



TE TUPU NGĀTAHI
SUPPORTING GROWTH

Redhills Arterial Transport Network Assessment of Transport Effects

December 2022

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2020 Draft	Author	M Seymour
	Reviewer	J Phillips Matthew Kerr-Ridge
1.0	Author	M Seymour
	Reviewer	A Murray
	Approver	Bridget O'Leary

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Acronym/Term	Description
AEE	Assessment of Environmental Effects
AT	Auckland Transport
ATAP	Auckland Transport Alignment Plan
AUP:OP	Auckland Unitary Plan Operative in Part 2016
CTMP	Construction Traffic Management Plan
ITA	Integrated Transport Assessment
LoS	Level of Service
MSM	Macro Strategic Model
NoR	Notice of Requirement
RMA	Resource Management Act 1991
RPTP	Regional Public Transport Plan
RTN	Rapid Transit Network
SH16	State Highway 16
SH18	State Highway 18
SSTMP	Site Specific Traffic Management Plan
TDM	Transport Design Manual
Waka Kotahi	Waka Kotahi NZ Transport Agency

1 Introduction

1.1 Background

Auckland's population is growing rapidly; driven by both natural growth (more births than deaths) and migration from overseas and other parts of New Zealand. The Auckland Plan 2050 anticipates that this growth will generate demand for an additional 313,000 dwellings and require land for approximately 263,000 additional employment opportunities.

In response to this demand, the Auckland Unitary Plan Operative in Part (**AUP:OP**) identifies 15,000 hectares of predominantly rural land for future urbanisation. To enable the urban development of greenfield land, appropriate bulk infrastructure needs to be planned and delivered.

The Te Tupu Ngātahi Supporting Growth Programme is a collaboration between Auckland Transport (**AT**) and Waka Kotahi NZ Transport Agency (**Waka Kotahi**), to investigate, plan and deliver the transport networks needed to support Auckland's future urban growth areas over the next 30 years.

1.2 Purpose of this Report

The Te Tupu Ngātahi Supporting Growth Programme has identified the need for a new arterial transport network in Redhills to support the urban development of the area. This report has been prepared to support AT's notices of requirement (**NoRs**) for the Redhills Arterial Transport Network (the **Project**). The NoRs under the Resource Management Act (**RMA**) are to designate land to enable the future construction, maintenance, and operation of the Project.

This report provides an assessment of transport effects associated with the construction, operation and maintenance of the Project. This assessment has been prepared to inform the Assessment of Environmental Effects (**AEE**) for the NoRs.

2 Redhills Project Description

The Project consists of two new arterial corridors through the Project area, providing sufficient space for two-lanes for vehicles, new footpaths and dedicated cycleways on both sides of the road. The Project has been broken down into the following NoRs:

Table 1: Notice of Requirements within the Redhills Project

Notice	Project	Description
NoR1	Redhills North-South Arterial Corridor	New urban arterial transport corridor and upgrade of Don Buck and Royal Road intersection.
NoR2a	Redhills East-West Arterial Corridor – Dunlop Road	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the remaining East-West corridor (NoR2c) at the intersection with the Redhills North-South arterial corridor.
NoR2b	Redhills East-West Arterial Corridor – Baker Lane	New urban arterial transport corridor that intersects with Fred Taylor Drive and connects to the intersection of the remaining East-West connection and Dunlop Road (NoR2a).
NoR2c	Redhills East-West Arterial Corridor – Nixon Road connection	New urban arterial transport corridor that intersects with the Redhills East West Arterial Corridor – Dunlop Road. This includes the upgrade of the existing Red Hills Road/Nelson Road/Nixon Road intersection, and the existing Nixon Road/Henwood Road intersection

To safely tie into the existing road network, the Project includes the upgrade of existing intersections where the new corridors will connect, as follows:

- Signalisation of the intersection at Don Buck Road and Royal Road (NoR 1);
- Signalisation of the intersection at Fred Taylor Drive and Dunlop Road (NoR 2a);
- Signalisation of the intersection at Fred Taylor Drive and Baker Lane (NoR 2b); and
- A new roundabout at the intersection of Red Hills Road, Nixon Road and Nelson Roads (NoR 2c).

The Project also provides for new stormwater wetlands for the treatment and attenuation of stormwater from the new corridors.

This report has primarily considered the Project area as a whole. Where relevant, NoR 1 is referred to as the N-S Project, and NoR2a, NoR2b and NoR2c are collectively referred to as the E-W Project.

The Project has been split between four NoRs to reflect the likely implementation of the Project. It may also be possible for each designation to be delivered in stages as the Project area develops.

An overview of the Project is provided in Figure 1. This design, along with the wider designation boundary, is referred to as the Project area throughout this report.

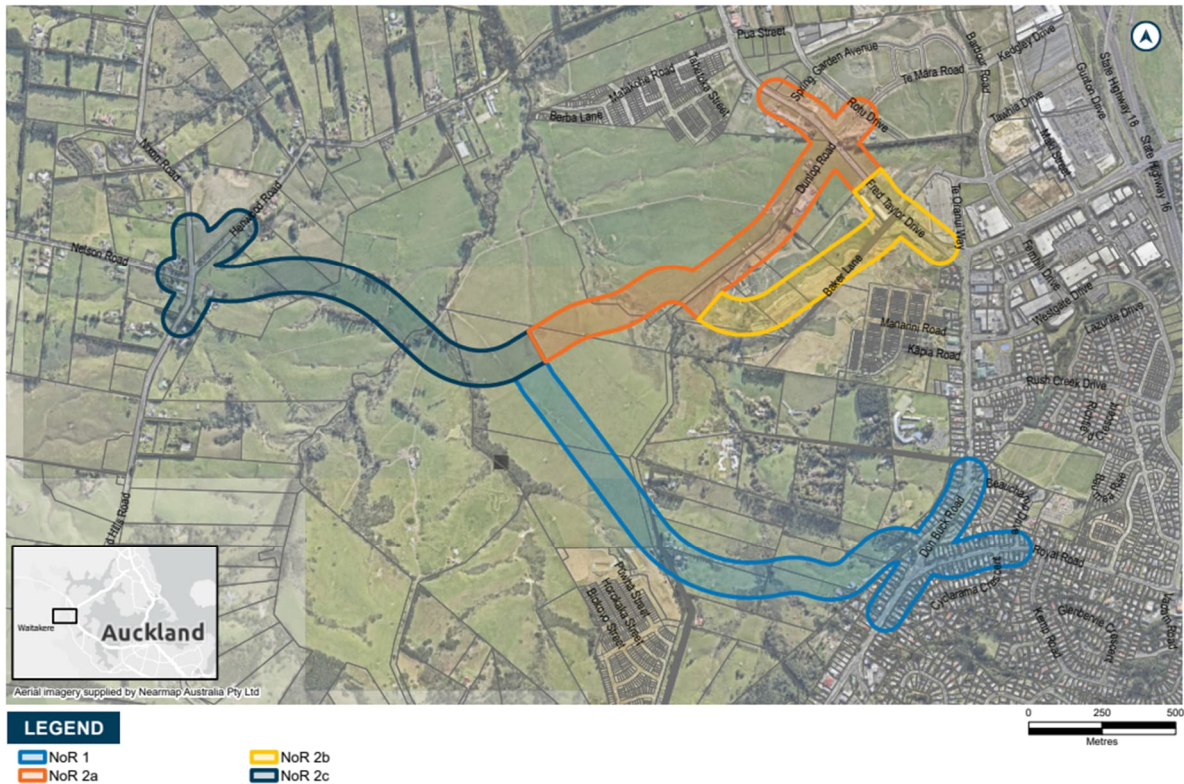


Figure 1: Redhills Arterial Transport Network

2.1 Project Features

The indicative transport features of the Project include:

E-W Project

- Two-lane arterial standard road (24m cross section) between Fred Taylor Drive and Nelson Road
- Signalised intersection at Dunlop Road and Fred Taylor Drive, to include a bus advance box and signal priority, cycle advance box, and pedestrian crossing facilities
- Signalised intersection at Baker Lane and Fred Taylor Drive to include a cycle advance box and pedestrian crossing facilities
- Footpaths on both sides of the road
- Dedicated uni-directional cycle lanes on both sides of the road
- A new roundabout at the intersection of Red Hills Road, Nelson Road and Nixon Road
- Posted speed of 50kph

N-S Project

- Two-lane arterial standard road (24m cross section) between Don Buck Road and the E-W Project
- Signalised intersection at N-S Project, Don Buck Road and Royal Road, to include a bus advance box and signal priority, cycle advance box, and pedestrian crossing facilities
- Footpaths on both sides of the road
- Dedicated uni-directional cycle lanes on both sides of the road
- Posted speed of 50kph

Upgrade to Fred Taylor Drive

- Four-lane arterial standard road between Don Buck Road and the Dunlop Road
- Signalised intersection at Dunlop Road and Baker Lane, to include cycle advance box, and pedestrian crossing facilities, with Dunlop Road also providing a bus advance box
- Footpaths on both sides of the road
- Dedicated uni-directional cycle lanes on both sides of the road
- Posted speed of 50kph

Figure 2: Indicative Redhills Arterial Transport Network Cross Section

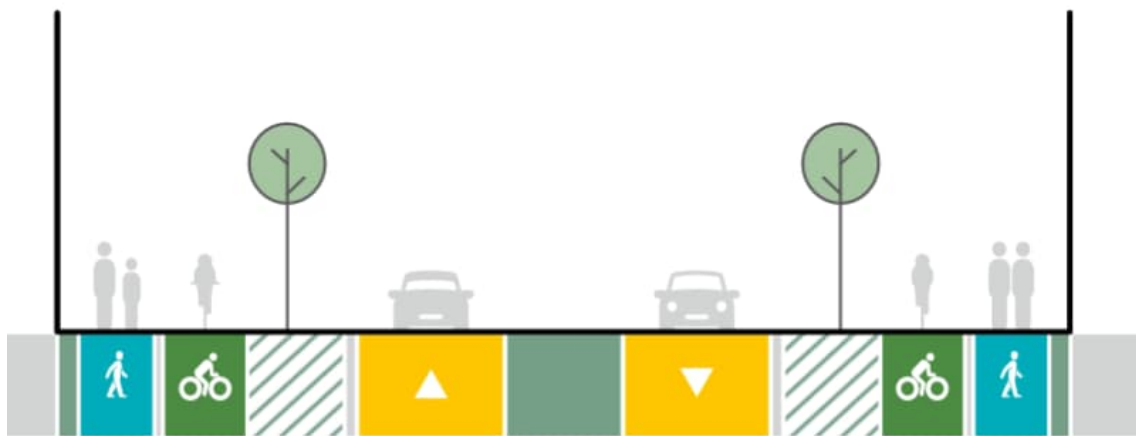


Figure 3: Indicative Fred Taylor Drive Cross Section



3 Assessment Framework

3.1 Statutory Context

3.1.1 Notice of Requirement

This assessment has been prepared to support the NoR process for the Project. Section 171 of the RMA sets out the matters that must be considered by a territorial authority in making a recommendation on an NoR. This includes consideration of the actual or potential effects (including positive effects) on the environment of allowing the requirement.

No regional resource consents are currently being applied for. The necessary regional resource consents will be sought prior to construction of the corridors, at which time any regional consenting matters will be assessed.

3.1.2 Redhills Precinct Plan

When the AUP:OP was originally notified the Redhills area was zoned Future Urban Zone. Through submissions and decisions, the zoning was changed to the current urban zones and a new Precinct was introduced. The Redhills Precinct (I610. Redhills Precinct) includes specific policies, objectives and rules and an indicative proposed roading network was developed (Precinct Plan 1). The inclusion of the Precinct Plan, and specifically the indicative roading network, was appealed to the Environment Court¹.

AT was part of these proceedings and advised the Court that AT and Waka Kotahi were progressing the Te Tupu Ngātahi Supporting Growth Programme. Through this Programme, AT would further investigate and plan for key arterial transport networks to support the future urban growth planned in Auckland and route protect for them. This included accelerated investigation and planning of the transport needs for Redhills.

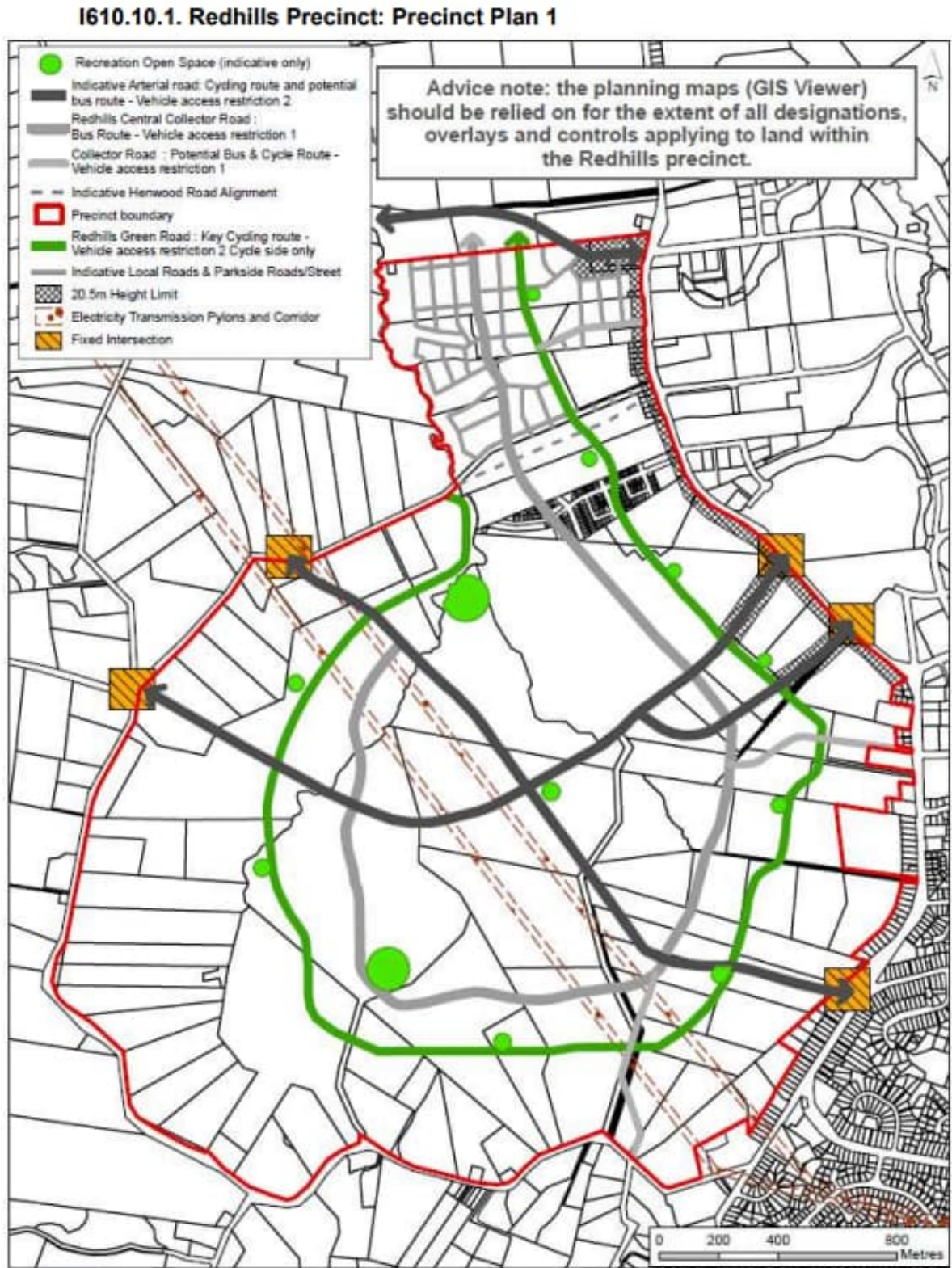
These investigations were used to support the resolution of the appeal and several key factors were identified as preferred outcomes for the Redhills area:

- The future intersection locations with the existing road network – including the use of Baker Lane to connect with Fred Taylor Drive, rather than a connection at the existing Don Buck Road/Fred Taylor Drive roundabout.
- An indicative alignment of the future arterial road network, particularly the relationship of the roading network and the future Redhills local centre. Given scope limitations in the Environment Court proceedings, AT noted that it would subsequently follow up these indicative alignments with confirmed alignments via typical planning processes (such as these NoRs) as part of the wider Te Tupu Ngātahi Supporting Growth Programme, discussed below.
- Confirmation of the core function of the arterial road network – including a key public transport corridor on Dunlop Road to provide greater benefits for walking and cycling and public transport. This would establish connections between the commercial centre of Redhills local centre, Westgate Metropolitan Centre, the future Westgate Rapid Transit Station and the Rapid Transit Network (RTN).

¹ ENV-2016-AKL-000232 Bunnings Limited v Auckland Council

The resulting indicative transport network is shown below in Figure 4.

Figure 4: Redhills Precinct Plan



3.1.2.1 North-South Arterial

It is noted that the arterial alignments in the Precinct Plan as shown in Figure 4 differ from the NoR alignment assessed in this report. A notable difference is related to the N-S Project connection. While the Precinct Plan indicates that this corridor would continue in a northerly direction until the corridor meets with Henwood Road, the NoR alignment terminates at the intersection with the E-W Project connection, adjacent to the future local centre.

Work completed by the Supporting Growth Programme in the North West in 2018 identified that the section of the N-S Project connection extending north to Henwood Road, while providing connectivity and accessibility for walking and cycling, did not form a critical part of the wider connections for private vehicles or public transport. Based on this, the connection is expected to form the function of a collector road rather than an arterial road. The Programme concluded that the existing Taupaki Road corridor through to State Highway 16 (**SH16**) would provide the core movement function between Redhills and Kumeu, Huapai and Riverhead, supported by a collector network. Further detail of the indicative North West Transport Network is provided in Section 4.2.4.

On this basis, the northern section of the indicative North-South arterial identified in the Precinct Plan is not included in this Project. The current Project does not preclude a corridor being provided in this location should this be progressed in the future.

3.1.2.2 East-West Arterial

Another deviation is the location of the E-W Project to the north of the new Redhills local centre. While this was identified as the preferred option at the time the Precinct Plan provisions were settled, the change in the alignment was not considered to be within the scope of the appeals process and as such this change was not incorporated in the Precinct Plan. A collector road will provide more appropriate connectivity for movements to and from that centre, with the arterial adjustment providing a limited access East-West link across the Redhills area.

3.1.2.3 Northside Drive Extension

The extension of Northside Drive from Fred Taylor Drive to the west was investigated as part of the Supporting Growth Programme. The corridor was identified as part of the wider North West Transport Network identified in the North West Detailed Business Case. It is noted that a Notice of Requirement is not being sought for this corridor at this time.

3.2 Project Objectives

The Project objectives are as follows:

N-S Project

- **Project Objective 1:** Provide a new north-south urban arterial transport corridor from Royal Road to the future east-west arterial corridor to support and integrate with planned urban growth in Redhills.
- **Project Objective 2:** Provide arterial transport corridors that are safe for all transport users.
- **Project Objective 3:** Contribute to mode shift by providing a choice of transport options including walking, cycling and public transport.

- **Project Objective 4:** Provide for the identification and protection of the future Redhills arterial transport network and key connections which enables growth.

E-W Project

- **Project Objective 1:** Provide new east-west urban arterial transport corridors from Fred Taylor Drive to Nixon Road to support and integrate with planned urban growth in Redhills.
- **Project Objective 2:** Provide arterial transport corridors that are safe for all transport users.
- **Project Objective 3:** Contribute to mode shift by providing a choice of transport options including walking, cycling and public transport.
- **Project Objective 4:** Provide for the identification and protection of the future Redhills arterial transport network and key connections which enables growth.

4 Receiving Environment

Chapter Summary: Receiving Environment

The existing transport environment includes several arterial routes that currently facilitate movements north to south along Don Buck Road and Fred Taylor Drive, as well as east to west on Royal Road.

The existing roads currently provide two traffic lanes, with footpaths provided on much of the existing network. Cycling facilities are variable, with a mix of no facilities (Royal Road), shared path and on-road cycles lanes (Don Buck Road and Fred Taylor Road).

Generally, the cycle facilities provide for a relatively disjointed journey for cyclists, and pedestrian facilities, while provided for in the way of footpaths, currently have limited crossing facilities and relatively narrow paths. Aside from bus stops, there are currently no dedicated public transport facilities.

4.1 Approach to Receiving Environment

A key objective of the Te Tupu Ngātahi Supporting Growth Programme is to protect land now to ensure that the transport networks required to support growth areas in the future, around Auckland, can be provided in an efficient and co-ordinated manner. This Project supports the development of housing in the Redhills area.

The AUP:OP zoning provides the future urban context in which the Project will operate. Table 2 sets out the likely future receiving environment of the Redhills area based on zoning provisions. This zoning signals a high probability of land use change over time from the currently mostly rural character of the area. This likely future receiving environment has been used to inform the assessment.

Table 2: Redhills Arterial Transport Network receiving land use environment

Redhills Arterial Transport Network receiving environment	
Residential – Single House Zone	<ul style="list-style-type: none"> Maintain and enhance amenity values of established neighbourhoods 'Generally characterised by one to two storey buildings with multi-unit development not anticipated'
Residential – Mixed Housing Suburban Zone	<ul style="list-style-type: none"> 'Largely characterised by one and two storey, mainly standalone buildings with boundary setbacks and landscaped gardens', however 'enables intensification through attached two storey housing in a variety of types and sizes'
Residential – Mixed Housing Urban Zone	<ul style="list-style-type: none"> 'Reasonably high-intensity zone enabling greater intensity of development than previously provided for' Development 'typically up to three storeys in a variety of sizes and forms including detached dwellings, terraced housing and low-rise apartments'
Residential – Terraced Housing and Apartment Building Zone	<ul style="list-style-type: none"> 'A high-intensity zone...providing for urban residential living in the form of terraced housing and apartments...with the greatest density, height and scale of development of all the residential zones' Buildings enabled up to five, six or seven storeys 'Predominantly located around metropolitan, town and local centre zones and the public transport network', also providing for a range of non-residential activities within an 'urban residential character'

Redhills Arterial Transport Network receiving environment

Business – Local Centre Zone	<ul style="list-style-type: none"> • ‘Generally located in areas of good public transport’ • ‘Primarily provides for local convenience needs of surrounding residential areas, including local retail, commercial services, offices, food and beverage, and appropriately scaled supermarkets’
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Proposed Plan Change 78 was notified on 18 August 2022 in response to the government’s National Policy Statement on Urban Development 2020 (amended in 2022) and requirements of the Resource Management Act. The plan change proposes to up-zone land within the Redhills area from Single House Zone and Mixed Housing Suburban Zone to Mixed Housing Urban Zone. Implications of this Proposed Plan Change in terms of transport modelling can be found in Section 5.1.1. For additional information refer to the AEE.

4.2 Transport Specific Context

The following section provides a brief summary of the existing transport environment and the likely future transport environment.

4.2.1 Existing Transport Environment

Table 3 and Table 4 provide a summary of the key characteristics of the existing road network and intersections.

Table 3: Existing Road Transport Network

Existing Corridor	Key Characteristics
Fred Taylor Drive	<ul style="list-style-type: none"> • 80kph speed limit north of the roundabout with Hobsonville Road. • Mixed urban and rural two lanes in majority, four lanes at signalised intersection approaches. • Currently in state of change with iterative upgrades being provided by developers as the road frontages are upgraded. • Corridor changes in form between sections with no kerb and channel or active mode facilities in parts, and in other sections footpath and cycling facilities are provided. • Various cycle standards have been in used, and the facilities change between on road cycle lanes, shared paths and more recently “Copenhagen style” off-road cycle facilities. These variations are largely a result of changes to design standards and a shift in preference towards off-road separated cycle facilities to support Auckland Council and AT mode shift objectives.
Royal Road	<ul style="list-style-type: none"> • 50 kph speed limit. • Urban two-lane corridor with footpaths and limited cycle facilities. • Provides access to SH16 interchange. • Local bus services.

Existing Corridor	Key Characteristics
Don Buck Road	<ul style="list-style-type: none"> • 50 kph speed limit. • Urban two-lane road with footpaths, mix of shared path and on road cycle facilities. • Over dimension route with flush median. • Part of the frequent public transport network.
Dunlop Road and Baker Lane	<ul style="list-style-type: none"> • Dunlop Road currently is approximately 20m wide and has no walking or cycling facilities. It operates as a local road that provides access to the rural properties to the west and a panel beater. • Baker Lane is currently a construction access for development within Redhills. Prior to this Baker Lane was a private unsealed driveway providing access to the rear rural properties.
Red Hills Road	<ul style="list-style-type: none"> • 80 kph speed limit. • Rural two-lane road with a footpath from Don Buck Road to Sunnyvale Road for approximately 1.8km. • There are no walking and cycling facilities in the vicinity of the Henwood Road intersection.

Table 4: Existing Intersections in Redhills

Existing Corridor	Key Characteristics
Fred Taylor Drive and Dunlop Road	<ul style="list-style-type: none"> • Priority give way intersection • Single approach lane in all directions, no flush median • No footpaths or cycle facilities
Fred Taylor Drive and Royal Road	<ul style="list-style-type: none"> • Roundabout intersection • Two approach lanes, partial dual lane roundabout • Shared path adjacent on Don Buck Road, leads to on road cycle lanes • No cycle facilities on Royal Road • 1.2m – 1.5m footpath on Royal Road
Fred Taylor Drive and Baker Lane	<ul style="list-style-type: none"> • Priority give way intersection • Single approach lane in all directions, no flush median • No footpaths or cycle facilities
Nixon Road and Nelson Road	<ul style="list-style-type: none"> • Stop controlled intersections • Single approach lane with no flush median • No footpaths • No cycling facilities

4.2.2 Existing Traffic Volumes

Existing traffic volumes in the Redhills area have been counted by AT in from October 2020 to March 2022. The results of these surveys are shown in Table 5 below.

Table 5: Existing Traffic Volumes on Surrounding Road Network

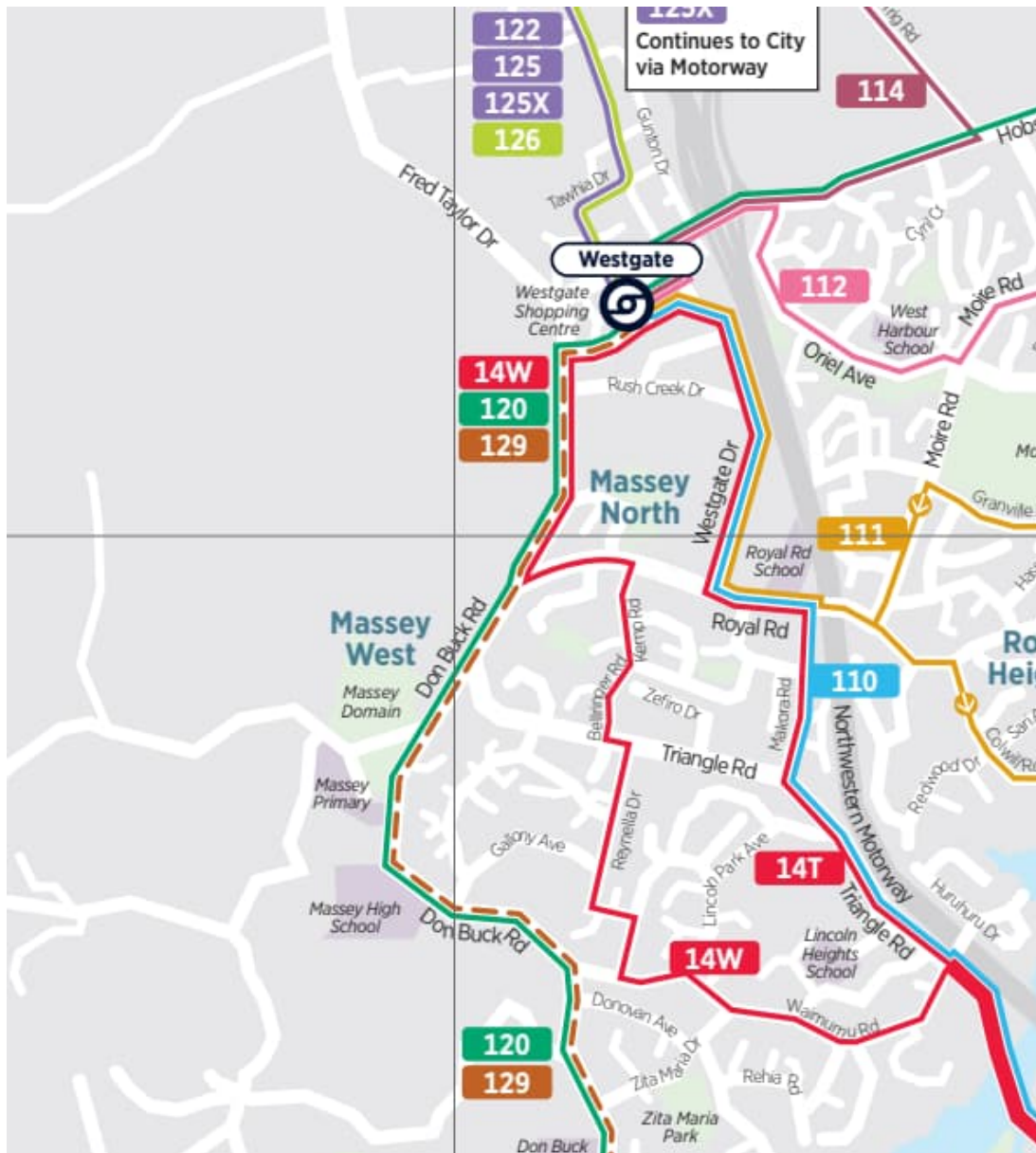
	Survey Date	5 Day ADT ²	7-day ADT	AM Peak Volumes	PM Peak Volumes
Fred Taylor Drive: between Bakers Lane and Don Buck Road roundabout	February 2022	14,030	13,140	870	1,260
Royal Road: between Kemp Road and Lawson Creek Street	October 2020	7,040	7,970	760	810
Don Buck Road: between Beauchamp Road and Rush Creek Drive	August 2021	21,940	21,220	2,070	1,880
Red Hills Road: between Don Buck Road and Birdwood Road	March 2022	9,350	8,830	970	1,060

4.2.3 Existing Bus Services

The following figure shows the existing bus services in the Redhills area. As detailed in Table 3, there are currently services on Don Buck Road and Royal Road.

² Average Daily Traffic

Figure 5: Existing Bus Services



4.2.4 Future Transport Environment

The transport corridors within Redhills and the surrounding area will be delivered as part of the wider urbanisation that is scheduled to occur in the North West of Auckland.

To understand the future transport network requirements an indicative network for the North West has been developed to support Auckland Council’s planned urban growth and is shown below in Figure 6.

Figure 6: Indicative North West Transport Network



Subsequent to the North West Indicative Business Case for the Te Tupu Ngātahi Supporting Growth Programme, the Housing Infrastructure Fund Detailed Business Case was completed under the Te Tupu Ngātahi Supporting Growth Programme, which focussed on the development of the Redhills Arterial Transport Network (this Project) and the southern section of Trig Road.

The assessment identified that, once the Redhills area is developed, the corridors will need to serve a variety of movement needs, including:

- Access to the surrounding residential land
- Access to the east to the strategic roading network via Don Buck Road, Fred Taylor Drive, and onward to SH16 and State Highway 18 (**SH18**)
- Access to the Westgate Shopping Mall and transport links in that area
- Access to the proposed RTN station at Royal Road

The Redhills corridors will, in the future, serve a range of local and strategic land use activities across a range of modes and therefore needs to provide the facilities associated with an urban arterial.

The access that these corridors will facilitate will need to allow for all modes of travel, including walking, cycling, public transport and private vehicles.

4.2.5 Future Walking and Cycling Network

It is proposed that the future arterial corridors in Redhills will provide walking and cycling facilities on both sides of the road. These will connect to the existing networks at signalised intersection points at Royal Road and Fred Taylor Drive, which are also expected to have pedestrian and dedicated cycle facilities in the future. The facilities on all arterial roads include:

- 1.8m footpaths on both sides of the road
- 2.0m protected cycle paths on both sides of the road.

Within the Redhills area, the corridors will eventually integrate with a series of corridors identified indicatively as a 'green network' on the Redhills Precinct Plan in the AUP:OP. The green network will be provided by landowners/developers through subdivision and development proposals. The green network includes:

- A green road that provides for two way separated cycle facilities (3.0 – 3.4m) with a 2.5m to 3.0m footpath on the cycle side, and 1.8m – 2.2m footpath on the other side;
- Stream edge routes that provide for pedestrian and cycle paths on both sides of permanent streams, and one side of intermittent streams; and
- Reserve edge roads with facilities along the northern and western side of permanent and intermittent streams.
- The N-S Project and the E-W Project have been developed having consideration for future corridors in the Redhills area both for traffic and walking and cycling, and do not preclude future intersections with the remainder of the network.

4.2.6 Future Local Public Transport Network

Two core public transport services are proposed by AT to support the future urban development within the Redhills Area. These are currently envisaged as bus services with the exact route dependent on roading infrastructure being in place (and as such a delivery date has not been determined). The provisions for these as per the RPTP are shown in Table 6.

Figure 7: Future Local Public Transport Services in Redhills (for key see Table 6)

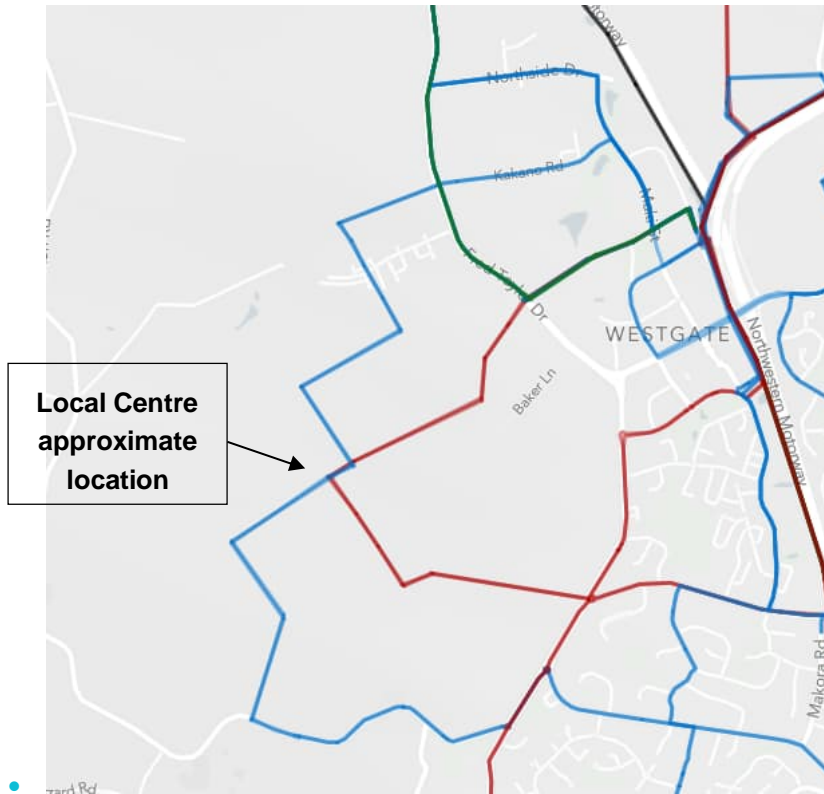


Table 6: Future Public Transport Services in Redhills Source: RPTP 2018

Route	Service Category	Frequency
Westgate / Redhills / Westgate Circuit (Red)	<ul style="list-style-type: none"> Frequent 	<ul style="list-style-type: none"> Every 10 mins in the peak, Every 15 mins outside of the peak
Westgate / Redhills / Westgate Circuit (Blue)	<ul style="list-style-type: none"> Connector 	<ul style="list-style-type: none"> Every 15 mins in the peak, Every 20 mins outside the peak

4.3 Summary of Transport Context

Overall, it is considered that the existing transport networks surrounding Redhills, and the lack of transport network within the Redhills area currently will not support the overall urban outcomes sought for the area as urbanisation continues. The existing network has intermittent facilities for walking and cycling, a low level of public transport and no dedicated facilities to provide for reliable and attractive travel by bus.

As growth increases in the area the current lack of an arterial network will reduce connectivity and result in a heavy reliance on the existing network around Redhills including Fred Taylor Drive and Don Buck Road. Without an arterial network, there will be an increasing reliance on the local and collector network. This will result in longer, less efficient bus networks, and safe cycle connections on desire lines would be limited. Without providing for through movement functions on arterials, there will likely be an increase in traffic utilising lower order corridors such as local and collector roads, with potential adverse effects on amenity and capacity.

5 Methodology and Analysis

Given the long-term nature of the designations being sought by the NoRs, this assessment does not assess the interim staging of individual Projects and development staged over the next three decades but instead places a greater focus on the 'full build out' of the future urban area in 2048+ to support future communities. Therefore, this assessment focusses on the likely future environment (full build out 2048+) and wider infrastructure upgrades.

To ascertain the long-term effects of the Projects, this assessment assesses the transport effects arising from each of the Projects in a future context.

The methodology for the operational and construction transport effects are applicable for each NoR specified within this document. Any nuances are specified throughout the assessment.

The Assessment of Transport Effects has two elements:

- Assessment of operational effects on the transport system
- Assessment of construction effects on the transport network

The assessment is targeted at route protection, rather than imminent implementation. As such, it:

- Makes greater use of generic cross-sections and design standards
- Focuses more on desired outcomes and footprints
- Takes a longer-term view, with its inherent uncertainties
- Assumes more use of recommended management plans and planning processes rather than specific design details to manage potential effects

A key element of the assessment is the definition of the 'existing/likely future environment', against which the effects are assessed. This is a complex issue as the proposed works are planned to support urban development and will be unlikely to occur without such development. Additionally, the source of the potential effects (such as people and vehicle movement), is generally from that urban development itself, rather than from the planned infrastructure.

To isolate the effects of the planned works, the 'Existing Environment' includes the likely future urban development but does not include the planned Projects for which designations are sought. The effects of the Projects are then assessed using the same land use assumptions. Given the long-term perspective of the assessment, the analysis is based on the estimated 'full build out' for the future urban area. It is also noted that the Redhills network has been designed as part of an overall integrated system, but in general can be delivered separately. As such this assessment considers the projects individually – with commentary on interdependencies where appropriate.

5.1 Approach to Assessment of Operational Transport Effects

5.1.1 Transport Modelling

Throughout the transport network analysis process, a range of different transport modelling tools have been used to undertake quantitative assessments of the transport system. These then inform decisions about planning the transport network, corridors, and intersections.

The impacts of the Projects on the future transport environment are assessed using forecasting transport models, owned by the Auckland Forecasting Centre (AFC). The models include:

- The regional multi-modal model (MSM). This model creates estimates of car, truck and public transport movements at a regional level based on land use, network and policy inputs. This model is the primary tool to estimate future PT usage. Generally, this model is run using regional assumptions as per recent ATAP planning, but with scenario-specific inputs in the growth areas.
- A local traffic model (SATURN). This uses the traffic demands from MSM on a more detailed representation of the road network.
- A strategic active model (walk/cycling) model (SAMM). This tool gives strategic-level estimates of walking and cycling demands.

The assessment of operational effects will therefore be informed by modelled estimates of travel and network performance for a future full-build-out scenario.

A key input to the models are regional land use forecasts, which influence the future quantum and location of travel. Regionally agreed land use forecasts are prepared by Auckland Council via the Auckland Forecasting Centre (AFC), with the most recent available forecasts (at the time of this assessment), referred to as Scenario I11.5. Those forecasts are based on regional population forecasts from Statistics NZ, with spatial allocation to individual spatial areas based on the AFC land use model and known detail around specific land use planning processes.

Land use forecasts have inherent uncertainty, particularly in terms of the specific rate of new growth in specific areas. Currently, there is additional uncertainty around the likely outcomes and rate and location of higher-density development sought through central Government policies such as the National Policy Statement on Urban Development (NPS-UD) and Auckland Council's Plan Change 78. A key intent of those policies is to enable higher density development, especially around high-quality public transport systems. The specific planning response to those policies is currently being progressed by Auckland Council, and revised land use forecasts reflecting any expected changes were not available at the time of preparing this assessment. Generally, it is considered that this Project is not inconsistent with such policy direction, regarding supporting higher density urban development via more sustainable travel modes. Given this context, the use of those available I11.5 forecasts is considered acceptable for this assessment.

In addition to the SATURN modelling, SIDRA³ modelling has been undertaken to assess the operational outputs of key intersections along the project corridors. The regional model (MSM) was used to inform assessment of the public transport network components.

In regard to traffic modelling analysis used in this report, a Level of Service (LOS) metric has been used. This refers to a qualitative measure used to assess the quality of motor vehicle traffic service. LOS is used to analyse road corridors and intersections by categorising traffic flow and assigning quality levels of traffic based on a performance measure ranging from A to F and can be summarised as follows:

- **LOS A: free flow.** Traffic flows at or above the posted speed limit and motorists have complete mobility between lanes.
- **LOS B: reasonably free flow.** LOS A speeds are maintained, manoeuvrability within the traffic stream is slightly restricted.

³ SIDRA modelling enables an assessment of individual intersections using inputs from regional models.

- **LOS C: stable flow, at or near free flow.** Ability to manoeuvre through lanes is noticeably restricted and lane changes require more driver awareness.
- **LOS D: approaching unstable flow.** Speeds slightly decrease as traffic volume slightly increase. Freedom to manoeuvre within the traffic stream is much more limited and driver comfort levels decrease.
- **LOS E: unstable flow, operating at capacity.** Flow becomes irregular and speed varies rapidly because there are virtually no usable gaps to manoeuvre in the traffic stream and speeds rarely reach the posted limit.
- **LOS F: forced or breakdown flow.** Every vehicle moves in lockstep with the vehicle in front of it, with frequent slowing required. Travel time cannot be predicted, with generally more demand than capacity

5.1.2 Relevant Standards and Guidelines

Integrated Transport Assessment

The AT Integrated Transport Assessment (ITA) Guidelines⁴ have been used to inform the preparation of this ITA. In particular, the Guidelines identify that an ITA should provide an assessment of the accessibility of a proposal by walking, cycling, public transport and private motor vehicles. The Guidelines also indicate that the ITA should consider the potential effects a proposal could have on the existing and future transport network and any mitigation measures needed to ensure that any adverse effects of a proposal are avoided, remedied or mitigated.

Design Standards

The proposed cross sections have been developed in coordination with AT design specialists with reference to AT's Transport Design Manual (TDM)⁵.

It is considered that the TDM aligns with AT's future design approach and enables a design consistent with the future transport aspirations for the Redhills area, such as providing facilities to support travel by walking, cycling, and public transport.

5.1.3 Assessment Methodology - Transport Mode

As detailed in Section 3.2, the N-S Project and the E-W Project each have an identified set of Project Objectives. From a transport perspective these objectives are focused predominantly on the themes of connectivity, safety, travel choice and mode shift from private vehicles to walking, cycling, and public transport.

Based on this, Table 7 summarises the key network components that have been assessed in terms of operational effects resulting from the Project.

Table 7: Summary of Assessment Methodology

Criteria	Information sources	Assessment Method
Safety	Project design drawings Crash Analysis (CAS) database	Assessment to determine alignment with Vision Zero standards and design compliance with Transport Design Manual

⁴ Integrated Transport Assessment Guidelines, January 2015, Auckland Transport

⁵ <https://at.govt.nz/about-us/manuals-guidelines/roads-and-streets-framework-and-the-transport-design-manual/>

Criteria	Information sources	Assessment Method
Walking and Cycling	Walking and cycling network plans Proposed cross sections	Assessment to determine alignment with walking and cycling strategic documents and design compliance with Transport Design Manual
Public Transport	Transport Model tools (MSM, SATURN and SIDRA) Supporting Growth Indicative Future Public Transport Network (Remix) ⁶	Assessment to determine alignment with future network provisions and design compliance with the Transport Design Manual
Property Access	Engineering Standards	Assessment identifying where there is a potential effect on access in the existing environment
General Traffic	Transport Model tools (MSM, SATURN and SIDRA) Project design drawings	Assessment using key model outputs including traffic volumes, levels of service for corridor midblock performance and intersection performance. Assessment of surrounding network connections
Overall Assessment against Project Objectives	Connectivity Travel choice Mode Shift	Qualitative assessment based on above assessments

Note: A Road Safety and Audit and Safe System assessment will be done as part of the implementation business case/detailed design stage prior to implementation.

5.2 Approach to Assessment of Construction Traffic Effects

In order to assess the potential construction traffic effects, an indicative construction methodology has been prepared. This can be found in the AEE.

Based on the indicative construction methodology an assessment of construction effects has been completed for the package sufficient to support each Notice of Requirement. This assessment will consider:

- An overview of key considerations including speed, potential impacts to pedestrians and cyclists and property access
- Identification of any works that should not occur at the same time
- Assessment of potential conflict areas with vulnerable road users that will need specific mitigation within a Construction Traffic Management Plan (CTMP) and / or Site-Specific Traffic Management Plans (SSTMP).

The Project specific construction effects will be managed via a CTMP and/or SSTMP which will be developed immediately prior to implementation when the greatest certainty is available.

⁶ SGA Remix file provided by Auckland Transport on the draft plan of the bus network to be implemented by 2048

5.2.1 Temporary Traffic Management

The impact of any temporary traffic management measures implemented to undertake the projects will be re-assessed in the future, prior to construction, when a greater level of detail is available in terms of the specific construction methodology and traffic environment.

It is noted that there may be some nuances between projects delivered 'online' as they are existing roads and those delivered 'offline' as new greenfield roads. It is noted that the majority of the Project is expected to be capable of being delivered "offline" or without impact to the existing road corridors, with the exception of intersections and tie ins. In particular, any future assessment should be required to consider potential road closures, any capacity reductions on key corridors through lane closures, and any other ancillary effects such as shoulder closures.

At the time of construction of the Project or any stage of the Project, a Construction Traffic Management Plan (**CTMP**) will be developed with the purpose of managing traffic and transport effects on the local community and wider network and community. The CTMP will consider the effects on the transport network of potential road closures, any capacity reductions on key corridors through lane closure, and effects of any other ancillary activities such as shoulder closures.

6 Assessment of Transport Effects

Chapter Summary: Assessment of Transport Effects

The assessment of transport effects of the Project has identified the following outcomes and it is considered that, where necessary, the adverse effects identified in this report can be appropriately mitigated through the measures identified and detailed in Section 7. Significant positive transport effects of the Project, including the provision of separated walking and cycling facilities and public transport priority measures have also been identified.

Assessment of Walking and Cycling Effects

- All corridors within the Project are proposed to include separated walking and cycling facilities to encourage increased mode share for walking and cycling. This is achieved through the provision of safe separated facilities.
- The proposed facilities are a considerable improvement on the existing facilities and provide a significant contribution to achieving the Project outcomes. In particular, the provision of high quality walking and cycling facilities will support walking and cycling as safe travel choice for future and existing communities.
- Cycle and pedestrian crossings are proposed at all new and upgraded intersections which will provide safe crossing for these modes across arterial roads, also reducing crossing delays for pedestrians and cyclists.

Assessment of Safety Effects

- The Project design is consistent with Vision Zero outcomes sought by AT and prioritises facilities to support safe travel by foot, bike or public transport.
- The provision of separated facilities significantly improves safety for people that travel by walking and cycling.

Assessment Public Transport Effects

- The provision of bus priority at the intersections of Royal Road and Don Buck and Fred Taylor Drive and Dunlop Road is consistent with the future route intentions identified in the RPTP.
- The implementation of bus priority at these intersections will improve bus reliability and travel times, encouraging mode shift to public transport.
- Prioritising bus services at these intersections is consistent with the future RTN intentions for the North West, enabling connectivity to a new planned RTN station on SH16 at Westgate and at Royal Road.

Assessment of Access Effects

- For the majority of existing properties, there will be little to no change in the level of vehicle access provided, however for 10 properties on Royal Road it has been identified that reinstatement of a driveway will not be possible. These properties have been included within the designation.
- For properties that currently gain access via a low-level access on Don Buck Road, these accesses will be reformed. The ability to turn right to and from the low level access at the point closest to the Royal Road intersection will be limited to left in left out, however full movements will still be provided at the opposing point of the low level access. As such this effect is considered minor.
- Limited access is proposed to be maintained on Fred Taylor Drive and there is no additional effect when compared to the current environment. Limited access is also proposed to be provided on the new corridors – consistent with the provisions in AUP:OP for arterial roads and provisions within the Redhills Precinct Plan.

Assessment of General Traffic Effects

- The proposed intersections, as modelled with 2048 traffic volumes, generally operate well.

Chapter Summary: Assessment of Transport Effects

- The overall Level of Service (LoS) for all intersections is a LoS D (refer to section 6.5.2), which suggests some delay to private vehicles, but generally a level of delay that would be expected in an urban context during peak commuter periods.
- The Royal Road and Don Buck Road intersection experiences some capacity constraints by 2048, with queuing experienced on some approaches in the peak weekday commuter periods.
- With the significant growth expected in Redhills and the North West area, travel by car will continue to be subject to congestion in the weekday peak periods. The Project Objectives seek to provide for travel capacity through increased travel choice (such as pedestrian, cycle and public transport improvements), rather than through additional lane capacity for vehicles. Accordingly, it is considered that overall, these effects are minor.
- To provide for an efficient public transport network, where necessary, additional capacity, is provided for bus priority at intersections.

Roads and Streets Framework Assessment

- A Roads and Streets Framework Assessment has been completed. This assessment indicates that the new corridors will have a Place 1/Movement 2 functionality.
- A Place 1 categorisation recognises that the adjacent land use has a primarily local function with a localised catchment of users.
- A Movement 2 categorisation recognises that the network function is of medium strategic significance. The corridors provide connectivity to the wider arterial network and to Westgate Metropolitan Centre.

Assessment of Construction Effects

- Construction effects are proposed to be managed via a detailed CTMP. This will be completed in relation to a confirmed construction methodology at the time of delivery of the Project or stages of the Project.
- The assessment of expected construction traffic has been developed based on the indicative construction methodology. The expected volumes of construction traffic are capable of being accommodated within the existing road network.
- Specific measures related to access and safe movement of vulnerable road users, including pedestrians and cyclists, are expected to be provided at the time of resource consent.

6.1 Walking and Cycling

The Redhills area is in close proximity to several key trip attractors, including Westgate shopping centre and the public transport interchange (1.5km from the centre of the Redhills area). Travelling along Royal Road, from the Redhills local centre, access to the SH16 strategic shared path and the potential Royal Road rapid transit station is approximately 2.5km.

Due to relative distances, there are many opportunities to encourage local residents to walk or cycle to these facilities. The proposed cycle lanes and footpaths will provide safe alternative transport options and encourage a mode shift for these local movements.

Based on the TDM, specifically the Urban Street and Road Design, the standard for walking and cycling is to provide separated, protected walking and cycling facilities where general traffic volumes exceed 5,000 vehicles per day and 30km/hr.

In situations where roads are heavily or moderately trafficked, such as Don Buck Road or Fred Taylor Drive, this can encourage people on bicycles to utilise pedestrian facilities – leading to additional safety conflicts – whilst cyclists remaining on the road carriageway are also at risk. As such, separated cycle and pedestrian paths are proposed for all corridors in the Project.

All intersections within the Project have been provided with pedestrian and cycle crossing facilities, which connect with the expected future adjacent facilities.

All the corridors within the Project extents meet these triggers and therefore these facilities are proposed, not only for safety, but also to provide walking and cycling opportunities equal to those available to people who choose to drive, i.e. that footpaths are safe, coherent and connected.

Overall, the proposed walking and cycling facilities provide a significant improvement over the current walking and cycling facilities.

Table 8: Assessment of Geometry of Walking and Cycling Facilities

Standards	Minimum Standard Width	Assessment
Redhills Precinct Plan⁷	<p>Footpaths: 2.0m for all arterials except in town centre 1.8m each side on Baker Lane</p> <p>Cycle Paths Baker Lane: 2.2m each side including mountable kerb and excluding 1m separation to on-street parking, where applicable All other arterials: 1.8m each side excluding 0.6m buffer to carriageway and 1m separation to on-street parking where applicable</p>	<p>The indicative footpath provision is 1.8 m, which is less than the minimum identified in the Redhills Precinct Plan. However, it is consistent with AT TDM standards and therefore will provide adequately for capacity and safety of users in the future urban environment. A 2.3m berm is indicated between the pedestrian, and cycling, facilities, and the carriageway. This significantly exceeds the 0.6m buffer requirement of the AT TDM and provides sufficient width for design flexibility whilst providing for safety and amenity for walking and cycling.</p>

⁷ As the purpose of the NoR is to confirm a designation, in accordance with s 176(1)(a) of the RMA, the provisions of the Redhills Precinct Plan relating to transport requirements will not apply to the Project, unless specifically required by designation conditions. As such, the standards set out in the Redhills Precinct Plan are used as guidelines for the purpose of this assessment.

		No on street parking is proposed to be provided on Baker Lane. There is no expected effect from this.
Auckland Transport Design Manual	Footpaths: 1.8m minimum	There is sufficient space to enable the indicative design to be in accordance with the AT TDM requirements. This will provide adequate widths and capacity for the safe and efficient use by pedestrians and cyclists in the future urban environment.
	Cycle Paths 2.0m width recommended for raised cycle paths.	

6.2 Road Safety

The design of the Project has been undertaken with consideration of the latest safety guidance. This includes AT’s Vision Zero and Waka Kotahi’s Road to Zero. The Project is expected to result in positive effects on safety, and these consist of:

- Significantly improved walking and cycling facilities on Fred Taylor Drive and Don Buck Road (including separation), resulting in improved protection for vulnerable road users.
- Significantly improved walking and cycling crossing facilities (crossing Fred Taylor Drive and Don Buck Road), resulting in a significantly safer environment for all road users.
- New walking and cycling facilities on the E-W and N-S corridors resulting in greater levels of safe connections

Overall, the indicative proposed design of the Project is well aligned with the transport safety principles from AT and Waka Kotahi. It will provide a much safer transport system which will likely reduce the number of deaths and serious injuries and result in positive effects for all road users. It is noted that the detailed design will be completed in the future to further detail measures to achieve the anticipated safety outcomes.

6.3 Public Transport Network

The Project proposes to provide for a new arterial network through the Redhills area, which will support the urbanisation of the area provided for under the AUP:OP. The provision of these key corridors will enable public transport services to operate within the area.

The E-W Project within Redhills will utilise the existing Dunlop Road corridor to provide a direct link for frequent public transport services from Redhills to Westgate, particularly connecting the proposed Local Centre at Redhills with the Metropolitan Centre at Westgate. The intersection of Dunlop Road with Fred Taylor Drive provides for bus priority measures, enabling buses to travel through (from the left turn lane) in both directions, reducing the potential for delays for buses.

A similar approach is proposed at the intersection of Royal Road and Don Buck Road. This includes a dedicated bus approach lane on Royal Road, and bus priority on all other approaches (being able to travel through from the left turn lanes).

The design philosophy has sought to minimise the footprint of the approach arms to the intersections, thereby minimising crossing distances for pedestrian and cyclists. An analysis of the performance of these proposed intersections can be found in Section 6.5.

The proposed corridor width allows space to incorporate bus stops. The exact location of bus stops will be defined at later stages, as part of detailed design for the Project when there is greater certainty on the location of key land use activities, and high demand locations for bus stops can be determined, e.g. around centres and schools.

6.4 Access

The proposed Project corridors within the Redhills Precinct are to be classified as 'Arterial' corridors. Being arterial corridors, the core purpose of these corridors is to facilitate safe and efficient movement along the corridor for connection between key destinations, rather than property access. These arterial corridors will not provide for direct property access in the longer term. It is therefore expected that any new accesses on the corridors will be limited.

As such, this section primarily addresses the effects of the Project on existing property access.

6.4.1 Existing Driveway Access and Standards

In terms of existing properties, the overarching design philosophy for the Project has been to maintain driveway access where practicable and minimise impacting land other than where necessary.

There are 10 existing properties where it has been identified that a driveway (compliant with the AUP:OP) may not be possible to implement, primarily due to changes to road levels and the incursion of the corridor into the front of the properties. These properties have been included within the designation boundary. They include the following properties:

- 13, 15A, 17A, 18, 19, 20, 22, 24, 26, 28 Royal Road.

6.4.2 Low-Level Access Lanes – Don Buck Road

There are currently existing low-level access lanes provided in three sections on Don Buck Road contained within the Project area. These are located south of the Don Buck Road and Royal Road intersection on both sides of the road, and north of the intersection on the western side of the road. These are all provided at a lower level than the existing road. These are shown below in Figure 8 and Figure 10.

Figure 8: Existing Low Level Access on Don Buck Road South of Royal Road



Figure 9: Existing Low-Level Access on Don Buck Road North of Royal Road



The low-level vehicle access in these locations will be retained, and these access lanes will be reformed. Walking and cycling facilities will be located adjacent to the carriage way, at the higher level.

The low-level access on Don Buck Road to the north of Royal Road (Figure 9) will be reformed within the existing road corridor.

The low-level access on Don Buck Road to the south of Royal Road on the western side will also be largely reformed in the road reserve, with some minor property impacts.

In terms of the low-level access on Don Buck Road to the south of Royal Road on the eastern side, the low-level access is currently not within the road reserve. The connection of this low-level access at the Royal Road intersection has been reformed to deliver an access with appropriate grades, which has resulted in a northward shift. This access rearrangement, in addition to the road realignment in this location has resulted in access and property impacts on 1 Royal Road, 443 and 445 Don Buck Road. These three properties have accordingly been included within the designation boundary.

The low-level accessways are proposed to be 3.0m wide, which will allow for vehicle travel one way at a time. This is slightly narrower than the current provisions of between 3.5m and 3.8m – however this also only provided one-way access at a time and is not expected to have operational effects.

6.4.3 Implications on Access Movements

As part of the design of the signalised intersection at Royal Road a raised traffic island has been proposed to separate traffic at the intersection approaches. The provision of the raised island has been provided as a safety measure to prevent crashes between vehicles at the intersection.

The additional lanes provided at the approach to the intersections will also create an additional barrier for vehicles to complete a right turn movement near the intersection.

The implication of these raised islands is that properties accessing the road network from the low level access at the nearest point to the intersection will no longer be able to turn right, and the access will in effect be a left in-left out arrangement at this location. Vehicles will however be able access the roading network from the low level access point further from the intersection and complete all movements at this location.

As stated above, the provision of driveways will enable vehicles to pass each other in the low-level access if necessary.

6.4.4 Limited Access – Fred Taylor Drive

Fred Taylor Drive is an existing arterial road that was previously part of the State Highway network. Currently there is limited vehicle access for properties adjacent to Fred Taylor Drive. The Project does not propose to change this, and consolidated access will continue to be required for this corridor. There are no additional property access effects for those properties located on Fred Taylor Drive and all existing movements will be maintained.

6.4.5 Summary

The identified access effects are primarily related to the signalisation of the intersection at Don Buck Road and Royal Road (NoR1). The remaining NoR's do not have any identified access effects.

In terms of the access for properties within the NoR1 extents this assessment finds that:

- There are 10 properties on Royal Road where reinstatement of a driveway will not be possible. These properties have been included within the designation.
- For properties that currently gain access via a low-level access on Don Buck Road, these accesses will be reformed. The ability to turn right to and from the low level access at the point closest to the Royal Road intersection will be limited to left in left out, however full movements will

still be provided at the opposing point of the low level access. As such this effect is considered minor.

- Limited access is proposed to be provided on the new corridors – consistent with the provisions in the AUP:OP for arterial roads and provisions within the Redhills Precinct Plan. Limited access is also proposed to be maintained on Fred Taylor Drive and there is no additional effect when compared to the current environment.

6.5 General Traffic

6.5.1 Traffic Volumes

The following table provides a summary of the expected traffic volumes on the identified corridors within Redhills and those adjacent to the Redhills Precinct. A two-lane corridor can efficiently accommodate vehicles volumes as shown below and therefore the proposed corridor design is expected to meet forecasted needs, with the additional lane provision at intersections to accommodate greater bus priority.

Table 9: Predicted AADT⁸ Volumes for 2028 and 2048

Count Location	2048 predicted AADT
Dunlop Road	8,300
Baker Lane	14,400
E-W Project between Baker Lane and N-S Project	16,800
Don Buck Road north of Royal Road	21,800
N-S Project between E-W Project and Royal Road	8,500
E-W Project between N-S Project and Nixon Road	11,400

6.5.2 Intersection Performance

The performance of the road network within the Project has been assessed using inputs from SATURN to understand intersection performance. SIDRA enables isolated intersection models to be performed to understand the network capacity, predicted LoS and anticipated queue lengths. A summary of these key performance measures is shown below in Table 10.

Table 10: Summary of Intersection Performance 2048

Intersection	Peak Period	Overall Level of Service	Degree of Saturation (worst movement)	Maximum Queue Distance (m)
Dunlop Road and Fred Taylor Drive	Morning Peak	C	0.52	94
	Evening Peak	C	0.48	71
Baker Lane and Fred Taylor Drive	Morning Peak	C	0.72	134
	Evening Peak	C	0.90	134

⁸ Annual Average Daily Traffic

Royal Road and Don Buck Road	Morning Peak	C	0.90	258
	Evening Peak	D	1.00	397
E-W Project and Nixon Road	Morning Peak	A	0.53	30
	Evening Peak	A	0.42	22

Overall, the proposed intersections are predicted to perform at a satisfactory level during the peak periods under a 2048 scenario.

The overall LoS for all intersections is LoS D or below, with only the Royal Road and Don Buck Road intersection experiencing significant capacity constraints by 2048. A LoS D means that intersections will be generally within an acceptable performance level. Based on the Highway Capacity Manual standards, a LoS D suggests that occasionally a driver may have to wait through more than one signal cycle before proceeding. This is not uncommon in peak periods in urban environments and overall, not considered a significant delay.

It is noted that at the intersection of Royal Road and Don Buck Road there are approaches that are reaching practical capacity (defined as an intersection movement with a degree of saturation above 0.900) and experiencing approximately 400m queues in the 2048 scenario.

However, it should be noted that with the significant growth in Redhills and the North West area, travel by car will continue to be subject to congestion in the weekday peak periods. The Project Objectives however seek to provide for travel capacity through increased travel choice (such as pedestrian, cycle and public transport improvements), rather than through additional lane capacity for vehicles.

The current intersection at Royal Road and Don Buck Road currently experiences significant delays in the peak period with significant queues. The projected growth in Redhills would exacerbate the intersection performance should the intersection remain as existing. As such, while the performance in 2048 suggest delays to private vehicles in the peak period, bus reliability will improve, operational performance in other periods should improve, and facilities for pedestrians and cyclists will be much greater.

In regard to Fred Taylor Drive, there will be increased delay to vehicles travelling along this corridor because of the introduction of two intersections. This delay is not considered to be significant within an urbanising context, and in light of increased outcomes for pedestrians and cyclists this is considered to be an acceptable effect.

6.6 Roads and Streets Framework Assessment

The Roads and Streets Framework describes, balances, and integrates the intended strategic and local place and movement functions of road and streets, as well as the levels of service for all transport modes.

Based on the future land use and the surrounding road network, a draft assessment has been completed for the N-S Project and E-W Project. This identifies a categorisation of Place (1) and Movement (2). This recognises that the adjacent land use has a primarily local function, with a small catchment of users, while a Movement 2 category recognises that the network function is of medium strategic significance. The proposed routes provide connectivity for the wider rural area and Redhills

to the east through to the Metropolitan Centre for all modes, and the connections on the N-S Project from Redhills through to SH16 and future rapid transit stations.

6.7 Overall Assessment against Project Objectives

From a transport perspective the Project Objectives are focused on the themes of connectivity, safe travel choice, mode shift and supporting planned urban growth. The above assessments have detailed the expected outcomes that the Project will provide, and overall, the Project achieves these outcomes. Without the Project, the walking and cycling facilities both along the corridors and at the key intersections with Fred Taylor Drive and Don Buck Road are substandard within an urbanising context and are not attractive for travel by these modes. Currently public transport priority is limited at these intersections and without priority treatments buses on the Project will be subject to increasing levels of delay.

The Project addresses these outcomes in the following ways:

- In terms of connectivity, the provision of the N-S Project and the E-W Project provides corridors for multi-modal travel through the Redhills area. This provides for increased connectivity for all travel modes between Redhills, Taupaki (to the north and west of Redhills), Massey (to the east) and the metropolitan centre at Westgate. In addition, the provision of these corridors provides increased resilience to the wider network, decreasing reliance on Fred Taylor Drive and Don Buck Road to provide for all through movement in the Project area.
- All corridors within the Project will include the provision of safe walking and cycling facilities to enable attractive travel choices for residents in the Project area and enable connections to the existing and/or future active networks. The Project also includes the upgrade of intersections within the existing arterial network, providing safe crossing for pedestrians and cyclists.
- Improved public transport facilities at the intersection Don Buck Road with Royal Road and Dunlop Road with Fred Taylor Drive will provide for improved reliability for bus travel times, thereby increasing the efficiency and attractiveness of public transport travel to future RTN's.

Overall, the Project provides a safe, attractive arterial network that supports future travel choice and will sufficiently provide for increased connectivity in the Redhills area.

6.8 Assessment of Staging Effects

The Redhills network has been assessed as a complete network, with the assessment focused on the long-term outcomes of the Project in the context of the future environment.

This is a project of considerable magnitude, and it is likely that the Project will be separated into discrete construction projects, or at a minimum be delivered in stages.

For the various modes of travel, an assessment of the effects, that a staged delivery may have on these travel choices, and how these may be overcome is detailed in Table 11. This does not preclude measures that may be put in place to provide safe movement for all modes during construction which is discussed further in Section 6.9.

Table 11: Staged Delivery of Redhills Network

Transport Mode	Key Staging Considerations
Walking and Cycling	<ul style="list-style-type: none"> Integration with the existing walking and cycling facilities present at the time of construction is critical to providing a safe and connected journey for those that travel by foot and cycle.
Public Transport	<ul style="list-style-type: none"> To achieve an efficient public transport network, the entire Redhills network will need to be delivered. It is likely that a staged result may reduce efficiency and catchment opportunities for the public transport services until such time that the full network is available. Public transport services on the existing roads within the Project extents will continue to operate. There may be opportunities for new bus routes to be implemented on stages of the new network supported by supplementary collector roads.
General Traffic	<ul style="list-style-type: none"> The intersections are proposed to be constructed to accommodate traffic volumes as anticipated at the full build out of Redhills. Should a staged approach be undertaken there will be ample capacity within these intersections to allow for interim levels of land use. The delivery of elements of the network in stages is likely to occur congruent with the land development. For example, large portions of land in the eastern part of Redhills will require access via the Redhills network to enable the development.

6.9 Assessment of Construction Effects

It is anticipated that the larger part of works required for this package of projects will likely be delivered offline. However, there is still likely to be some works in the live carriageway, which means that temporary traffic management will be required. The scale of temporary traffic management to delineate live traffic away from the construction zones is largely dependent on the various stages and requirements of the construction activities. It is expected that short term temporary road closure for nights or weekends may be required for some specific activities, such as road surfacing, traffic switches and gas relocation. Other activities may require stop/go or contraflow traffic management, such as drainage, utility relocation, survey and investigation work.

The effect of temporary road closure or other traffic management methods to existing traffic on the specific corridor and adjacent road network should be confirmed in the future as part of the CTMP for each Project on the basis of the current traffic environment. This will take into account the level of growth and activities that has occurred in Redhills, the availability of the alternative routes, and any additional sensitive land use activities.

The construction of the Projects will each likely require significant earthworks. Final cut and fill volumes will be confirmed following detailed design prior to construction. The construction traffic movements to accommodate the earthworks will likely result in the increase of traffic volume on construction routes used during the construction period of each of the Projects.

Given the construction timing and staging of the package has yet to be determined, there is a degree of uncertainty associated with any predicted construction methodology and associated traffic routes. This means:

- The routes that will be used by construction vehicles will depend on the location of quarries and disposal sites which are not yet certain
- The exact location and extent of compound sites/lay down areas has yet to be determined
- The timing of construction of other projects could impact on likely construction vehicle routes

Notwithstanding this, it is considered that with available connectivity to the strategic network and available capacity in the network, construction traffic will be able to be readily accommodated.

It is noted that the access to compound sites/laydown areas and construction zone for construction vehicles, plant and materials will be via site access points identified as part of future CTMPs.

Details of the routes and time restrictions will need to be updated and refined as part of the CTMP process. It is anticipated that the routes for construction traffic will likely be limited to arterial corridors and intersections with the provision of adequate vehicle tracking.

Speed Limits

In order to maintain the safety of all road users, it is recommended to implement a safe and appropriate temporary speed limit during the construction period on the network within the extent of works, and along the construction routes if needed. This should be in accordance with the latest traffic management standards at the time of construction. These recommended measures and other measures highlighted in the CTMP are expected to reduce the potential safety risks that may be associated with construction traffic.

Pedestrians and cyclists

The existing provision for pedestrian and cyclists is variable across the network. It is likely that the demand for these modes will increase if urbanisation occurs prior to construction, but future parallel collectors could also be used as alternative routes. Therefore, effects should be assessed again when a greater level of detail is available about surrounding facilities and land use activities prior to construction. However, it is recommended that residents and stakeholders be kept informed of construction times and progress, and general observations of pedestrian and cyclist activity be used to inform appropriate traffic management measures in the CTMP.

Property access for residents and businesses

During the time of construction, there will be temporary traffic management controls such as temporary concrete or steel barriers. Existing driveways that remain during construction will be required to have temporary access provision. It is anticipated that the contractor should undertake a property specific assessment of any affected driveways and provide temporary access arrangements if required. The temporary access should ensure the ability for residents to safely access and exit the property. These requirements should be captured in the CTMP or SSTMP, if required. Confirmation of traffic management controls will be required immediately prior to works to reflect the land use considerations at that time.

Land use activities that will need further consideration in the CTMP

At the time of this report, no specific land use or activities have been identified as requiring specific consideration during the development of the CTMP. Overall, it is considered that expected construction effects can be managed via the use to the CTMP or SSTMP prior to implementation.

7 Managing Effects and Achieving Project Outcomes

7.1 Managing Operational Effects

Table 12 below summarises the proposed measures to manage the identified effects of the Project and help to ensure that the positive effects are achieved.

Table 12: Summary of Proposed Measures

Operational Transport Effects	
Walking and Cycling Effects	<p>In order to provide safe and attractive walking and cycling facilities to appropriate standards that are integrated with the wider network an Outline Plan should specify:</p> <ul style="list-style-type: none"> • The type of walking and cycling infrastructure to be provided within the corridor including confirmation of the proposed dimensions; • Details on the integration proposed for walking and cycling facilities between the extent of the works and the existing facilities; • Details of any staging implications and measures in place to ensure connectivity between stages.
Safety Effects	<p>All transport design in New Zealand is subject to a Road Safety Audit at the detailed design stage. Once through that audit, the design will form part of the Outline Plan process.</p>
Access Effects	<p>It is recommended that a detailed access assessment is completed by a suitably qualified traffic engineer and/or transport planner following detailed design that considers property access implications and identifies appropriate mitigation where an access compliant with the AUP:OP cannot be provided.</p>

7.2 Managing Construction Traffic Effects

It is considered that the potential construction traffic effects can be accommodated and managed appropriately via a CTMP. The purpose of the CTMP is to ensure the construction of each Project is managed in such a way that enables safe and efficient movement of local traffic throughout the construction period and to minimise disruption to road users, particularly the adjacent residential properties and local activities. Based on the assessment of transport construction effects, it is recommended:

- 1) A CTMP shall be prepared prior to the Start of Construction for a Stage of Work. Any potential construction traffic effects shall be reassessed prior to construction taking into account the specific construction methodology and traffic environment at the time of construction.
- 2) The objective of the CTMP is to avoid, remedy or mitigate, as far as practicable, adverse construction traffic effects. To achieve this objective, the CTMP shall include:
 - a) Methods to manage the effects of temporary traffic management activities on traffic;
 - b) Measures to ensure the safety of all transport users;

- c) The estimated numbers, frequencies, routes and timing of traffic movements, including any specific non-working or non-movement hours to manage vehicular and pedestrian traffic near schools or to manage traffic congestion;
 - d) Size access routes and access points for all construction vehicles, the size and location of parking areas for plant, construction vehicles, and the vehicles of workers and visitors;
 - e) Identification of detour routes and other methods to ensure the safe management and maintenance of traffic flows, including pedestrians and cyclists, on existing roads;
 - f) Methods to maintain vehicle access to property and/or private roads where practicable, or to provide alternative access arrangements when it will not be;
 - g) The management approach to loads on heavy construction vehicles, including covering loads of fine material, the use of wheel-wash facilities at site exit points and the timely removal of any material deposited or spilled on public roads;
 - h) Method that will be undertaken to communicate traffic management measures to affected road users (e.g. residents/public/stakeholders/emergency services);
- 3) Auditing, monitoring and reporting requirements relating to traffic management activities shall be undertaken in accordance with Waka Kotahi's Code of Practice for Temporary Traffic Management.
 - 4) Any CTMP prepared for a Stage of Work shall be submitted to Council for information ten (10) working days prior to the Start of Construction for a Stage of Work.

8 Conclusion

This assessment of transport effects has identified that the Project provides safe and appropriate urban arterial corridors that support future travel choice and provides for increased connectivity for the current and future communities in Redhills.

Without the Project, the walking and cycling facilities at the intersections are substandard in an urban context, and the current capacity at the intersections will result in unreliable journey times for public transport. If key arterial routes are not provided in Redhills, a transport network hierarchy that enables journeys to be undertaken on appropriate corridors will not occur.

Transport outcomes are significantly improved by the Project and will include:

- Connectivity between the future growth area in Redhills and the Metropolitan Centre at Westgate and, connectivity by foot, cycle, and public transport;
- The level of provision for walking and cycling to enable attractive travel choices for future residents in the Project area;
- Connections to the arterial network through the upgrade of intersections providing safe crossing for pedestrians and cyclists;
- Public transport facilities at the intersection of Dunlop Road and Fred Taylor Drive and Royal and Don Buck Road as key intersections on key future public transport corridors.

In terms of adverse effects, the Project will likely result in 10 properties on Royal Road where the provision of a safe and appropriate driveway will be not be achievable and as such these properties have been included within the designation.

At the intersection of Royal Road and Don Buck Road there are approaches that are reaching practical capacity (defined as an intersection movement with a degree of saturation above 0.90) and experiencing approximately 400m queues in the 2048 scenario. While this results in an effect on car drivers, also provided at the intersection is public transport priority to increase reliability for buses and dedicated walking and cycling facilities for active modes. Within the context of increased travel choices, and an urban environment the peak commuter period delays for drivers are considered to be minor.

Overall, the Project provides safe, attractive arterial roads that support future travel choice and will sufficiently provide for increased connectivity in the Redhills area.

Appendix 1

Modelling Assumptions

Within the SATURN model there are a series of assumptions included within each forecast year. The below table summarises the assumptions regarding related projects and their likely impacts on the network if they do not occur. Assumptions have been made about the implementation years of these projects, which have in turn informed the years in which the projects have been included in the transport model.

Table A1: Infrastructure Assumptions and Potential Impacts

Project	Model Years included			Potential impacts on RATN
	2028	2038	2048	
SH16/18				
Squadron Drive Ramps	Y	Y	Y	No impact
SH16/18 Connections	-	Y	Y	Northside Drive ramps relieve capacity on Hobsonville Road as additional south facing ramps are provided, and east/west connection over is SH16 completed. May reduce traffic volumes at intersection of Fred Taylor Drive and Don Buck Road.
SH16 Brigham Creek Interchange	-	Y	Y	Moderate impact. Current access to Westgate from north of SH16 Brigham Creek interchange is via Fred Taylor Drive. This will remain the primary access to Westgate, as no north facing ramps are to be provided at Hobsonville Road or Northside Drive. Interchange will influence form of the northern end of Fred Taylor Drive.
SH18 Brigham Creek Interchange	-	-	Y	No impact
City Centre to North West RTN				
Interim Bus Solution	Y	-	-	Limited impact. Attractive public transport solution considered necessary to influence transport choice.
To Westgate	Y	Y	Y	Significant impact. Provision of high frequency, rapid transport option for residents. Prior to this fragmented priority offering via bus lanes on SH16. Dunlop Road provides direct link between Redhills Centre and Westgate RTN station.
To Kumeu		Y	Y	Moderate impact. Station locations in between Westgate and Kumeu may support travelling south in the morning to reach RTN. Most significant impact on Taupaki / Nelson Road connection.
Other Projects				
SH18 RTN	-	Y	Y	Limited impact on Redhills network.

Kumeu Alternative Corridor	-	Y	Y	Moderate impact. Most significant impact on Taupaki/Nelson Road connection, and function of Fred Taylor Drive in the north.
Rawiri Road Bridge and Connections	-	Y	Y	No impact.