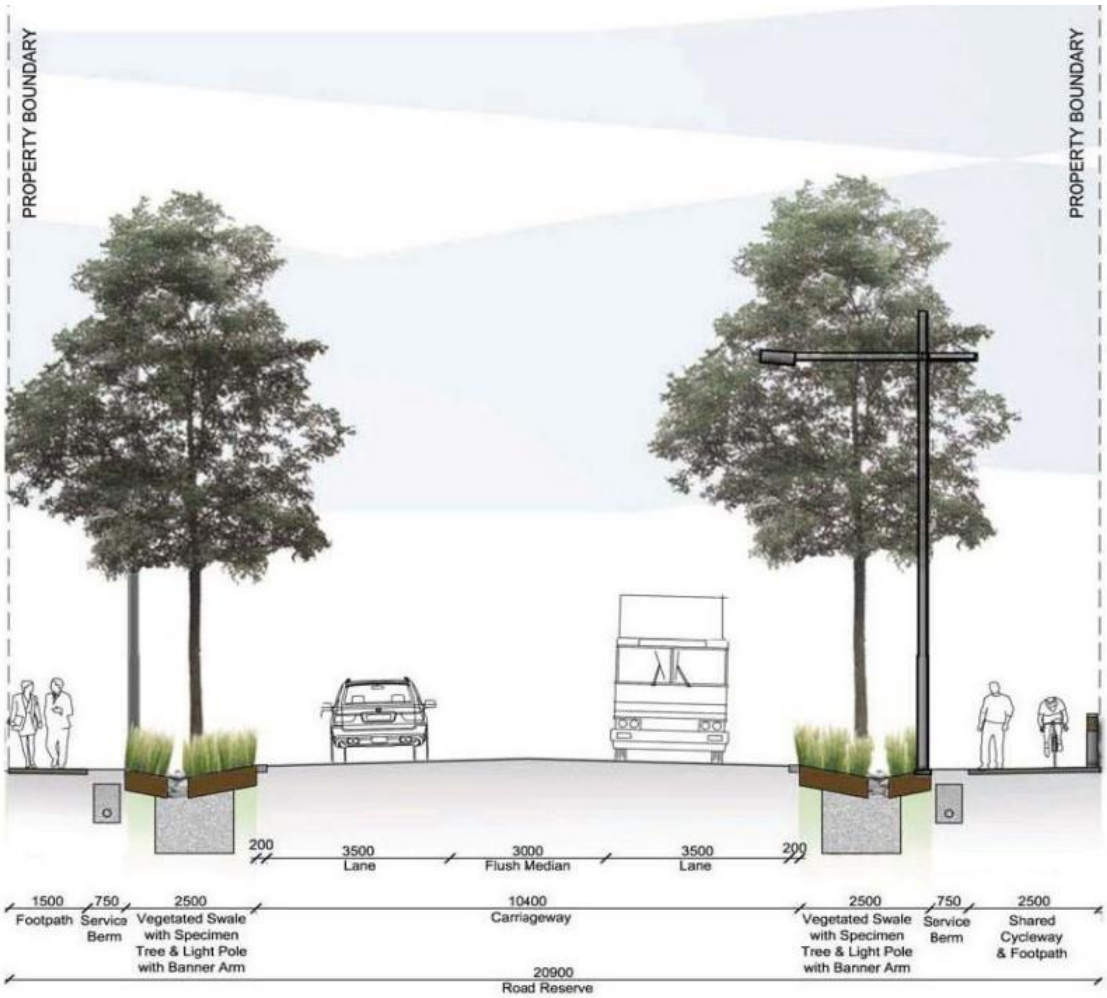


Figure 6: Airport Business Zone Typical Road Cross-Section.

5.6 EXISTING SH 21 / AIRPORT INTERSECTION CRASH HISTORY

The New Zealand Transport Agency Crash Analysis System (CAS) has just two reported crashes on SH 21 in the vicinity of the Hamilton Airport access intersection in the last 10 years (2007 – 2016).

One crash occurred in 2010 and involved a northbound vehicle on SH 21 colliding with a car doing a U-turn on SH 21 from the same direction. The crash was recorded as a minor injury crash. There is no information provided to confirm that the intersection was a factor in the cause of this collision.

The second crash in the 10 year history occurred in 2011 and involved a southbound vehicle on SH 21 hitting another vehicle head on at a point 15m from the centre of the intersection. The crash was recorded as a non-injury crash. Again, there is no information provided to confirm that the intersection contributed to this collision.

Based on the crash types and the low number of crashes, together with the existence of good sight lines and a high standard of intersection design, it is appears that there is no underlying safety problem with the existing Hamilton Airport access intersection.

6.0 REVISED ACCESS STRATEGY – CENTRAL AND SOUTHERN PRECINCTS

Section 2.3 outlined that WRAL's and TPL's core focus is different from the original TPJV, in that the airport and terminal operations are their core business, and the business park development and operations secondary to that.

Three of the key issues that WRAL and TPL wish to address, as identified in Section 2.3, relate to the overall Airport Business Zone access strategy. These are:

- Ensuring the Airport terminal is the prominent focal point upon entry from SH 21 in future by providing a 'gateway' access feature.
- Revise the future SH 21 roundabout access position to achieve the above objective, while also serving appropriate access to the business park.
- Develop the Southern Precinct separately from the Central Precinct. No vehicle connectivity between the two areas due to the significant topographical constraint (deep gully) and existing and future airport operations constraints (fuel storage, water reservoir, car parking, terminal traffic circulation). However, walking and cycling connectivity between the two precincts is to remain.

6.1 AIRPORT ACCESS AND CENTRAL PRECINCT ACCESS

Given the above objectives, BBO have reviewed the SH 21 frontage to the Airport and Central Precinct to identify whether it is physically possible to relocate and fit the future concept roundabout design from a geometrics and topographical/physical constraints perspective.

The existing constraints include:

- The level difference of SH 21 to the Business Park land to the north of the existing entrance
- The land already sold for development within Central Precinct, fronting SH 21
- The Hamilton go-cart track opposite and to the northeast of the Business Park
- The Hamilton Pistol Club opposite and to the southwest of the Business Park
- The deep gully in which the Pistol Club are located
- The private access road to Mystery Creek Events centre between the go cart track and the pistol club
- The Hamilton Airport Motel
- The Honey New Zealand land and buildings opposite the Airport entrance
- Mystery Creek Road, located 465m south of the existing Airport entrance

A further complexity in the investigations for a new access location is how it affects internal circulation and parking for the Airport Terminal, whilst also providing separate suitable access to the Central Precinct of the Business Park.

All of these factors have been considered in detail to arrive at the proposed roundabout position and connections shown in Figures 7 and 8 on the following pages. The overall diameter of the roundabout is 60m. An A3 drawing of Figure 8 is included in Appendix B.

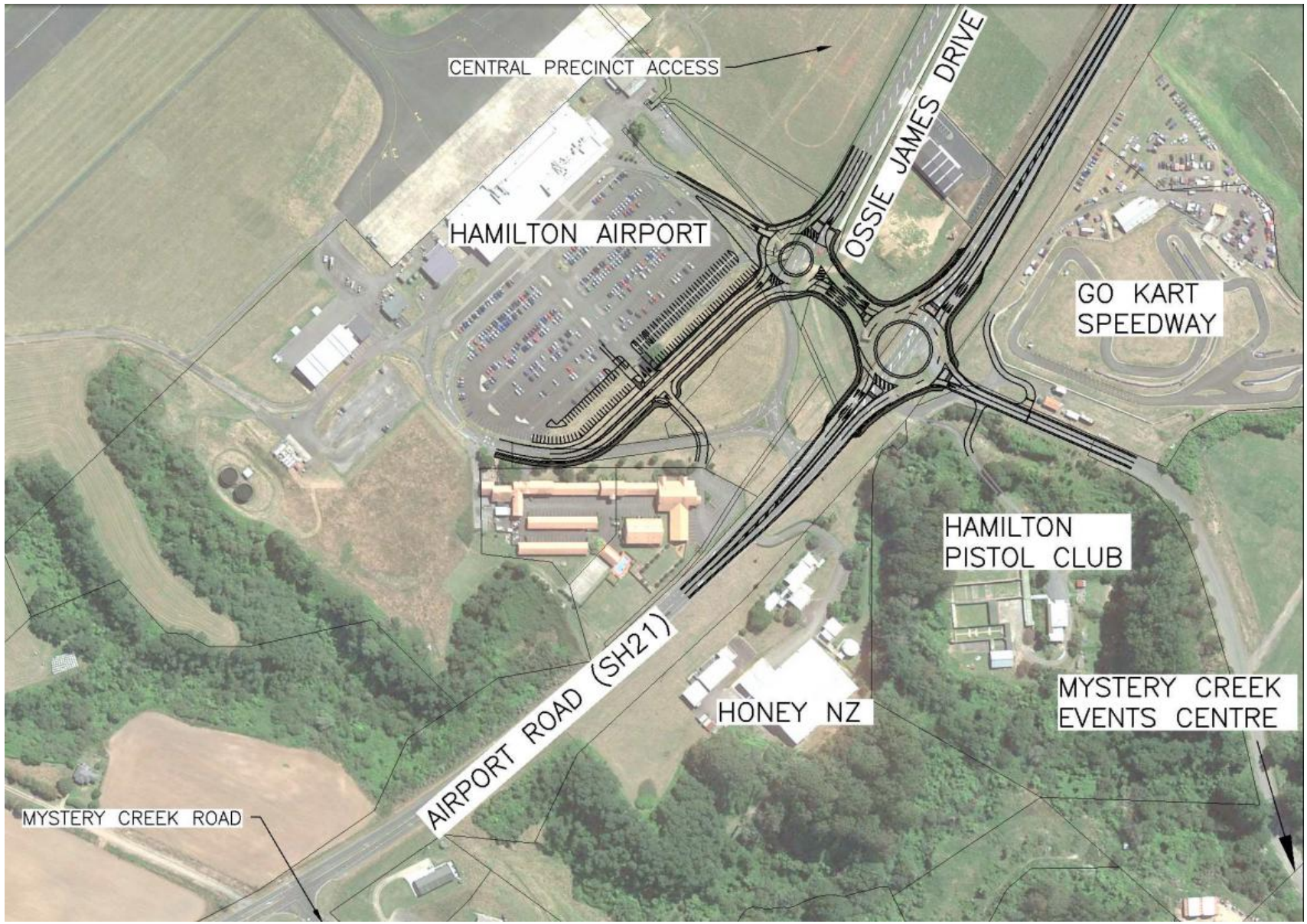


Figure 7: Revised Access Strategy: Airport and Business Zone Central Precinct Roundabout

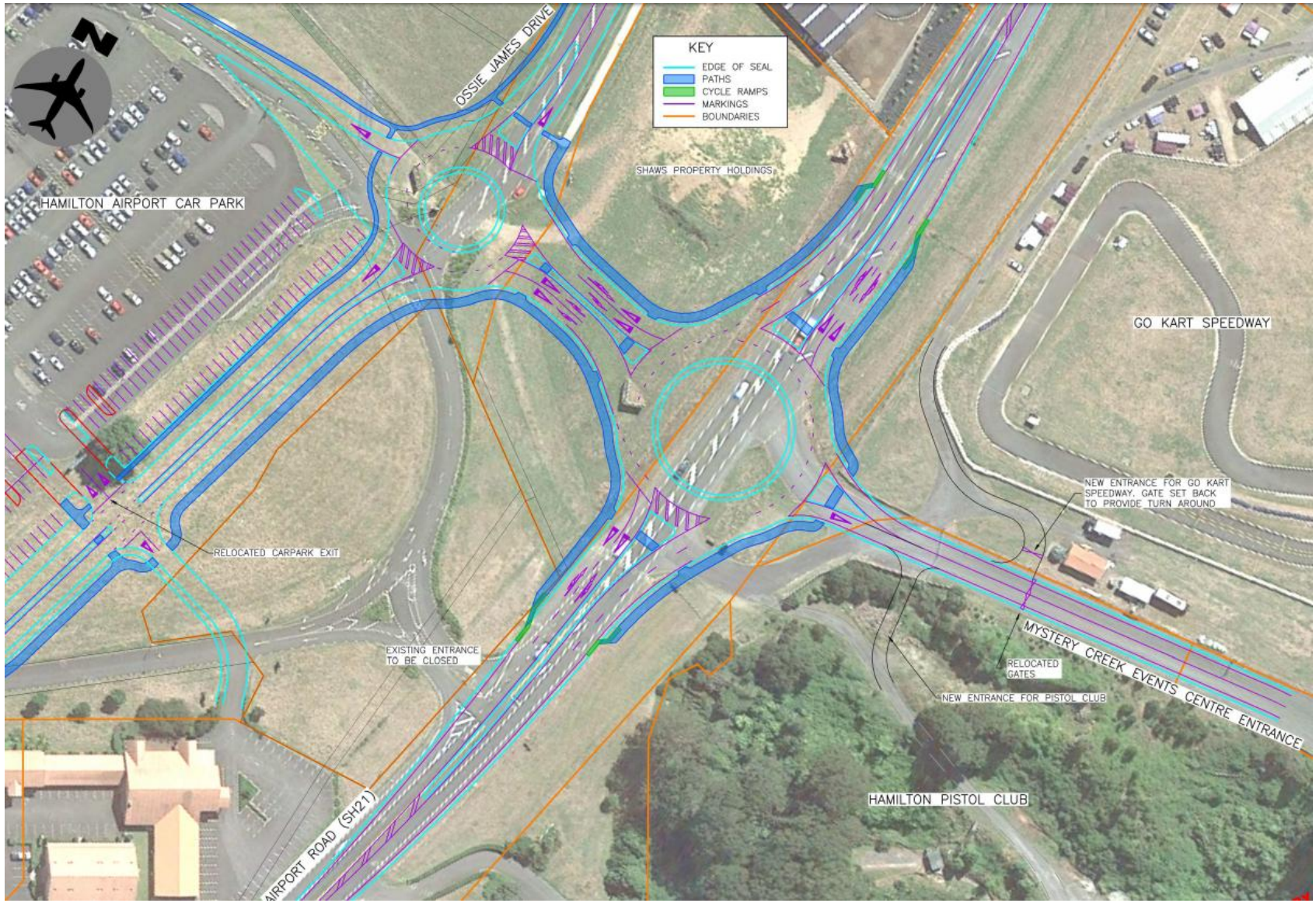


Figure 8: Revised Access Strategy: Airport and Business Zone Central Precinct Roundabout

The roundabout geometric design is to Austroad standards, and the position achieves a separation distance of 560m to Mystery Creek Road from the centre of the roundabout. Typically, NZTA prefer the separation distance of intersections on State Highways to be at least 500 m according to the Planning Policy Manual, which is achieved in this case.

Sightlines at the roundabout can achieve Austroad mandatory Category 2 requirements and potentially also Category 3 requirements on all approaches.

The existing accesses to the Pistol Club and Go-kart track are affected due to the need to cut the Mystery Creek Events access down. This results in the access to the Go-kart track being 10% grade if the driveway was to remain in its current location. The proposal is to reposition the driveway as shown in Figure 8, to connect to the Mystery Creek Events access further east.

Similarly, the Pistol Club entrance needs relocating to a position that connects safely to the new access leg of the roundabout and achieves and appropriate grade of access into the site. Consultation is ongoing with the Pistol Club in regards to their entrance.

Locating the roundabout near the Airport entrance means that Lochiel Road would remain as a 'T' intersection with SH 21. While the roundabout designated near Lochiel Road would help to improve the safety for users of Lochiel Road, there is no prominent safety issue there at the present time. The recorded crash history in the CAS database demonstrates this with just one crash recorded since 2012, and that involved a vehicle losing control on SH21 and driving off the road into a ditch, so is not directly related to the intersection. Lochiel Road is controlled by a compulsory Stop at the intersection, and has very low daily flows (190 vpd estimated by Waipa Council in 2016). A compliant sight distance of 285m for 110 kph design speed exists looking northwards from Lochiel Road to SH 21. Given the type of intersection, this is the most critical turning movement at the intersection in terms of safety risk. However, the sight distance from Lochiel Road to the south is 187m. It is non-compliant due to the state highway curving east into a dip, causing the roadside paddock fence to become an obstruction to greater visibility. The lack of crash history suggests that this is not a significant impediment to the safe function of this intersection.

The reason the roundabout was designated to be connected to Lochiel Road was to address the non-complying separation distance between the two intersections. The roundabout could not be located at the intersection of Lochiel Road / SH21 due to the effects on adjacent land owners.

Access for the block of land that was previously known as the Ashton Block will also be affected by the proposed roundabout relocation. The block of land was not rezoned as industrial land at the time of plan change 57, or the District Plan review, and has since been purchased by Mystery Creek Events. Consultation with the operators of Mystery Creek has not yet occurred but the roundabout in the now proposed location still provides access to the ex-Ashton Block via the Mystery Creek access road opposite the Airport and adjacent to the Go-Cart track.

6.2 SOUTHERN PRECINCT ACCESS

Vehicle access is a fundamental issue for the development of the Southern Precinct due to the area being disconnected from the Central Precinct by a deep gully and the Airport terminal operations and car parking area.

As outlined earlier in this report, WRAL's and TPL's review of the masterplan after taking over ownership from the TPJV identified that providing access through the Airport Terminal operations area and across the adjacent gully to the south would be both very expensive and hugely disruptive to the function of the Airport. The likely presence of heavy vehicles mixing with airport traffic on a daily basis across the front of the Terminal building and public parking areas, under the current structure plan road network, is at odds with TPL's mandate to promote and enhance the Airport operations. Furthermore, with the Airport having returned to operating as a regional Airport with no international services for the foreseeable future, TPL consider that the significant disruption and cost to build the internal road connection is not justified.

Accordingly, BBO have investigated at a high level, a concept design of a separate access intersection on SH 21 from a geometrics, safety and topographical/physical constraints perspective. The section of SH 21 under consideration is shown below.

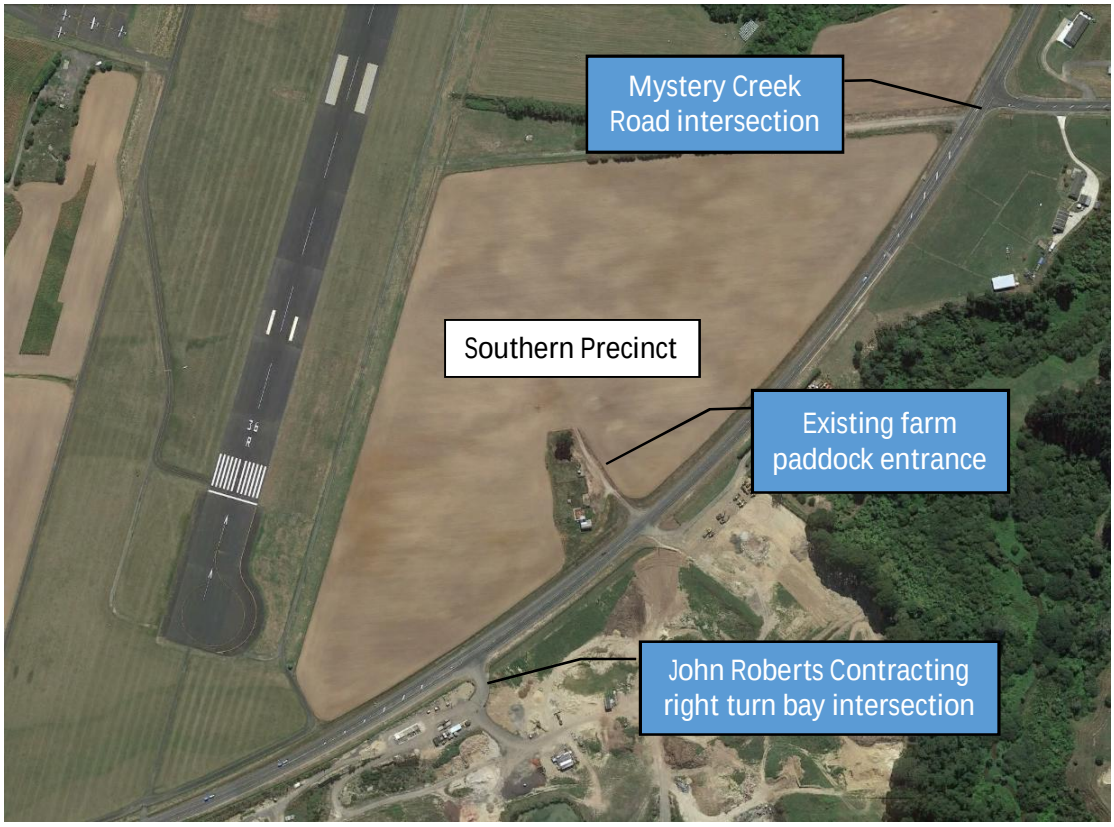


Figure 9: SH 21 adjacent to the Southern Precinct

Benefits for the Southern Precinct of a separate access to SH 21 in this location include:

- Greater efficiency for traffic serving the Southern Precinct than the current structure plan road network, which sees this traffic, including heavy vehicles

having to use approximately 1.8km of internal roads to access SH 21. This requires traffic to pass across the front of the Airport terminal, mixing with Airport terminal traffic.
- Freeing up the Southern Precinct to be developed earlier by making it independent of the need to construct the current Structure Plan internal road network. It potentially also delays the need for construction of the more costly roundabout intersection on SH 21 by not being dependant on it for access.

The existing physical constraints for a new access in this proposed location include:
- The low level of SH 21 relative to the Southern Precinct land, potentially restricting sight distance.
- Sufficient separation distance to the existing Mystery Creek Road / SH 21 intersection
- The two existing accesses to the John Roberts Contracting property on the opposite side of the road, including a right turn bay for northbound vehicles and deceleration / acceleration auxiliary lanes for southbound vehicles.

The NZ Transport Agency Planning and Policy Manual sets out the minimum requirements for access and intersection sight distance and separation distances on State Highways. The required sight distance for a 110 km/h operating speed is 285m and the separation distance between accesses is 200m while intersections are to be at least 500m.

SH 21 in this location is on a large radius sweeping bend. The road reserve width is generous at 40 m wide, and the existing carriageway width is typically 9.0-9.25m wide. Sightlines in this location are good but to achieve the 285m standard will require some minor earthworks to reduce the height of land on the road reserve boundary. This is easily achievable as the affected land is all owned by WRAL and no structures exist in the way.

Two concept design options for the proposed access intersection are shown below in Figures 11 and 12. The primary difference between the two options is location, being approximately 95m apart, and this has some subsequent design outcomes concerning integration with the other existing accesses nearby. The general location of the proposed new intersection in context with the Mystery Creek Road and the proposed roundabout access near the Airport Terminal is shown in Figure 13. Full drawings are included in Appendix B.

The separation distance from the proposed access road centre line of Option 1 to Mystery Creek Road centre line is 595m, and for Option 2 it is 500m. Both options comply with the NZ Transport Agency Policy Manual requirement. However, the separation distance of Option 1 to the John Roberts Contracting access is 100m, which does not comply, while the Option 2 access separation would be 195m, which is deficient by 5m to the Policy Manual minimum requirement of 200m.

Locating the new access intersection as per Option 2 provides a more centralised access road to the Southern Precinct land area, and is therefore preferred by TPL.
However, this option comes with two safety issues to mitigate. The first being that the location is directly opposite an existing property access at #108 which serves Numax

Industries. This would add complexity for right turn movements into that property, so it is proposed to permanently close the existing access to #108 and reconstruct it approximately 85m further north towards Mystery Creek Road as indicatively shown in Figure 12.

The proposed access relocation provides improvements in terms of safety as vehicles turning right into #108 will benefit in future from the extra width in the centre of the road provided by the right turn bay taper of the Southern Precinct intersection. Relocation of the access is practical from a physical works perspective, and agreement between WRAL and the land owners (the operators of Numax Industries) has been reached in principle subject to the new vehicle entrance being constructed to the same standard as the existing entrance and all associated internal site works are completed. Figure 10 illustrates the proposed new access configuration.

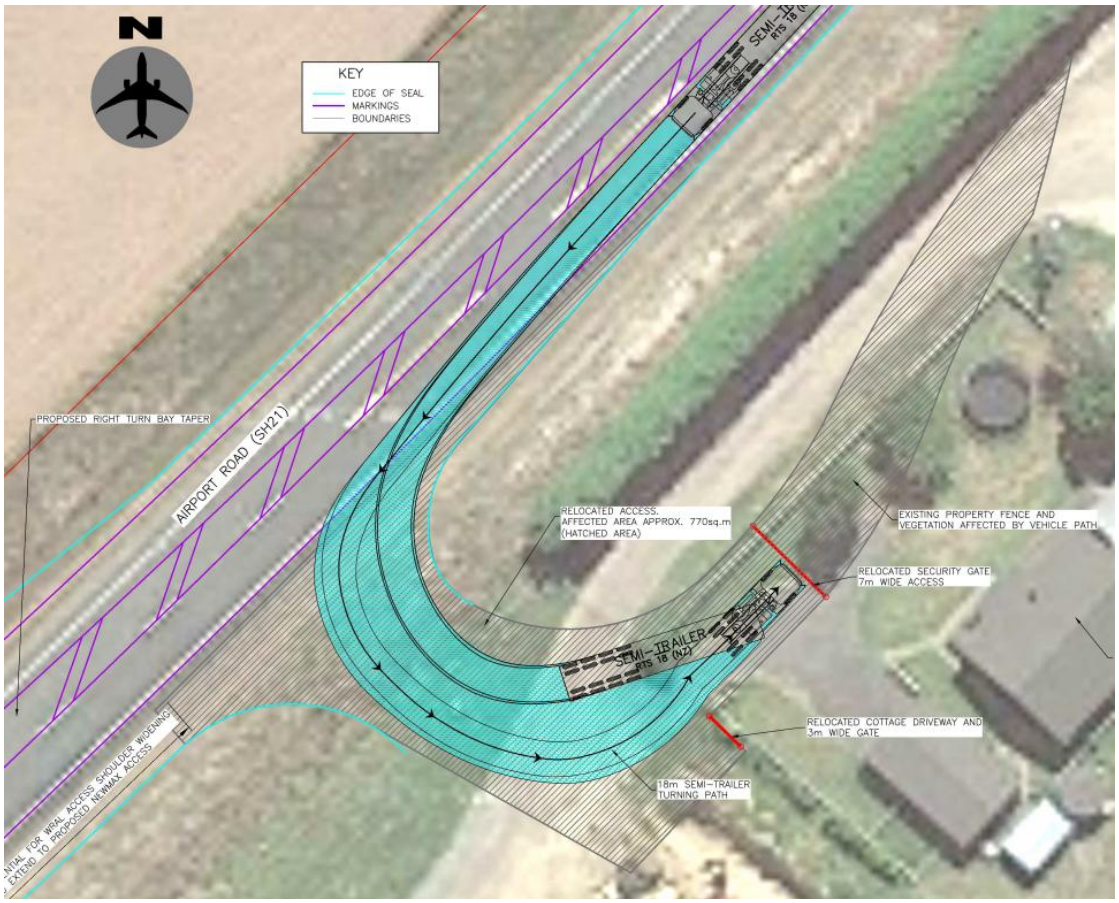


Figure 10: Proposed New Access to #108 Airport Road

The second issue is that Option 2 results in a deficiency with respect to the NZ Transport Agency Manual of Traffic Signs and Markings (MOTSAM) for the right turn out acceleration pocket length in the centre of SH 21. The deficiency is approximately 10m and is due to the presence of the right turn bay on SH21 to the John Roberts Contracting access.

This minor deficiency is expected to only affect fully laden HCVs turning out of the new access road. Mitigation to address this is proposed by extending the existing deceleration lane on the opposite side of the road northwards approximately 40-50m,

and remarking this lane with hatched chevron markings to form a wide shoulder. HCVs turning right out of the new access road can then use the wide shoulder for acceleration towards SH 3. Acceleration on a wide shoulder, where available, is common and recommended safe practice for slow vehicles turning onto NZ rural roads. Changing the appearance of the deceleration lane to that of a wide shoulder is considered necessary to minimise driver confusion regarding the use of the extra road width.

6.3 INTERNAL WALKING AND CYCLING CONNECTION

An internal walking and cycling path is proposed near the head of the gully system connecting the Southern and Central Precincts. This will enable future occupants to connect with a high degree of safety and convenience, and avoid having to walk or cycle on the State Highway where the safety of vulnerable road users is subject to greater risk. Refer to Figure 13.

6.4 PUBLIC TRANSPORT (PT)

There are no specific public transport services or infrastructure serving passengers or employees of the Airport or business park at the present time due to insufficient demand for such services. Airport passengers arrive and depart the facility either by private vehicle, rental vehicle or taxis and airport shuttles. There is a specific drop-off and pick-up platform for Taxi's and shuttles directly outside the Airport Terminal. This could in future be easily transformed to allow for public buses if services were to commence operation.

However, discussions at a high level between WRAL, the NZ Transport Agency and Hamilton and Waipa Councils are occurring about long-term future public transport provision between Hamilton and the Airport. The current thinking is that the Southern Links project provides the best opportunity and affords the most direct route for a future-proofed integrated public transport service. The concept will be developed further when the Southern Links project advances towards detailed design.

In the meantime, the revised access strategy with the roundabout positioned near the existing main entrance will allow greater efficiency and safety for future public bus movements to and from the airport and employment areas of the Central Precinct than the existing network provides. Figure 13 shows an indicative PT access route.

It is unlikely that future public bus services would access the proposed Southern Precinct road since it will be a cul-de-sac. Users of PT could instead access the Southern Precinct employment area from a stop located at the Airport terminal via the connecting walking and cycling track around the gully that separates the two Precincts.

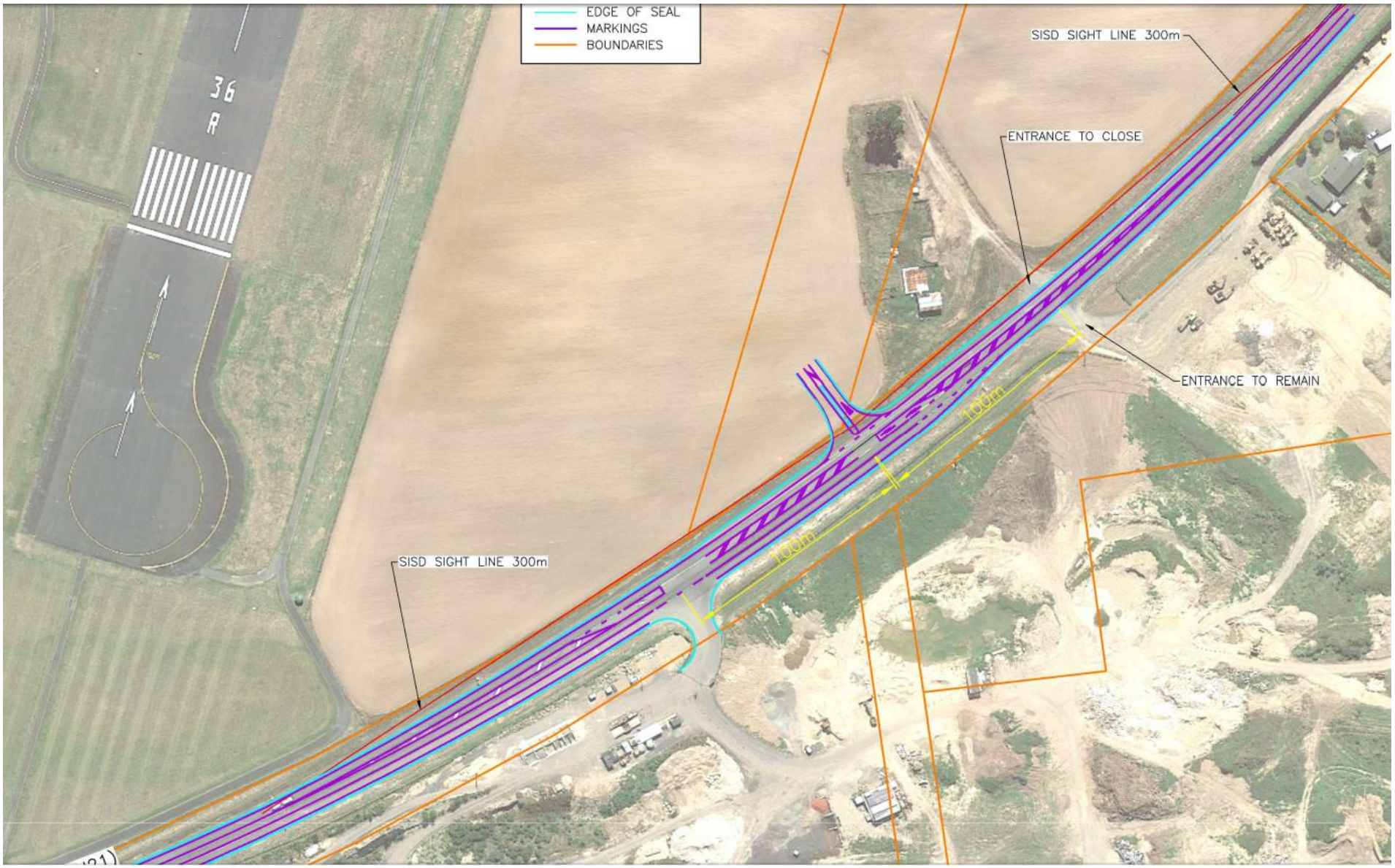


Figure 11: Revised Airport Business Zone Access Strategy - Southern Precinct Access Intersection Option A

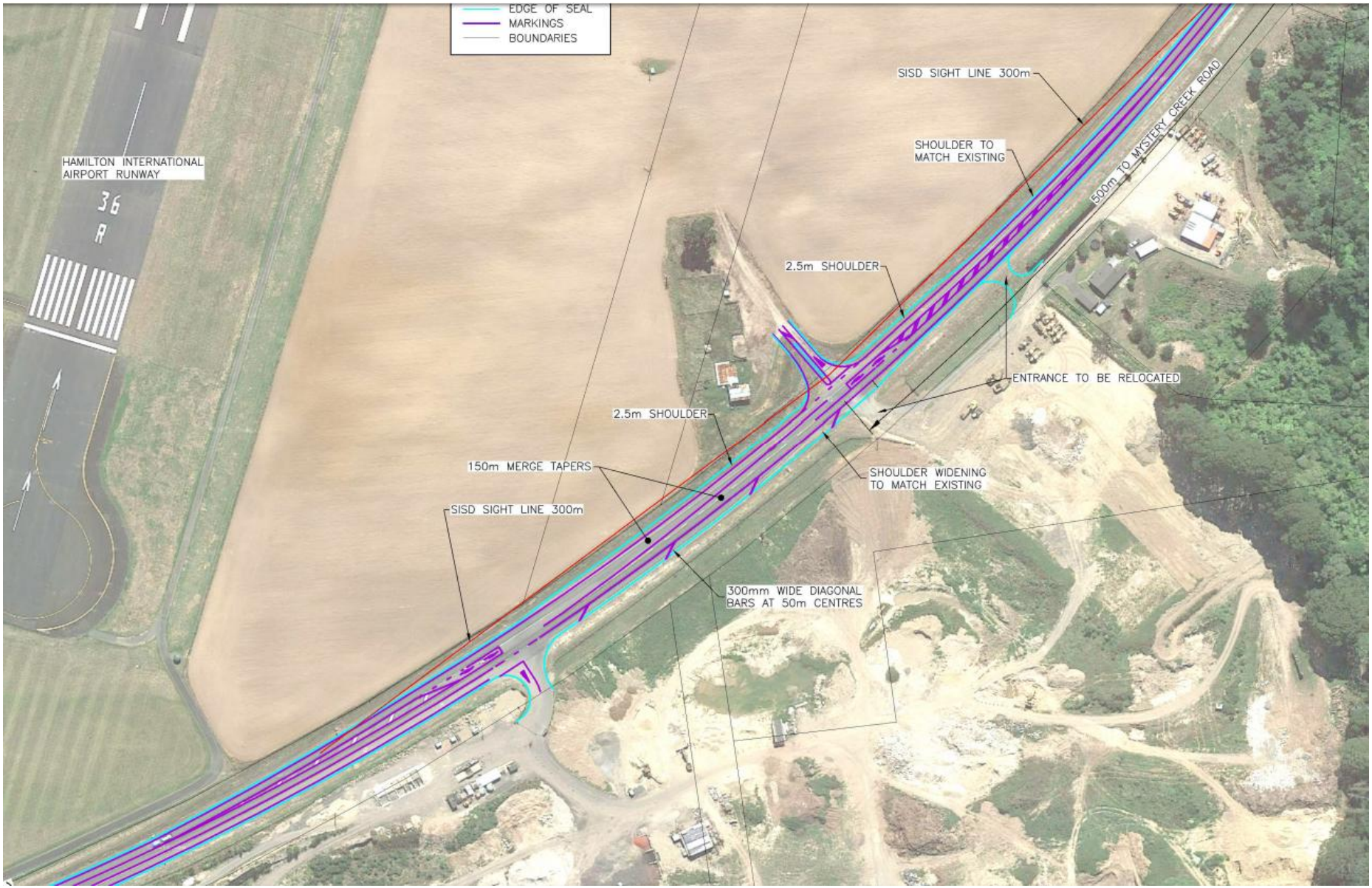


Figure 12: Revised Airport Business Zone Access Strategy - Southern Precinct Access Intersection Option B (Preferred Option)

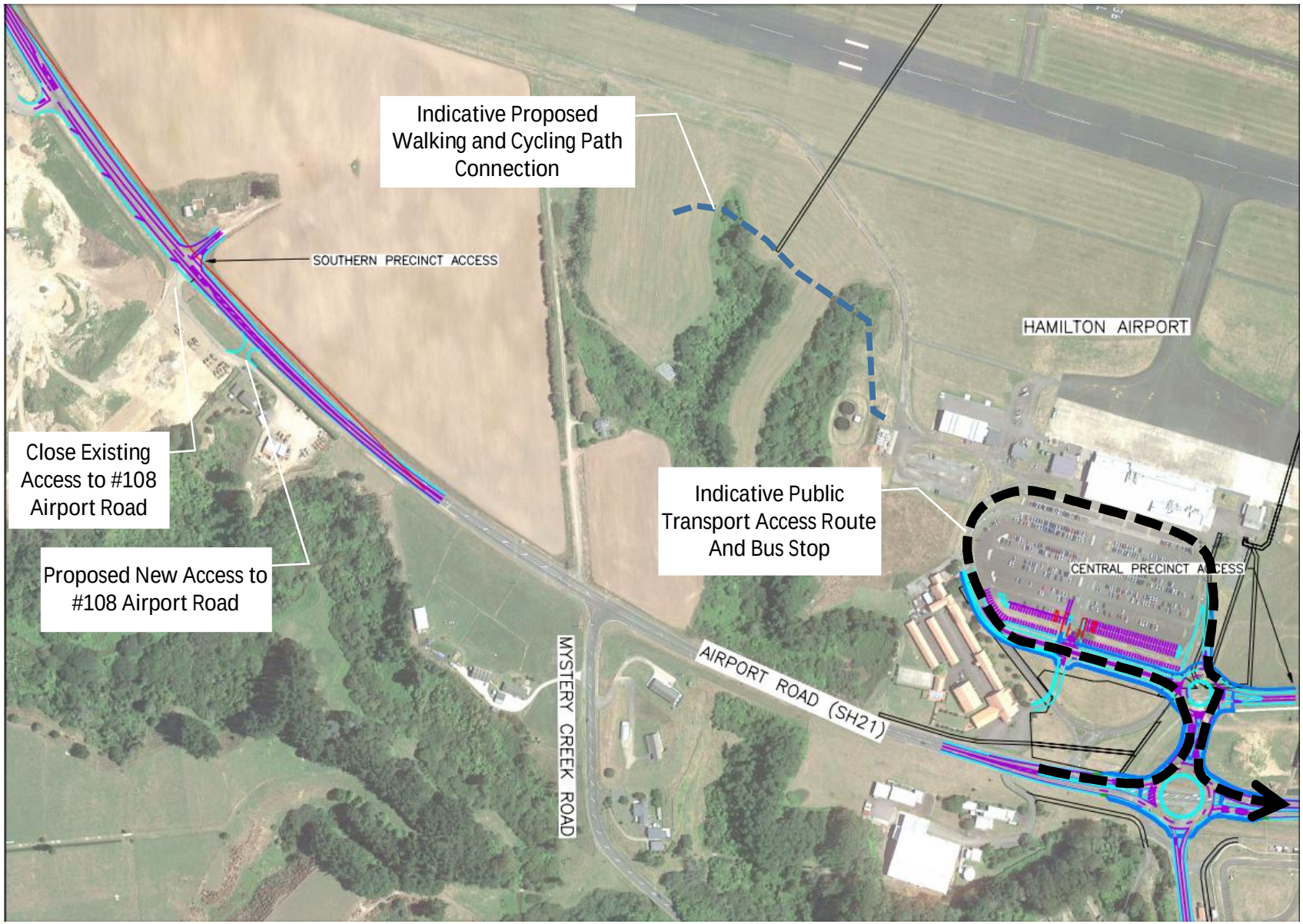


Figure 13: Revised Access Strategy - Concept Southern Precinct Access in context with wider network

7.0 FUTURE NETWORK IMPROVEMENTS

Transport volumes and travel patterns on SH 21 are not only affected by the Airport and TPL development but also by two wider network improvement projects in future; the Hamilton Section of the Waikato Expressway (HamWEX) and Hamilton Southern Links project (HamSL).

At the time of the original Airport Business Zone plan change in 2007/8, the HamWEX project timeframe was not confirmed and the Southern Links project was a concept with no detail or certainty. Now in 2018, the HamWEX project is under construction and expected to be completed in 2020, and the future Southern Links corridors and interchanges have been designated. Recent indications from the NZ Transport Agency is that some stages if not all of the Southern Links roads, may be constructed over the next 15 years (by 2033). The recent successful application by Hamilton City Council to the central government Infrastructure Fund for development of the Peacocke Residential Growth Cell could be a catalyst for advancing construction of the highway sections of Southern Links.

7.1 HAMILTON SECTION OF WAIKATO EXPRESSWAY EFFECTS

The HamWEX project is due to open to traffic in 2020. The strategic network connectivity improvements that this road offers, including the ability for inter-regional freight on SH 3 and SH 1 to bypass the city altogether, is likely to alter the distribution of traffic flows on SH 3 and SH 21 past the airport. Various versions of the Waikato Regional Transportation Model (WRTM) exist that give an indication of the effects of these strategically important projects, but they were developed at different times for different purposes. The models include the Southern Links designation WRTM, the HamWex alteration to designation WRTM and the latest (2017) update to the WRTM.

The result is inconsistent volume predictions for SH 21 with HamWEX complete. The difference in predicted 2021 ADT volumes for SH 21 south of Mystery Creek Road is approximately 4,100 vpd, and for 2041 it is approximately 3000 vpd. The volume difference for SH 21 north of Mystery Creek Road is 4,000 vpd, and 6,450 vpd respectively for the 2021 and 2041 models. The Southern Links Model and latest WRTM predictions are all consistently lower than the HamWex model. Refer to the WRTM volume print outs attached in Appendix C.

The HamWex WRTM model predictions appear to be the most appropriate on the basis that the Southern Links Do Min model (with HamWex) predicts a similar 2021 ADT on SH 21 as existing in 2016 (6000 vpd) without HamWex being open yet. Therefore, the Southern Links models have only been used as an input to identify the relative change in volume on SH 21 as a result of southern links operating in 2041. Refer to Section 6.2 below.

The WRTM version used for the HamWEX project alteration to designations identifies that SH 21 traffic volumes will be 9500 vpd in 2021 (with HamWEX). That is an increase of 3500 vpd from 2016 (6000 vpd, no HamWEX), representing an average growth rate of 11.6% p.a. However, assuming that the existing average growth rate of 3.5% on SH

21 continues from now until 2020, the increase on SH 21 due to HamWEX in 2021 is actually only 2500 vpd.

7.2 HAMILTON SOUTHERN LINKS ARTERIAL EFFECTS

The WRTM model developed for the Southern Links designation process identifies that the new arterials are expected to decrease traffic volumes on SH 21 south of the Airport (between SH 3 and Mystery Creek Road), by 45-50% in the peak hours in 2041. North of the Airport entrance the volume decrease due to Southern Links is significantly less, at only 640 vpd in 2041.

8.0 REVISED CENTRAL AND SOUTHERN PRECINCT LAND USE TRIP GENERATION

In March 2017 BBO undertook a review for TPL concerning the traffic related triggers and timing for various intersection upgrades as set out in the MoA, to test the timing assumptions from the original Plan Change TIA of July 2007.

The review demonstrated that the existing SH 21 / Airport right turn bay intersection is likely to reach the delay-based trigger in the MoA for construction of the new roundabout on SH 21 in about 2023 with 60% of the area developed, using the Plan Change 57 master plan mixed land use scenario (i.e. including office/research and development) and the following growth assumptions:

- A growth rate of 1% per annum in passenger numbers at Hamilton Airport and a corresponding 1.5% per annum growth in traffic generation. Determined from WRAL's current Airport operations data.
- A land development uptake rate of 1 hectare per annum for Titanium Park, in proportion to the individual land uses percentage of total land. (Exceeds current development rate).
- Application of the SH 21 average annual growth rate to 2021, changing to a constant growth rate between the 2021 and 2041 ADT volumes in the HamWex WRTM.
- No Southern Links arterials commence construction until 2033 (15 years from 2018)
- The Southern Precinct has a separate access to SH 21

As outlined in Section 2.2, TPL now intend to develop industrial land use in the place of research and development due to the lack of demand for this activity type.

This change effectively reduces the overall development trip generation prediction for the 18.4 ha of land that is affected, as summarised in the following Tables 1 and 2 below. In addition, TPL intend to develop the area named 'Terminal Support' (Area G) also for industrial land use. Note the zone areas relate to the master plan image in Figure 2.

Area	Land Use in PC57 Assessment	Land Area	PC57 Trip Generation	Site Coverage	AM Peak Hr Trips	PM Peak Hr Trips
Zone D, E	Airport Cargo and Light Industrial	4.95ha	59.1 trips/ha (GFA)	25%	72	72
Zone G	Airport terminal support (commercial)	3.64ha	AM = 280 Trips/ha (GFA) PM = 262 trips/ha (GFA)	34%.	346	324
Zone H	Office/Research and Development	3.5ha	PM = 1.6 trips/100m^2 GFA	25%	140	140
Zone H	Retail	0.53ha	PM = 4.0 trips/100m^2 GFA	100%	69	212
Zone M	Office/Research and Development	14.9ha	PM = 1.6 trips/100m^2 GFA	25%	596	596
				Total	1224	1345

Table 1: Airport Business Zone - Master Plan Land Use Total Trip Generation

Area	Land Use in PC57 Assessment	Land Area	Trip Generation Change	Site Coverage	AM Peak Hr Trips	PM Peak Hr Trips
Zone D, E	Airport Cargo and Light Industrial	4.95ha	No Change	25%	72	72
Zone G	Airport Cargo and Light Industrial	3.64ha	59.1 trips/ha (GFA)	25%.	54	54
Zone H	Airport Cargo and Light Industrial	3.5ha	59.1 trips/ha (GFA)	25%	52	52
Zone H	Retail	0.53ha	PM = 4.0 trips/100m^2 GFA	100%	69	212
Zone M	Large Lot Industrial / Light Industrial	14.9ha	30.1 trips/ha (GFA)	42%	190	190
				Total	438	580

Table 2: Airport Business Zone – Revised Zone Land Use and Associated Total Trip Generation

The revised trip generation rate for Zone M (the Southern Precinct) is based on a more pure mix of industrial land use than intended for the central precinct, which reflects airport cargo and airside related industrial activities on small lots. The Southern Precinct is intended to be developed into larger lots of 1-3ha with large warehousing facilities. Accordingly, the trip generation rate is based on the traffic generation data for the VIZY building which is currently under construction on the Western Precinct. This has a predicted peak hour trip generation rate of 30.1 trips/ha GFA based on 110 employee and delivery trips in the peak hours, and 42% site coverage by floor area. This rate is generally equivalent to the trip generation rate of 15.4 trips/net hectare (net being the area after excluding 15% for roads and right of ways) that is applicable to the Rotokauri and Horotiu Industrial areas in the north of Hamilton.

As shown in the above tables, the change from office/research, and Terminal Support (Commercial) activities to industrial reduces the total combined trip generation of the Southern and Central precincts by 64% in the AM Peak and 56% in the PM Peak.

9.0 ACCESS INTERSECTION ASSESSMENTS

9.1 EXISTING AIRPORT ACCESS RTB INTERSECTION

The performance of the existing right turn bay intersection to the Airport has been checked with the revised trip generation figures from Table 2, using SIDRA Intersection v 7. This was conducted on a similar basis to the review outlined in section 7 including:

- A growth rate of 1% per annum in passenger numbers at Hamilton Airport and a corresponding 1.5% per annum growth in traffic generation.
- A land development uptake rate of 1 hectare per annum for Titanium Park. (Exceeds current development rate).
- Application of the SH 21 average annual growth rate to 2021, changing to a constant growth rate between the 2021 and 2041 WRTM volumes (with HamWex).
- No Southern Links arterials commenced construction until 2033 (15 years from 2018)
- Southern Precinct has a separate access to SH 21

This analysis showed that the existing Airport intersection is now predicted to reach the MoA "construction" trigger of 45s (LOS D) average delay for building the SH 21 roundabout in about 2027 with 95% of the Central Precinct developed rather than 2023 with 60% developed as determined for the previous mixed land use scenario. This is on the basis of the WRTM model predictions for volume change on SH 21 with the HamWex project opening in 2021. If traffic growth on SH21 or redistribution of SH3 traffic volumes is lower than forecast, then this would push the timeframe out longer until the trigger is reached.

The intersection layout tested in SIDRA is shown in Figure 14, while Figure 15 shows the PM Peak hour (worst case) demand flows and corresponding Lane Summary Results for year 2027.

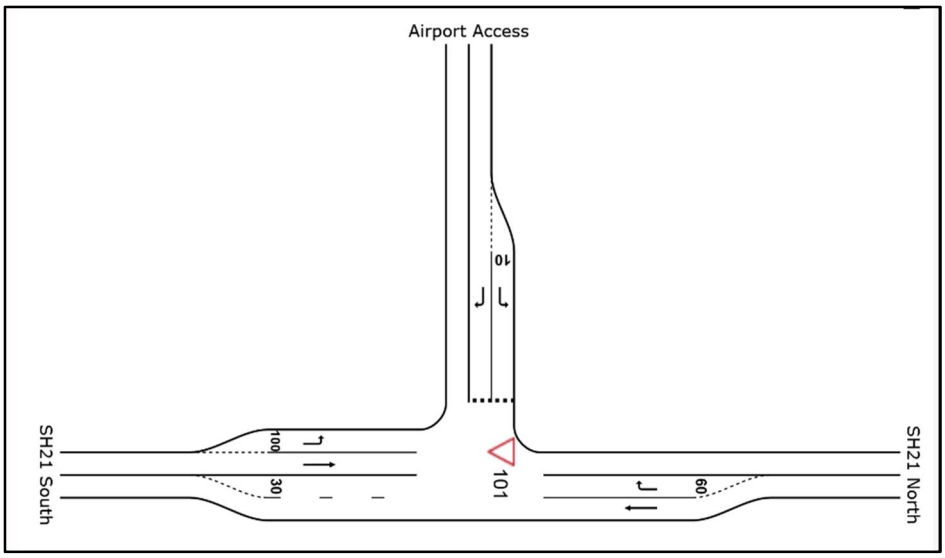
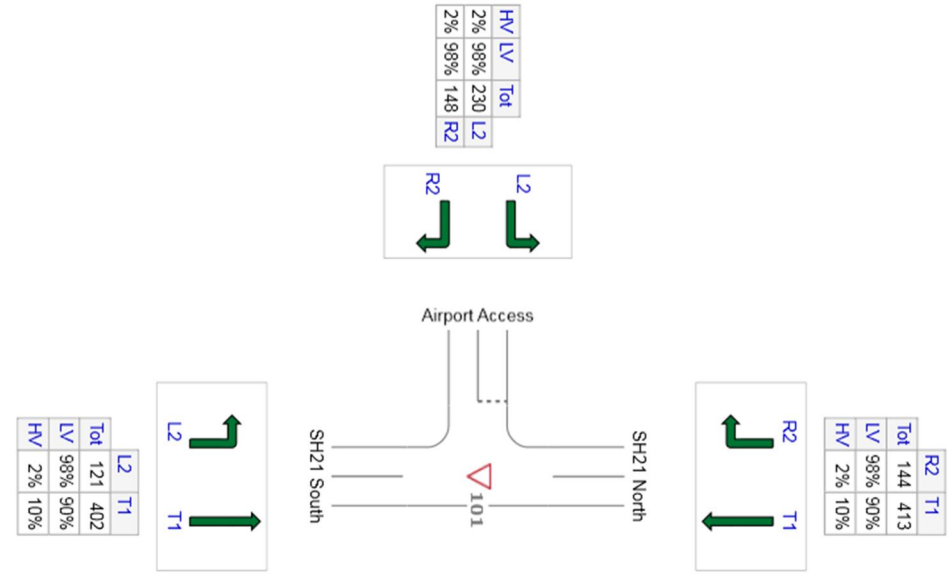


Figure 14: Existing SH 21 / Airport intersection layout in SIDRA



LANE SUMMARY

Site: 101 [2027 PM Peak]

Hamilton Airport Access
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SH21 South													
Lane 1	127	2.0	1850	0.069	100	4.6	LOS A	0.0	0.0	Short	100	0.0	NA
Lane 2	423	10.0	1850	0.229	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	551	8.1		0.229		1.1	NA	0.0	0.0				
North: SH21 North													
Lane 1	435	10.0	1850	0.235	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	152	2.0	758	0.200	100	8.0	LOS A	0.8	5.7	Short	60	0.0	NA
Approach	586	7.9		0.235		2.1	NA	0.8	5.7				
West: Airport Access													
Lane 1	242	2.0	819	0.296	100	7.5	LOS A	1.3	9.0	Short	10	0.0	NA
Lane 2	156	2.0	200	0.779	100	45.6	LOS E	4.6	32.7	Full	500	0.0	0.0
Approach	398	2.0		0.779		22.4	LOS C	4.6	32.7				
Intersection	1535	6.5		0.779		7.0	NA	4.6	32.7				

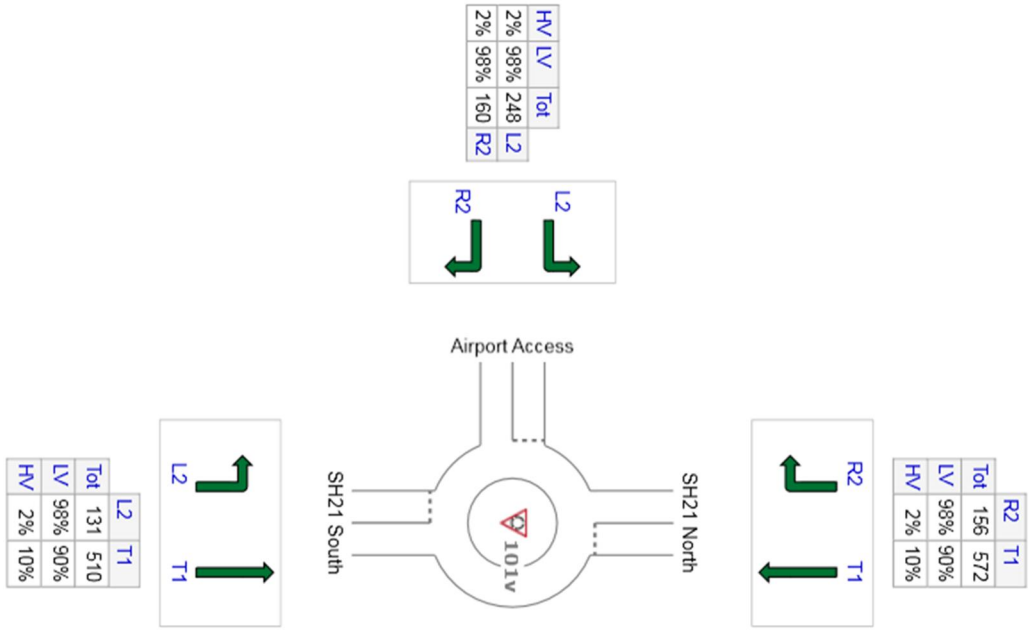
Figure 15: Existing RTB Intersection PM Peak Hour Demand Flows and Lane Summary Results

9.2 PROPOSED AIRPORT AND CENTRAL PRECINCT ROUNDABOUT INTERSECTION

The performance of the proposed roundabout intersection as presented in Section 5.1 has been assessed with the revised trip generation figures from Table 2, using SIDRA Intersection v 7. The same further bullet pointed inputs in 8.1 are also included.

The assessment identified that the roundabout functions well with LOS A on SH 21 and LOS B (10s average delay) on the Airport access road through to 2041. These results are on the basis that Southern Links arterials have not been built. With the WRTM predicted flow reductions on SH 21 due to Southern Links the roundabout functions at LOS A for all movements.

Figure 16 shows the PM Peak hour (worst case) demand flows and corresponding Lane Summary Results for year 2041 with no Southern Links related flow reductions on SH 21.



LANE SUMMARY

Site: 101v [2041 PM Peak One Lane RAB no SL]

Hamilton Airport Access
Roundabout

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: SH21 South													
Lane 1[d]	675	8.4	1151	0.586	100	3.5	LOS A	5.2	39.1	Full	500	0.0	0.0
Approach	675	8.4		0.586		3.5	LOS A	5.2	39.1				
North: SH21 North													
Lane 1[d]	766	8.3	1146	0.669	100	4.8	LOS A	6.9	51.7	Full	500	0.0	0.0
Approach	766	8.3		0.669		4.8	LOS A	6.9	51.7				
West: Airport Access													
Lane 1[d]	429	2.0	777	0.553	100	10.0	LOS B	4.7	33.4	Full	500	0.0	0.0
Approach	429	2.0		0.553		10.0	LOS B	4.7	33.4				
Intersection	1871	6.9		0.669		5.5	LOS A	6.9	51.7				

Figure 16: Proposed SH 21 / Airport Roundabout – 2041 PM Peak Hour Performance Results

9.3 PROPOSED SOUTHERN PRECINCT RIGHT TURN BAY INTERSECTION

The performance of the proposed Southern Precinct right turn bay intersection as presented in Section 5.2 has been assessed on the basis of the industrial land use trip generation figures from Table 2. The same further bullet pointed inputs in Section 8.0 have also been applied. Figure 17 illustrates the modelled intersection layout.

With 100% of traffic generation from the Southern Precinct the separate intersection access performs well (around 35 s/veh average delay for the right turn out movement) for the next 15 years, to 2032. After 20 years (2037/38) the average delay per vehicle for the right turn out is approximately 45 seconds, which incidentally is the "construction" trigger delay as defined in the NZTA / WRAL MoA for upgrading the Airport RTB intersection. SIDRA results for 2038 are in Figure 18.

Note that this assessment reflects the weekday PM peak hour period, being the typical worst case for industrial activities. This assessment assumes 10% inbound traffic and 90% outbound for this period. Traffic distribution is based on flow data from the 2041 WRTM (Ham Bypass model) for the airport intersection. The WRTM shows 38% of trips towards SH3 and 62% towards SH1. This is rounded to 40/60 for this assessment.

On the basis that construction of Southern Links SH3 section commences in 2033 and is completed four years later (2036) this assessment demonstrates that the intersection has sufficient capacity to operate with the full development until Southern Links is built. If Southern Links SH 3 section is delayed beyond 2038 then the Southern Precinct industrial access road traffic delays is likely to increase above 45 s/veh in the PM Peak hour if traffic growth on SH 21 were to continue at the average rate derived from the 2041 and 2021 WRTM models.

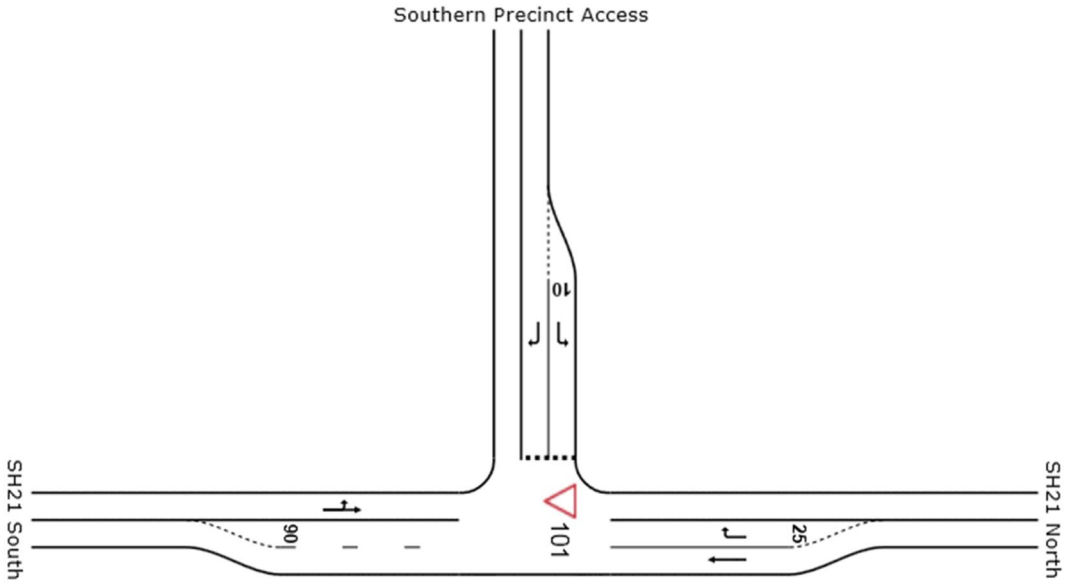
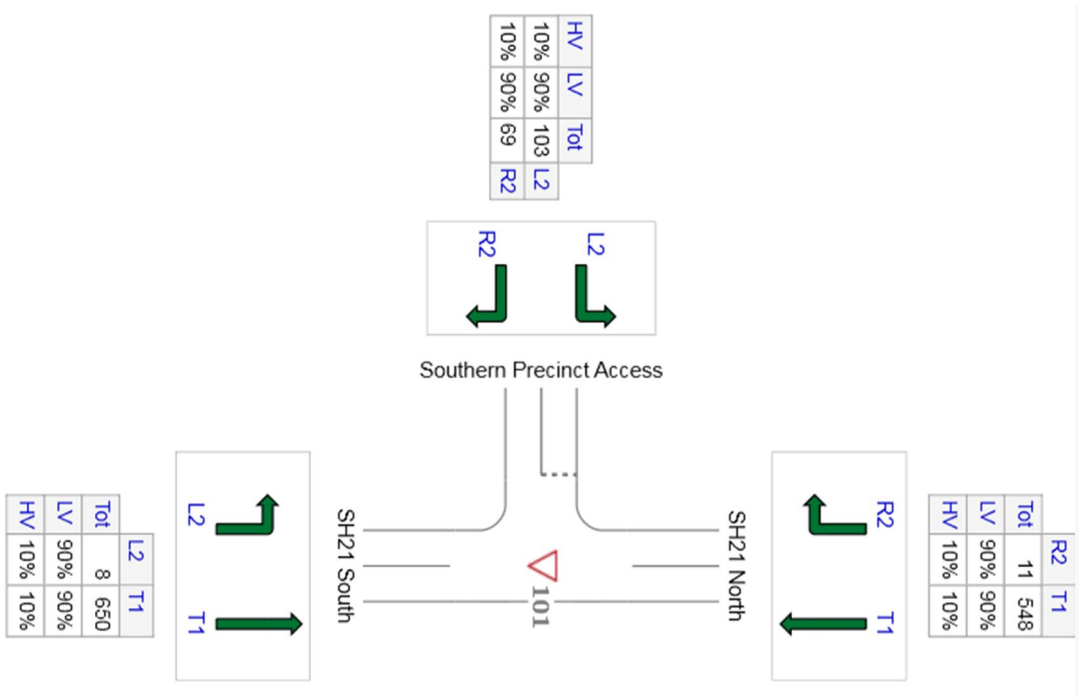


Figure 17: Proposed Southern Precinct Access Intersection Layout in SIDRA



LANE SUMMARY

Site: 101 [2038 PM Peak 100% Dev no SL]

Southern Precinct Access - pre Southern Links
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SH21 South													
Lane 1	693	10.0	1849	0.375	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	693	10.0		0.375		0.1	NA	0.0	0.0				
North: SH21 North													
Lane 1	577	10.0	1850	0.312	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	12	10.0	715	0.016	100	8.5	LOS A	0.1	0.5	Short	25	0.0	NA
Approach	588	10.0		0.312		0.2	NA	0.1	0.5				
West: Southern Precinct Access													
Lane 1	108	10.0	675	0.161	100	8.9	LOS A	0.6	4.5	Short	10	0.0	NA
Lane 2	73	10.0	135	0.539	100	45.1	LOS E	2.1	15.6	Full	500	0.0	0.0
Approach	181	10.0		0.539		23.4	LOS C	2.1	15.6				
Intersection	1462	10.0		0.539		3.0	NA	2.1	15.6				

Figure 18: Proposed SH 21 / Southern Precinct - 2038 PM Peak Hour Performance Results

A sensitivity test has been conducted to identify the effect of the trip distribution being 50/50 for SH3 and SH1 respectively, or potentially as a worst case, a 60/40 split as opposed to the predicted 40/60 split. For the 50/50 directional split, the average delay for right turn out vehicles is 53.3 s/veh. On the basis of the 60/40 split the delay increases to 68.5 s/veh. The full SIDRA results for each are included in Appendix D.

While it is acknowledged that these are significant delays with potentially serious safety implications given the high speed environment, the effects are in 20 years' time when construction of Southern Links arterials is expected to have commenced if not already be partially (or fully) complete.

On the basis that the SH 3 section of Southern Links is completed and in use by 2038, the volume reduction for the PM Peak hour on SH 21 south of Mystery Creek Road as derived from the Southern Links WRTM models is approximately 45%.

Figures 19 and 20 show the resulting PM Peak hour flow demands and improved intersection performance for the Southern Precinct access, with Southern Links and the worst case sensitivity trip distribution of 60/40 to SH3 and SH1 respectively.

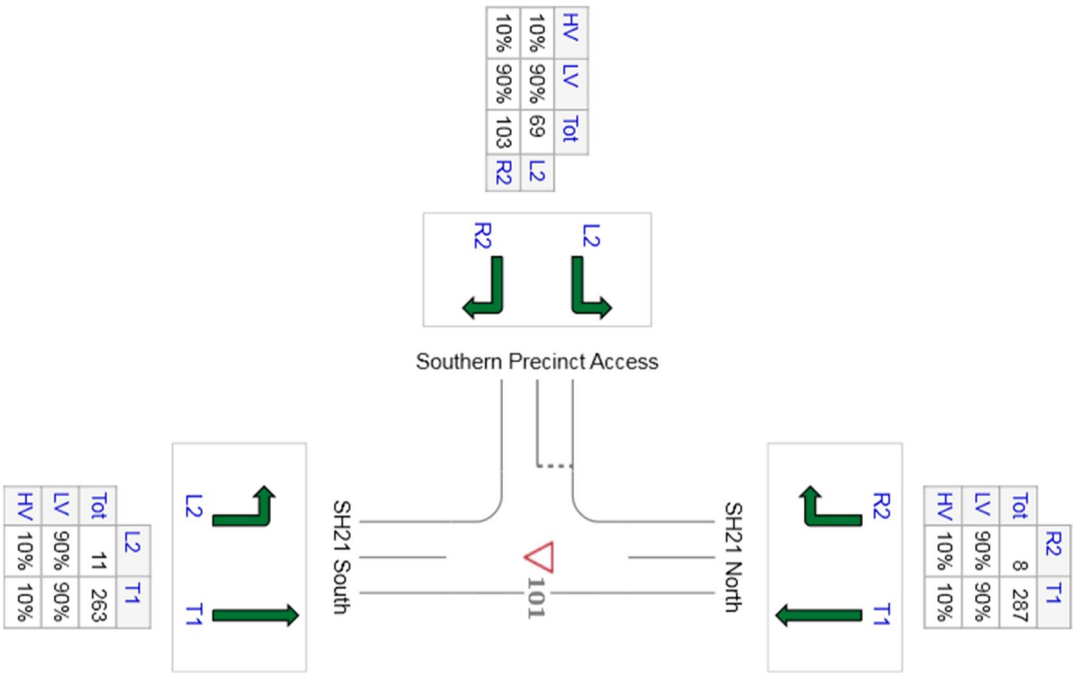


Figure 19: 2038 PM Peak SH 21 / Southern Precinct Intersection, with Southern Links

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SH21 South													
Lane 1	288	10.0	1846	0.156	100	0.2	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	288	10.0		0.156		0.2	NA	0.0	0.0				
North: SH21 North													
Lane 1	302	10.0	1850	0.163	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	8	10.0	1272	0.007	100	5.7	LOS A	0.0	0.2	Short	25	0.0	NA
Approach	311	10.0		0.163		0.2	NA	0.0	0.2				
West: Southern Precinct Access													
Lane 1	73	10.0	1183	0.061	100	5.7	LOS A	0.2	1.8	Short	10	0.0	NA
Lane 2	108	10.0	509	0.213	100	10.4	LOS B	0.8	6.3	Full	500	0.0	0.0
Approach	181	10.0		0.213		8.5	LOS A	0.8	6.3				
Intersection	780	10.0		0.213		2.1	NA	0.8	6.3				

Figure 20: 2038 PM Peak Hour with Southern Links, SH 21 / Southern Precinct Intersection

Figure 20 reveals that LOS B is the worst movement performance with an average delay of 10.4 s/veh on the right turn out movement once Southern Links SH3 section is open to traffic. This is a significant improvement and demonstrates that the intersection is a viable long term solution for access to the Southern Precinct of Titanium Park.

10.0 CONSULTATION WITH NZ TRANSPORT AGENCY AND WAIPA DISTRICT COUNCIL

10.1 THE NEW ZEALAND TRANSPORT AGENCY

Consultation with the NZ Transport Agency has commenced and the parties agreed to work collaboratively through the various issues, including any necessary updates to the MoA that TPL's revised masterplan and access strategy raises.

A meeting between WRAL representatives and BBO, with the NZ Transport Agency and their consultant planner and traffic engineer was conducted on 9 August 2017 at the Airport to discuss the proposed new access strategy.

This meeting involved discussion around the strategic importance of the airport facility to the Waikato, and the different focus by WRAL to that of the previous Central and Southern Precinct operators, the TPJV, now that WRAL have responsibility for the development of these precincts. WRAL's focus on the airport means that future road access and infrastructure plans for the site support and promote the airport as the main priority.

Discussions also centred on the role of SH 21 as a strategic link between the SH1 Waikato Expressway and SH 3, and potentially over the longer term reducing in strategic importance as the Southern Links arterials are completed. In relation to this the NZ Transport Agency identified the need for a strong 'story' supporting the need for the separate access to Southern Precinct when presented to the NZ Transport Agency board. The NZ Transport Agency also highlighted the importance of providing a conveniently located walking and cycling connection internally between the Southern and Central Precincts. This will ensure that future employees can easily move between the Central and Southern employment areas with a high degree of safety, and avoid the need to walk or cycle on the State Highway where safety for vulnerable road users is much lower due to the higher vehicle speeds. Accordingly, an internal shared path connection is proposed in Section 5.3 of this report.

10.2 WAIPA DISTRICT COUNCIL

An initial meeting with Wayne Allan and Richard Bax of Waipa District Council occurred on 28 September 2017, at which the proposed revised access strategy was presented and explained. Council's response was generally supportive in principle given the benefits to the Airport operations over the existing Structure Plan access layout, and the potential for enhanced visual gateway to the Terminal that the relocated roundabout would offer. Council advised that the most appropriate planning process given the extent of changes was to carry out a private plan change to amend the rules and structure plan in the District Plan.

Consultation with council will continue in tandem as progress is made on the planning aspects, and with the NZ Transport Agency to confirm the final access locations.

11.0 CONCLUSION

The following conclusions are reached as a result of this ITA report for the revised Access Strategy:

Central Precinct Access

- WRAL have taken over ownership of the Central and Southern development Precincts of Titanium Park, adjacent to the Airport Terminal.
- The Airport terminal and operations are WRALs core business. WRAL wish to shift the position of the future SH 21 roundabout access to ensure it serves the objectives of the Airport first and foremost, while providing appropriate access to the business park.
- Section 5.1 identifies the proposed new location for the future roundabout, being approximately 100m to the north of the existing Airport access intersection.
- The overall diameter of the roundabout is 60m, and the geometric design achieves Austroad standards.
- The position of the roundabout achieves a separation distance of 560m to Mystery Creek Road, which complies with the NZTA Planning Policy Manual requirement for intersections.
- Lochiel Road intersection with SH 21 will remain in its present form as a stop controlled 'T' intersection. Lochiel Road has very low daily flows with compliant sightlines looking to the north from the stop limit line, but non-compliant sight distance to the south by 98m. The lack of crash history suggests that this is not a significant impediment to the safe function of this intersection. The resulting effects of Lochiel Road / SH 21 remaining as a 'T' intersection are considered to be minor and acceptable.
- Relocating the roundabout may also affect future access for the "Ashton Block" of land. However the block was not rezoned for industrial land use and there is no formal requirement to provide access via the roundabout.

Southern Precinct Access

- TPL consider that the significant disruption and cost to the Airport operations to build an internal road connection between the Central and Southern Precinct is not viable. Therefore, BBO have identified at a high level, a concept design for a separate access intersection on SH 21, for the Southern Precinct.
- Two potential 'T' intersection options are identified, with Option 2 being the preferred in principle by WRAL, NZTA and Waipa District Council. The Option 2 intersection separation distance to Mystery Creek Road is 500m, and to the SH 3 roundabout, 965m. This complies with the NZTA Planning Policy Manual minimum separation distance of 500m between intersections.
- The separation distance to the right turn bay access to the John Roberts Contracting site access on the opposite side of the road is 200m, which complies with the NZTA Planning Policy Manual minimum of 200m.

- An existing property access at #108 Airport Road requires relocation northwards to maximise safety. Permission from the land owner and NZTA will be required to achieve this.
- The preferred intersection location also involves extending the existing deceleration lane on the opposite side of the road northwards approximately 40-50m, and remarking this lane with hatched chevron markings to form a wide shoulder. HCVs turning right out of the new access road can then make efficient use of the wide shoulder for acceleration towards SH 3.
- A walking and cycling path will be provided internally between the Southern and Central precincts. This avoids any need for walking or cycling trips on SH 21 to travel between the two precincts.

Intersection Performance and Timing

- The WRTM identifies that SH 21 traffic volumes are predicted to increase by 2500 vpd in 2021 due to the Hamilton Section of the Waikato Expressway.
- Similarly, the Southern Links SH 3 section is predicted to reduce volumes on SH21 between Mystery Creek Road and SH 3 by 45-50%.
- TPL now intend to develop the total 18.4 ha area previously identified as office/research and development, as light industrial. On this basis the total combined light industrial area in the Central and Southern Precincts will be 23.35 ha. The reduction in trip generation is 64% in the AM Peak and 56% in the PM Peak.
- The existing Right Turn Bay Airport intersection is now predicted to reach the MoA "construction" trigger of 45s/veh delay for building the SH 21 roundabout in about 2027 with 95% of the Central Precinct developed. This is on the basis of SH 21 volumes increasing with the opening of the Hamilton Section of the Waikato Expressway in 2021.
- The proposed SH 21 / Airport access roundabout performs well with LOS A on SH 21 and LOS B (10s average delay) on the Airport access road through to 2041, with full development of the Central Precinct as predominantly industrial land use. With Southern Links SH 3 section built by 2038 the roundabout performance improves to LOS A for all movements.
- The recent successful application to the central government Infrastructure Fund to enable development of the Peacocke Residential Growth Cell, may be a catalyst that brings forward construction of the highway sections of Southern Links.
- The proposed SH 21 / Southern Precinct intersection performs well for 15 years (up to LOS D) with 100% development traffic added. The performance worsens to LOS E (45s/veh average delay) after 20 years, at 2037-38.
- On the basis that the SH3 section of Southern Links is under construction from 2033 and completed by 2038 the right turn out delay at the Southern Precinct intersection is unlikely to reach 45 seconds per vehicle, and instead will be performing much better with 10 seconds average delay per vehicle (LOS B). This assessment demonstrates that the intersection has sufficient capacity to perform satisfactorily for 20 years until Southern Links provides an alternative route to SH 21.

Overall, this assessment demonstrates that the proposed revised access strategy for the Central and Southern Precincts of Titanium Park is practical, and safe with effects that are either less than minor or acceptable for the long term until Southern Links arterials provide an alternative to SH 21 as a strategic link between SH 3 and SH 21.

The access strategy also aligns with the draft GPS2018, and Regional and District land transport strategies which all have transport safety, economic development and increased walking and cycling as key objectives. The proposed roundabout and separate intersection access for the Southern Precinct, together with the walking and cycling path between the two Precincts meet these objectives.

12.0 RECOMMENDATIONS

Bloxam Burnett and Olliver Ltd recommend the following actions be undertaken in support of the revised access strategy for the Titanium Park Central and Southern Precincts:

- That the revised roundabout location for the Central Precinct together with the Option 2 Southern Precinct intersection concept, as described in this ITA, be advanced with the NZ Transport Agency for written approval;

- That, upon agreement with the NZ Transport Agency and Waipa District Council, the revised access arrangements are confirmed in the District Plan with an amended Airport Business Structure Plan that shows:
    - The future SH 21 roundabout position in general accordance with Drawing 144380/01/P/0101_A
    - The proposed Southern Precinct access intersection in general accordance with Drawing 144380/01/P/0221_A

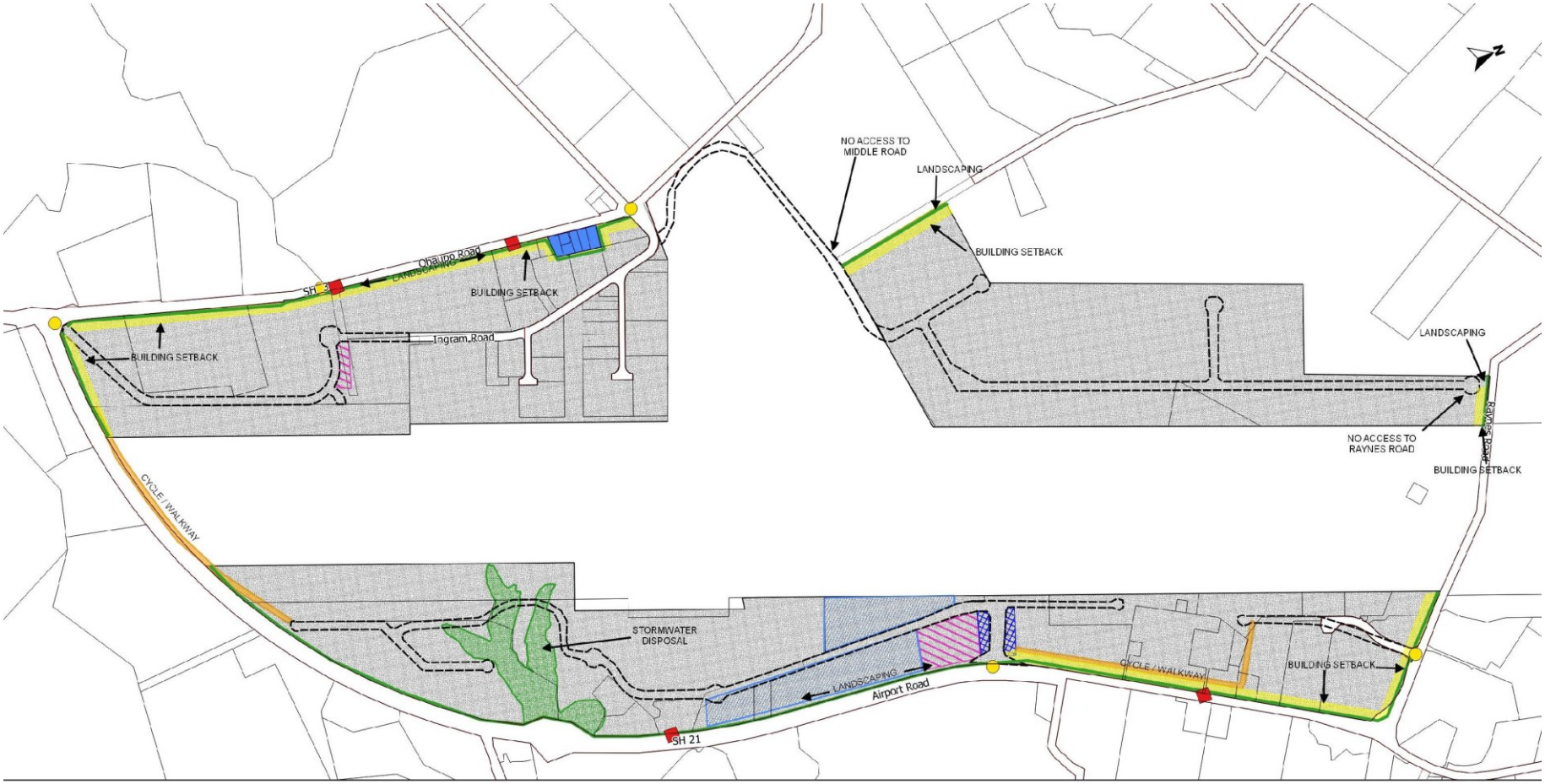
- That the Airport Business Zone Structure Plan is amended to delete the internal road connection presently shown between the Southern Precinct and Central Precinct, and only a shared walking and cycling path be provided.

- That the existing designation for the roundabout at Lochiel Road, and for the Lochiel Road realignment be uplifted.

- That the existing vehicle access to #108 Airport Road (Numax Industries) is permanently closed and replaced by a new access to the same standard approximately 85m north of the existing access location, subject to NZ Transport Agency approval.

Appendix A

Airport Business Zone Structure plan



Legend

Road/Access Stopped	Stage 1 Development	Cycleway/Walkway Connection
Access Point/Gateway	Airport Business Zone	Building Setback
Landscaping	Special Amenity Area	Landscape/Open Space
Indicative Road	Stormwater Disposal	Retail Area

Airport Business Zone Structure Plan

Appendix S10

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Waipa DISTRICT COUNCIL

Revision 1	Reference
Scale at A3 1:9000	Print Date Wed Jun 10 2015

Appendix B

Drawings - Revised Access Strategy Concept Intersection Designs

100mm

SCALE FOR VALIDATING SIZE OF A3 PLOT ONLY

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A	27.07.2017	INITIAL ISSUE	GT	JS	

mx model version:

Version 2.04 – October 2013

Designed: GT | Checked: JS
Drawn: GT | Approved:

BLOXAM BURNETT OLLIVER
Phone 64-7-838 0144, Fax 64-7-839 0431

Client: TITANIUM PARK LIMITED

Project: CENTRAL & SOUTHERN PRECINCT ACCESS

Drawing: OVERALL PLAN

Status: PRELIMINARY

Date: 27.07.2017 | Scale (Original Size A3): 1:5000

Drawing Number: 144380/01 /P /0101 | Revision: B

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100mm

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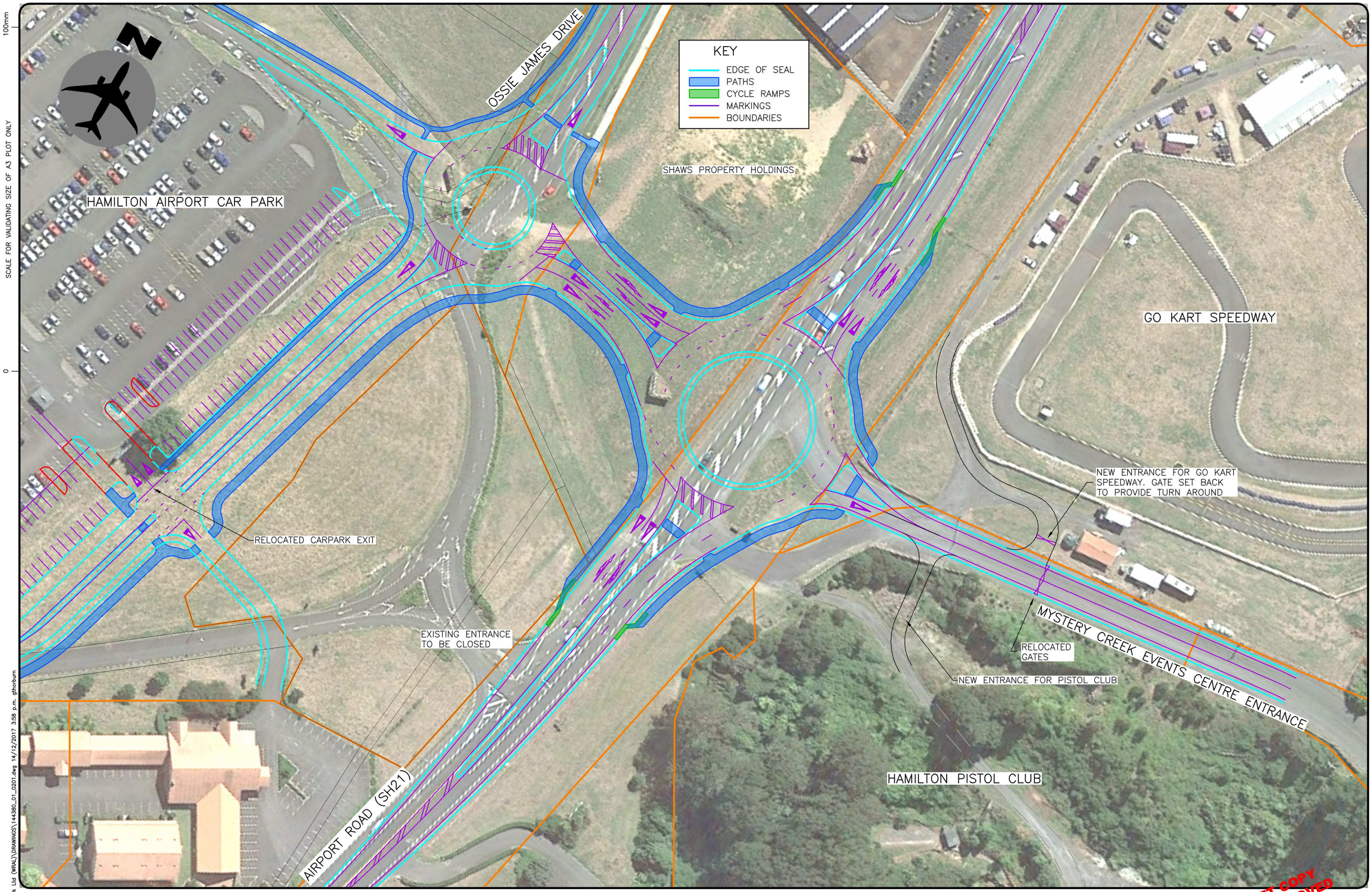

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A	27.07.2017	INITIAL ISSUE	GT	JS	

Version 2.04 – October 2013

Designed: GT | Checked: JS
Drawn: GT | Approved:
mx model version:

BLOXAM BURNETT OLLIVER
Phone 64-7-838 0144, Fax 64-7-839 0431

Client: TITANIUM PARK LIMITED

Project: CENTRAL PRECINCT ACCESS CONCEPT ROUNDABOUT

Drawing: GENERAL ARRANGEMENT

Status: PRELIMINARY
DRAFT COPY NOT APPROVED

Date: 27.07.2017 | Scale (Original Size A3): 1:1000

Drawing Number: 144380/01 /P /0201 | Revision: –

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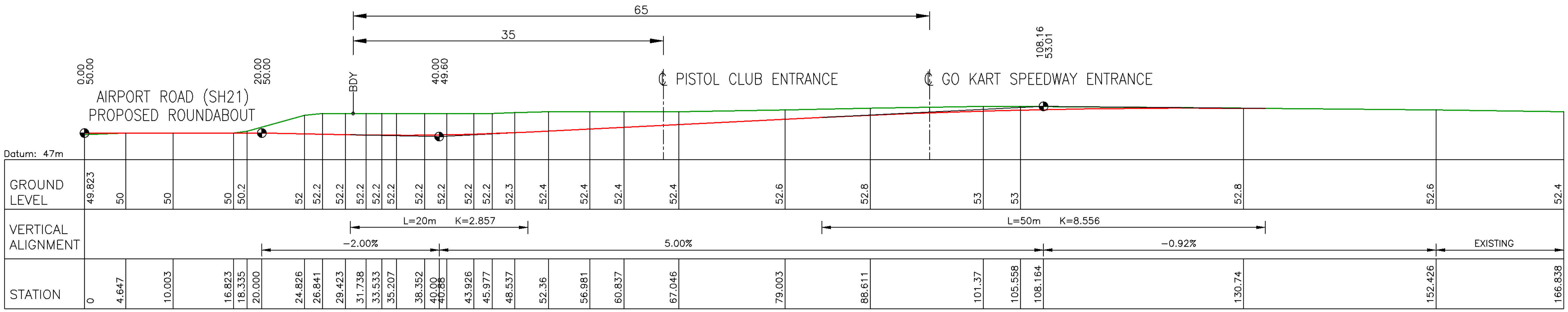

MYSTERY CREEK EVENTS CENTRE ENTRANCE LONG SECTION

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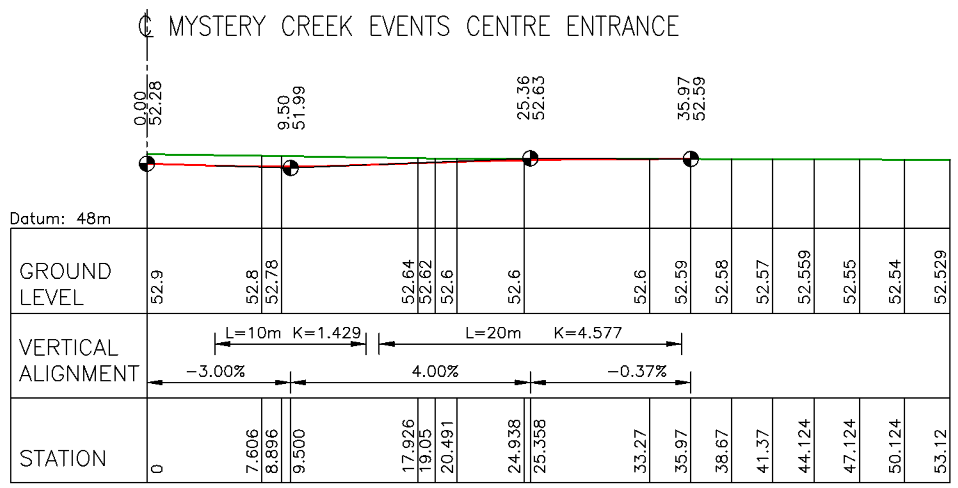

GO KART SPEEDWAY ENTRANCE LONG SECTION

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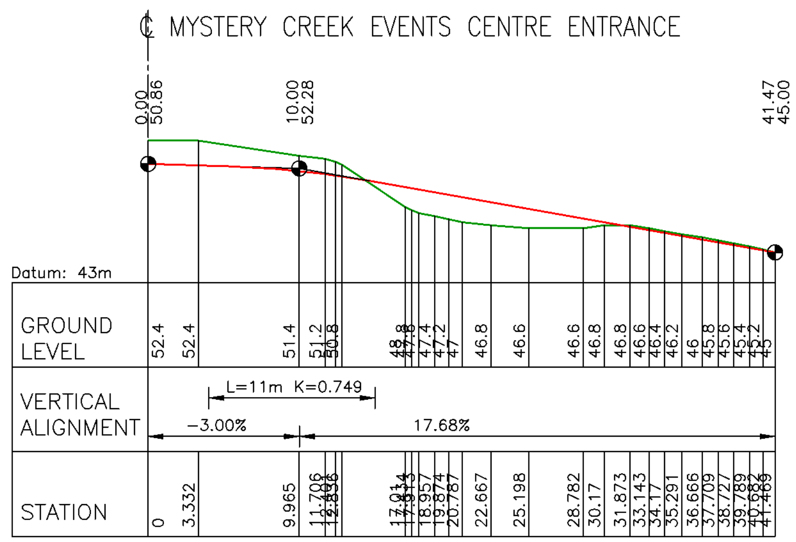

PISTOL CLUB ENTRANCE LONG SECTION

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Drawn: GT | Approved:
mx model version:

BLOXAM BURNETT OLLIVER

Phone 64-7-838 0144, Fax 64-7-839 0431

Client: TITANIUM PARK LIMITED

Project: CENTRAL PRECINCT ACCESS CONCEPT ROUNDABOUT

Drawing: ENTRANCE LONG SECTIONS

Status: PRELIMINARY

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Date: 14.12.2017

Scale (Original Size A3): 1:500

Drawing Number: 144380/01 /P /0204

Revision: –

Version 2.04 – October 2013

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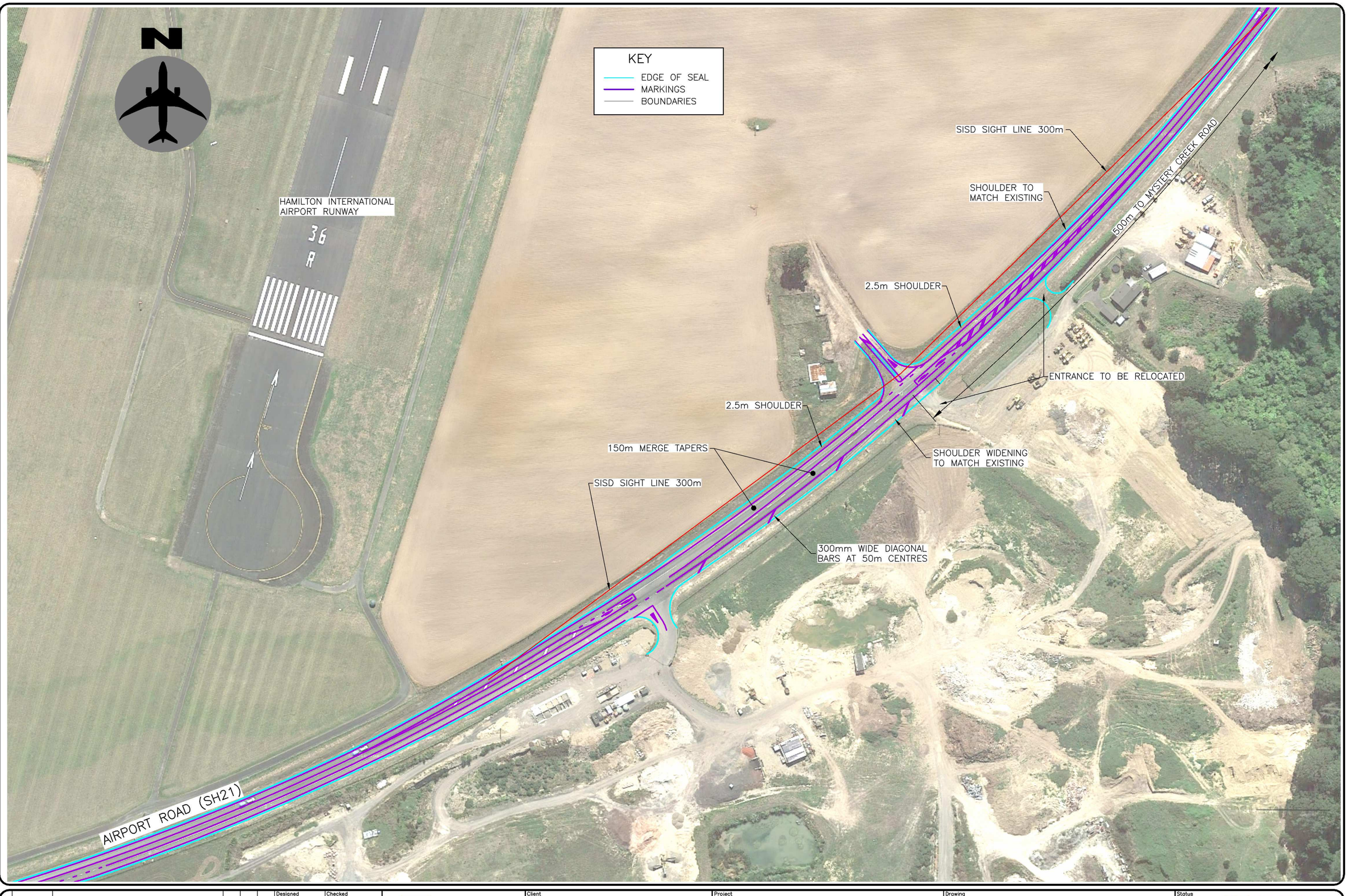

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	Date	Issue/revision detail	By	Chk	Appr	

BLOXAM BURNETT OLLIVER
Phone 64-7-838 0144, Fax 64-7-839 0431

Client: TITANIUM PARK LIMITED

Project: SOUTHERN PRECINCT ACCESS CONCEPT LAYOUT

Drawing: RIGHT TURN BAY

Status: PRELIMINARY

Date: 27.09.2017

Scale (Original Size A3): 1:2000

Drawing Number: 144380/01 /P /0221

Revision: B

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100mm

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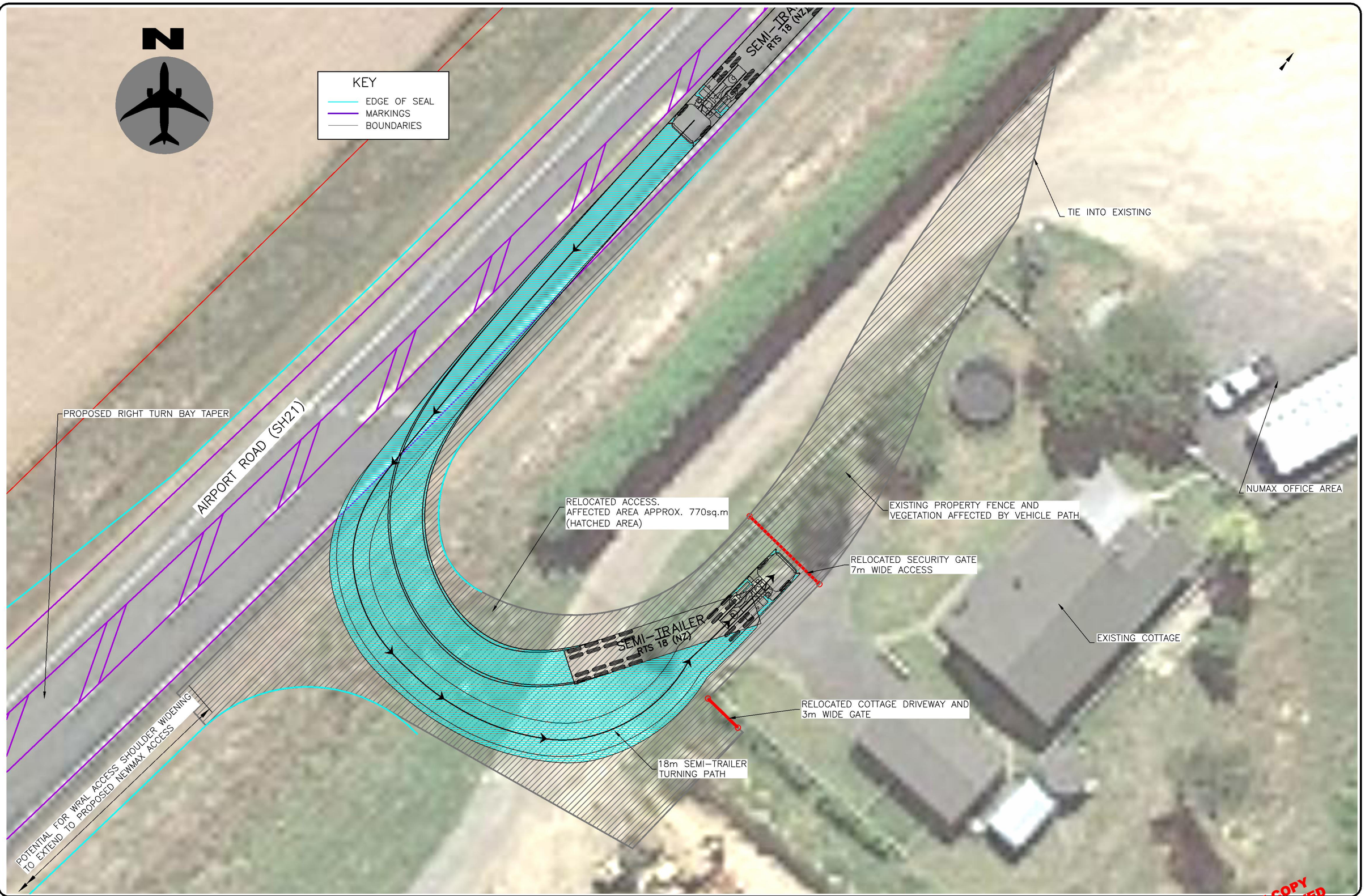

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mx model version:

Version 2.04 – October 2013

BLOXAM BURNETT OLLIVER
Phone 64–7–838 0144, Fax 64–7–839 0431

Client: TITANIUM PARK LIMITED

Project: SOUTHERN PRECINCT ACCESS CONCEPT LAYOUT

Drawing: ACCESS #108 AIRPORT ROAD PROPOSED RELOCATED ACCESS SEMI–TRAILER TURNING PATH

Status: PRELIMINARY

DRAFT COPY NOT APPROVED

Date: 25.01.2018 | Scale (Original Size A3): 1:250

Drawing Number: 144380/01/SK/0001 | Revision: B

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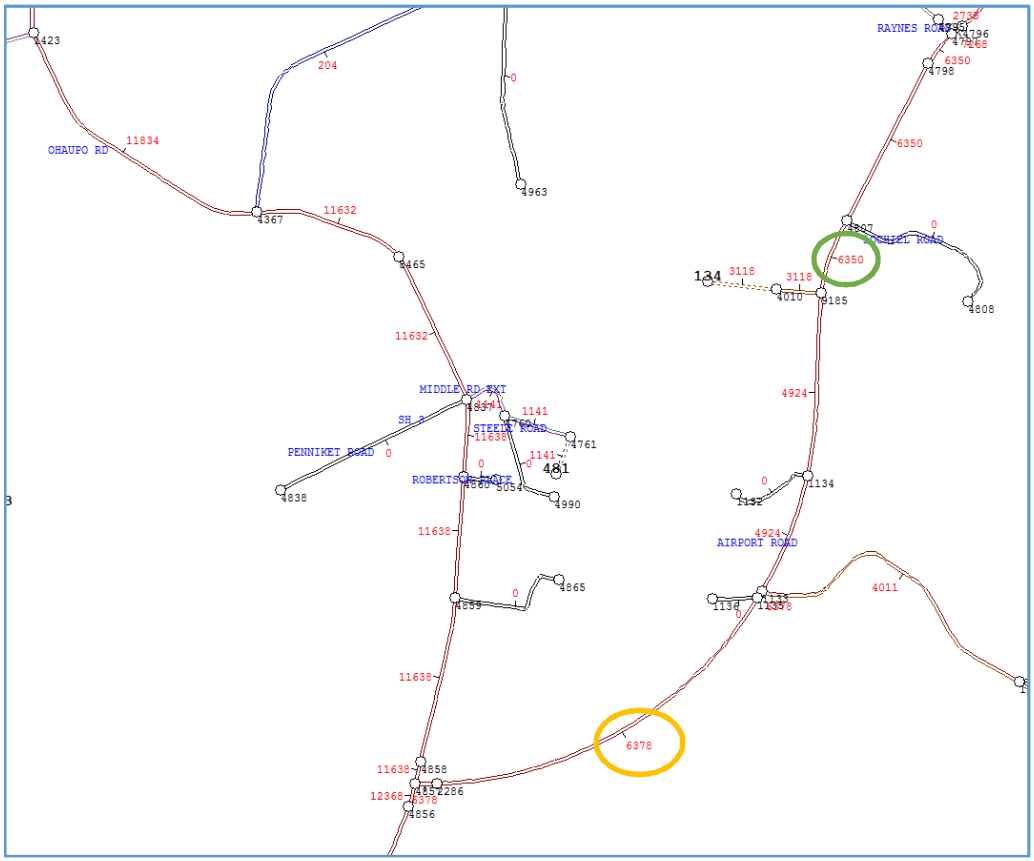
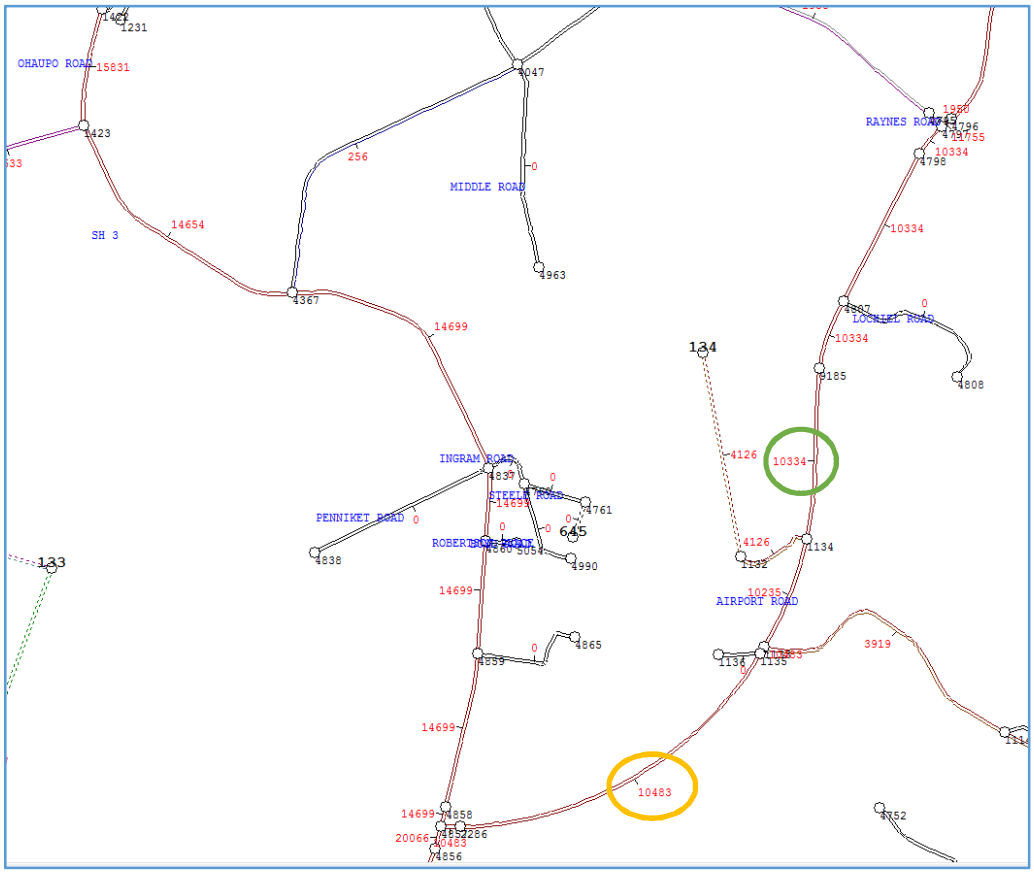
Appendix C

Waikato Regional Transportation Model 2021 and 2041 Daily Demand Volumes

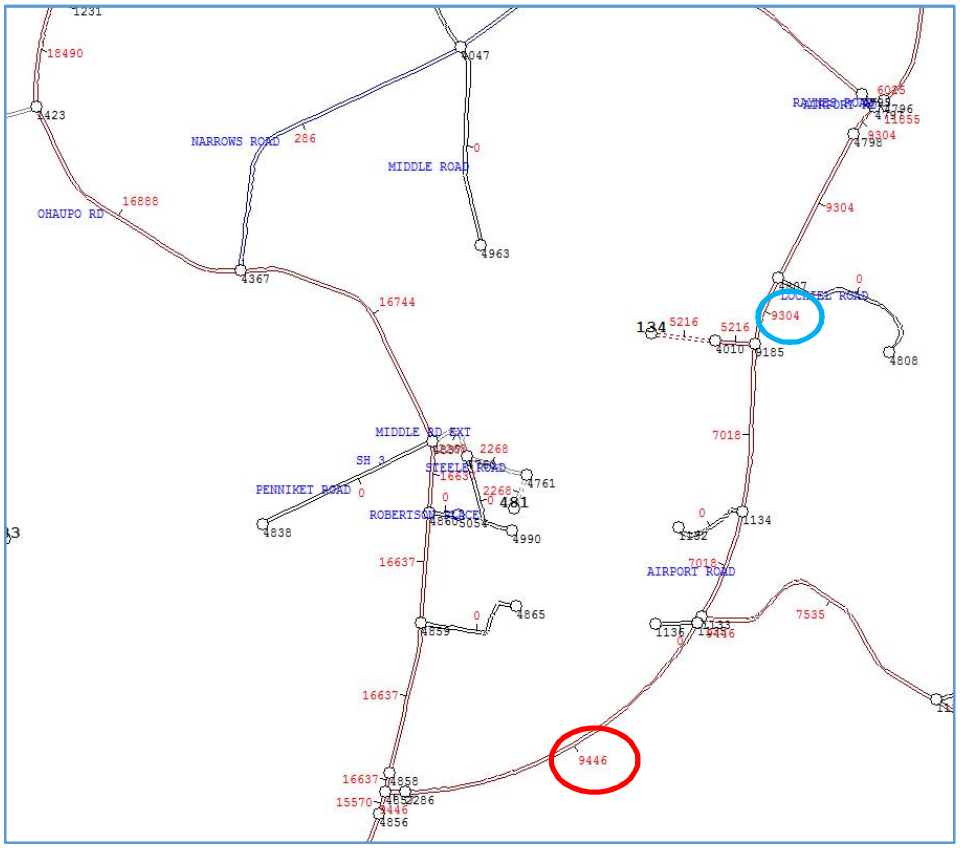
2021 Southern Links Do Min WRTM (with HamWex) Average Daily Traffic Volumes



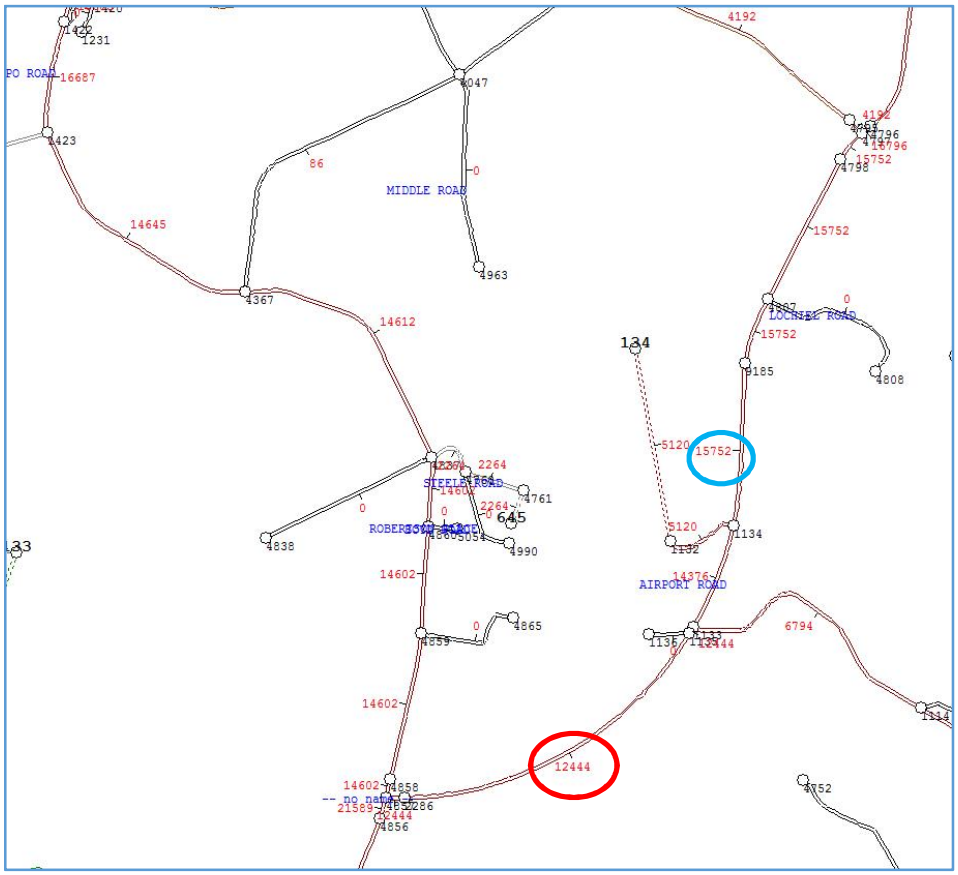
2021 HamWex WRTM Average Daily Traffic Volumes



2041 Southern Links Do Min WRTM (with HamWex) Average Daily Traffic Volumes



2041 HamWex WRTM Average Daily Traffic Volumes



Appendix D

SIDRA Model
Sensitivity Test Results

LANE SUMMARY

Site: 101 [2038 PM Peak 100% Dev no SL 50/50]

Southern Precinct Access - pre Southern Links
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: SH21 South													
Lane 1	694	10.0	1849	0.375	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	694	10.0		0.375		0.1	NA	0.0	0.0				
North: SH21 North													
Lane 1	577	10.0	1850	0.312	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	9	10.0	714	0.013	100	8.5	LOS A	0.1	0.4	Short	25	0.0	NA
Approach	586	10.0		0.312		0.2	NA	0.1	0.4				
West: Southern Precinct Access													
Lane 1	91	10.0	675	0.134	100	8.8	LOS A	0.5	3.7	Short	10	0.0	NA
Lane 2	91	10.0	135	0.671	100	53.3	LOS F	2.8	21.6	Full	500	0.0	0.0
Approach	181	10.0		0.671		31.0	LOS D	2.8	21.6				
Intersection	1461	10.0		0.671		4.0	NA	2.8	21.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

LANE SUMMARY

Site: 101 [2038 PM Peak 100% Dev no SL 60/40]

Southern Precinct Access - pre Southern Links
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: SH21 South													
Lane 1	696	10.0	1848	0.376	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	696	10.0		0.376		0.1	NA	0.0	0.0				
North: SH21 North													
Lane 1	577	10.0	1850	0.312	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	8	10.0	711	0.012	100	8.5	LOS A	0.0	0.3	Short	25	0.0	NA
Approach	585	10.0		0.312		0.2	NA	0.0	0.3				
West: Southern Precinct Access													
Lane 1	73	10.0	675	0.108	100	8.7	LOS A	0.4	3.0	Short	10	0.0	NA
Lane 2	108	10.0	135	0.805	100	68.5	LOS F	4.1	31.0	Full	500	0.0	0.0
Approach	181	10.0		0.805		44.5	LOS E	4.1	31.0				
Intersection	1462	10.0		0.805		5.6	NA	4.1	31.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.