Riverhead Plan Change

Integrated Transport Assessment

October 2023

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TRANSPORTATION SPECIALISTS

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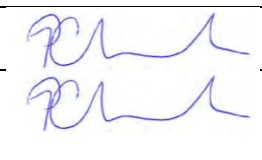
12 December 2022	For Notification	R1F221212	T Church	
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SUMMARY OF OUR ASSESSMENT

Riverhead Landowner Group (Applicant) has engaged Flow Transportation Specialists Ltd (Flow) to assess the transport planning and traffic engineering matters relating to a Structure Plan and subsequent Private Plan Change (Proposal) for land zoned Future Urban, located in Riverhead, adjacent to Coatesville-Riverhead Highway and Riverhead Road (Site).

The Structure Plan and Plan Change Proposal includes the following elements that are material to transport matters

- Rezoning the Future Urban Zone land to a variety of zones, including
  - Residential – Mixed Housing Suburban and Terrace Housing and Apartment Buildings[1]
  - Business – Local Centre, providing for a supermarket, ancillary retail, café and offices
  - Business – Neighbourhood Centre, providing a smaller scale retail offering to the local neighbourhood
  - Rural – Mixed Rural
- Enabling of future activities and amenities including a potential school, early childhood centre, and open space.
- Upgrading the transport network within the Plan Change area which provides access to Riverhead and the development area, including
  - Upgrading the surrounding road network within the Plan Change area to improve road safety and provide new separated facilities for pedestrians and cyclists. These upgrades align with those being assessed by Auckland Transport and Te Tupu Ngātahi Supporting Growth for Coatesville-Riverhead Highway. Similar upgrades are also provided for Riverhead Road, with Lathrope Road also being sealed and a pedestrian path provided on the northern side. Upgrades are also included for Cambridge Road fronting the Site, with a pedestrian path also provided for along Queen Street to connect to Coatesville-Riverhead Highway.
  - Anticipated speed limit reductions (through Bylaw changes) by extending the existing 50 km/h speed limits on Coatesville-Riverhead Highway, Riverhead Road and Lathrope Road which front the extended urban area to enable safer speed environments for all road users, and provide new speed threshold treatments.
- Upgrading the following intersections to improve safety and facilitate active modes
  - Coatesville-Riverhead Highway / Riverhead Road – upgrade existing roundabout
  - Coatesville-Riverhead Highway / Riverhead Point Drive / new collector road – upgrade to a roundabout and construct a fourth west leg to provide a collector road into the site

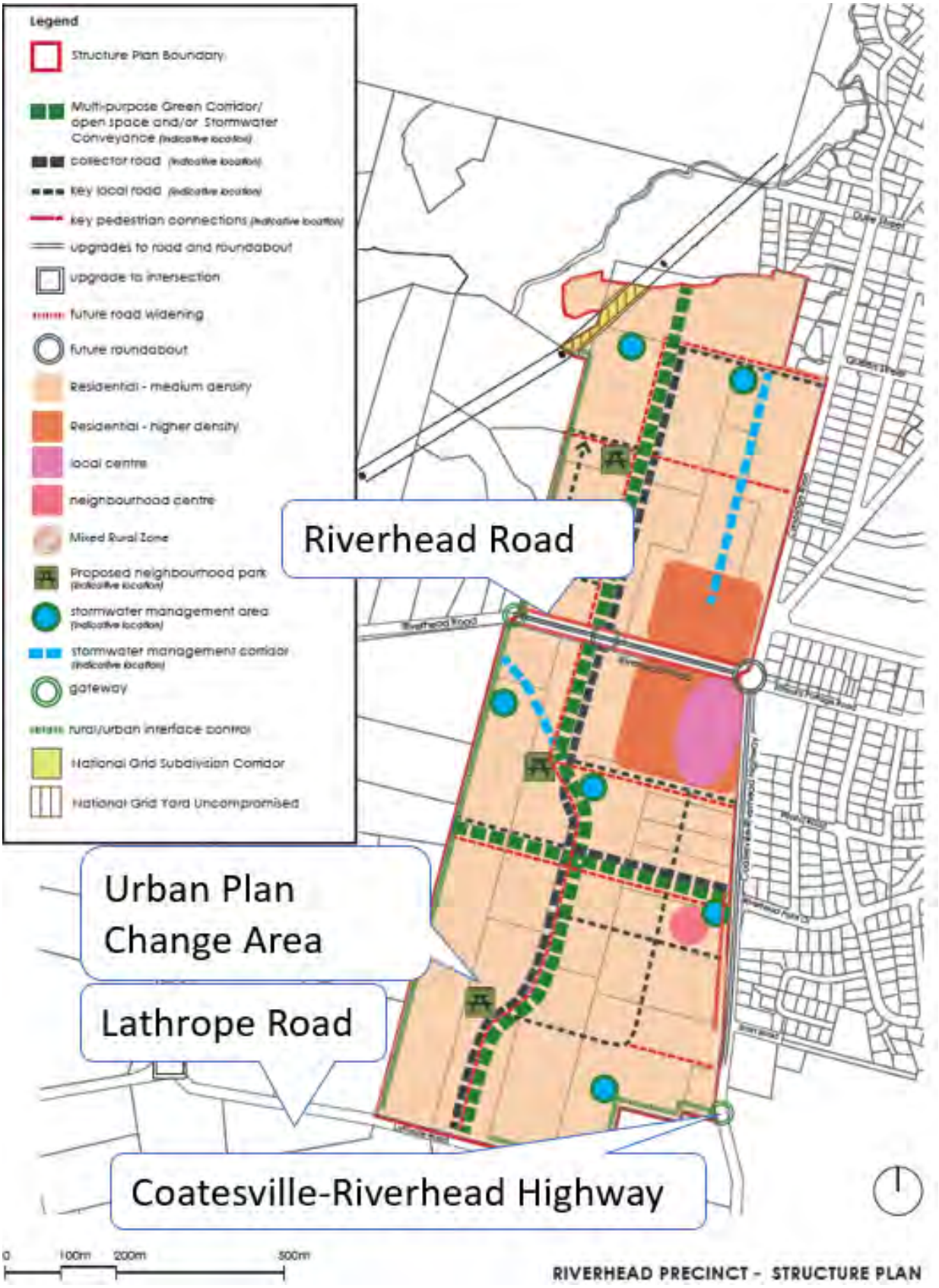
[1] Allowing up to 1,558 residential dwellings, a retirement village with some 310 apartments, 90 aged care beds, a childcare centre, a medical centre and supporting café and retail

- Coatesville-Riverhead Highway / new local road – construct a new local road access onto Coatesville-Riverhead Highway between Riverhead Point Drive and Short Road as a priority-controlled intersection
- Riverhead Road / new collector road – construct a new roundabout west of Coatesville-Riverhead Highway. The new collector road will provide a north and south approach to the roundabout, providing a total of four approaches
- Lathrope Road / Riverhead Road – upgrade the existing priority control intersection. Realign the Lathrope Road access into one point, and provide a right turn bay and a flush median on Riverhead Road
- Right turn bays on Coatesville-Riverhead Highway will be required at the Riverland Road and Old Railway Road intersections.

- Precinct plan provisions, which ensure the necessary infrastructure upgrades are operational prior to relevant development being occupied. This includes the infrastructure upgrades outlined above and tying occupied development to the SH16 / Coatesville-Riverhead Highway intersection upgrade being progressed by Waka Kotahi, given the safety improvements this upgrade provides to all of Riverhead.

A plan showing the Site and general layout is included at Figure ES1.

Figure ES1: Proposed Structure Plan



Based on the analysis described in this report, we conclude that the Structure Plan and proposed Plan Change can enable activities that can operate safely and efficiently from a transportation perspective.

We conclude that

Planning context

- The Plan change aligns well with the Auckland Plan and Auckland Unitary Plan transport objectives by providing people with choices of healthy and sustainable transport modes and encourages a range of activities. A full assessment of the relevant objectives and policies is provided in the section 32 report prepared by Barker & Associates
- The rezoning of Future Urban land will enable a range of complementary activities, including residential dwellings, a local centre, early learning childcare centres and a retirement village complex
- Provision of education options are being provided
- The Plan Change brings the development ahead of the 2028 – 2032 current schedule in the Future Urban Land Supply Strategy by three to four years although that timing is principally based on issues applying to Kumeu and Huapai that do not constrain Riverhead. We note that the roading improvements captured in the Precinct Provisions are all that is required prior to development being occupied.

Local access and roads

- The sections of Riverhead Road and Coatesville-Riverhead Highway that front the plan change area and provide the entry points to Riverhead will receive full corridor upgrades within the vicinity of the Site as part of the Plan Change. This includes providing new dedicated facilities for pedestrians and cyclists on both sides of these roads, which will significantly improve active mode accessibility for existing and future residents of Riverhead
- Lathrope Road will be upgraded and sealed to provide a footpath on the northern side, and allow this road to be used as an external vehicle access route from the Site to Riverhead Road
- An internal road network will be provided to support the activities included in the Plan Change. Several new intersections will be constructed. Existing intersections in the local area will be upgraded. These intersections will be designed in accordance with Vision Zero and designed to safely accommodate all road users. The proposed Precinct Provisions set out the anticipated design elements of local roads, requiring low speed designs that offer a safe outcome to all users
- New footpaths on Queen Street and Cambridge Road will be provided to improve pedestrian connectivity
- Precinct Plan provisions will allow improved public transport facilities to be provided in the future
- It is anticipated that speed limits will be revised (through the Bylaw) on Riverhead Road and Coatesville-Riverhead Highway, as a result of urbanisation of the area. This will provide safety benefits for all road users and align with Vision Zero principles (see Section 6.1.1).

Wider network

- There are existing capacity constraints on the road network, particularly on SH16. The section of SH16 south of the Site has funding to be upgraded by Waka Kotahi NZTA by 2025, which will increase capacity and improve safety from the Plan Change area. The Notice of Requirement for

this project has now been lodged with Auckland Council. The proposed Precinct Provisions include a requirement to ensure that this upgrade is provided before development is occupied

- There will be a noticeable number of trips generated by the development in time, but the impact on the wider network will be reduced by pass-by trips, multi-purpose trips, and trips that can be undertaken locally within Riverhead. All intersections within the Riverhead Plan Change area are anticipated to perform without any noticeable queue lengths or delays with the increased traffic volumes
- The SH16 / Coatesville-Riverhead Highway intersection is predicted to perform well, even when considering the full 100% Plan Change buildout by 2038, due to the Waka Kotahi upgrade
- Coatesville-Riverhead Highway is serviced by a bus route, which connects to the Westgate public transport hub and Albany station. The upgrades proposed on Coatesville-Riverhead Highway will include the provision of public transport infrastructure to support provision of increased services and encourage travel by public transport
- Right turn bays on Coatesville-Riverhead Highway will be required at the Riverland Road and Old Railway Road intersections, noting the Old Railway Road right turn bay is already required.

Overall, we are of the view that the Plan Change will enable development that aligns with or implements transport network upgrades as planned by Waka Kotahi and Auckland Transport. The upgrades proposed as part of the Plan Change will significantly improve accessibility for all transport modes in Riverhead.

We therefore consider that there are no transportation planning or traffic engineering reasons to preclude the implementation of the Plan Change as set out in the proposed Precinct Provisions.

CONTENTS

APPENDICES

1 WHAT THIS REPORT INCLUDES

Riverhead Landowner Group[2] (Applicant) has engaged Flow Transportation Specialists Ltd (Flow) to assess the transport planning and traffic engineering matters relating to a Structure Plan and Private Plan Change (Proposal) for land zoned Future Urban, located in Riverhead, adjacent to Coatesville-Riverhead Highway and Riverhead Road (Site). The Private Plan Change will consist of rezoning land from Future Urban to allow residential and local retail activities.

This Transport Assessment provides the following information

- A description of the Proposal, focussing on the transport matters
- An assessment of the Proposal against the relevant transport planning documents, including the Auckland Plan, Auckland Unitary Plan (Unitary Plan), Future Urban Land Supply Strategy and Future Connect
- The provision of background information to provide context to the transport assessment of the Proposal. This information includes
  - the Site location and immediate surrounding transport network, including traffic volumes
  - a description and assessment of the historic crash record of the immediate transport network
  - a description of the private vehicle, public transport and walking and cycling accessibility of the Site
- An assessment of the Proposal and potential transport effects with regard to
  - vehicle access
  - traffic generation and impacts on the surrounding transport network
  - safety impacts and upgrades
  - active mode and public transport provisions
- Outcomes in relation to the implementation of upgrades, including who is responsible for delivering the upgrade.

[2] Consisting of Fletcher Living, Matvin Group, Neil Group

2 THE PLAN CHANGE PROPOSAL

The Proposal includes the following elements and infrastructure upgrades that are material to transport matters

- Rezoning the Future Urban Zone land to a variety of zones, including
  - Residential – Mixed Housing Suburban and Terrace Housing and Apartment Buildings
  - Business – Local Centre
  - Business – Neighbourhood Centre
  - Rural – Mixed Rural
- This will enable the following activities within the proposed urban zones[3]
  - Some 1,468 residential dwellings including
    - 385 lower density dwellings with the Mixed Housing Suburban zone
    - 775 medium density dwellings with the Mixed Housing Suburban zone
    - 100 dwellings in the Terrace House and Apartment Buildings zone
    - 208 retirement village villas.
  - A local centre, which could contain
    - a supermarket of up to 4,000 m^2
    - ancillary retail of 650 m^2
    - café of 600 m^2
    - offices of up to 1,000 m^2
    - medical centre up to 250 m^2
  - A neighbourhood centre of approximately 300 m^2
  - A retirement village complex, which could contain
    - Some 310 retirement village apartments (158 villas are included in the total number of retirement villas for residential dwellings above, which would bring the total to 468 if included here)
    - 90 aged care / dementia beds
    - A café of 450 m^2
    - Retail of 150 m^2
    - A childcare centre accommodating 100 children
    - A medical centre of 250 m^2
  - A potential school could be provided, with an assumed capacity to accommodate some 1,100 students.

[3] Based on anticipated development implemented over a 5-10 year period

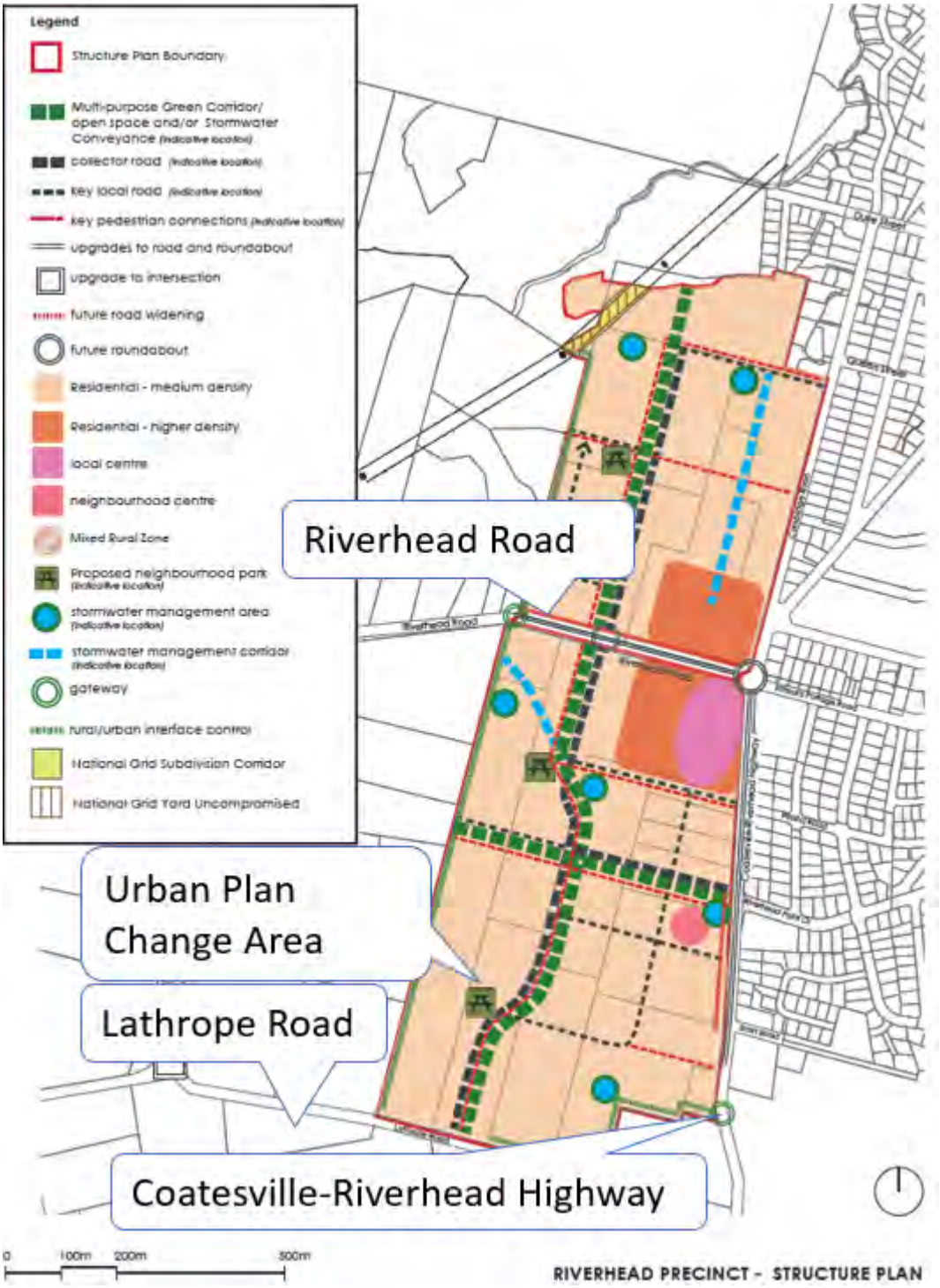
- Anticipated speed limit reductions through the Bylaw process (consistent with those being implemented fronting other new urban areas) on Coatesville-Riverhead Highway, Riverhead Road and Lathrope Road to 50 km/h, enabling safer speed environments for all road users, and provide new speed threshold treatments (referred to as 'gateways' in the Precinct Provisions)
    - Coatesville-Riverhead Highway – extend the existing 50 km/h speed limit further south and relocate the speed threshold treatment south of Short Road
    - Riverhead Road – reduce from 80 km/h to 50km/h in front of the Plan Change Site, and provide a new speed threshold treatment west of the Site
    - Lathrope Road – reduce from 60 km/h to 50 km/h
- Providing the following corridor upgrades to the surrounding road network to improve road safety and provide new separated facilities for pedestrians and cyclists. The Coatesville-Riverhead Highway upgrade aligns with that lodged by Auckland Transport and Te Tupu Ngātahi Supporting Growth, with the Riverhead upgrade being consistent with this design
    - Coatesville-Riverhead Highway – upgrade from Riverhead Road to 80 m south of Short Road to provide separated cycle lanes and pedestrians footpaths on each side
    - Riverhead Road – upgrade from Coatesville-Riverhead Highway to the eastern boundary of 307 Riverhead Road to provide separated cycle lanes and pedestrians footpaths on each side
    - Lathrope Road – upgrade the full length of Lathrope Road to provide a sealed carriageway and a footpath on the northern side
    - Cambridge Road – urbanise Cambridge Road fronting the Site, including a footpath on the western side of Cambridge Road and on the northern side of Queen Street
- Upgrading or constructing the following intersections to improve safety and facilitate active modes
    - Coatesville-Riverhead Highway / Riverhead Road – upgrade existing roundabout
    - Coatesville-Riverhead Highway / Riverhead Point Drive / new collector road – upgrade to a roundabout and construct a fourth west leg to provide a collector road into the site
    - Coatesville-Riverhead Highway / new local road – construct a new local road access onto Coatesville-Riverhead Highway between Riverhead Point Drive and Short Road as a priority-controlled intersection
    - Riverhead Road / new collector road – construct a new roundabout west of Coatesville-Riverhead Highway. The new collector road will provide a north and south approach to the roundabout, providing a total of four approaches
    - Lathrope Road / Riverhead Road – upgrade the existing priority control intersection. Realign the Lathrope Road access into one point, and provide a right turn bay and a flush median on Riverhead Road
    - Right turn bays on Coatesville-Riverhead Highway will be required at the Riverland Road and Old Railway Road intersections.

- Introducing Precinct Plan provisions, which include requirements for specific infrastructure upgrades to be provided prior to development being occupied. This includes the infrastructure upgrades outlined above, and the SH16 / Coatesville-Riverhead Highway intersection upgrade being progressed by Waka Kotahi, given the safety improvements this upgrade provides to all of Riverhead.

The Neighbourhood Design Statement, which forms part of the application provides further details about how the yields for the various activities have been established.

A diagram of the Structure and Plan Change is shown in Figure 1.

Figure 1: Proposed Structure Plan



3 STRATEGIC CONTEXT

3.1 Auckland Plan

The Auckland Plan is a long-term spatial plan for Auckland, with a 2050[4] outlook. It considers how we will address key challenges such as high population growth and shared prosperity.

There are six outcomes of the Auckland Plan, with transport and access being one. Within the transport and access outcome, there are three key directions

- Better connect people, places, goods and services
- Increase genuine travel choices for a healthy, vibrant and equitable Auckland
- Maximise safety and environmental protection.

The Riverhead Plan Change provides opportunity to align with these directions

- New active mode facilities for pedestrians and cyclists will provide genuine travel choices for current and future residents in Riverhead. This will also maximise safety for active modes
- People can be better connected to places, goods and services in Riverhead by providing a mix of new land uses, such as new local and neighbourhood centres, education facilities and residential accommodation for all age groups.

3.2 Auckland Unitary Plan

The Auckland Unitary Plan has the following region-wide transport objectives in Auckland[5]

- Land use and all modes of transport are integrated in a manner that enables
  - the benefits of an integrated transport network to be realised
  - the adverse effects of traffic generation on the transport network to be managed
- An integrated transport network including public transport, walking, cycling, private vehicles and freight is provided for
- Parking and loading support urban growth and the quality compact urban form
- The provision of safe and efficient parking, loading and access is commensurate with the character, scale and intensity of the zone
- Pedestrian safety and amenity along public footpaths are prioritised
- Road/rail crossings operate safely with neighbouring land use and development.

The Riverhead Plan Change align with several transport objectives of the Unitary Plan

- Achieving a quality compact urban form consistent with the Unitary Plan's hierarchy of centres

[4] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/auckland-plan/Pages/default.aspx

[5] https://unitaryplan.aucklandcouncil.govt.nz/Images/Auckland%20Unitary%20Plan%20Operative/Chapter%20E%20Auckland-wide/4.%20Infrastructure/E27%20Transport.pdf

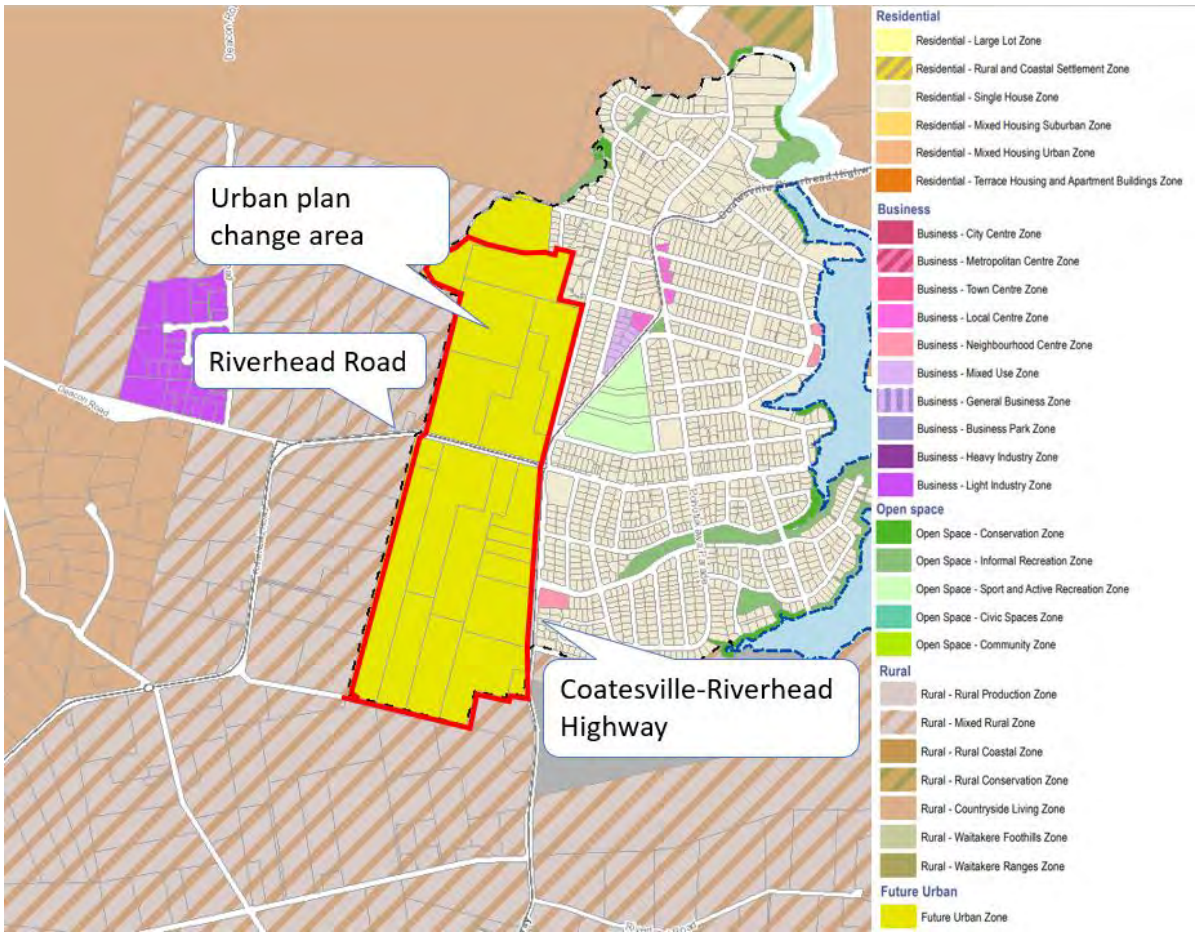
- Providing a mix of land use activities, including local and neighbourhood centres, can ensure that land use is integrated to minimise the need to travel longer distances to other areas
- Adverse effects of trip generation can be managed by providing upgrades to the local road network and providing new activities in Riverhead, allowing existing residents to undertake trips locally
- Providing new and upgraded facilities for walking and cycling can ensure that all modes of transport are provided in an integrated manner, and will increase opportunities for local active mode use
- Pedestrian safety and amenity can be improved by providing new and upgraded facilities.

The Section 32 report by Barker & Associates provides a full assessment against the transport policies and objectives of the Unitary Plan. We also note this Section 32 report provides an assessment against the relevant transport provisions of the National Policy Statement on Urban Development.

3.2.1 Site Context

The Unitary Plan zoning of the Site is shown in Figure 2. The Site is zoned Future Urban Zone.

Figure 2: Unitary Plan zoning[6]



[6] https://unitaryplanmaps.aucklandcouncil.govt.nz/upviewer/

Land to the north, west and south is primarily zoned for rural activities being Mixed Rural and Countryside Living zones. The existing Riverhead settlement is located to the east, which mostly consists of Residential – Single House Zone land.

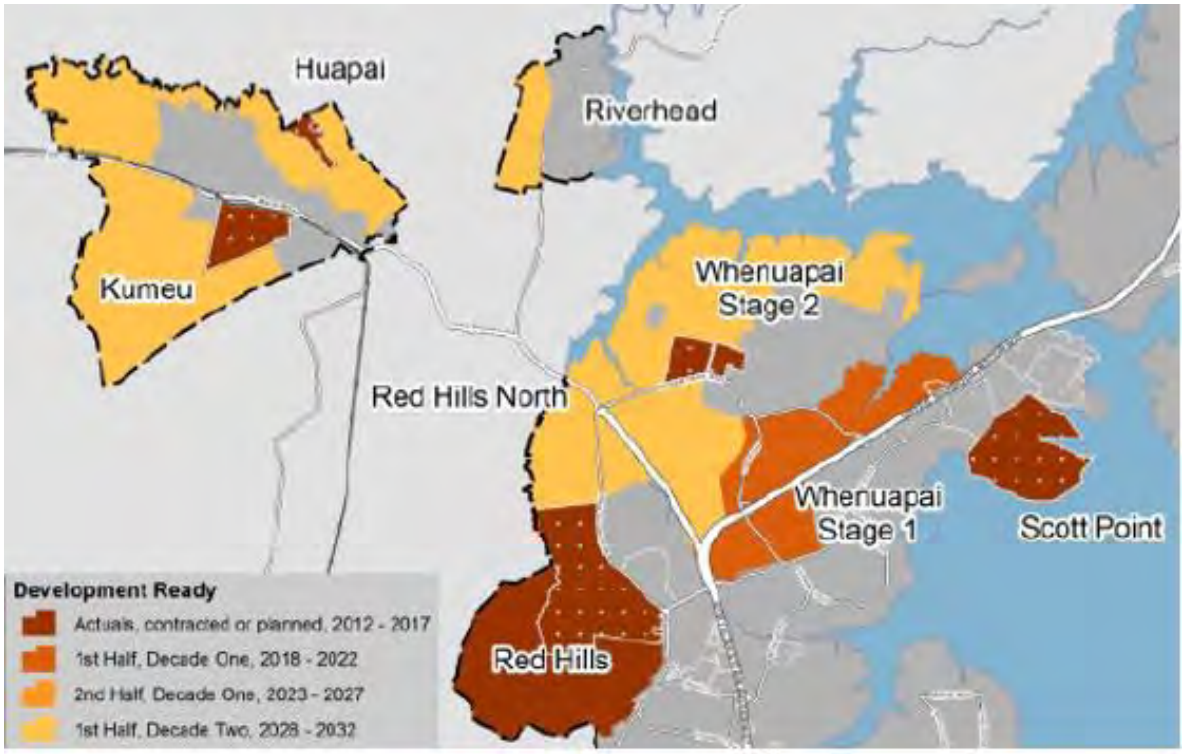
Riverhead Road and Coatesville-Riverhead Highway are classified as Arterial Roads under the Unitary Plan. This means that direct access onto these roads triggers Vehicle Access Restrictions, which is a Restricted Discretionary activity.

3.3 Future Urban Land Supply Strategy

The Future Urban Land Supply Strategy (FULSS)[7] is a non-statutory document which identifies a programme to sequence land over 30 years in Auckland. It is a strategy which assists with the ongoing supply of greenfield land for development. It determines sequencing and timing for when future urban areas will be ready for development to commence which requires necessary underpinning zoning and bulk infrastructure to be in place.

Figure 3 shows a map of the sequencing for Northwest Auckland. Riverhead is identified to be development ready between 2028 – 2032. This Plan Change would effectively bring development in Riverhead forward, ahead of the 2028 – 2032 schedule. However, it is noted that Riverhead is grouped with Kumeu and Huapai, whereas the constraints that are the basis for this schedule as identified in the FULSS, particularly those relating to transport can be appropriately managed as identified in this report. The key transport constraint for this particular area is the SH16 safety and capacity upgrades.

Figure 3: Future Urban Land Supply Strategy – Sequencing of Northwest Auckland



[7] https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-plans-strategies/topic-based-plans-strategies/housing-plans/Documents/future-urban-land-supply-strategy.pdf

3.4 Future Connect

Auckland Transport's Future Connect programme sets out the long-term network plan for Auckland's integrated transport system, with the network plan helping to inform the 10-year investment programme. For Riverhead, Future Connect classifies the following for the first decade (2021-2031)

- Cycle and micro-mobility – Coatesville-Riverhead Highway and Riverhead Road as local (supporting) corridors. The network about Riverhead is not considered to be Regional, Major or Connector routes
- Public Transport – Coatesville-Riverhead Highway has a supporting local transit route highlighted, being that which connects Albany Station to Westgate Station. There are no Frequent or Strategic routes planned through Riverhead at this time.
- General Traffic – Coatesville-Riverhead Highway is a Primary Arterial, with Riverhead Road being a (supporting) Secondary Arterial. Both these corridors about the plan change area are proposed to be upgraded, with the upgrades reflecting these classifications
- Walking – Coatesville-Riverhead Highway is classified as being a Primary and Secondary classification fronting the Plan Change site, with Riverhead Road being a supporting tertiary route. Again, the corridor and intersection upgrades proposed will significantly improve the safety and provision for walking about Riverhead.

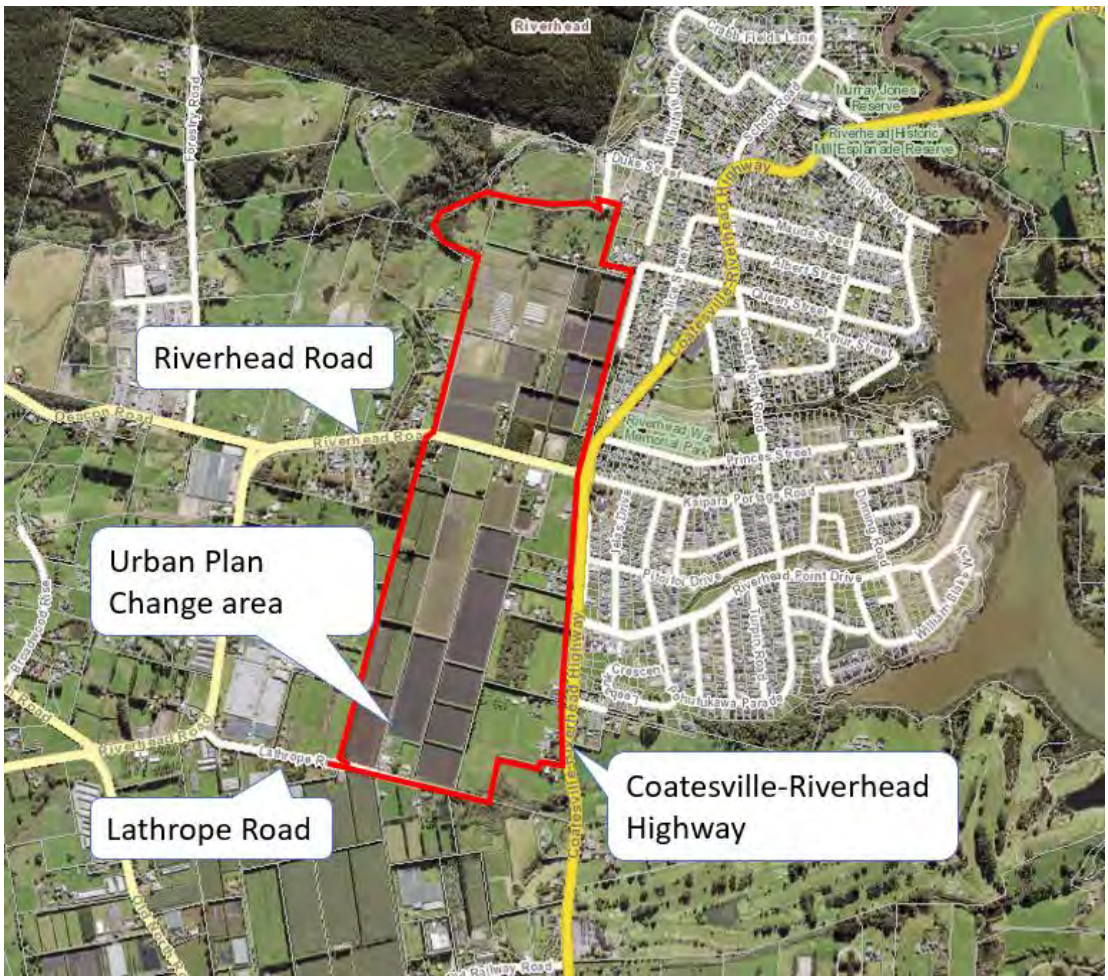
The Plan Change and recommended upgrades align with the network anticipated by Auckland Transport for Riverhead.

4 A DESCRIPTION OF THE EXISTING ENVIRONMENT

4.1 The Site and surrounding environment

The extent of the Urban Plan Change area is shown in Figure 4. While the Riverhead Landowner Group own or have rights to the majority of land within the Plan Change boundary, the Site comprises several smaller sites, which currently contain rural activities and some residential dwellings.

Figure 4: The site and immediate surrounds



We note that

- Land to the west and south is primarily rural in nature
- An industrial area is located west of the Site, near Deacon Road and Forestry Road
- The existing Riverhead residential area is located immediately east of the Site, which mostly consists of low density residential houses
- The Riverhead Forest is located north of the Site, which contains walking and cycling tracks
- The Kumeu town centre is located approximately 3-4 km west of the Site
- The Site has access points onto Riverhead Road, Coatesville-Riverhead Highway and Lathrope Road. The northern section of the Site also has access points onto Cambridge Road.

4.2 Existing roads

4.2.1 Coatesville-Riverhead Highway

Coatesville-Riverhead Highway is a 14 km long road which connects SH16 at its southern end to Dairy Flat and Albany to the northeast. It is primarily a two-lane rural road, with no formal footpaths.

Within the existing Riverhead town area and along the Site boundary, Coatesville-Riverhead Highway is constructed to a more urban standard on the eastern edge.

Figure 5 shows a photo of the urbanised section of Coatesville-Riverhead Highway along the Site boundary. There is one traffic lane in each direction separated by a painted flush median. There is no footpath along the west side of the road. Along the east side, a footpath is provided between Riverhead Road and Riverhead Point Drive along Grove Way, which is a frontage road giving access to local properties.

Figure 5: Typical layout of urban section of Coatesville-Riverhead Highway (shown south of Grove Way entrance, looking north)

4.2.2 Riverhead Road

Riverhead Road is currently a rural arterial road which connects Riverhead to Kumeu (via SH16) at its southwest end.

Riverhead Road typically has one traffic lane in each direction, with no dedicated footpaths or cycling facilities.

Figure 6: Typical layout of Riverhead Road (shown west of Coatesville-Riverhead Highway, looking west)

4.2.3 Lathrope Road

A photo of Lathrope Road is shown in Figure 7. Lathrope Road is an unsealed rural road, which has no dedicated footpaths. It currently serves local properties and is a no exit road. Its intersection with Riverhead Road is the only external access point to the wider road network.

Figure 7: Typical layout of Lathrope Road

4.3 Existing traffic conditions

4.3.1 Coatesville-Riverhead Highway and Riverhead Road

Daily and peak hour traffic count information available from the Auckland Transport traffic count database is presented in Table 1.

Table 1: Auckland Transport traffic count data near the Site

Location	Date	Weekday Average Daily Volume (vpd)	Morning Peak Hour Volume (vph)	Afternoon Peak Hour Volume (vph)
Riverhead Road (west of Coatesville-Riverhead Highway)	5/08/2022	6,754	776	794
Coatesville-Riverhead Highway (north of SH16)	5/08/2022	8,598	9271	793

We have obtained the profiles of the Coatesville-Riverhead Highway traffic counts. These traffic profiles for the average weekday, Saturday and Sunday are presented in Figure 8 and Figure 9.

Figure 8: Coatesville-Riverhead Highway hourly traffic volumes, southbound direction

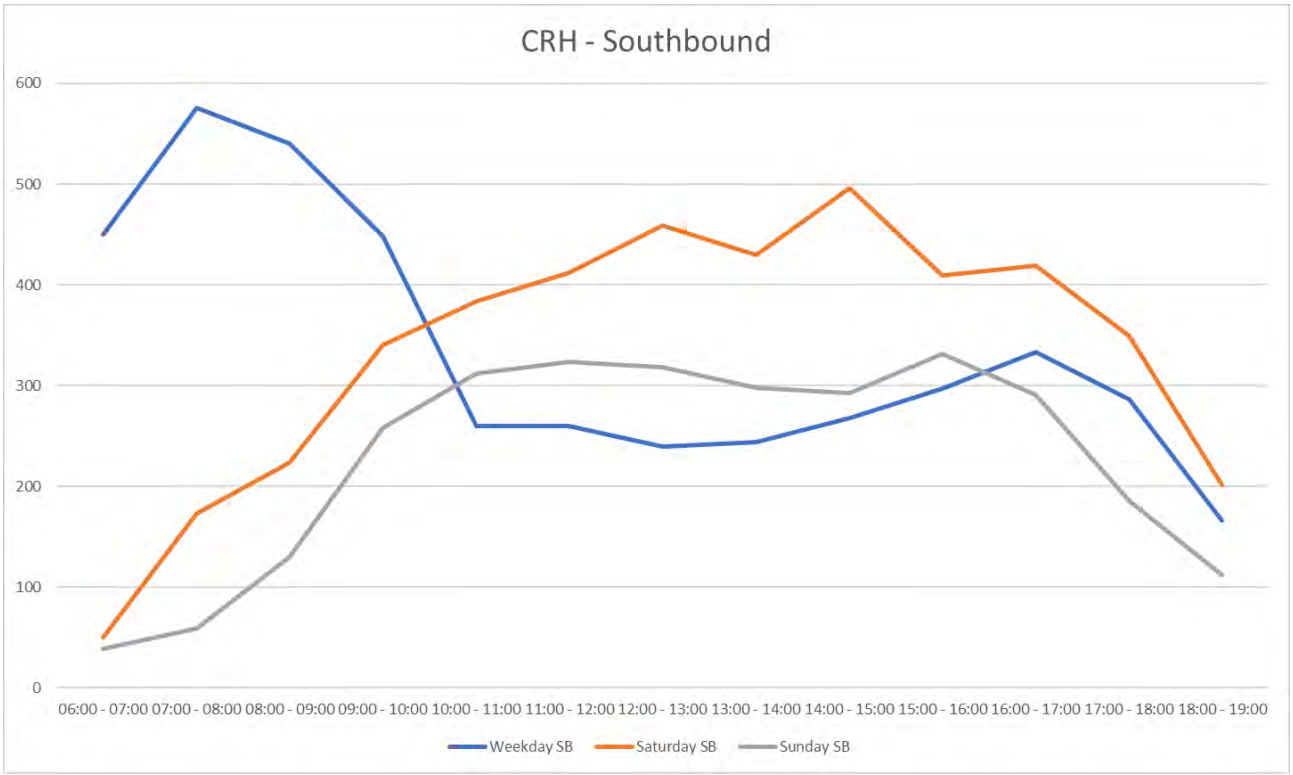
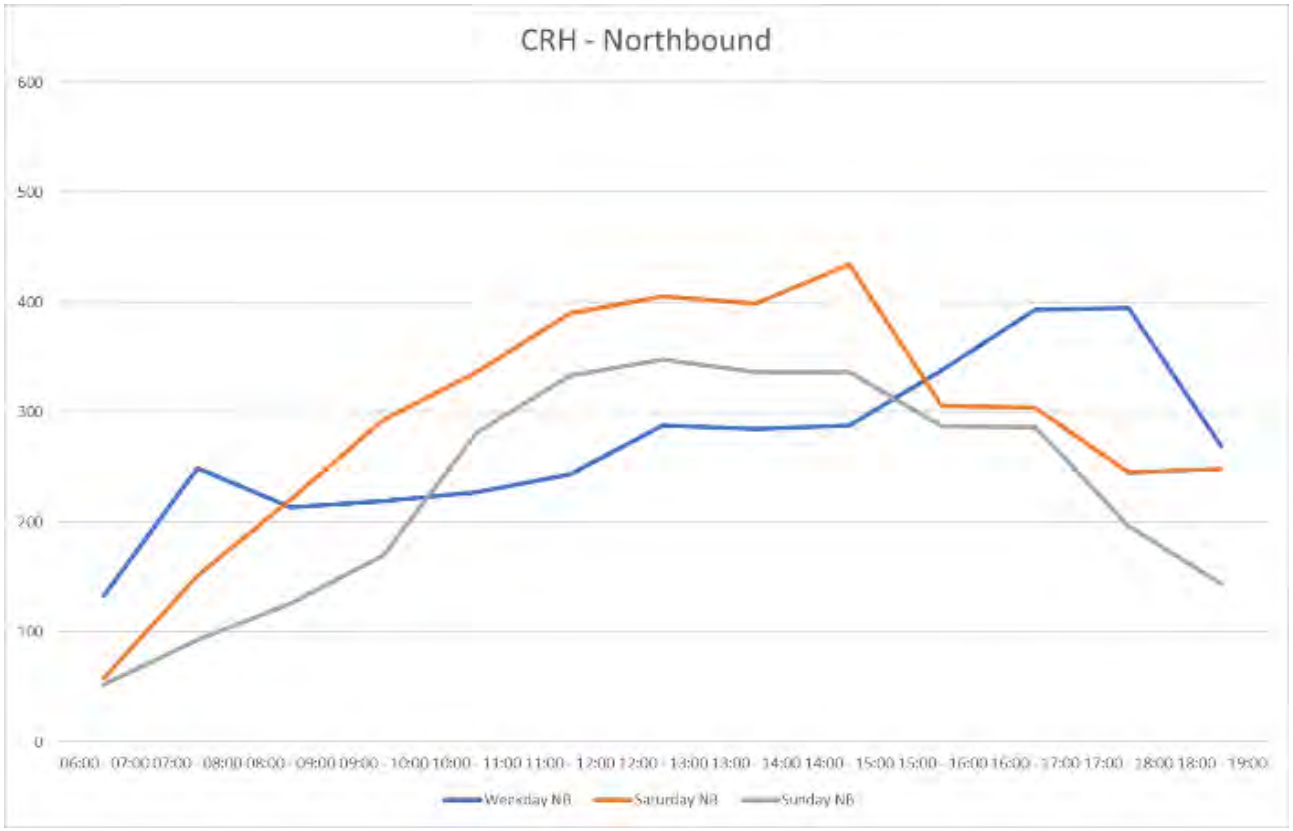


Figure 9: Coatesville-Riverhead Highway hourly traffic volumes, northbound direction



The weekday peak periods are observed to be 7:00 to 8:00 am and 4:00 to 5:00 pm. We note that Saturday volumes on Coatesville-Riverhead Highway (southbound) are higher than the typical weekday (outside of the AM Peak hour), however the AM Peak volume is the busiest southbound volume.

4.3.2 SH16

SH16, between Coatesville-Riverhead Highway and Brigham Creek Road, recorded an average of 22,900 vehicles per day in 2019 based on Waka Kotahi NZTA's traffic count system.

We have obtained traffic counts from Waka Kotahi's Traffic Management System (TMS) for a week, starting Monday 15 August 2022. Waka Kotahi collects traffic volumes on SH16 to the east and west of Coatesville-Riverhead Highway. As such, each of the sites have been assessed, allowing for the constraint at Coatesville-Riverhead Highway to be assessed and accounted for in our assessment.

When viewing the eastbound traffic profile either side of Coatesville-Riverhead Highway, the impact of the existing intersection at Coatesville-Riverhead Highway is evident. The profile of traffic to the west of Coatesville-Riverhead Highway shows the reduction in demand on the approach to Coatesville-Riverhead Highway intersection caused by motorists letting people in and therefore reducing the capacity of SH16 eastbound. Once through the intersection, the profile located to the east of the Coatesville-Riverhead Highway intersection resembles a profile more in keeping with traffic demands along the corridor, as shown in Figure 10 and Figure 11.

Figure 10: SH16 Eastbound traffic flow profile, west of Coatesville-Riverhead Highway

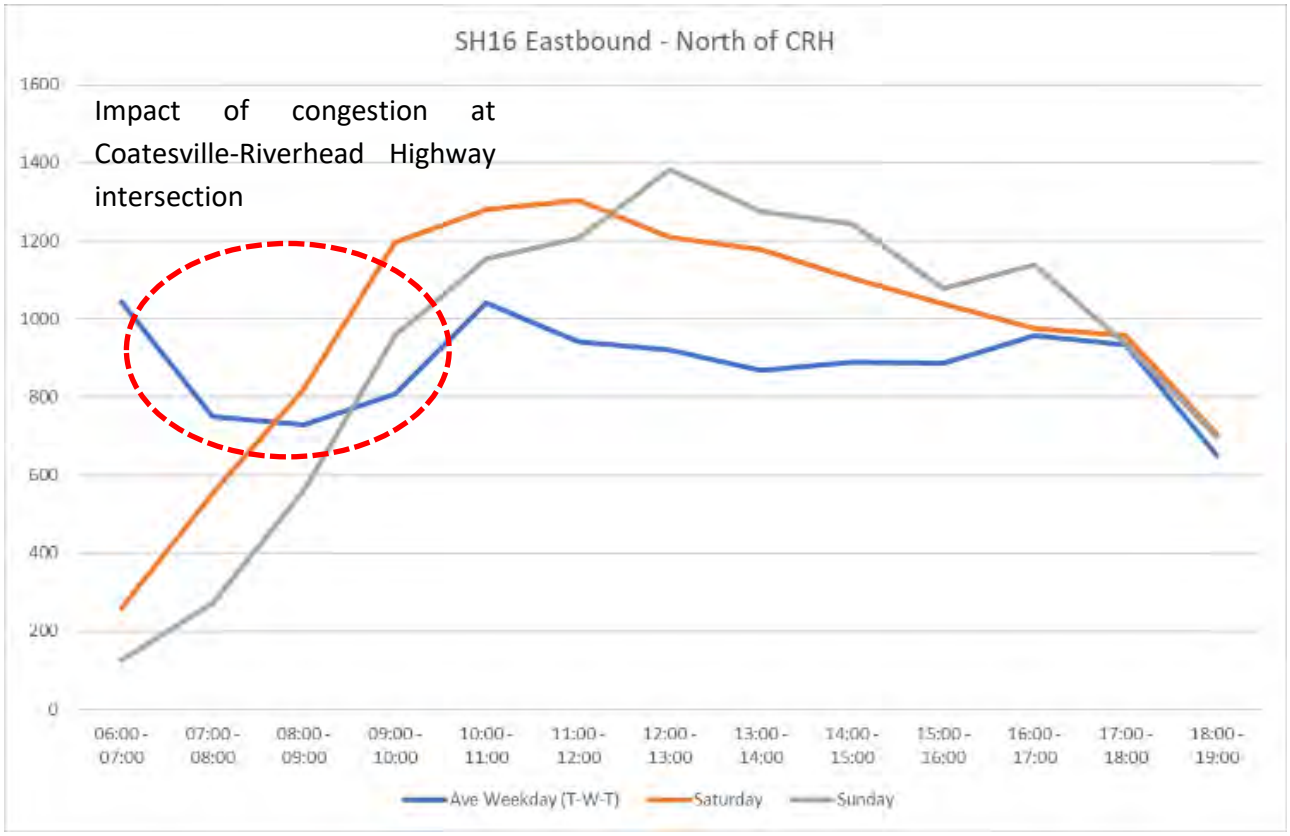
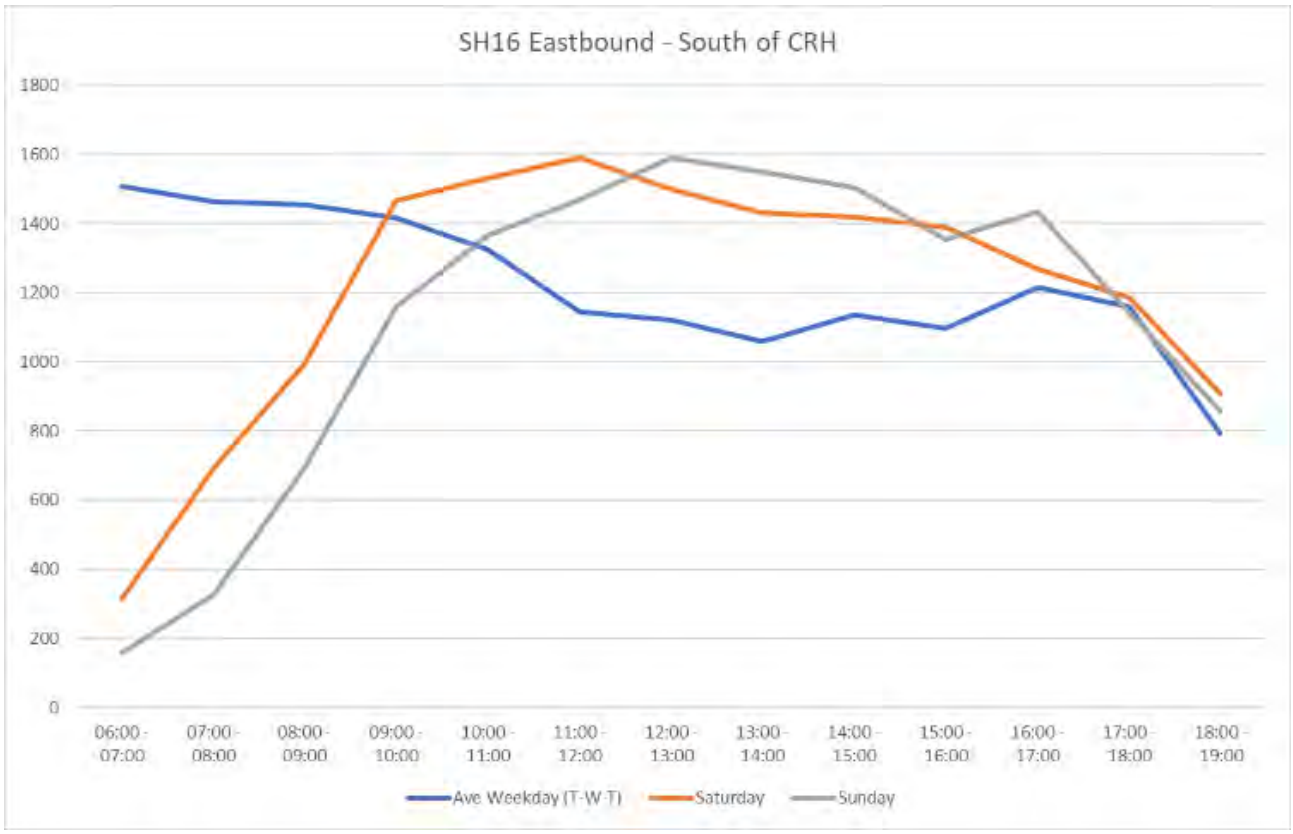


Figure 11: SH16 Eastbound traffic flow profile, east of Coatesville-Riverhead Highway



For the westbound direction, traffic profiles recorded to the west and east of Coatesville-Riverhead Highway are consistent, with the traffic volumes reducing by some 200 vehicles per hour, being the reduction in traffic turning right into Coatesville-Riverhead Highway. Westbound traffic profiles are summarised in Figure 12 (west) and Figure 13 (east), with the westbound traffic demand being 1,600 vehicles per hour.

Figure 12: SH16 Westbound traffic flow profile, west of Coatesville-Riverhead Highway

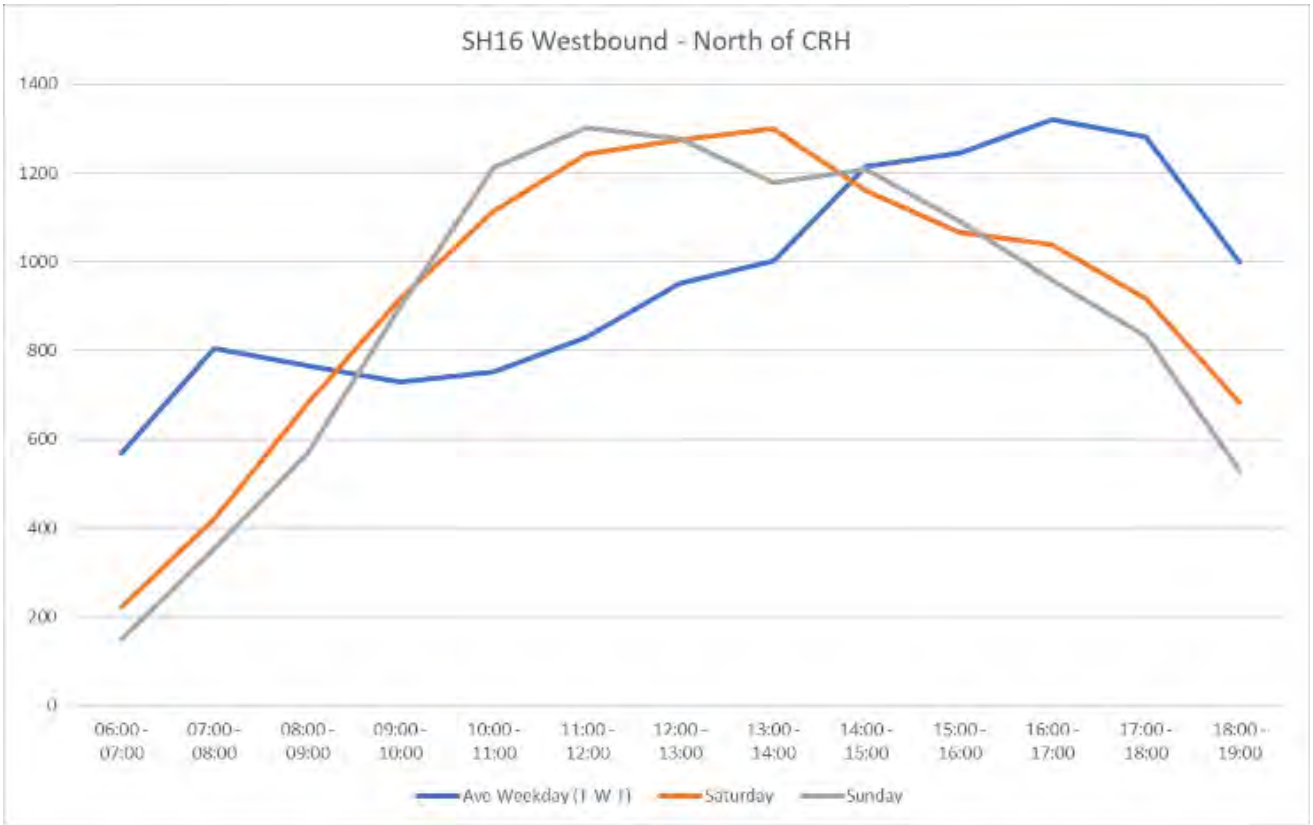
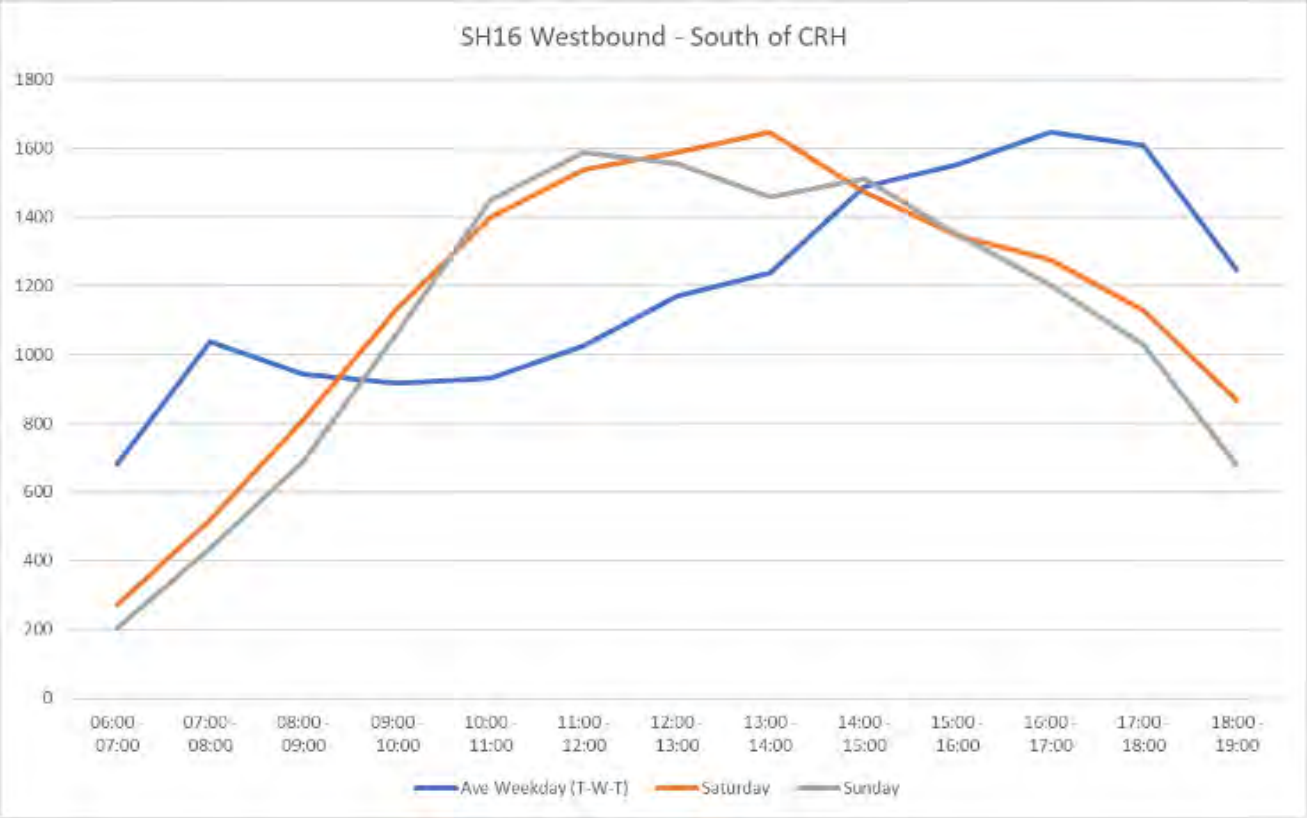


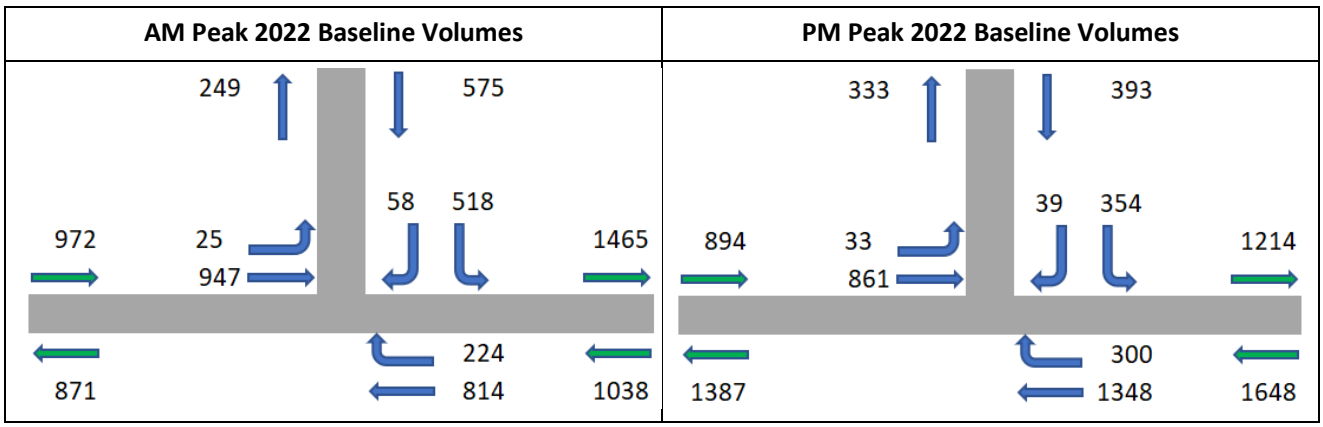
Figure 13: SH16 Westbound traffic flow profile, east of Coatesville-Riverhead Highway



4.4 SH16 / Coatesville-Riverhead Highway intersection

The baseline traffic volumes for the SH16/Coatesville-Riverhead Highway intersection have been based on the above information. While the right turn from Coatesville-Riverhead Highway is currently banned, we have assumed the right turn movement remains open in our analysis, as the upgrade to a roundabout will reintroduce the right turn movement. The 2022 baseline volumes are shown in Figure 14.

Figure 14: 2022 Baseline Traffic Volumes – SH16/Coatesville-Riverhead Highway intersection



4.5 The existing road safety record

4.5.1 Immediate transport network

We have assessed the crash records from 2016 to 2020 (plus all available crashes up to mid/late 2021) for the surrounding roads obtained from the NZTA Crash Analysis System. With Covid restrictions impacting the 5 year sample data, earlier data has been used in this assessment. The search area is shown in Figure 15 and generally includes all the areas within the plan change that could have direct access to the road network.

Figure 15: Crash search history of Riverhead Plan Change Area, 2016 – 2021

A total of 19 crashes were reported, summarised as follows

- There was 1 fatal injury crash, 2 serious injury crashes, 6 minor injury crashes, and 10 non-injury crashes

- The fatal injury crash occurred on Riverhead Road near Deacon Road, where the driver of a car lost control as they travelled around the bend. The car flipped over as it went over a ditch, and collided with a concrete power pole
- 1 of the serious injury crashes occurred when a motorcyclist was travelling on Coatesville-Riverhead Highway and lost control as they drove up onto the grass berm. The driver hit a street pole, and was not wearing a helmet
- The other serious injury crash occurred when a vehicle turning left from Coatesville-Riverhead Highway into Riverhead Point Drive collided with a southbound cyclist
- 2 of the serious injury crashes involved cyclists
- No crashes involved pedestrians
- The most common crash type was loss of control around a bend, which consisted of 7 (37%) of the total 19 crashes
- The next most common crash types were loss of control on a straight section of road and rear-end / obstruction with 4 crashes (21%) each.

The crash history indicates that there are some existing road safety issues within the study area. The rural nature of the roads mean that they have higher vehicle speeds, and below standard facilities for active modes.

The Plan Change provides the opportunity to improve road safety by upgrading these facilities, as Riverhead further urbanises. This can be achieved by intersection and corridor upgrades, and speed limit reductions as are proposed for this Plan Change.

4.5.2 Wider transport network

We have also assessed the crash records from 2016 to 2021 for the wider transport network around Riverhead. The search area is shown in Figure 16, and includes areas to the south of the Plan Change site. This includes Coatesville-Riverhead Highway, Old North Road and Old Railway Road.

Figure 16: Crash search history of wider transport network, 2016 – 2021

A total of 77 crashes were reported, summarised as follows

- There were 0 fatal injury crashes, 12 serious injury crashes, 26 minor injury crashes, and 39 non-injury crashes
- On Old North Road, 4 serious injury crashes were reported. There are also two clusters of crashes on Old North Road at the Old Railway Road intersection and at the horizontal bend 290 m south of this intersection. We note that speed cameras have now been installed on Old North Road, which will bring vehicle speeds down, and therefore reduce crash likelihood and severity
- On Coatesville-Riverhead Highway, 24 crashes were reported. 3 of these crashes were serious injury crashes, although we note that 1 of these is included in the immediate Plan Change area. We assess the intersections along Coatesville-Riverhead Highway and the requirement for right turn bay treatments further below
- 1 of the serious injury crashes involved a cyclist

- No crashes involved pedestrians
- The most common crash type was loss of control around a bend, which consisted of 30 (39%) of the total 19 crashes
- The next most common crash type was crossing / turning crashes, consisting of 28 (37%) of the total 77 crashes.

Like the crash history for the local Riverhead area, the crash history indicates that there are some existing road safety issues within the wider Riverhead network. The rural nature of the roads mean that they have higher vehicle speeds. We have considered these intersections and corridors further in our assessment.

4.5.3 SH16/Coatesville Riverhead Highway Intersection

A key access point to the wider transport network for Riverhead is the SH16/Coatesville Riverhead Highway intersection. This intersection has a poor safety record and presents operational concerns throughout the day. The proposed upgrade to SH16 is discussed further at Section 5.1, with this section summarising the crash history for this site.

While the crash history has been assessed for 2016-2020 (inclusive), we note that there has been a recent change to the intersection layout which includes banning the right turn movement out of Coatesville-Riverhead Highway.

The search area is shown in Figure 17 and extends around 50 m from the approach lanes including the west approach slip lane.

Figure 17: Crash search history of the SH16/Coatesville Riverhead Highway intersection, 2016 – 2020

A total of 17 crashes were reported, summarised as follows

- There was 1 serious injury crash, 5 minor injury crashes, and 11 non-injury crashes
- The serious injury crash occurred in 2016 when a vehicle right turning out of Coatesville-Riverhead Highway collided with a southbound vehicle, 2 non-injury crashes occurred with the same movement
- 1 minor injury crash involved a motorcyclist losing control turning left from Coatesville-Riverhead Highway colliding with a vehicle intending on turning right into Coatesville-Riverhead Highway
- 3 minor injury crashes involved rear end incidents in the lefthand slip lane on Coatesville-Riverhead Highway
- The other minor injury crash involved a driver turning right into Coatesville-Riverhead Highway failing to give way to a motorcyclist although weather conditions were noted as heavy rain
- No crashes involved pedestrians or cyclists
- The most common crash type was rear end crashes, which consisted of 6 (35%) of the total 17 crashes. 1 occurred on SH16 while the other 5 occurred on Coatesville-Riverhead Highway
- The next most common crash types were right turning movements with 3 (18%) crashes.

The improvements being implemented by Waka Kotahi, which is outlined in Section 5.1 will assist in addressing the issues currently experienced at the intersection.

The Precinct Provisions recognise the existing safety issues, with a standard being included that requires the intersection upgrade to be completed prior to development within the Plan Change being occupied. This is to ensure occupied development traffic does not add to an existing problem and that a safe intersection is in place prior to increasing the population of the Riverhead area.

4.6 The Site's transport accessibility

4.6.1 Public transport accessibility

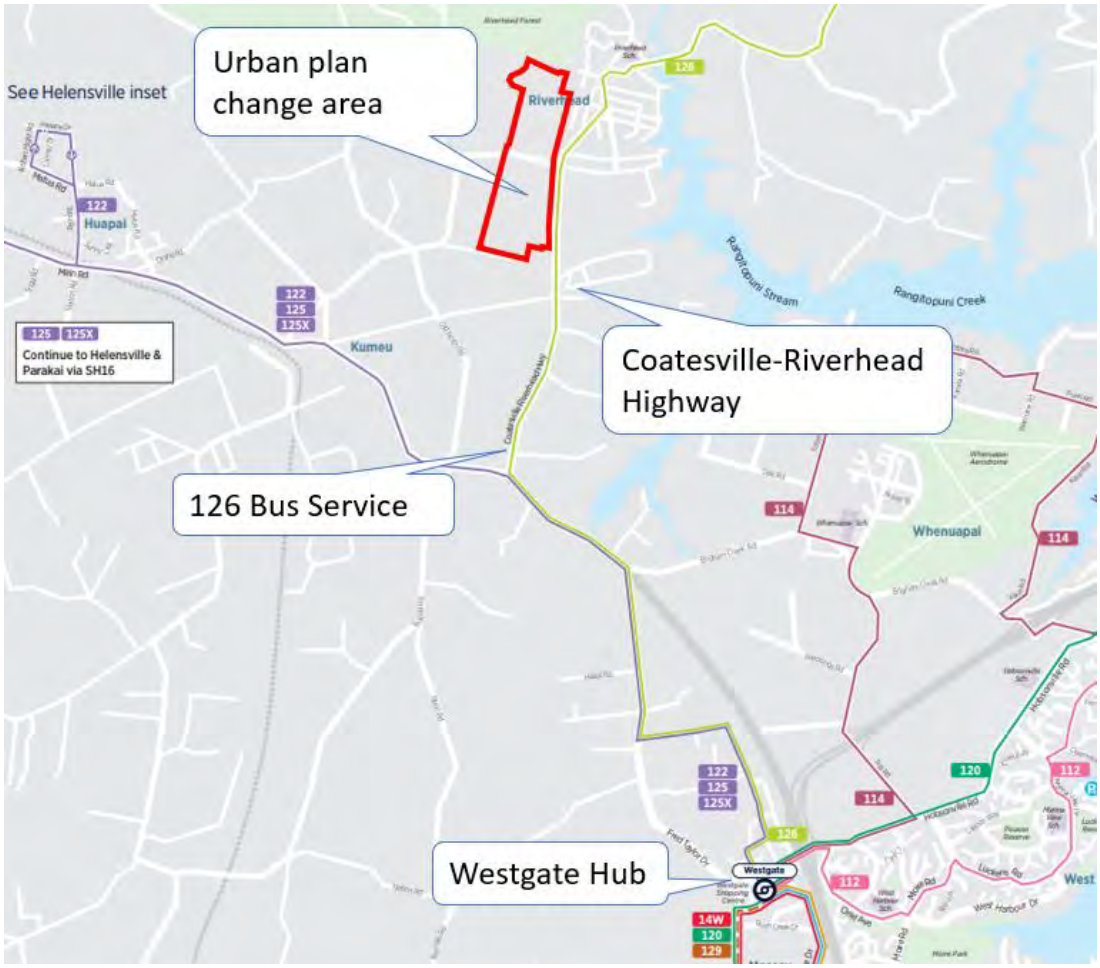
A map of the public transport network about the wider area is shown in Figure 18.

The Site is currently served by the 126 bus service, which connects Albany to Westgate via Riverhead. It typically operates at a frequency of one bus per hour per direction. We understand that Auckland Transport are looking to increase the frequency of this bus service in the future, with the increase in frequency subject to funding.

Based on the timetables, the service typically takes 15 – 20 minutes to travel between Riverhead and Westgate, and 20 – 25 minutes to travel between Riverhead and Albany Station.

This service connects to Westgate, which is a key connection point in the West Auckland public transport network. A number of bus services connect to Westgate, where a person using the 126 service can connect to, providing public transport access to the wider area.

Figure 18: Public transport network in the wider area near the Site



Overall, we consider that the Site will have adequate accessibility to the existing public transport network.

The Plan Change also provides the opportunity to improve public transport facilities, such as bus shelters, near the Site. The Plan Change provides connectivity between the site and Coatesville-Riverhead Highway, ensuring connectivity with existing bus facilities, with the upgrades both internal and external to the Precinct requiring the provision of bus infrastructure.

4.6.2 Walking and cycling accessibility

Given the mostly rural nature of the site, there are currently limited active mode facilities available. We note that

- Within the existing Riverhead village, there are typically footpaths on both sides of the road
- Riverhead Road has no footpaths on either side of the road
- On Coatesville-Riverhead Highway, there is a footpath on the eastern side between Riverhead Road and Short Road
- There are no footpaths about the local road network northeast of the Plan Change area, namely those of Cambridge Road and Queen Street
- There are no dedicated cycling facilities in the local area.

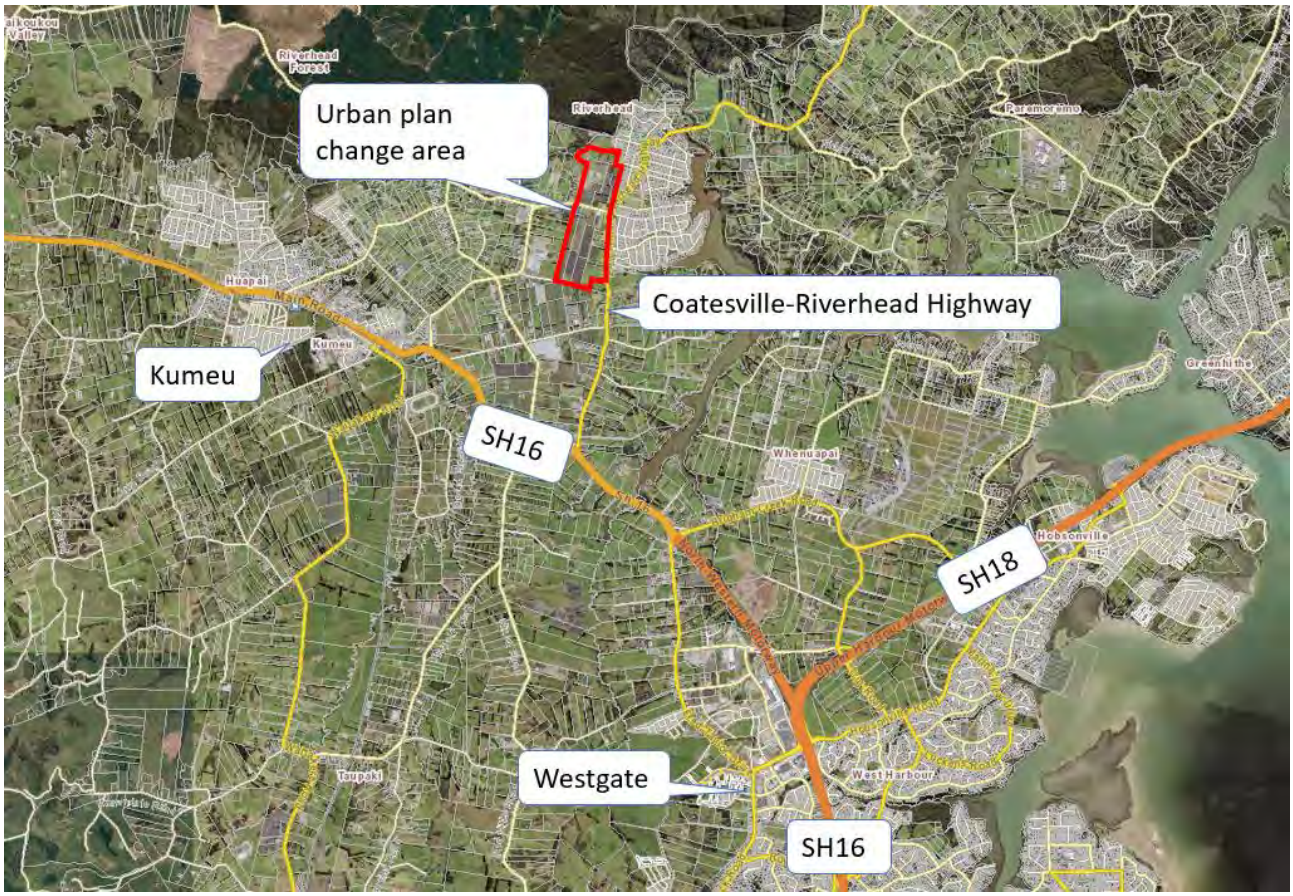
We understand that the Local Board is looking to address the 'gaps' in footpath provision about the surrounding road network to the plan change, with conceptual plans produced. The roads include Cambridge Road, George Street, Duke Street, Princes Street, York Terrace, Alice Street Queen Street, and King Street. We are unsure as to the timing of these upgrades. Importantly however, the Local Board acknowledges the gaps in the existing footpath network which need to be addressed.

4.6.3 Private vehicle accessibility

As shown in Figure 19, the Site is well-located with respect to providing vehicle accessibility to the State Highway network.

- SH16 is located approximately 2 km south of the Site, which can be accessed from the Site via Coatesville-Riverhead Highway, Old North Road or Riverhead Road
- SH16 provides connections to Kumeu to the west, and Westgate to the south
- SH16 connects to SH18 (via Brigham Creek Road or Trig Road) which provides a connection to Albany and the North Shore
- Coatesville-Riverhead Highway and Riverhead Road are arterial roads which provide connections about the local area. Coatesville-Riverhead Highway provides an alternative route to Albany.

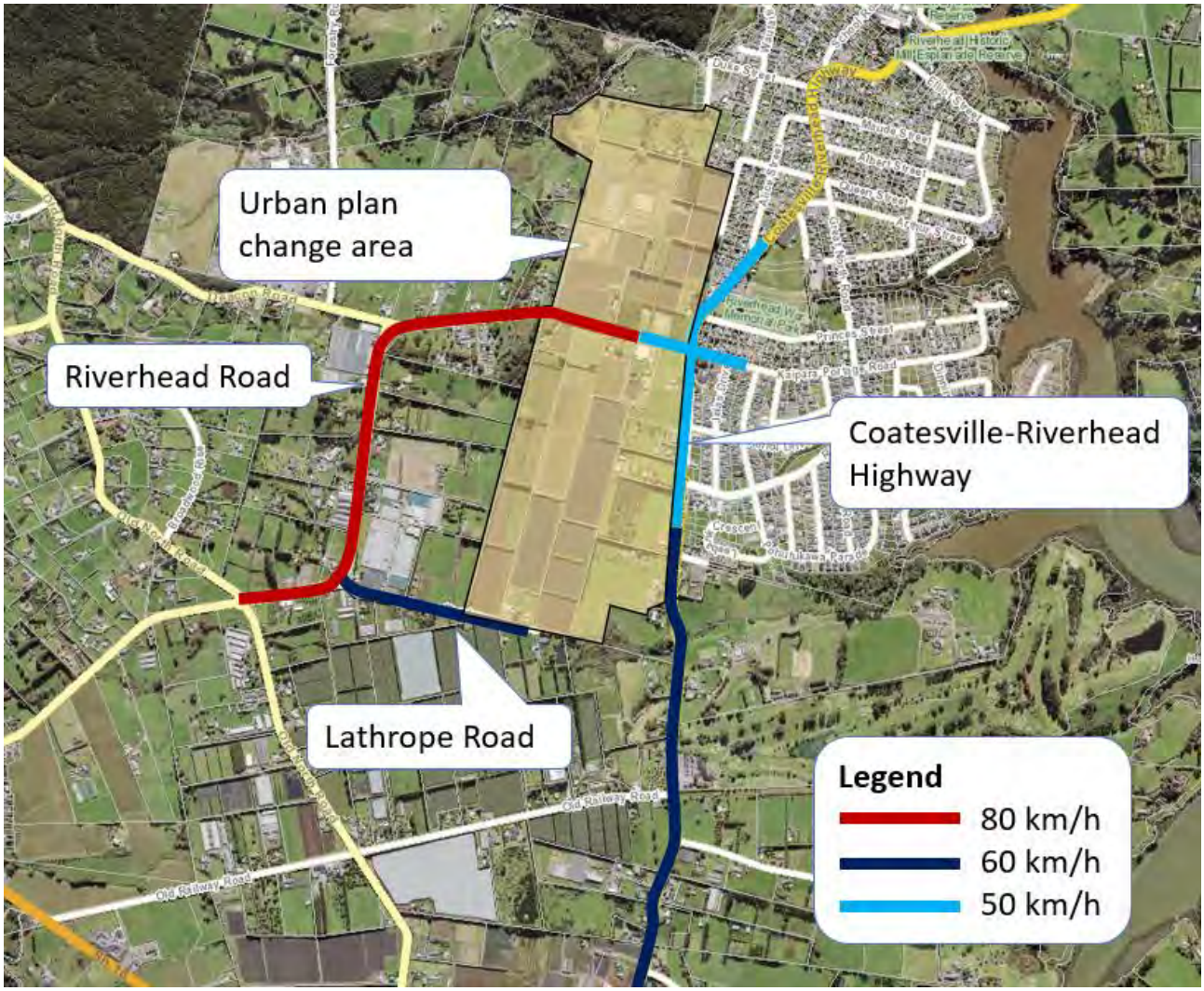
Figure 19: Site location in the strategic transport network



4.7 Existing speed limits

A diagram of the existing speed limits on Riverhead Road, Coatesville-Riverhead Highway and Lathrope Road is shown in Figure 20.

Figure 20: Existing speed limits near the Site



Riverhead Road currently has a posted speed limit of 80 km/h, which reduces to 50 km/h approximately 200 m east of Coatesville-Riverhead Highway. An 80 km/h speed limit requires a design speed environment of 90 km/h.

Coatesville-Riverhead Highway currently has a speed limit of 60 km/h, which reduces to 50 km/h approximately 90 m north of Short Road. This results in a speed environment of approximately 70 km/h and 60 km/h for these two sections respectively.

Lathrope Road has a posted speed limit of 60 km/h. It is an unsealed rural road which provides access to properties. The only connection point to the road network is at Riverhead Road at its west end.

Other roads within the Riverhead village and those that site to the northeast of the Plan Change Site generally have a speed limit of 50 km/h.

5 FUTURE ROAD NETWORK

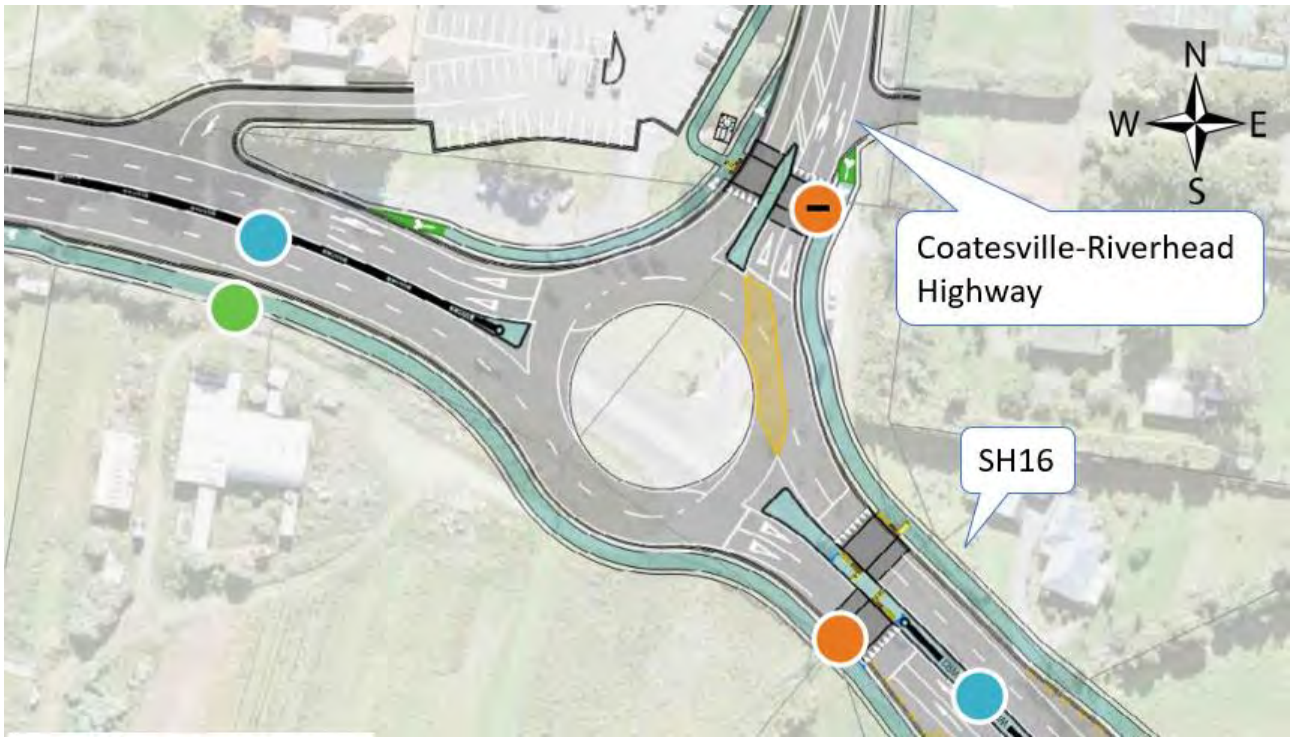
5.1 SH16 Brigham Creek to Waimauku Upgrade

This project, proposed under the Regional Land Transport Plan 2021-2031 (RLTP), will deliver safety and capacity improvements between Waimauku and the end of the North Western Motorway (SH16) at Brigham Creek Road.

The relevant components to the Plan Change include

- Safety improvements, with a new roundabout being located at the Coatesville-Riverhead Highway / SH16 intersection, as shown in Figure 21
- Upgrading the SH16 corridor to four traffic lanes between Brigham Creek Road to the Taupaki Roundabout, therefore removing the bottleneck experienced at the Coatesville-Riverhead Highway intersection citybound during the morning peak, and removing the two to one lane merge west of the SH16 / Brigham Creek Road / Fred Taylor Drive roundabout westbound, which causes congestion during the evening peak
- A shared path from Brigham Creek Road to Kumeu.

Figure 21: SH16/Coatesville-Riverhead Highway Upgrade



These upgrades will improve safety, increase capacity of the road network and alleviate congestion at the SH16/Coatesville-Riverhead Highway intersection, which is the main intersection used to access the state highway network from Riverhead. The planned upgrades along SH16 results in several consecutive roundabouts, being located at the Riverhead Road intersection, Old North Road intersection (existing), Coatesville-Riverhead Highway intersection and the SH16/Brigham Creek Road/Fred Taylor Drive intersection. As per the Waka Kotahi website, the upgrade provides a consistent intersection design,

provides priority to the right and is influenced by incoming traffic, but can also be signalised to adjust priority during peak traffic flows[8].

As shown in the intersection layout in Figure 21, the design of the Coatesville-Riverhead Highway approach contains two southbound lanes on the approach to SH16. This consists of a dedicated left turning lane and a shared left/right turning lane from Coatesville-Riverhead Highway onto SH16, which will increase vehicle capacity from Riverhead.

The 2021 RLTP has this project having 'Priority 1 – Committed and Essential Funding' set out for 2021 to 2025 financial years. The RLTP includes some $137.4 Million for this Waka Kotahi project.

As of late 2022, the detailed design has been completed and the resource consent has been lodged. The Notice of Requirement for Stage Two (Brigham Creek to Kumeu) has now been lodged with Auckland Council.

As this project provides critical safety and capacity upgrades to the external transport network, this upgrade is included within the proposed Precinct Provision as part of the Plan Change. As outlined in Section 8, any development within the Plan Change area undertaken prior to this upgrade would be a Restricted Discretionary Activity. This would ensure effects of any occupied development are appropriate assessed. This recognises the importance of ensuring a safe transport network exists prior to significantly increasing traffic demand about the Riverhead area. We also note that Waka Kotahi has recently implemented a right turn ban at the SH16/Coatesville-Riverhead Highway intersection which again improves safety at the intersection until such time as the roundabout is constructed.

5.2 SH16 Northwest Bus Improvements

This project, also proposed under the RLTP, will deliver infrastructure to allow a new Northwest Express bus service to operate along SH16, connecting Northwest Auckland with the central city. This project has also been classed as Priority 1 – Committed and Essential under the RLTP.

Interim bus interchange facilities are being delivered at Westgate, Lincoln Road and Te Atatu, with improved bus shoulder lanes along the North Western Motorway. A long-term rapid transit solution for the Northwest corridor is expected to follow in the future.

This facility will offer benefits for Riverhead in terms of transport choice and alleviated congestion citybound.

[8] https://www.nzta.govt.nz/assets/projects/sh16-brigham-creek-and-waimauku/SH16-Brigham-Creek-to-Waimauku-Coatesville-1-web.pdf

https://www.nzta.govt.nz/assets/projects/sh16-brigham-creek-and-waimauku/SH16-BC2W-walking-and-biking.pdf

5.3 Te Tupu Ngātahi Supporting Growth Programme

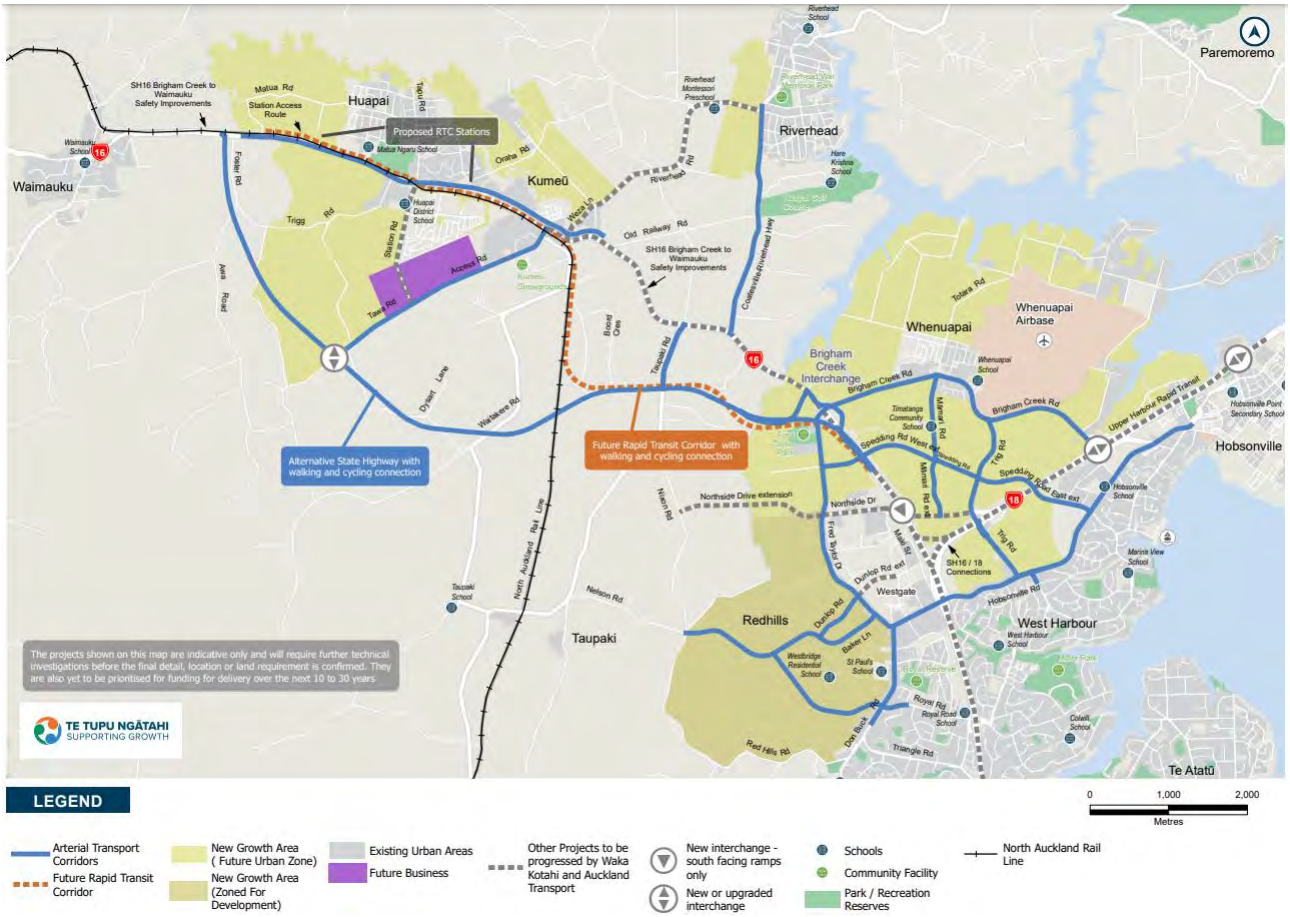
Road improvements as part of the Te Tupu Ngātahi Supporting Growth Programme are identified for Coatesville-Riverhead Highway (between SH16 and Riverhead Road). Safety improvements are also included on Coatesville-Riverhead Highway north of the Riverhead township.

The current designation process (with the designation lodged, notified and hearings underway in September/October 2023) focusses on Coatesville-Riverhead Highway, which includes the frontage of the Site. There are no dates as to when the Coatesville-Riverhead Highway upgrade will occur or what detailed design of the upgrade will consist of, with the current focus being to secure route protection by designation. The designation being sought for Coatesville-Riverhead Highway includes a 20 year lapse period. There is no funding currently allocated for construction.

As noted above, the role of Te Tupu Ngātahi Supporting Growth Programme is to secure the designations that enable the anticipated upgrades (from rural to urban) to occur at a future date. The role is not to construct the upgrades, with this being subject to future processes including funding availability. This Plan Change however presents an opportunity for key components to be delivered by developers, as a means of mitigating effects and ensuring a safe and efficient transport network exists when development comes online. As set out in the Implementation Plan, the developers propose to construct the roading upgrades fronting the Plan Change Site, transitioning the rural environment to urban and providing the infrastructure for future upgrades anticipated along Coatesville-Riverhead Highway to tie into.

A map of the indicative strategic transport network for Northwest Auckland identified by Te Tupu Ngātahi Supporting Growth Programme to support growth in this area is shown in Figure 22.

Figure 22: Supporting Growth Indicative Strategic Transport Network for Northwest Auckland[10]



6 PROPOSED ROAD NETWORK

6.1 Design philosophy

To assist with the design and development of the Plan Change, we have used several guiding documents and guidelines to form the overall design philosophy of the road network. This includes Auckland Transport's Roads and Streets Framework (RASF) and Transport Design Manual (TDM), and the Vision Zero principles.

6.1.1 Vision Zero

Vision Zero is an ethics-based transport safety approach. Developed by Sweden in the late 1990s, responsibility for safety is placed on people who design and operate the transport system. The goal is to provide a safe system which accommodates human beings. It acknowledges that people in the transport system make mistakes, and people are vulnerable to high-impact forces in a crash. The Vision Zero system looks at the whole system to ensure everything works together to protect road users from forces that can cause traumatic injury.

[10] http://www.supportinggrowth.govt.nz/assets/supporting-growth/docs/Northwest-Auckland/North-West-Auckland-Strategic-Connections-Map.pdf

Vision Zero for Tāmaki-Makaurau Auckland is a transport safety vision that states that there will be no deaths or serious injuries on our transport system by 2050[11].

As transport system designers and operators, reducing the likelihood and severity of serious injury crashes from occurring aligns with the goals of Vision Zero. Measures to align with Vision Zero include speed limit reductions, as road users are much less likely to sustain serious injuries at lower speeds. It also encourages designs and intersections which minimise crash likelihood and severity, such as using roundabouts at intersections which reduce the likelihood of head-on crashes.

The proposed Plan Change provides the opportunity to make Riverhead a safer place for all road users by adopting Vision Zero principles. The roading and intersection upgrades proposed achieve this outcome external to the development, with the layout and functions of roads internal to the development presenting safe outcomes for all road users.

6.1.2 Roads and Streets Framework

The RASF is an Auckland Transport strategic planning tool used to guide the future planning and development of Auckland's roads, streets and places. It is used to inform any development design of a road or street and reflects the needs and catchment of the adjoining land use as well as the movement of people, goods and services[12].

The RASF provides an approach for thinking about the movement and place functions of a road and identifies their level of significance in the context of the whole Auckland region. It is used as the first step in a process to identify the issues that must be addressed by a project.

As the Plan Change will provide a new internal road network and upgrade existing road corridors, the RASF is a useful tool to inform the requirements and typology for each road.

We note that the traffic on the internal local roads is expected to be very low, with those living and working in the area predominantly being the only people using the roads. That is, there would be a very low throughput of external traffic. As such, designing for low speed environments, with a focus on place, movement by active modes and safety is a key outcome achieved through the proposed planning provisions.

6.1.3 Transport Design Manual

Auckland Transport's Transport Design Manual (TDM) is a set of guides, codes and specifications that are specifically created for the Auckland region based on international best practice and robust common engineering theory[13].

The TDM has three sections, design principles, engineering standards and specifications. Together, these sections allow end user outcomes, engineering design and construction requirements to be clearly identified and designed.

[11] https://at.govt.nz/projects-roadworks/vision-zero-for-the-greater-good/
[12] https://at.govt.nz/about-us/transport-plans-strategies/roads-and-streets-framework/
[13] https://at.govt.nz/about-us/manuals-guidelines/transport-design-manual/

For the Riverhead Plan Change, the TDM can be used alongside the RASF to provide safe and appropriate transport infrastructure. We have designed our proposed upgrades for the Plan Change in accordance with the TDM, noting that future Resource Consents and Engineering Plan Approval applications will assess the TDM requirements in more detail.

6.2 Proposed speed limits

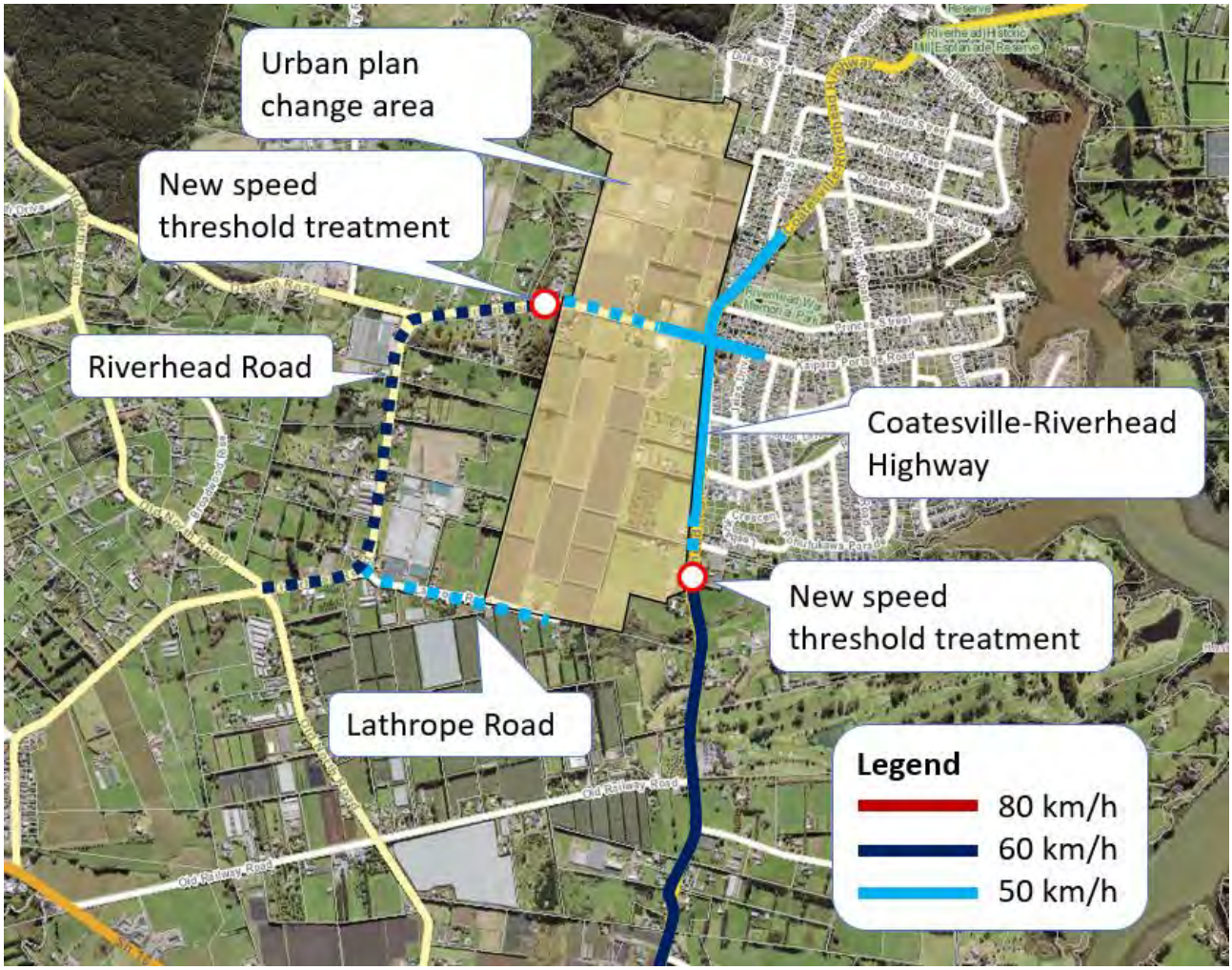
To support the Plan Change, we are proposing a series of speed limit reductions on sections of Riverhead Road, Coatesville-Riverhead Highway, and Lathrope Road. These changes will improve road safety for all users by reducing the likelihood and severity of crashes. They will also allow new intersections and private property access to be constructed in a safer manner.

A diagram of our proposed speed limits is shown in Figure 23. The existing speed limits are outlined in Section 4.7.

We note that each of the roads external to the Site play either an arterial function or a collector function. For the roads fronting the plan change area, while posted speed limits will be 50km/h, treatments will be used to slow vehicles and ensure a safe environment exists for all road users. Roads internal to the plan change area will have a focus on reducing speeds further, with treatments bringing speeds down to 30km/h, using measures consistent with the TDM. These measures will be addressed through future Engineering Plan Approval processes.

We also note that there is a formal bylaw process which Auckland Transport would need to undertake at the appropriate time to change existing external speed limits. This is a common exercise, with a number of speed change about the Region planned over the coming years. The change proposed in this assessment can be captured in future bylaws that align with the roading upgrades.

Figure 23: Proposed speed limits near the Site



The key changes are (shown in dashed lines above)

- Riverhead Road – moving the existing speed threshold treatment west by approximately 300 – 350 m, and reducing the posted speed limit fronting what will be an urban area to 50 km/h. The rural section west of this speed threshold treatment is proposed to be reduced from 80 km/h to 60 km/h.
- Coatesville-Riverhead Highway – moving the existing speed threshold treatment south by approximately 160 – 200 m and reducing the posted speed limit to 50 km/h
- Lathrope Road – lowering the speed limit from 60 km/h to 50 km/h.

These changes are intended to lower vehicle speeds when entering the expanded Riverhead urban area. This will provide safer vehicle speeds for all road users, including pedestrians and cyclists.

The speed limit changes will be accompanied by changes to the road reserve to ensure the road environment is safe and appropriate to the new speed limits.

Internal roads will be designed to a 30 km/h speed limit, which is in accordance with Vision Zero principles of creating survivable speeds for road users.

For Lathrope Road, the intent is to retain the current rural look and feel. While it will be sealed (as outlined later in Section 6.6), a possible outcome would be for the road to include edge beams, with swales and a footpath on the northern side. While taking this form, and based on its length, we consider that a 50 km/h speed is appropriate. This would provide a transition from Riverhead Road (which would be 60 km/h) and the local roads once turning into the Plan Change area, which will be designed to a 30 km/h speed limit.

The gateway treatments are intended to be physical measures. The design of the gateway treatments will take into consideration the transition from a rural to an urban road environment. The treatments will also consider the character of Riverhead as a smaller village with some rural characteristics. While we note that the design of the gateway treatments will be addressed at a subsequent detailed design stage, we anticipate they could include the following measures

- Kerb buildouts to narrow the carriageway width and lower vehicle speeds
- Trees or planting in the kerb buildouts to match Riverheads character
- A different coloured surface treatment of the carriageway, indicating that drivers should slow down
- Signage, displaying the speed limit and 'Riverhead' to ensure advance visibility to drivers.

In summary, the proposed speed limit reductions will improve safety for all existing and future road users in Riverhead. The reduction in speed will reduce the likelihood and severity of serious and fatal injury crashes, in accordance with Vision Zero.

6.3 Overview of the road network

A concept showing the proposed road network within the Site is included in Figure 24. We note

- The Site's proximity to Riverhead Road and Coatesville-Riverhead Highway as arterial roads
- New access points onto the arterial roads are limited through a few new collector roads, which will provide internal access to the wider Site.
- The intersections of the arterial roads and collector roads have been selected to ensure safe sight distances can be provided. The intersections will typically be roundabouts
- Walking and cycling facilities will be provided as part of the proposed road network.

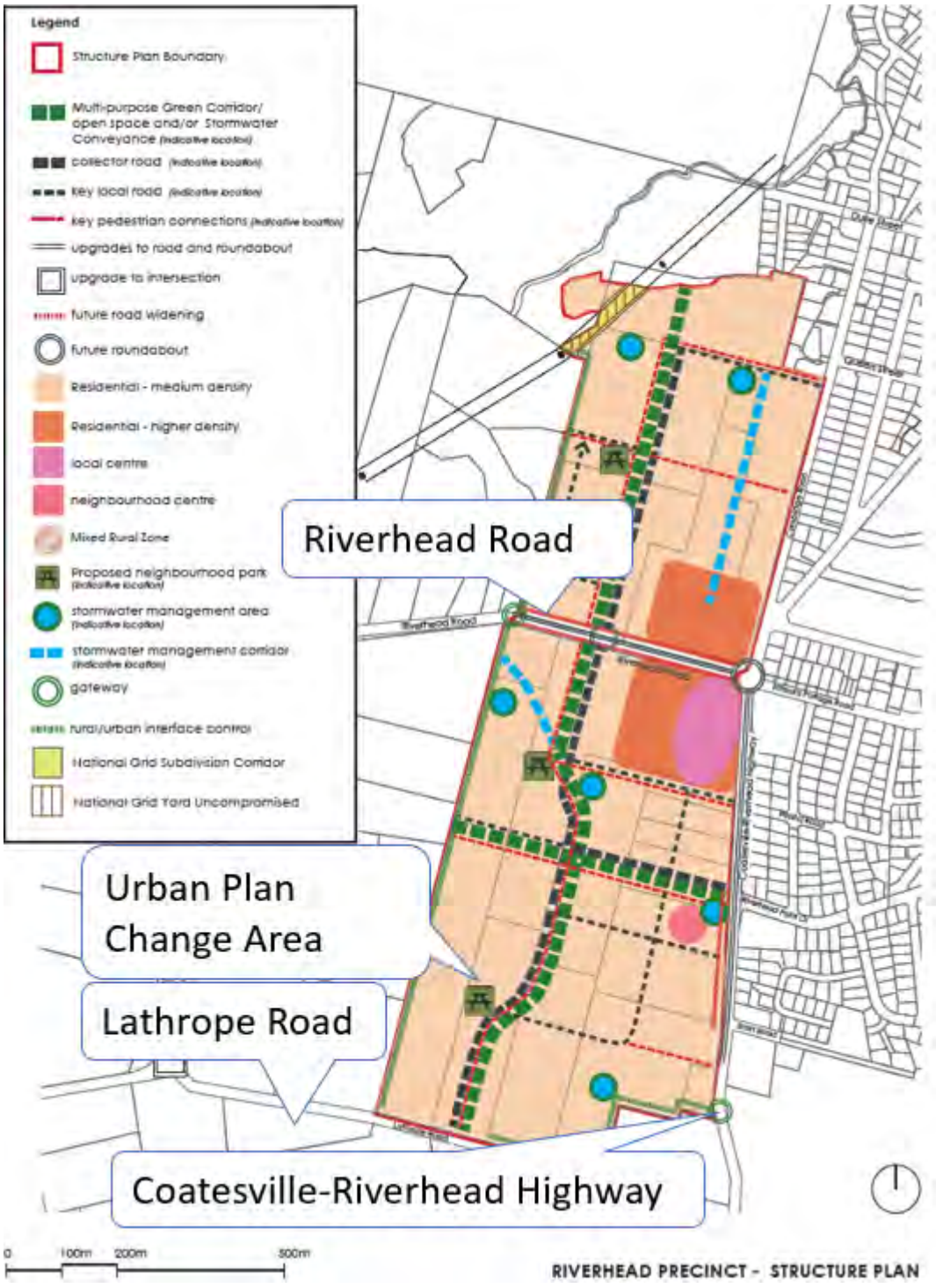
The road network has been designed in accordance with the RASF by providing appropriate road typologies to accommodate their place and movement function within the future Riverhead road network

- Riverhead Road and Coatesville-Riverhead Highway provide higher movement functions, catering for public transport services and general traffic. They also provide the opportunity to provide new walking and cycling connections, as being investigated by Supporting Growth
- The new local and connector roads will generally facilitate trips within the Plan Change area and will have lower place and movement functions due to the smaller catchment of users. There will be some activities within the Site such as the potential school and local centre (containing a supermarket), which would result in a higher place function

- The internal road network has not been designed in detail at the Plan Change level, but the proposal aligns with the guidelines of the RASF and ensures both movement and place are accommodated in Riverhead.

We note that only key local roads are shown. Further local roads will be provided at subsequent detailed design stages, but we consider these are not necessary for the purposes of the Precinct Plan.

Figure 24: Site's proposed road network



6.4 Riverhead Road

The proposed cross-section for Riverhead Road is shown in Figure 25.

The road reserve will be widened from 20 m to 24 m to accommodate the following facilities

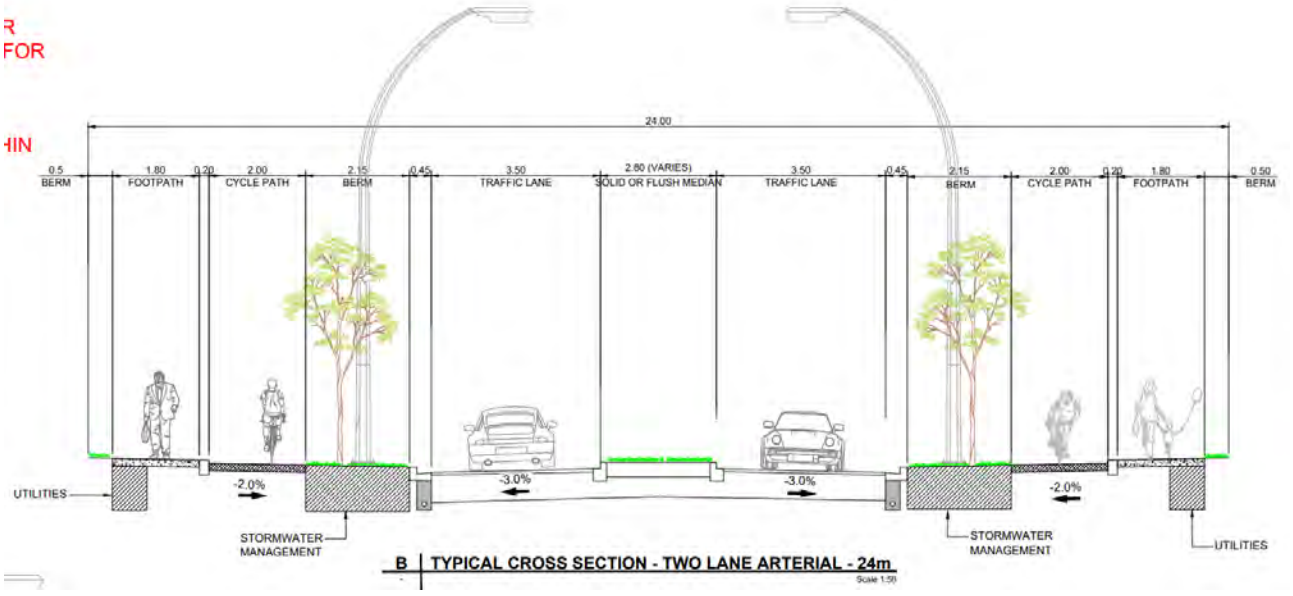
- One traffic lane in each direction, separated by a central median
- Front berms and back berms
- Dedicated 1.8 m footpaths and 2 m cycle paths, both separated from traffic lanes by the front berm.

These facilities will provide significant improvements for active mode accessibility. The upgrade will be applied from the Coatesville-Riverhead Highway roundabout, extending west to the new proposed roundabout on Riverhead Road. West of the new roundabout, the urban road upgrade will include a transition back to a rural environment through a new threshold treatment.

Riverhead Road provides for both local and regional movement as an arterial road. It needs to accommodate vehicle and freight movement, but also provides the opportunity to provide new and safe facilities for active modes. The proposed cross-section caters for these modes.

We understand that there is no expectation for buses to operate along Riverhead Road fronting the development site.

Figure 25: Riverhead Road cross-section



6.5 Coatesville-Riverhead Highway

The proposed upgrades on Coatesville-Riverhead Highway will generally be similar in principle to the upgrades described above for Riverhead Road. Both roads are arterial roads and need to cater for regional freight movements but also local walking and cycling trips in Riverhead. Coatesville-Riverhead Highway also needs to accommodate public transport movements.

Due to the existing layout of Coatesville-Riverhead Highway, a consistent cross-section along the corridor cannot be applied. This is largely due to Grove Way, which acts as a local frontage road to provide access to residential properties.

The layout for Coatesville-Riverhead Highway differs for the northern section (between Riverhead Road and Riverhead Point Drive) and the southern section (between Riverhead Point Drive and Small Road). Each section provides for active mode facilities according to that being investigated by Te Tupu Ngātahi Supporting Growth. We discuss each below.

Northern section (between Riverhead Road and Riverhead Point Road)

Our proposed layout for Coatesville-Riverhead Highway considers the existing layout of Grove Way. On the west side, separated pedestrian footpaths and cycle lanes can be provided, like on Riverhead Road. On the east side of Coatesville-Riverhead Highway, separated footpaths and cycle lanes can be provided through Grove Way. As Grove Way already contains a footpath, the existing grass berm would effectively be substituted with a cycle path.

Wider front berms (2.8m) on the west side can be provided due to the additional width that Grove Way allows. This provides the opportunity to plant more trees and landscaping along the corridor.

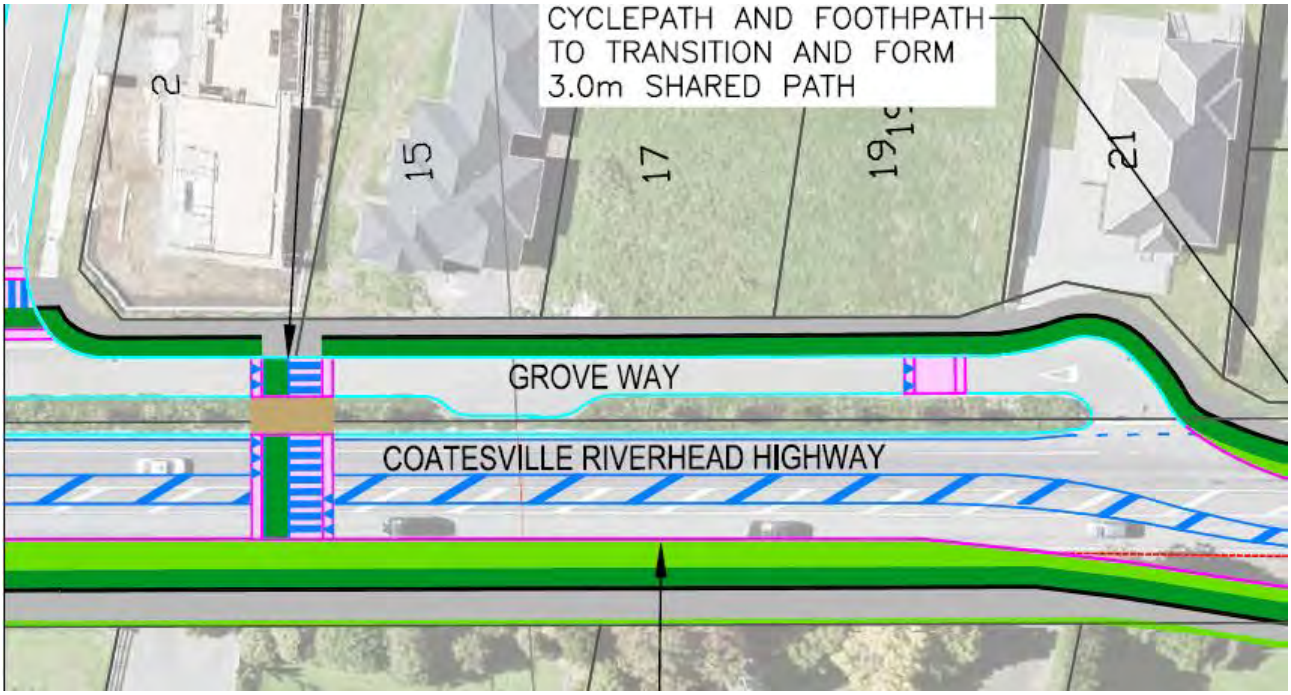
This section of Coatesville-Riverhead Highway may accommodate an access point into the local centre. This detail is not confirmed yet at the Plan Change stage and can be designed in the future to ensure that any access point is safe for all road users.

A raised table zebra crossing for pedestrians and cyclists will be provided south of Pitoitoi Drive. This will provide a new mid-block crossing point for active modes. This will improve accessibility in the area, as the current crossing points are located approximately 230 m north at Riverhead Road and 140 m south at Riverhead Point Drive. It will also provide a more direct connection for residents from Pitoitoi Road into the proposed local centre area. The crossing is located on a straight section of Coatesville-Riverhead Highway, which will allow safe sight distances to be provided for pedestrians.

Figure 26 shows a sample of the Coatesville-Riverhead Highway layout near Grove Way.

We consider that the upgrades will provide significant improvements for pedestrians and cyclists and make efficient use of the existing road corridor width. Providing separated facilities for active modes aligns with the goals of vision zero by isolating vulnerable road users from vehicle movements. As highlighted in the sample upgrade design, the upgrades can be accommodated within the existing road reserve, with localised widening required about key intersections only.

Figure 26: Coatesville-Riverhead Highway proposed upgrade



Southern section (between Riverhead Point Road and Short Road)

We understand that Te Tupu Ngātahi Supporting Growth propose a shared path along Coatesville-Riverhead Highway between SH16 (to the south) and Riverhead. We have therefore incorporated this element into the design, with the tie in point about Short Road. We note that Te Tupu Ngātahi Supporting Growth is classifying this as a shared path as a placeholder to protect land for the facilities via designation. The 4.0 m width allows for separated facilities to be provided in the future (1.8 m footpath + 2.0 m cycle lane + 0.2 m kerb) which would be addressed through detailed design. The width provides flexibility to provide these facilities in the future.

Separated pedestrian and cycle facilities on both sides will be provided up to Short Road. A raised zebra crossing for active modes will be provided north of Short Road to allow pedestrians and cyclists to cross safely. As shown in Appendix C, Crossing Sight Distance can be provided for pedestrians. Due to the vertical geometry on Coatesville-Riverhead Highway, a speed environment of 30 km/h will need to be achieved for this crossing. This could be achieved through the design of the threshold treatment and by raising the zebra crossing. These features can be developed further in the detailed design stage,

Figure 27 and Figure 28 show samples of the Coatesville-Riverhead Highway, south of Riverhead Point Drive. Minor localised widening is required on the western boundary of Coatesville-Riverhead Highway about the new intersections and to tie into the shared path proposed by Te Tupu Ngātahi Supporting Growth.

We consider that the upgrades will provide significant improvements for pedestrians and cyclists and makes efficient use of the existing road corridor width.

Figure 27: Coatesville-Riverhead Highway - proposed upgrade south of Riverhead Point Road, 1 of 2

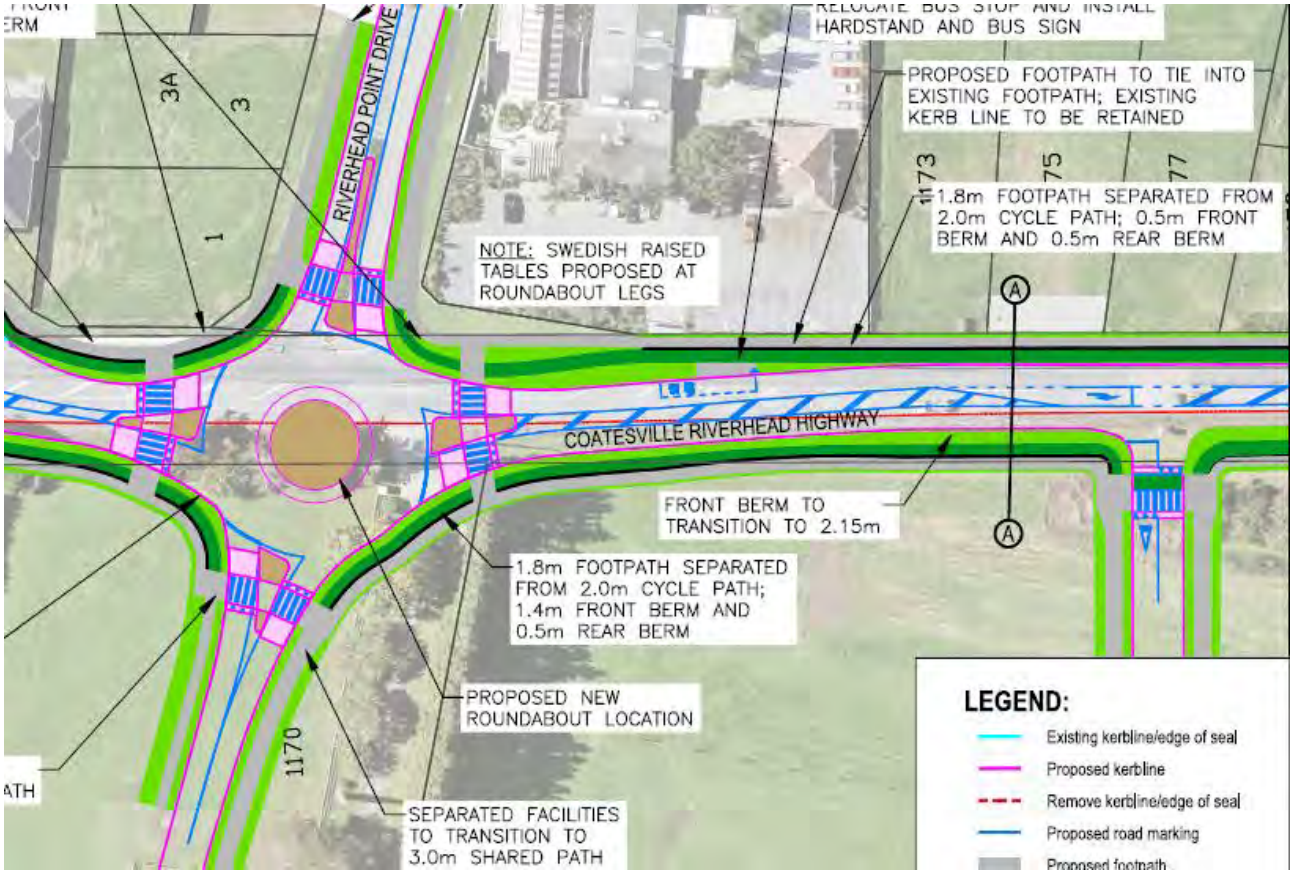
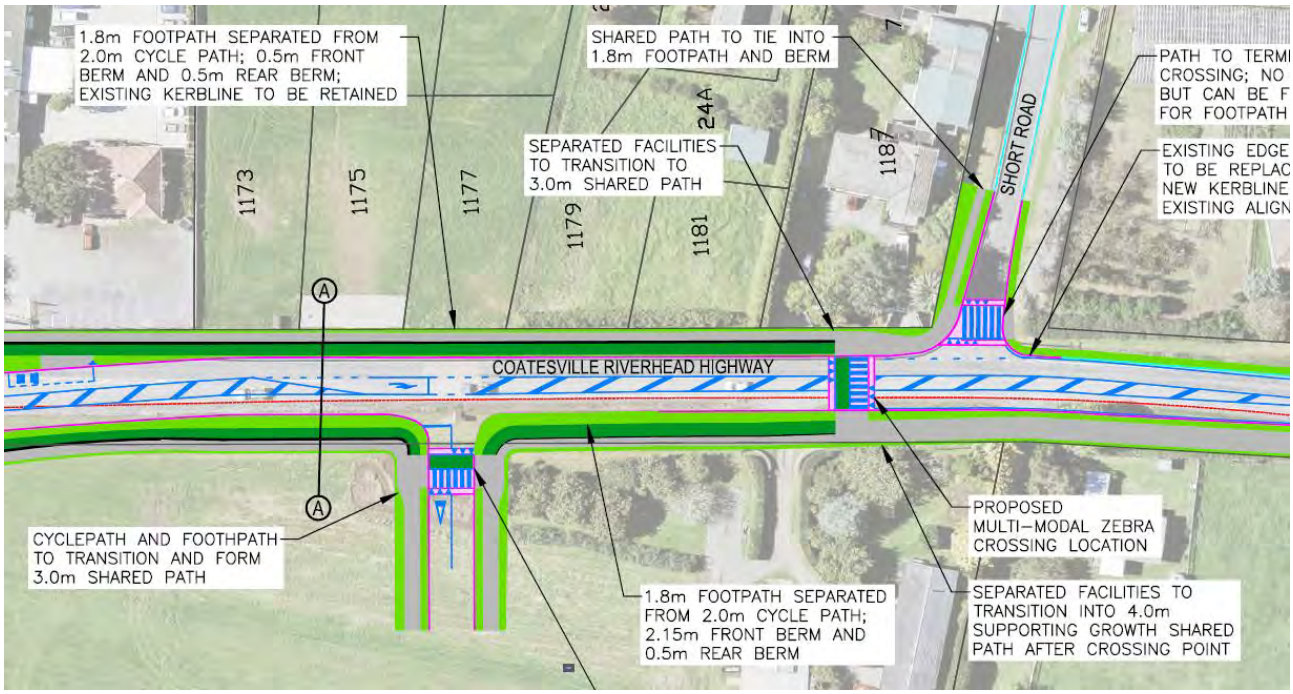


Figure 28: Coatesville-Riverhead Highway - proposed upgrade south of Riverhead Point Road, 2 of 2



Based on information from Auckland Transport, we understand that Coatesville-Riverhead Highway is planned to be an over-dimension route in the future. This can be addressed at the detailed design stage, when designing elements such as the roundabouts. We note that our vehicle tracking currently accommodates a 19.45 m semi-trailer truck.

With buses operating along Coatesville-Riverhead Highway, the existing bus stops will need to be retained or altered slightly to work in with the upgrade proposed. These details can be assessed at detailed design, with the Precinct Provisions highlighting the need to provide for bus infrastructure.

North of Riverhead Road

Outside of the northern and southern sections, a new pedestrian crossing facility will be provided. As outlined in the Precinct Provisions, an additional crossing will be required between Edward Street and Princes Street. The exact location of the crossing will be confirmed at a later consenting stage.

6.6 Lathrope Road

Lathrope Road is an unsealed road. To support the Plan Change, we propose to upgrade Lathrope Road by providing a sealed carriageway, allowing one traffic lane in each direction. This will allow vehicles to use Lathrope Road as a viable access point to reach the wider road network.

There are currently no footpaths provided on Lathrope Road. We propose that the northern side of Lathrope Road will contain a footpath to provide some pedestrian facilities, noting that all of the adjacent properties on Lathrope Road are zoned rural, and there are no activities to connect to. The proposed footpath provides some future proofing of the road for new activities.

As outlined in Section 6.2, we propose that Lathrope Road will have a speed limit reduction from 60 km/h to 50 km/h. The intent is to retain the current rural look and feel. Lathrope Road will effectively provide a transition from Riverhead Road (which would be 60 km/h) and the local roads once turning into the Plan Change area (designed to a 30 km/h).

Auckland Transport have indicated Lathrope Road to be part of a future bus route. The Precinct Provisions acknowledge this and require bus provision to be considered during the design phase of the upgrade. This is specified in the road function and design elements table for external roads, included as Appendix 2 of the Precinct Provisions.

Figure 29: Proposed Lathrope Road layout

6.7 Cambridge Road and Queen Street

Cambridge Road runs alongside the eastern boundary of the site to the north of Riverhead Road. Currently rural in nature, Cambridge Road will be upgraded fronting the Site to ensure it is safe and in keeping with the anticipated development that will be located alongside.

Along the development frontage, Cambridge Road (south of Queen Street) will be upgraded to an urban standard, including

- a 6 m wide carriageway
- vehicle crossings to access activities that front Cambridge Road
- a pedestrian footpath along the development frontage, up to Queen Street.

While the detail of the upgrade can be worked through at detailed design and Engineering Plan Approval, upgrading Cambridge Road similar to that provided along the recently upgraded sections of Duke Street is considered appropriate given the challenging environment presented on the eastern side of Cambridge Road, where the berm sits higher than the road level and rises towards the north.

With Cambridge Road being upgraded and a new pedestrian facility being included on the western side (between Queen Street and Riverhead Road), a pedestrian path is also proposed on the northern side of Queen Street (between Coatesville-Riverhead Highway and Cambridge Road) on the existing grass

berm, connecting the development site to the existing Riverhead area, as well as existing bus stops, War Memorial Park and playground, the existing village and the new local centre.

As mentioned earlier, we understand that the Local Board is looking to address the 'gaps' in footpath provision about the surrounding road network to the plan change, with includes the above road sections. The provisions require the developer to deliver the upgrades discussed above, which in turn reduces the extent of the works the Local Board plans to undertake.

6.8 New internal local roads and collector roads

Internal roads will have road reserve widths ranging between 18 m (local) to 25 m (collector without adjacent open space reserve). The Precinct Provisions include a road function and design elements table (Appendix 1) that sets the key outcomes of each road type internal to the development. We note that the detailed layout for each road will be subject to future resource consent stages, with the Precinct table providing guidance to the outcomes sought.

6.8.1 Local roads

Local roads will be designed to achieve a speed limit of 30 km/h, providing a safe environment for all road users. Local roads will accommodate front and back berms, footpaths and two-way vehicle movement. The front berms can be used for landscaping and street furniture.

With a design speed of 30km/h, there is no requirement for dedicated cycle facilities to be provided on these roads. The Precinct Plan does however indicate routes where key pedestrian and cycling routes pass through the Precinct where safe facilities will be provided.

We note that the local road volumes will generally be very low, with most local roads for this development serving residential traffic only. The potential school would be the only high traffic generator around the new residential development.

The local road and collector road layout is designed in a way that will mean there is limited through traffic internal to the development. Riverhead Road and Coatesville-Riverhead Highway will carry out this function. This will keep the internal local road traffic volumes low, providing a safer environment for all road users. With regard to the local centre, this is located on the periphery of the development, and therefore traffic will generally remain on the outer of the residential streets.

6.8.2 Collector roads

The collector roads will provide separated walking and cycle facilities which connect to the proposed facilities on Riverhead Road and Coatesville-Riverhead Highway.

The design speed is 40km/h and could include two traffic lanes, separated cycle lanes and footpaths on both sides, front berms for street trees, street furniture and optional indented parking bays.

The Precinct Provisions also require bus facilities to be considered during subsequent design phases.

While the proposed collector roads will generally carry low volumes compared to other collector roads in Auckland, they have been designated collector roads for the purposes of ensuring Precinct Plan provisions can be made.

6.9 Intersection designs

The following major intersections are proposed to either be upgraded or constructed to support the Plan Change

- Coatesville-Riverhead Highway / Riverhead Road – upgrade existing roundabout
- Coatesville-Riverhead Highway / Riverhead Point Drive – upgrade to roundabout with fourth leg
- Coatesville-Riverhead Highway / Site access – provide new priority control intersection between Riverhead Point Drive and Short Road
- Riverhead Road / Site access (330 m west of Coatesville-Riverhead Highway) – new intersection with new north and south approach roads
- Riverhead Road / Lathrope Road – update existing priority control intersection.

All of these intersections will involve at least one arterial road. We have considered what the intersection upgrades will possibly include and are designed to accommodate 17.9 m semi-trailer trucks.

Apart from Riverhead Road / Lathrope Road intersection, all intersection upgrades will provide new and separated facilities for pedestrians and cyclists. Swedish table crossing points will be provided on each approach leg of the roundabouts to allow pedestrians and cyclists to safely cross. The permitter of the roundabouts allow the option for either separated pedestrian and cycle lanes, or shared paths. The desired outcome can be addressed during detailed design and Engineering Plan Approval.

The Coatesville-Riverhead Highway / Site access intersection between Riverhead Point Drive and Short Road is proposed to be a priority-controlled intersection. It will cater for a small number of trips within the Site, with the intersection at Riverhead Point Drive being designed as the primary collector road into the site. This intersection will contain a raised table across the Site approach leg to prioritise pedestrians and cyclists that will use the shared path on Coatesville-Riverhead Highway.

Riverhead Road / Lathrope Road is proposed to be upgraded to a priority-controlled intersection based on a lower speed environment discussed earlier. The two existing access points into Lathrope Road will be consolidated into one point, which will provide drivers with improved visibility of Riverhead Road. A right turn bay and median will also be provided on Riverhead Road to facilitate vehicle turning movements. This will allow Lathrope Road to safely accommodate the level of traffic anticipated to use this as an external access point. The current intersection layout is unsuitable for higher volumes of traffic and does not enable safe levels of visibility. The proposed design provides sufficient visibility for vehicles on Riverhead Road, Lathrope Road and the right turn bay given the proposed speed limit changes.

Detailed design and assessments such as road safety audits can be undertaken at future stages.

At the Plan Change level, the intersection designs show that all transport modes can be accommodated within the proposed road reserve boundaries. Localised intersection widening is required, however the

designs have assumed all localised road widening to occur within the current road reserve or within land that sits within the Plan Change boundary.

6.10 Coatesville-Riverhead Highway right turn bay treatments

We have reviewed the requirements for intersection upgrades to include right-turn bays at the Riverland Road intersection and the Old Railway Road intersections on Coatesville-Riverhead Highway.

We have outlined, in the technical note attached as Appendix D, the guidelines and criteria we use to determine the requirement for right-turn bays at intersections as well as indicated if the intersection upgrades are required now according to the current volumes using the intersection (that is, prior to any development within Riverhead), at the 60% development phase and at the 100% development phase.

We reviewed the crashes involving traffic turning right or left, as well as the traffic flows and volumes for these scenarios against Austroads warrants and find the following

- At the Riverland Road intersection, the warrant indicates there is some demand for a channelised turn treatment in the existing scenario however the crash record indicates the current demand for it is low
- At the Old Railway Road intersection, the warrant indicates that the demand for a channelised turn treatment is high in the existing scenario
- In both the 60% development scenario and the 100% development scenario, the predicted increase in traffic flows indicate a high demand for channelised turn treatments at both intersections
- The increase in traffic using Coatesville-Riverhead Highway may also lead to an increase in delays experienced by turning vehicles and therefore an increase in risk to vehicles turning into the side roads.

Therefore, to achieve safe outcomes for each intersection, right-turn bays are recommended for the Old Railway Road intersection pre-development but for the Riverland Road intersection, right-turn bays may be provided at the 60% development scenario.

We note that for the Old Railway Road intersection, Auckland Transport were planning to upgrade this intersection based on the existing conditions. We understand that the associated safety programme has been put on hold due to funding constraints. However, this intersection still requires upgrading due to existing conditions.

Concept plans of the right turn bays are provided in Appendix C.

7 DESCRIPTION AND ASSESSMENT OF THE PROPOSAL

7.1 Access assessment of the proposal

7.1.1 Vehicle access

The road network will provide several new roads and intersections to support the Plan Change. This will provide suitable access for Site users. The roads will also allow existing residents to access the new activities, such as the proposed local centre and education facilities.

The upgrade of Lathrope Road provides a viable access point to travel towards SH16 to the south via Old North Road and Riverhead Road. This will relieve pressure on Coatesville-Riverhead Highway and Riverhead Road as the primary access routes.

7.1.2 Visibility

All intersections and accesses have been designed to achieve the Safe Intersection Sight Distance (SISD) in Austroads. This is based on the revised operating speed limit on the roads recommended earlier within this report. In addition to providing safety benefits, the proposed reduction in speed limits provides more flexibility to safely locate intersections.

The main constraints for visibility are

- On Riverhead Road, the horizontal and vertical curvature 450 m west of the existing Coatesville-Riverhead Highway roundabout
- On Coatesville-Riverhead Highway, the main constraint is the horizontal and vertical curvature south of Short Road.

The proposed intersections comply with the visibility standards, assuming that the speed limits can be reduced to a safe and more appropriate level. We note that the speed limits will need to be amended through the bylaw at the appropriate time.

7.1.3 Vehicle access restrictions

Coatesville-Riverhead Highway and Riverhead Road are classified as arterial roads in the Unitary Plan. This means that vehicle access restrictions will apply, which would trigger restricted discretionary activity criteria for any private vehicle access on these roads.

The Plan Change is not proposing direct vehicle accesses onto the arterial roads. Instead, they will be subject to future resource consents.

The proposed road network is designed to minimise the need for any direct access onto arterial roads, and will instead funnel traffic through new local and collector roads. We note that no specific provisions to restrict access onto collector roads is proposed or considered necessary, given they will be low volume in the context of other collector roads in Auckland.

7.1.4 Pedestrian and cycle access

The following facilities will be provided for pedestrians and cyclists

- Corridor and intersection upgrades on Coatesville-Riverhead Highway and Riverhead Road, providing separated footpaths and cycle lanes and new mid-block crossing facilities (See Section 6.4 and 6.5)
- Footpaths on both sides of all local roads and collector roads. The collector roads will have separated cycle lanes
- Upgraded footpaths on Queen Street and Cambridge Street.

The internal road network will be designed to have low vehicle speeds, to provide safe environments for all users.

These will ensure that both current and future residents will have a range of safe and viable transport choices for travel within Riverhead. The separated facilities align with Vision Zero by minimising conflict points with vehicles.

7.1.5 Public transport access

As outlined in Section 4.6.1, Riverhead is served by one bus route which connects to Albany and Westgate. There are several bus stops on Coatesville-Riverhead Highway along the eastern boundary of the Site.

The Plan Change will support public transport by providing safe and convenient pedestrian connections to the bus stops. Upgrades to public transport shelters can be provided as part of the proposed corridor upgrades on Coatesville-Riverhead Highway, with these being worked through at detailed design. The Precinct Provisions will enable public transport facilities to be provided on Coatesville-Riverhead Highway, Riverhead Road, Lathrope Road and the new internal collector roads.

The increased catchment of residents enabled by the plan change will also support public transport by increasing demand for services, which could result in services becoming more frequent in the future, if additional funding becomes available.

7.2 Trip generation and distribution of the Proposal

7.2.1 Trip generation rates

The following weekday peak hour vehicle trip rates are applicable to this Proposal.

Residential dwellings

The RTA "Guide to Traffic Generating Developments" (RTA Guide) contains trip generation rates for residential dwellings.

- Dwelling houses – 0.85 trips per dwelling
- Medium density residential flat building, larger units or townhouses – 0.5 to 0.65 trips per dwelling.

We have adopted the following rates for the Plan Change, assuming 100% buildout in the long term (by 2038). We note that the calculations are based on a slightly higher residential yield of 1,560 dwellings

which reflects an earlier calculation. As such, the traffic modelling analysis provides a conservative assessment of the predicted effects.

- Lower density dwellings – 0.75 trips per dwelling
- Medium / high density dwellings – 0.60 trips per dwelling.

The trip rates we have adopted are similar to the RTA Guide rates. For the lower density rates, we have used a slightly lower rate of 0.75 trips per dwelling.

- This is because residents in Riverhead will likely travel outside of the peak hours more, given congestion on the wider network.
- It is important to note in responding to this request that the development of Riverhead is going to occur over a number of years (10 years or so)
- We also highlight that our underlying assumptions have retained today's (2022) volumes as background traffic. With the Plan Change introducing employment, including a local centre that offers the opportunity for a major retail offering, such as a supermarket, there is a strong likelihood that an element of existing traffic (which currently leaves Riverhead) will now remain in Riverhead to undertake their daily needs.

We acknowledge that trip rates may be higher in the short term to medium account for the availability of non-private vehicle transport modes. As a result, we have adopted the following trip rates for the residential activities as a sensitivity test

- Lower density dwellings – 0.95 trips per dwelling
- Medium / high density dwellings – 0.70 trips per dwelling.

School

We have adopted the following rates for the potential school. For the purpose of this assessment, we have assumed it will be a primary school

- AM peak – 0.65 trips per student
- PM peak – 0.15 trips per student.

The PM peak rate is lower than the AM rate, as the PM school peak hour occurs at a different time compared to the network PM peak.

Childcare centre

We have adopted rates of 1 trip per child during the peak periods for the childcare centre. The RTA Guide provides trip rates ranging from 0.5 – 1.4 trips per child, so we have adopted the upper mid-range of 1 trip per child.

Supermarket

For the proposed supermarket activity, we have adopted a rate of 11.6 trips per 100 m^2. This is based on the RTA Guide peak hour rate for supermarkets on a Thursday evening and converting from GLFA to

GFA. We note that in reality the AM rate would likely be lower, but we have used this rate conservatively for both peak periods.

Retail

The RTA Guide provides weekday supporting retail trip rates of 5.6 trips per 100 m^2 for weekdays. We have adopted this trip rate for both peak periods, as the proposed retail activities will primarily be small local shops, which will support existing and proposed land uses such as the proposed supermarket.

Offices

We have adopted a trip rate of 2 trips per 100 m^2 for office activities, based on the RTA Guide rates.

Retirement village and aged care facilities

For all of the retirement village and aged care facilities, we have adopted rates of 0.2 trips per unit for both peak hours. This is based on the upper range of the RTA Guide rate of 0.1 – 0.2 trips per unit for housing for aged and disabled persons.

Café

For the café activities, we have adopted a rate of 7.6 trips per 100 m^2. This is based on average trip rates from the NZ Trips Database for the PM peak period.

Medical centre

For the medical centre, we have assumed a flat rate trip assumption of 30 vehicles per hour for both peak hour periods. We note that the medical centre is relatively small and will primarily support the retirement village and aged care facility activities.

Neighbourhood centre

While the neighbourhood centre will consist of approximately 300 m^2 GFA, we have not included it in our modelling assessment. We note that the neighbourhood centre will predominantly serve the local area through convenience retail and services and is not expected to generate external vehicle trips. Given the walking and cycling upgrades that will be provided, many trips to the neighbourhood centre can be taken without a vehicle. Those that are vehicle related, will most likely be pass-by trips.

7.2.2 Trip generation volumes

The anticipated trip generation of the development is shown in Table 2. This shows the total raw number of trips, without any internalisation factors considered.

Table 2: Weekday peak hour trip generation (unfactored)

Activity	Size	Trip rate		Trip generation (vph)	
		AM	PM	AM	PM
Residential – lower dwelling houses	440 units	0.75 / dwelling	0.75 / dwelling	330	330
Residential – medium / higher density	910 units	0.60 / dwelling	0.60 / dwelling	545	545
Primary school	1,100 students	0.65 / student	0.15 / student	715	165
Childcare centre	100 children	1 / child	1 / child	100	100
Supermarket	4,000 m^2	11.6 / 100 m^2	11.6 / 100 m^2	465	465
Retail	650 m^2	5.6 / 100 m^2	5.6 / 100 m^2	35	35
Offices	1,000 m^2	2 / 100 m^2	2 / 100 m^2	20	20
Retirement village	518 units	0.2 / unit	0.2 / unit	105	105
Aged care facility	90 beds	0.2 / unit	0.2 / unit	20	20
Café	600 m^2	7.6 / 100 m^2	7.6 / 100 m^2	45	45
Medical Centre	250 m^2	30 trips	30 trips	30	30
Total				**2,410**	**1,860**

In reality, the number of trips generated external to the Plan Change Site will be lower, due to the following factors

- Internal trips within Riverhead – some trips can be completed internally within Riverhead, which will not generate any traffic on the wider road network. These are trips which can be completed locally due to a range of activities being provided
- Pass-by trips – these are trips where a person stops by at a destination on their way to another destination, meaning the trip is not a new trip added onto the network
- Multi-purpose trips – these are trips where a person can visit multiple destinations in one trip, for example a local centre. This will reduce the number of new trips on the network as one trip can replace several.

Table 3 shows the factors we have adopted for each activity.

Table 3: Peak hour trip generation factors

Activity	Internal trips within Riverhead (%)	Pass-by trips (%)	Multi-purpose trips (%)
Residential – dwelling houses	20%	0%	0%
Residential – medium / higher density	20%	0%	0%
Primary school	80%	0%	0%
Childcare centre	80%	0%	0%
Supermarket	90%	40%	10%
Retail	70%	35%	10%
Offices	20%	0%	0%
Retirement village	20%	0%	0%
Aged care facility	20%	0%	0%
Café	70%	40%	10%
Medical Centre	50%	0%	0%

Multi-purpose factors have only been applied to trips generated by retail type activities within the plan change area, including supermarket, retail and café.

Reference has been made to the ITE Trip Generation Handbook to source typical pass-by trip rates for these uses, with

- Table 5.6 (Land Use 820 – Shopping Centre) having an overall average pass-by rate of 34%. The supporting graph and statistics at Figure 5.5 suggest the smaller the centre, the higher the pass-by percentage
- Table 5.10 (Land Use 850 – Supermarkets) having an overall average pass-by rate of 35%, with the range sitting between 20% and 55%.

While Table 3 provides rates for pass-by trips, our modelling provided no additional volume reductions for pass-by trips for simplicity. This means that the modelling is conservative, as including pass-by trips would result in a reduction in through trips. We have used rates of 35% to 40% for the retail elements of the plan change, noting also that the vast majority of users will be from within Riverhead which doesn't currently have a major supermarket.

Multi-purpose factors have only been applied to trips generated by retail type activities within the plan change area, including supermarket, retail and café. Table 3 of the ITE Journal, dated January 2011 sets out internal capture rates for various land use pairs. We have adopted a 10% value, again only being attributed to the retail component of the plan change, with the ITE noting the following multi-purpose rates

- To Retail, From Residential 10%
- To Retail, From Office 8%

With regard to internal capture percentages, we have assumed percentages based on our judgement. We note that the internal capture percentage still generates traffic that is assigned to the local network, but the traffic is predicted to remain in Riverhead, whether that is for recreation, school pickup and drop off, childcare, shopping, visiting friends etc. External trips are assumed to leave Riverhead and use the wider transport network.

For the purpose of our modelling assessment, we have ignored pass-by trips, noting that these will be only from the supermarket, retail and café activities internal to Riverhead.

Table 4 and Table 5 shows the trip generation volumes, updated with these factors. This shows

- New trips, which accounts for the reduction of multi-purpose trips
- New external trips, which is new trips with that will be generated externally outside of Riverhead. These trips will have an effect on the wider road network.

For the purpose of our modelling assessment, we have ignored pass-by trips, noting that these will be only from the supermarket, retail and café activities internal to Riverhead.

Table 4: Factored peak hour trip generation, AM peak

Activity	Multi-purpose trips	New trips (unfactored minus multi-purpose)	New external trips (new trips reduced by internal trip proportion)
Residential – dwelling houses	0	330	265
Residential – medium density	0	545	435
Primary school	0	715	145
Childcare centre	0	100	20
Supermarket	45	410	40
Retail	5	30	10
Offices	0	20	15
Retirement village	0	105	85
Aged care facility	0	20	15
Café	5	40	10
Medical Centre	0	30	15
Total	**55**	**2,355**	**1,055**

Table 5: Factored peak hour trip generation, PM peak

Activity	Multi-purpose trips	New trips (unfactored minus multi-purpose)	New external trips (new trips reduced by internal trip proportion)
Residential – dwelling houses	0	330	265
Residential – medium density	0	545	435
Primary school	0	165	35
Childcare centre	0	100	20
Supermarket	45	465	40
Retail	5	35	10
Offices	0	20	15
Retirement village	0	105	85
Aged care facility	0	20	15
Café	5	45	10
Medical Centre	0	30	15
Total	**55**	**1,860**	**945**

These factors show that there will be a reasonable reduction of external trips generated by the Plan Change. The number of new external trips is noticeably lower compared to the unfactored trip volumes, which demonstrates that trips can be undertaken locally with the range of proposed activities.

7.2.3 Trip distribution

Appendix A show the trip distribution about the immediate roading network for the AM and PM peak hours. The diagrams show the total volumes of traffic with the Plan Change implemented, for the 2038 year. The volumes in brackets show the anticipated increase due to the trip generation of the Plan Change. While we have undertaken a spreadsheet assessment to distribute traffic, the distributions have been informed by the Northwest SATURN traffic model.

The trips have been grouped and distributed into four quadrants. The quadrants are

- North East – which essentially covers the proposed retirement village and Matvin land holdings
- North West – which is residential development, which is predominantly made up by Neil Group land holdings
- Southern commercial – being the commercial elements that are located south of Riverhead Road
- Southern residential – being the residential development located to the south of Riverhead Road which is predominantly made up by Fletcher land holdings.

External trips to the wider area beyond the immediate Riverhead catchment are based on 'new external trips' in Table 4 and Table 5. For the purposes of our modelling assessment, we have ignored pass-by trips, noting that these will only be from the supermarket, retail and café activities internal to Riverhead.

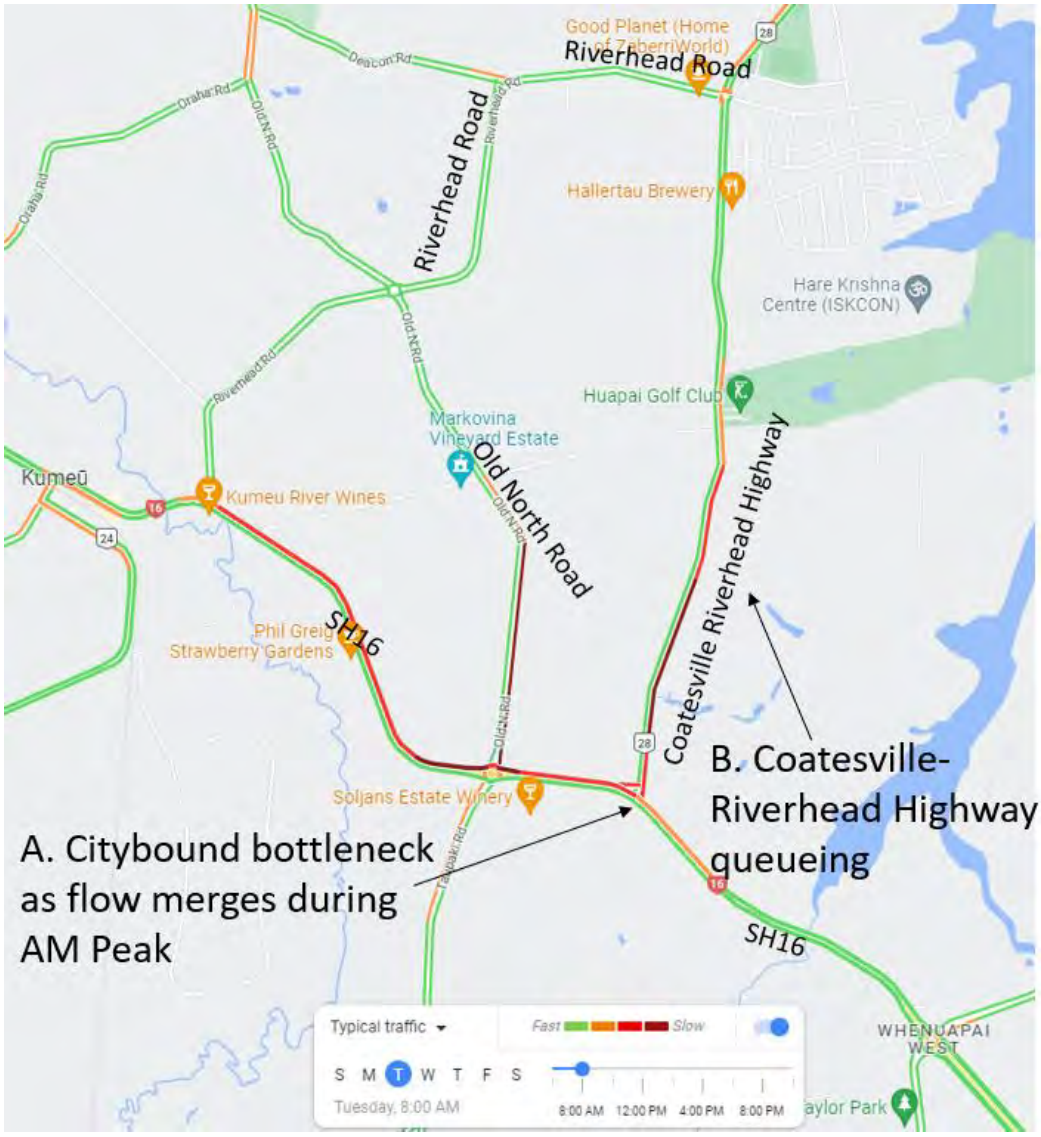
7.3 Existing network operation

Coatesville-Riverhead Highway and Old North Road (via Riverhead Road) connect the Site to SH16, providing access to the east and west. SH16 experiences congestion heading citybound in the morning peak and westbound in the evening peak. Congestion is also experienced during weekend periods, however we anticipate the performance of the network will be improved on weekends following the SH16 upgrade. As the weekend includes a number of discretionary trips, our focus has been on the weekday morning and evening peak periods, where the higher conflicting volumes occur.

During the morning peak, the congestion is caused by two busy traffic streams coming together at the Coatesville-Riverhead Highway intersection with SH16 (labelled "A" on Figure 30). Traffic on SH16 generally allows traffic from Riverhead to join, therefore causing queues that tail back towards Kumeu. Once traffic merges on SH16, traffic speeds increase going towards the city as shown by green in Figure 30 below.

The congestion on SH16 results in queuing on Coatesville-Riverhead Highway (labelled "B" on Figure 30). Based on the typical weekday morning commuter period, the queues reach the Huapai Golf Club, approximately 1.8 km from SH16. On the Coatesville-Riverhead Highway southbound approach, right turns out are restricted, meaning only left turns onto SH16 occur.

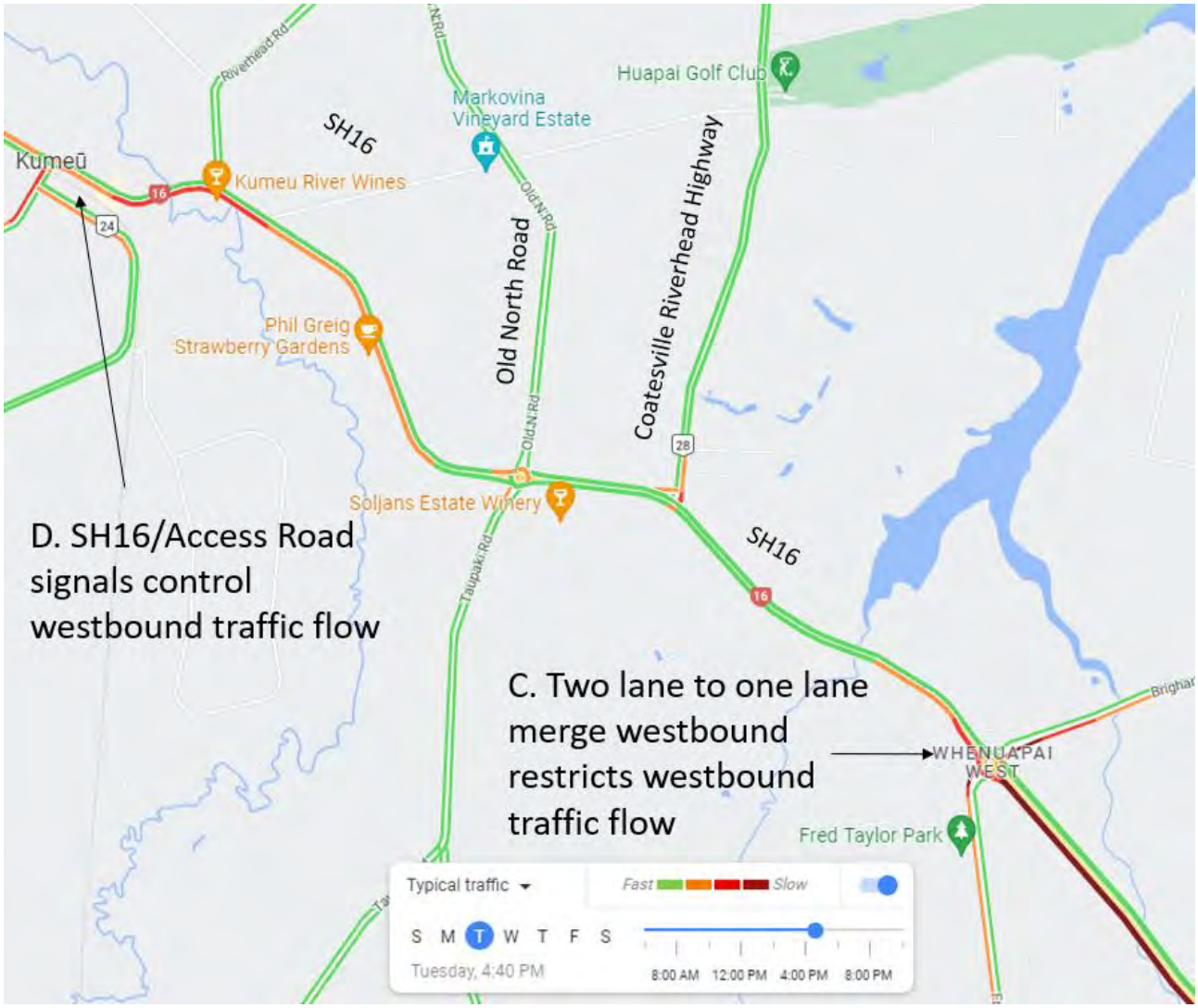
Figure 30: AM Peak Typical Commuter (8:00 am)



During the evening peak, large queues are experienced at the SH16/Brigham Creek Road/Fred Taylor Drive roundabout (labelled "C" on Figure 31), due to the heavy westbound demand. While turning movements between Brigham Creek Road and SH16 west have priority over the SH16 westbound movement, a key constraint at the intersection is the downstream merge from two lanes to one lane.

Once clear, traffic experiences acceptable conditions until approaching Kumeu, where the Access Road/SH16 signalised intersection governs the performance of traffic entering Kumeu and further west (labelled "D" on Figure 31).

Figure 31: PM Peak Typical Commuter (4:40 pm)



7.4 Modelling methodology

7.4.1 Summary of modelling methodology

To assess the traffic effects of the Plan Change, we have assessed the performance of key intersections using the SIDRA intersection modelling software.

We have assessed the following two scenarios in the weekday AM and PM peak hour periods as our primary scenarios

- 2038 base without Plan Change
- 2038 with Plan Change.

As sensitivity tests for the Coatesville-Riverhead Highway intersection, we have also tested the following scenarios (in addition to the primary scenarios above)

- 2031 Plan Change scenario which reflects 60% development complete with sensitivity trip rates
- Full build Plan Change scenario (background traffic for 2038) and reflects sensitivity trip rates for the residential activities, outlined in Section 7.2.1.

We have assessed the following intersections

- SH16 / Coatesville-Riverhead Highway
- Lathrope Road / Riverhead Road
- Riverhead Road / Site collector road
- Coatesville-Riverhead Highway / Riverhead Road
- Coatesville-Riverhead Highway / Riverhead Point Drive / Site collector road
- Coatesville-Riverhead Highway / Site access (south of Riverhead Point Drive)
- Riverhead Road / Old North Road
- Old North Road / Old Railway Road.

The intersection layouts assume all proposed upgrades have been completed in both scenarios.

The SIDRA intersection layouts and movement summary results of the peak periods are provided in Appendix B.

7.4.2 Methodology for network traffic volumes and network assumptions

Forecast traffic volumes have been sourced from Auckland Transport's Supporting Growth Northwest SATURN traffic model. This model relies on inputs from the higher tier Auckland Macro Strategic Model (MSM) which includes forecast land use and infrastructure assumptions (I11.5 land use scenario).

The Northwest SATURN traffic model was obtained from the Auckland Forecast Centre, with various versions being presented. We have used the Reference Case scenario on the basis that the other models provided included infrastructure upgrades, such as the Alternative State Highway (Kumeu Bypass) or Whenuapai Upgrades, being the Spedding Road connection which relieves pressure from the SH16/Brigham Creek Road roundabout.

The roading upgrades included in the 2028 Reference Case include

- SH16 4-laning between Brigham Creek and Old North Road roundabout
- Upgrade of the SH16/Coatesville-Riverhead Highway intersection to a roundabout
- Upgrade of the Main Road/Access Road intersection
- Upgrade of the Main Road/Station Road intersection to traffic signals
- Inclusion of the local road network being established about the Redhills development area.

No changes to the default land use assumptions were made for public transport availability.

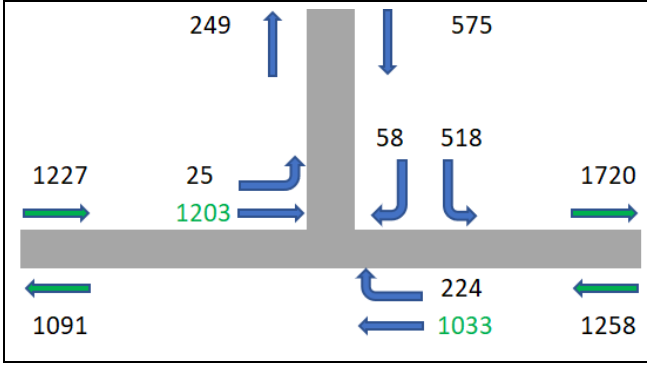
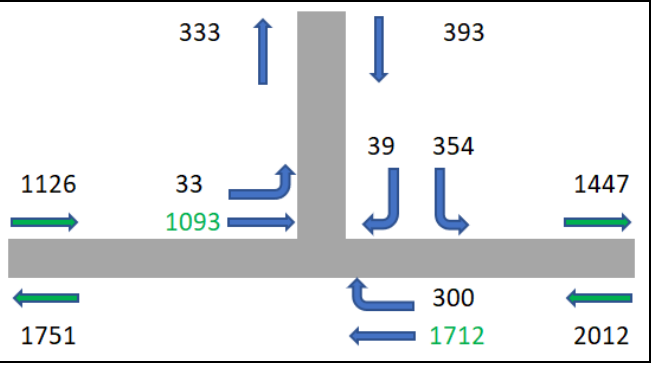
The Northwest SATURN traffic model, and higher tier MSM assumes growth about Kumeu and Huapai, but does not include growth within Riverhead, as the MSM aligns with the Future Urban Land Supply Strategy, which has growth in Riverhead starting in 2028. As such, an increase in housing is not projected until 2033 (being the next defined forecast year). Importantly however, growth is assumed in Kumeu and Huapai, with the volumes in the 2028 and 2038 forecast traffic model on SH16 being (on average) some 3% higher (annual arithmetic growth rate) when referenced against 2022 observed volumes.

Volumes predicted in the Northwest model for Coatesville-Riverhead Highway are very low and are therefore not a reliable source for the purposes of this assessment. That is, for 2028 and 2038, volumes on Coatesville-Riverhead Highway are lighter that 2022 volumes. We also note that the current volumes experience an element of rat running, and as such, the distribution of traffic using Coatesville-Riverhead Highway may reduce slightly when the SH16 constraint is addressed through the upgrade. We however have taken a worst case approach, whereby the existing volume on Coatesville-Riverhead Highway is assumed to remain unchanged.

Using the growth in traffic predicted on SH16 resulting from development further west (Kumeu and Huapai), we have developed a Do Minimum 2031 volume for the SH16/Coatesville-Riverhead Highway intersection. This is the volume predicted to use the intersection should the Riverhead Private Plan Change progress in line with the Future Urban Land Supply Strategy, where traffic associated with consented activities within the plan change area would be expected to be added to the network. The 2031 projected demand also forms as a basis where 60% of the development (ie the land holdings currently controlled by the Riverhead Landowner Group) could be completed by.

The volumes predicted for 2031 are set out in Figure 32, with the growth in through traffic on SH16 (eastbound and westbound) being comparable to the background volumes predicted in 2028 within the Northwest SATURN traffic model.

Figure 32: 2031 Do Minimum Traffic Volumes – SH16/Coatesville-Riverhead Highway intersection

AM Peak 2031 Do Minimum Volumes (excludes Riverhead Private Plan Change)	PM Peak 2031 Do Minimum Volumes (excludes Riverhead Private Plan Change)
	

The westbound volume in the PM Peak has been capped at 1,730 vehicles per hour on the basis that a westbound volume of some 2,400 vehicles per hour is likely to be the maximum hourly volume for traffic passing through the Brigham Creek roundabout located at the end of the Northwest Motorway. The analysis allows some additional 800 vehicles per hour over the current westbound demand, being 1,600 vehicles per hour in the PM Peak.

7.5 Traffic effects – SH16 / Coatesville-Riverhead Highway intersection

The intersection layouts assume a 3-leg roundabout with the proposed Waka Kotahi upgrades. This includes

- Two through traffic lanes from SH16 (east) to SH16 (west)
- Two through traffic lanes from SH16 (west) to SH16 (east)
- Two left turn lanes (with the second left turn lane being shared with the right turn) from Coatesville-Riverhead Highway to SH16 (east). The second lane is understood to be a short lane approximately 40 m long.
- A relatively large internal diameter (30 m) which we assume is required given location of the roundabout on SH16 and the need to allow trucks to circulate together in adjacent lanes.

7.5.1 2031 Do Minimum – Background growth and SH16 upgrade

The 2031 Do Minimum scenario reflects no development within Riverhead but includes growth about Kumeu and Huapai and the upgrade of the intersection to a roundabout consistent with the SH16 Brigham Creek to Waimauku project being completed by Waka Kotahi.

Table 6 summarises the predicted performance of the SH16/Coatesville-Riverhead Highway intersection. The roundabout is predicted to operate well within capacity, with relatively small queues on each of the approaches.

Table 6: 2031 Do Minimum SIDRA Modelling Results – No Riverhead Development

Approach	AM Peak			PM Peak		
	LOS	DoS (v/c)	Queue (m)	LOS	DoS (v/c)	Queue (m)
SH16 (East)	LOS A	0.40	25 m	LOS A	0.63	60 m
Coatesville-Riverhead Highway	LOS B	0.40	15 m	LOS A	0.27	10 m
SH16 (West)	LOS A	0.46	25 m	LOS A	0.45	25 m
Total Intersection	**LOS A**	**0.46**	**25 m**	**LOS A**	**0.63**	**60 m**

7.5.2 2038 Plan Change Scenario – Full Build 100% Plan Change Development

This test assumes the full build (100%) Plan Change scenario. The modelling assumes background growth out to 2038 and reflects long term trip rates.

Table 7 summarises the predicted performance of the SH16/Coatesville-Riverhead Highway intersection. The roundabout is predicted to operate within capacity when accommodating 100% development, with queue lengths queue lengths remaining within 100m for the busier trafficked movements (Coatesville-Riverhead Highway in the AM and SH16 (east) in the PM). The intersection operates at LOS B, with the predicted queues considered satisfactory, such that no concerns are raised with the operation of the roundabout long term.

We also note that this scenario excludes the potential long term Alternative State Highway (also referred to as the Kumeu Bypass) which would remove a large number of vehicles from the intersection.

Table 7: 2038 Plan Change SIDRA Modelling Results – Full Build (100%) Development/Long Term trip rates

Approach	AM Peak			PM Peak		
	LOS	DoS (v/c)	Queue (m)	LOS	DoS (v/c)	Queue (m)
SH16 (East)	LOS A	0.52	40 m	LOS A	0.74	95 m
Coatesville-Riverhead Highway	LOS C	0.88	75 m	LOS B	0.56	30 m
SH16 (West)	LOS B	0.62	50 m	LOS B	0.68	65 m
Total Intersection	**LOS B**	**0.88**	**75 m**	**LOS B**	**0.74**	**95 m**

7.5.3 2031 Plan Change Sensitivity – 60% Plan Change Development

This Plan Change scenario reflects 60% development with sensitivity residential trip rates for the short/medium term.

Table 8 summarises the predicted performance of the SH16/Coatesville-Riverhead Highway intersection. The roundabout is predicted to operate well within capacity when accommodating 60% development, with queue lengths generally increasing by 10-25 m across each approach. The predicted queues are considered satisfactory and do not raise any concerns with the operation of the roundabout.

Table 8: 2031 Plan Change SIDRA Modelling Results – 60% Development/Sensitivity Trip Rates

Approach	AM Peak			PM Peak		
	LOS	DoS (v/c)	Queue (m)	LOS	DoS (v/c)	Queue (m)
SH16 (East)	LOS A	0.47	35 m	LOS A	0.72	85 m
Coatesville-Riverhead Highway	LOS B	0.69	40 m	LOS B	0.44	20 m
SH16 (West)	LOS A	0.54	35 m	LOS B	0.56	40 m
Total Intersection	**LOS A**	**0.69**	**40 m**	**LOS A**	**0.72**	**85 m**

7.5.4 2038 Plan Change Sensitivity Test – Full Build 100% Plan Change Development

This test assumes the full build (100%) Plan Change scenario, with a sensitivity test assuming background growth out to 2038, and higher residential vehicle trip rates being applied to a long term horizon.

Table 9 summarises the predicted performance of the SH16/Coatesville-Riverhead Highway intersection. With the higher trip rates applied to the plan change area, the roundabout is predicted to operate within capacity, with a practicable degree of saturation of 95%. This is still acceptable, with LOS D being predicted for the Coatesville-Riverhead Highway approach during the AM peak. Queue lengths remain satisfactory, such that no concerns are predicted with the operation of the roundabout long term.

As with the previous scenario, we note that this scenario is based on higher trip rates and excludes the potential long term Alternative State Highway (also referred to as the Kumeu Bypass) which would remove a large number of vehicles from the intersection if constructed.

Table 9: 2038 Plan Change Sensitivity SIDRA Modelling Results – Full Build (100%) Development/Sensitivity trip rates

Approach	AM Peak			PM Peak		
	LOS	DoS (v/c)	Queue (m)	LOS	DoS (v/c)	Queue (m)
SH16 (East)	LOS A	0.53	45 m	LOS A	0.76	105 m
Coatesville-Riverhead Highway	LOS D	0.95	125 m	LOS B	0.60	35 m
SH16 (West)	LOS B	0.63	50 m	LOS B	0.72	80 m
Total Intersection	**LOS B**	**0.95**	**125 m**	**LOS B**	**0.76**	**105 m**

7.6 Traffic effects – local Riverhead intersections

7.6.1 Lathrope Road / Riverhead Road

The intersection layout assumes a priority control intersection with a right turn bay on Riverhead Road.

The intersection is anticipated to perform well in both peak periods and scenarios. All approaches are predicted to operate at LOS A and B, which indicates minimal delays being experienced. Queue lengths are expected to be minimal.

7.6.2 Riverhead Road / Site collector road

The intersection layout assumes a 4-leg roundabout with single lane approaches.

All legs are anticipated to operate at LOS A or LOS B, with negligible delays and queue lengths.

7.6.3 Coatesville-Riverhead Highway / Riverhead Road

The intersection layout assumes a 4-leg roundabout with single lane approaches. The geometry of the roundabout reflects the proposed upgrades to this intersection.

The intersection is expected to perform adequately with the plan change.

We note the following of the results

- Most approaches are anticipated to operate well at LOS A to C
- In the AM peak with the plan change, Kaipara Portage Road is predicted to operate at LOS D and E, with approximately 50 seconds of delays
- The 95th percentile queue lengths in the AM peak are predicted to be 120 – 150 m on the Kaipara Portage Road and Coatesville-Riverhead Highway southbound approaches
- We note that our modelling internal to Riverhead is conservative, as we haven't directly accounted for reduction in through traffic due to pass-by trips. These will be largely generated by the retail activities from the centres, which are expected to be close to this intersection. If the pass-by trips are considered, then there would be less traffic at this intersection. Nevertheless, we consider the performance is acceptable given these issues would only be for the AM peak hour, and the delays and queue lengths are not excessive.

7.6.4 Coatesville-Riverhead Highway / Riverhead Point Drive / Site collector road

The intersection layout assumes a 4-leg roundabout with single lane approaches.

All legs are anticipated to operate at LOS A to C, with negligible delays.

The 95th percentile queues are expected to be very minor. In the AM peak period with the Plan Change, the queue length is up to 120 m on the on the Coatesville-Riverhead Highway southbound approach.

7.6.5 Coatesville-Riverhead Highway / Site access (south of Riverhead Point Drive)

The intersection layout assumes a 3-leg priority control intersection with a right turn bay on Coatesville-Riverhead Highway.

With the Plan Change scenario, the Coatesville-Riverhead Highway movements are expected to perform without any issues, with LOS A for all movements on this road. Without the Plan Change, there would be no traffic on the site access road.

Some small delays are expected on the Site access approach with the Plan Change, which has a single lane. In the AM peak periods, LOS F and average delays of around 50 seconds are predicted on this approach. We note that vehicles using this approach have the option of using the Coatesville-Riverhead Highway / Riverhead Point Drive roundabout to avoid potential delays. We consider that this level of delay is acceptable, and will not affect the performance of Coatesville-Riverhead Highway.

7.6.6 Riverhead Road / Old North Road

We have assumed the existing intersection layout, with one lane on each approach and departure.

The intersection is predicted to perform without and issues in the peak periods with the Plan Change, with LOS A and B.

7.6.7 Old North Road / Old Railway Road

We have assumed the existing priority-controlled intersection layout. No turning bays on Old North Road are included. For the Old Railway Road approaches, we have assumed there is short space available for a vehicle to turn left in addition to another vehicle travelling straight or turning right.

The intersection is predicted to perform without and issues in the peak periods with the Plan Change, with LOS A and B on Old North Road.

On the Old Railway Road approaches, some delays of up to 40 seconds are predicted with LOS D or E. We note that the turning volumes on Old Railway Road are predicted to be minimal.

7.7 Summary of modelling results

In summary, all intersections within the Riverhead Plan Change area (and surrounding road network) are anticipated to perform without any noticeable queue lengths or delays with the increased traffic volumes. All intersections have been adequately designed to accommodate the level of traffic anticipated by the Plan Change.

We have also assessed the SH16 / Coatesville-Riverhead Highway intersection across multiple scenarios, including a worse case 100% buildout in 2038 with higher sensitivity trip generation rates. We note that the intersection is predicted to perform well, for each of the scenarios tested.

7.8 Wider network effects

With regard to the wider network, we have considered the safety of intersections further afield which are predicted to experience an increase in traffic volumes as a result of the Plan Change. For Coatesville-Riverhead Highway an additional 550-600 vehicles per hour are predicted (two-way), with some 180-210 vehicles per hour (two-way) predicted for Old North Road.

A summary of the safety outcomes of wider local road intersections is set out in Table 10.

Table 10: Wider intersection assessment

Intersection	Current Layout	Expected change and effect
Coatesville-Riverhead Highway / Short Road	Short Road is a minor cul-de-sac providing access to a small number of properties. There have been two reported crashes, with each related to turning right into Short Road.	The Plan Change proposes moving the threshold treatment and therefore reducing the speed limit fronting Short Road, as well as urbanising Coatesville-Riverhead Highway about the Short Road intersection. Furthermore, a raised crossing is proposed north of Short Road on Coatesville-Riverhead Highway. We expect these changes will slow vehicles about the Short Road intersection and improve safety.
Coatesville-Riverhead Highway / Old Railway Road	There have been 8 crashes at this intersection since 2016, with 3 crashes being serious in nature. We note that the speed limit has recently been reduced for Coatesville-Riverhead Highway and that there have been no reported crashes since Jan 2020.	See Section 6.10 for assessment. A right turn bay is required based on the existing traffic conditions. This is reflected in the Precinct Provisions.
Coatesville-Riverhead Highway / Riverland Road	Riverland Road is a stop-controlled intersection which serves 15 to 20 properties. Three crashes have occurred at the intersection (in 2016 and 2017 – all turning right) With Coatesville-Riverhead Highway having horizontal and vertical curves approaching the intersection, the recent reduction in speed limit on Coatesville-	See Section 6.10 for assessment. A right turn bay is required based on a 60% buildout scenario of the development. This is reflected in the Precinct Provisions.

Intersection	Current Layout	Expected change and effect
	Riverhead Highway provides greater safety for traffic turning into Riverland Road.	
Coatesville-Riverhead Highway / Moontide Road	Moontide Road is a stop-controlled intersection with a formed right turn bay. It serves 10 to 15 properties. Five crashes have occurred at the intersection, with one being a serious crash. No reported crashes have occurred since 2019.	The current intersection design is considered safe and we anticipate the reduced speed limit on Coatesville-Riverhead Highway will assist in catering for the additional traffic expected by the Plan Change through the intersection. We also note this intersection currently includes a right turn bay on Coatesville-Riverhead Highway.
Coatesville-Riverhead Highway / Brigham Lane	Located north of the Coatesville-Riverhead Highway intersection with SH16, the speed of traffic on Coatesville-Riverhead Highway through the intersection is slow, as vehicles either slow for the intersection (when queues are not present) or are queued on the approach to the intersection. A shoulder exists to allow northbound traffic to pass any vehicles turning right. Four crashes have occurred at this intersection since 2016, with 1 being minor injury.	Vehicle speeds on Coatesville-Riverhead Highway are low. We anticipate no change in operation of this intersection as a result of the Plan Change and do not consider any works are required in the immediate future.
Old North Road / Old Railway Road	A number of crashes have occurred at the Old North Road/Old Railway Road, with the current intersection presenting a safety issue. Currently a stop controlled cross road intersection, most crashes are those crossing the intersection. Speed interventions have been located at the intersection, including markings on Old Railway Road (both approaches) and a speed camera on Old North Road.	The Plan Change predicts some additional 180-210 vehicles travelling on Old North Road during the AM and PM peak hours. While good visibility exists at the intersection, the Plan Change is adding traffic to the priority route, rather than the crossing route. The SIDRA results outlined in Section 7.6.7 shows that the intersection will perform sufficiently with the additional traffic included. We would add that the current intersection does have a safety concern, with a longer-term upgrade needing to address the current concern. The footprint of the intersection however is small

Intersection	Current Layout	Expected change and effect
		and will likely require additional land for Auckland Transport to implement the necessary upgrade required.

8 PROPOSED PRECINCT PLAN PROVISIONS

8.1 Precinct Provisions

A Precinct is proposed as part of the Plan Change. The Precinct allows specific standards and assessment criteria to be included in the Unitary Plan, so that development of Riverhead can be managed appropriately.

The Precinct includes provisions that limit any dwellings within the Riverhead Plan Change area from being occupied prior to the SH16 / Coatesville – Riverhead Highway intersection from being upgraded. This is a key transport move in terms of safety and capacity for the Riverhead area. The intersection upgrade is proposed by Waka Kotahi and is currently scheduled to be completed by 2025. The Notice of Requirement has been lodged with Auckland Council. Should the intersection not be upgraded, matters of discretion are included in the precinct provisions such that any occupied development will be required to address the safety of the surrounding transport network, including at the SH16 / Coatesville-Riverhead Highway intersection.

The Precinct Plan provisions includes requirements to upgrade Riverhead Road, Coatesville-Riverhead Highway, Lathrope Road and Cambridge Road fronting the Site prior to any development being completed which would use these roads. Further, the implementation of a footpath on Queen Street is required that connects the plan change area through the existing Riverhead village and public transport facilities at the time development occurs. This will ensure that development will have safe infrastructure available in the local Riverhead area at the time development becomes occupied. As noted above, other localised footpaths are being proposed by the Local Board to address the 'gaps' in the existing network.

Proposed Standards related to transport, as set out in IX6.1 of the precinct provisions include

(1) Prior to occupation of a dwelling within the Riverhead Precinct, the following transport infrastructure must be constructed and operational:

  (a) Upgrade of the Coatesville-Riverhead Highway / Main Road (SH16) intersection to a roundabout, as part of the SH16 Brigham Creek to Waimauku project, led by Waka Kotahi NZ Transport Agency.

(2) Prior to occupation of a building on a site with vehicle access to and/or from Coatesville-Riverhead Highway, the following road infrastructure upgrades must be constructed and operational:

  (a) Upgrade and urbanise Coatesville-Riverhead Highway from 80m south of Short Road to the Coatesville-Riverhead Highway / Riverhead Road roundabout, including walking/cycling infrastructure, gateway treatment and public transport infrastructure in accordance with IX.10.3 Riverhead: Precinct plan 3 and IX.11.2 Appendix 2; and

  (b) Upgrade and urbanise the Coatesville-Riverhead Highway / Riverhead Road roundabout, in accordance with IX.10.3 Riverhead: Precinct plan 3 and IX.11.2 Appendix 2.

(3) Prior to occupation of a building on a site with vehicle access to and/or from Riverhead Road, the following road infrastructure upgrades must be constructed and operational:

  (a) Upgrade and urbanise Coatesville-Riverhead Highway from 80m south of Short Road to the Coatesville-Riverhead Highway / Riverhead Road roundabout, including

walking/cycling infrastructure, gateway treatment and public transport infrastructure in accordance with IX.10.3 Riverhead: Precinct plan 3 and IX.11.2 Appendix 2; and

(b) Upgrade and urbanise the Coatesville-Riverhead Highway / Riverhead Road roundabout, in accordance with IX.10.3 Riverhead: Precinct plan 3 and IX.11.2 Appendix 2; and

(c) Upgrade and urbanise Riverhead Road, from the eastern boundary of 307 Riverhead Road to Coatesville-Riverhead Highway, including walking/cycling infrastructure, gateway threshold treatment, and public transport infrastructure in accordance with IX.10.3 Riverhead: Precinct plan 3.

(4) Prior to occupation of a building on a site with vehicle access to and/or from Lathrope Road, the following road infrastructure upgrades must be constructed and operational:

(a) Upgrade Lathrope Road between Riverhead Road and the new access point, in accordance with IX.10.3 Riverhead: Precinct plan 3 and IX.11.2 Appendix 2; and

(b) Upgrade the Riverhead Road/Lathrope Road intersection to a Give-Way controlled intersection, in accordance with IX.10.3 Riverhead: Precinct plan 3 and IX.11.2 Appendix 2.

(5) Prior to occupation of a building on a site with vehicle access to and/or from Cambridge Road, the following road infrastructure upgrades must be constructed and operational:

(a) A new footpath on the western side of Cambridge Road between Queen Street and Riverhead Road in accordance with IX.10.3 Riverhead: Precinct plan 3;

(b) Upgrade and urbanise the existing carriageway of the formed portion of Cambridge Road south of Queen Street to an urban standard, in accordance IX.10.3 Riverhead: Precinct Plan 3;

(c) A new footpath on the northern side of Queen Street between Coatesville-Riverhead Highway and Cambridge Road in accordance with IX.10.3 Riverhead: Precinct plan 3; and

(d) An additional pedestrian crossing facility on Coatesville-Riverhead Highway between Edward Street and Princes Street.

In addition to the above upgrades, standard IX6.2 includes a road widening requirement of 2m on land adjoining Riverhead Road. This allows the Riverhead Road reserve to be widened from 20m to 24m, providing sufficient space to accommodate the upgrades required.

Localised road widening is required about new intersections on Riverhead Road and Coatesville-Riverhead Highway, with the extent of the widening to be addressed at detailed design. We note that the current Notice of Requirement process being undertaken by Supporting Growth has landed on an extent of designation which allows for the roundabout design discussed in this report. This is captured in Appendix 2 of the Precinct Provisions (refer to the Precinct provisions appended with the Plan Change documentation to review Appendix 2).

8.2 Infrastructure Implementation Plan

A summary of the proposed implementation plan for transport infrastructure is provided in Table 11.

As mentioned previously, it is anticipated that the SH16 / Coatesville-Riverhead Highway upgrade will be completed before any development within the Site occurs. This project is being delivered by Waka Kotahi and is scheduled to be completed by 2025.

The 2025 timeframe aligns with the anticipated date for buildings starting to be occupied on Site, with a development timeframe of 5-10 years (2030-35) for the key stakeholders. Should development come online earlier, the provisions ensure any proposals are adequately assessed, ensuring that a safe transport network exists prior to occupation of buildings.

The proposed corridor and intersection upgrades of Coatesville-Riverhead Highway, Riverhead Road, Lathrope Road, Cambridge Road and supporting footpath connections will be undertaken by the applicant, Riverhead Landowner Group. Each of these upgrades will be undertaken prior to any development connecting to these roads.

Table 11: Infrastructure implementation plan

Infrastructure upgrade	Implementation timing / trigger point	Party responsible
SH16 / Coatesville-Riverhead Highway	2025 –Prior to occupation of a dwelling within Riverhead Precinct	Waka Kotahi
Coatesville-Riverhead Highway corridor and intersections (Riverhead Road to 80 m south of Short Road)	Prior to occupation of a building on a site with a vehicle access to and/or from Coatesville-Riverhead Highway, or Riverhead Road	Riverhead Landowner Group
Riverhead Road corridor and intersections (Coatesville-Riverhead Highway to eastern boundary of 307 Riverhead Road)	Prior to occupation of a building on a site with a vehicle access to and/or from Riverhead Road	Riverhead Landowner Group
Lathrope Road corridor and Lathrope Road / Riverhead Road intersection	Prior to occupation of a building on a site with a vehicle access to and/or from Lathrope Road	Riverhead Landowner Group
Urbanise Cambridge Road fronting the development site and provide a footpath on the western side (between Queen Street and Riverhead Road)	Prior to occupation of a building on a site with a vehicle access to and/or from Cambridge Road	Riverhead Landowner Group
Provide a new footpath on the northern side of Queen Street (Cambridge Road to Coatesville-Riverhead Highway)	Prior to occupation of a building on a site with a vehicle access to and/or from Cambridge Road	Riverhead Landowner Group
Additional pedestrian crossing on Coatesville-Riverhead Highway between Edward Street and Princes Street	Prior to occupation of a building on a site with a vehicle access to and/or from Cambridge Road	Riverhead Landowner Group

Infrastructure upgrade	Implementation timing / trigger point	Party responsible
Coatesville-Riverhead Highway / Old Railway Road and Riverland Road intersections – provide right turn bay upgrades	Prior to occupation of dwellings within Riverhead Precinct	Riverhead Landowner Group

9 CONCLUSIONS

Based on the analysis described in this report, we conclude that the Structure Plan and proposed Riverhead Plan Change can enable activities that can operate safely and efficiently from a transportation perspective. We conclude that

- The Plan change aligns well with the Auckland Plan and Auckland Unitary Plan transport objectives by providing people with choices of healthy and sustainable transport modes, and encouraging a range of activities (assessed in further detail in the Section 32 report by Barkers & Associates)
- The rezoning of Future Urban land will enable a range of complementary activities, including residential dwellings, a local centre, early learning childcare centres and a retirement village complex and provisions support social facilities, including education facilities
- The Plan Change brings the development ahead of the 2028 – 2032 current schedule in the Future Urban Land Supply Strategy, by four or so years although that timing is principally based on issues applying to Kumeu and Huapai that do not constrain Riverhead. We note that the roading improvements captured in the Precinct Provisions are all that required. The Plan Change requires these to be in place prior to development being occupied
- The sections of Riverhead Road and Coatesville-Riverhead Highway that front the plan change area and provide the entry points to Riverhead will receive full corridor upgrades within the vicinity of the Site as part of the Plan Change. This includes providing new dedicated facilities for pedestrians and cyclists on both sides, which will significantly improve active mode accessibility for existing and future residents of Riverhead
- Lathrope Road will be upgraded and sealed to provide a footpath and allow this to be used as an external vehicle access route from the Site
- Anticipated speed limit reductions on Riverhead Road and Coatesville-Riverhead Highway will provide safety benefits for all road users and align with Vision Zero principles
- An internal road network will be provided to support the activities included in the Plan Change. Several new intersections will be constructed, while existing intersections in the local area will be upgraded. These intersections will be designed in accordance with Vision Zero, and designed to safely accommodate all road users. The proposed Precinct Provisions set out the anticipated design elements of local roads, requiring low speed designs that offers a safe outcome to all users
- New footpaths will be provided on Cambridge Road and Queen Street to provide facilities for pedestrians, as no footpaths currently exist along sections of these roads
- Right turn bays on Coatesville-Riverhead Highway will be required at the Riverland Road and Old Railway Road intersections, noting the Old Railway Road right turn bay is already required
- There are existing capacity constraints on the road network, particularly on SH16. The section of SH16 south of the Site has funding to be upgraded by Waka Kotahi NZTA by 2025, which will increase capacity and improve safety to all Riverhead residents. The proposed Precinct Provisions include a standard to ensure that this upgrade is provided before development is occupied
- There will be a noticeable number of trips generated by the development, but the impact on the wider network will be reduced by-pass trips, multi-purpose trips, and trips that can be undertaken

locally within Riverhead. All intersections within the Riverhead Plan Change area are anticipated to perform without any noticeable queue lengths or delays with the increased traffic volumes

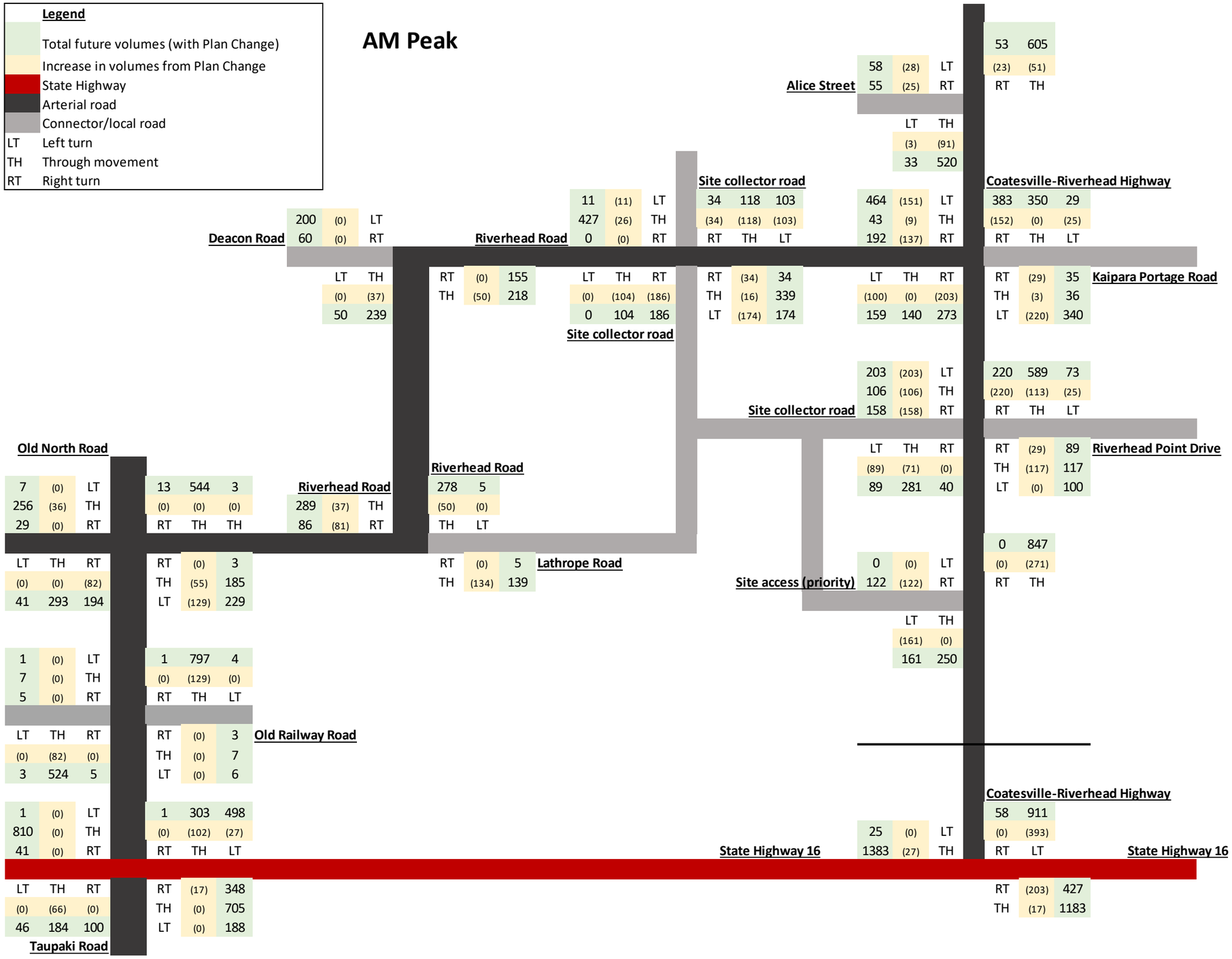
- The SH16 / Coatesville-Riverhead Highway intersection is predicted to perform well, even when considering the full 100% Plan Change buildout by 2038, due to the Waka Kotahi upgrade
- Coatesville-Riverhead Highway is serviced by a bus route, which connects to the Westgate public transport hub and Albany station. The upgrades proposed on Coatesville-Riverhead Highway will include the provision of public transport infrastructure to support and encourage travel by public transport.

Overall, we are of the view that the Plan Change will enable development that aligns with or implements transport network upgrades as planned by Waka Kotahi and Auckland Transport. The upgrades proposed as part of the Plan Change will significantly improve accessibility for all transport modes in Riverhead and will supplement upgrades to SH16 proposed by 2025.

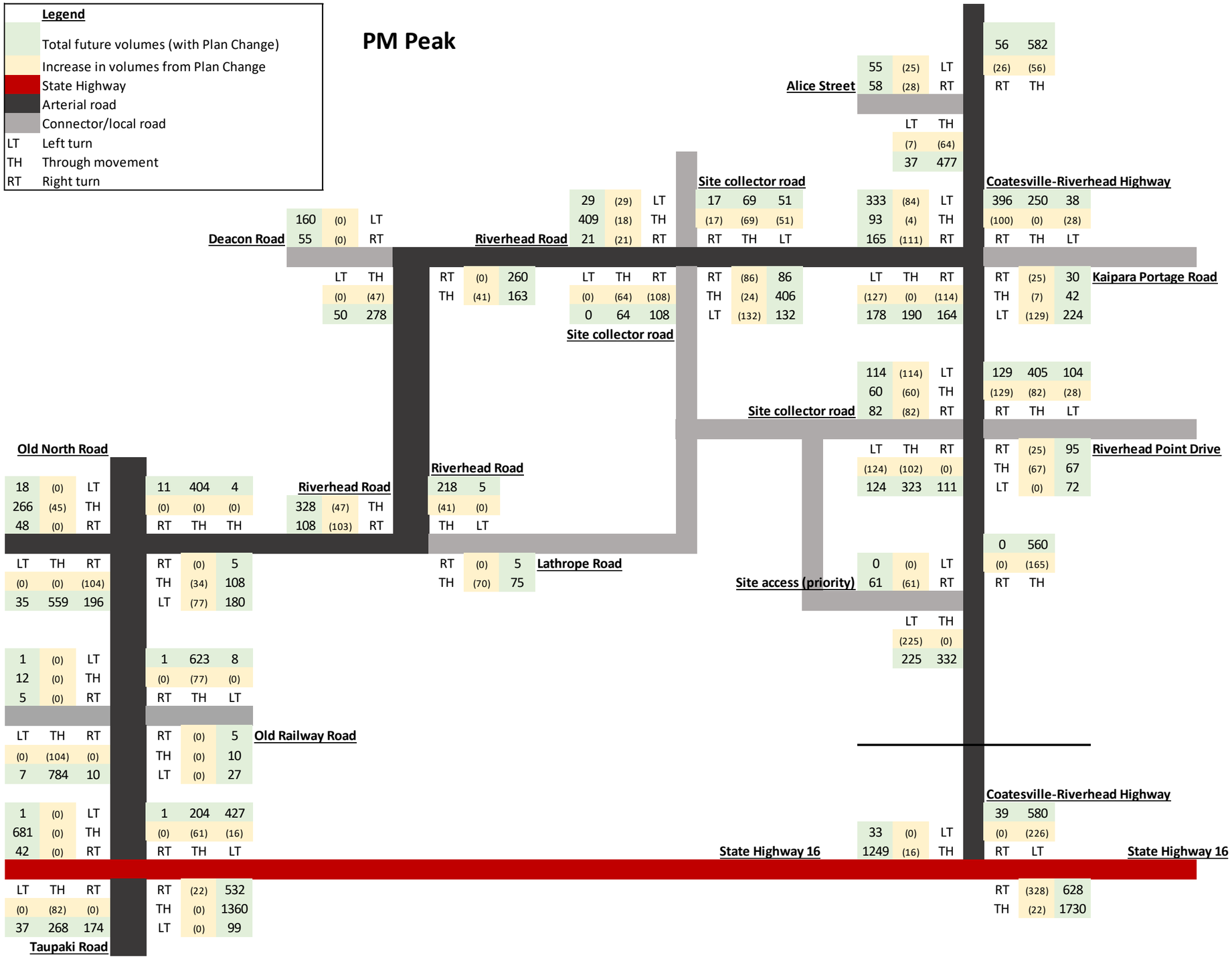
We therefore consider that there are no transportation planning or traffic engineering reasons to preclude the implementation of the Plan Change as intended.

APPENDIX A Trip distribution diagrams

Full Build Trip Distribution Diagram –AM Peak with Plan Change



Full Build Trip Distribution Diagram –PM Peak with Plan Change



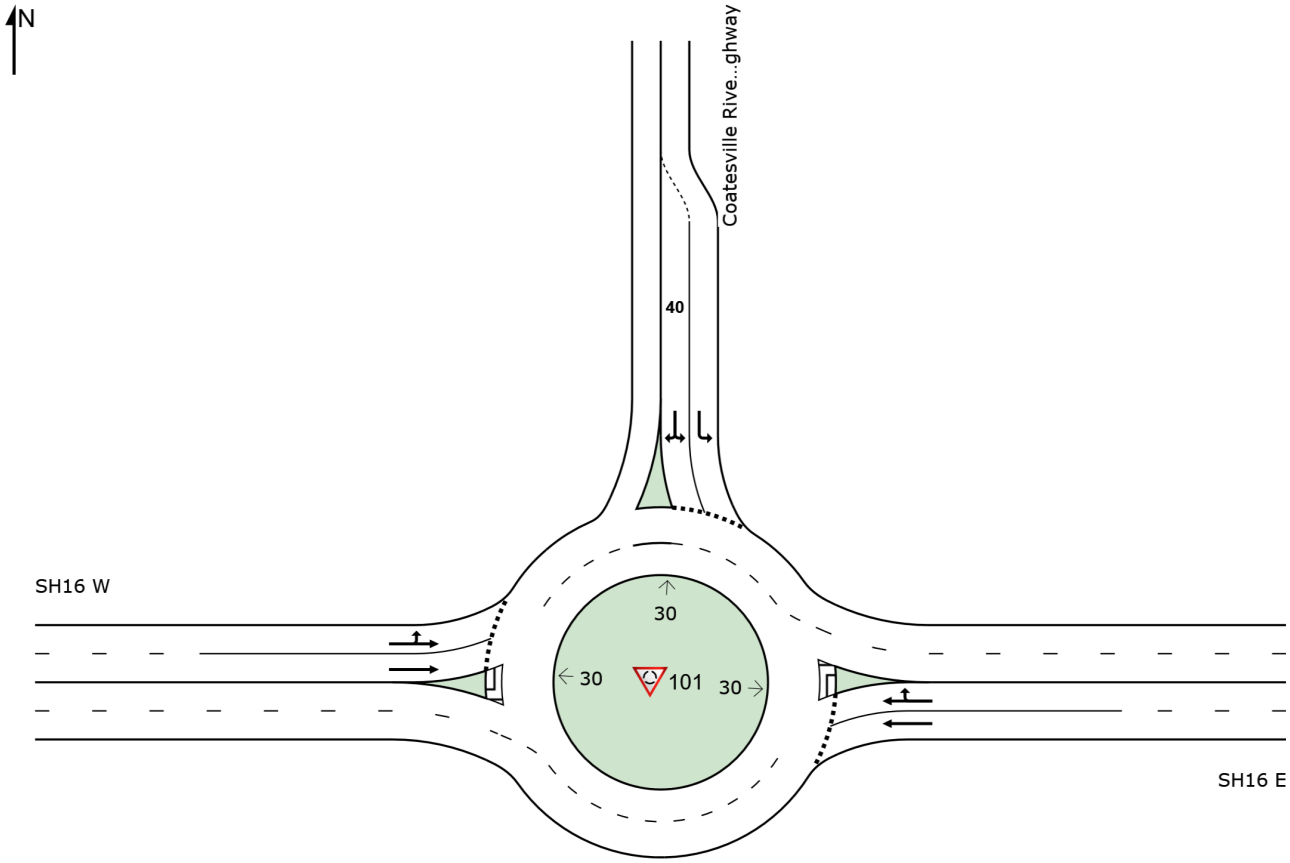
APPENDIX B SIDRA modelling outputs

SITE LAYOUT

Site: 101 [SH16/Coatesville-Riverhead Highway 2031 (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville-Riverhead Highway 2031 (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1034	9.0	1034	9.0	0.407	6.4	LOS A	3.5	26.5	0.29	0.48	0.29	65.3
6	R2	224	6.0	224	6.0	0.407	12.2	LOS B	3.4	25.5	0.30	0.54	0.30	64.3
Approach		1258	8.5	1258	8.5	0.407	7.4	LOS A	3.5	26.5	0.29	0.49	0.29	65.1
North: Coatesville Riverhead Highway														
7	L2	518	6.0	518	6.0	0.408	9.8	LOS A	2.3	16.8	0.76	0.92	0.85	61.7
9	R2	58	6.0	58	6.0	0.408	16.9	LOS B	2.1	15.5	0.76	0.93	0.86	61.6
Approach		576	6.0	576	6.0	0.408	10.5	LOS B	2.3	16.8	0.76	0.92	0.85	61.7
West: SH16 W														
10	L2	25	6.0	25	6.0	0.460	6.7	LOS A	3.5	26.2	0.50	0.56	0.50	63.0
11	T1	1203	9.0	1203	9.0	0.460	7.4	LOS A	3.5	26.2	0.52	0.57	0.52	64.3
Approach		1228	8.9	1228	8.9	0.460	7.4	LOS A	3.5	26.2	0.52	0.57	0.52	64.3
All Vehicles		3062	8.2	3062	8.2	0.460	8.0	LOS A	3.5	26.5	0.47	0.61	0.49	64.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville-Riverhead Highway 2031 (Site Folder: Base_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1712	9.0	1712	9.0	0.632	6.4	LOS A	7.7	58.2	0.32	0.46	0.32	65.2
6	R2	300	6.0	300	6.0	0.632	12.2	LOS B	7.7	57.7	0.34	0.51	0.34	64.4
Approach		2012	8.6	2012	8.6	0.632	7.2	LOS A	7.7	58.2	0.32	0.47	0.32	65.1
North: Coatesville Riverhead Highway														
7	L2	354	6.0	354	6.0	0.269	8.7	LOS A	1.3	9.9	0.71	0.83	0.71	62.5
9	R2	39	6.0	39	6.0	0.269	15.5	LOS B	1.2	9.1	0.71	0.88	0.71	63.1
Approach		393	6.0	393	6.0	0.269	9.3	LOS A	1.3	9.9	0.71	0.84	0.71	62.5
West: SH16 W														
10	L2	33	6.0	33	6.0	0.449	7.1	LOS A	3.4	25.4	0.57	0.60	0.57	62.6
11	T1	1093	9.0	1093	9.0	0.449	7.8	LOS A	3.4	25.4	0.59	0.61	0.59	63.8
Approach		1126	8.9	1126	8.9	0.449	7.8	LOS A	3.4	25.4	0.59	0.61	0.59	63.8
All Vehicles		3531	8.4	3531	8.4	0.632	7.6	LOS A	7.7	58.2	0.45	0.56	0.45	64.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville-Riverhead Highway 60% 2031 (Site Folder: Clause 23 Scenarios_Future_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1049	9.0	1049	9.0	0.468	6.4	LOS A	4.5	34.1	0.32	0.48	0.32	65.0
6	R2	397	6.0	397	6.0	0.468	12.3	LOS B	4.4	32.6	0.33	0.57	0.33	63.0
Approach		1446	8.2	1446	8.2	0.468	8.0	LOS A	4.5	34.1	0.32	0.51	0.32	64.4
North: Coatesville Riverhead Highway														
7	L2	820	6.0	820	6.0	0.688	13.2	LOS B	5.4	39.9	0.89	1.05	1.24	58.5
9	R2	58	6.0	58	6.0	0.688	20.7	LOS C	4.8	35.6	0.88	1.05	1.25	58.4
Approach		878	6.0	878	6.0	0.688	13.7	LOS B	5.4	39.9	0.89	1.05	1.24	58.4
West: SH16 W														
10	L2	25	6.0	25	6.0	0.536	7.8	LOS A	4.4	32.8	0.69	0.65	0.69	61.8
11	T1	1224	9.0	1224	9.0	0.536	8.8	LOS A	4.4	32.8	0.71	0.70	0.73	63.0
Approach		1249	8.9	1249	8.9	0.536	8.8	LOS A	4.4	32.9	0.71	0.70	0.72	63.0
All Vehicles		3573	7.9	3573	7.9	0.688	9.7	LOS A	5.4	39.9	0.60	0.71	0.69	62.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville-Riverhead Highway 60% 2031 (Site Folder: Clause 23 Scenarios_Future_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1730	9.0	1730	9.0	0.716	6.4	LOS A	11.2	84.5	0.38	0.46	0.38	64.6
6	R2	553	6.0	553	6.0	0.716	12.3	LOS B	10.9	80.8	0.42	0.53	0.42	62.9
Approach		2283	8.3	2283	8.3	0.716	7.9	LOS A	11.2	84.5	0.39	0.47	0.39	64.2
North: Coatesville Riverhead Highway														
7	L2	537	6.0	537	6.0	0.440	9.7	LOS A	2.7	19.7	0.81	0.93	0.90	61.8
9	R2	39	6.0	39	6.0	0.440	16.7	LOS B	2.5	18.1	0.80	0.95	0.91	62.3
Approach		576	6.0	576	6.0	0.440	10.2	LOS B	2.7	19.7	0.81	0.93	0.90	61.8
West: SH16 W														
10	L2	33	6.0	33	6.0	0.561	9.6	LOS A	5.4	40.5	0.82	0.81	0.91	60.9
11	T1	1107	9.0	1107	9.0	0.561	10.8	LOS B	5.4	40.5	0.83	0.84	0.94	62.1
Approach		1140	8.9	1140	8.9	0.561	10.8	LOS B	5.4	40.5	0.83	0.84	0.94	62.1
All Vehicles		3999	8.1	3999	8.1	0.716	9.0	LOS A	11.2	84.5	0.57	0.64	0.62	63.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville Riverhead Highway (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1183	9.0	1183	9.0	0.521	6.4	LOS A	5.5	41.8	0.35	0.48	0.35	64.8
6	R2	427	6.0	427	6.0	0.521	12.3	LOS B	5.4	40.0	0.37	0.56	0.37	62.9
Approach		1610	8.2	1610	8.2	0.521	8.0	LOS A	5.5	41.8	0.35	0.50	0.35	64.3
North: Coatesville Riverhead Highway														
7	L2	911	6.0	911	6.0	0.877	23.8	LOS C	10.2	75.1	0.98	1.26	1.99	50.1
9	R2	58	6.0	58	6.0	0.877	32.7	LOS C	8.8	64.4	0.96	1.25	2.01	49.1
Approach		969	6.0	969	6.0	0.877	24.3	LOS C	10.2	75.1	0.98	1.26	2.00	50.0
West: SH16 W														
10	L2	25	6.0	25	6.0	0.621	9.0	LOS A	6.3	47.6	0.77	0.76	0.85	61.2
11	T1	1383	9.0	1383	9.0	0.621	10.1	LOS B	6.3	47.6	0.79	0.79	0.89	62.5
Approach		1408	8.9	1408	8.9	0.621	10.1	LOS B	6.3	47.6	0.79	0.79	0.89	62.4
All Vehicles		3987	7.9	3987	7.9	0.877	12.7	LOS B	10.2	75.1	0.66	0.79	0.94	59.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville Riverhead Highway (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1730	9.0	1730	9.0	0.740	6.5	LOS A	12.7	96.0	0.41	0.45	0.41	64.4
6	R2	628	6.0	628	6.0	0.740	12.4	LOS B	12.2	90.4	0.45	0.52	0.45	62.5
Approach		2358	8.2	2358	8.2	0.740	8.0	LOS A	12.7	96.0	0.42	0.47	0.42	63.9
North: Coatesville Riverhead Highway														
7	L2	580	6.0	580	6.0	0.557	11.8	LOS B	3.8	28.3	0.89	1.00	1.07	59.8
9	R2	39	6.0	39	6.0	0.557	18.9	LOS B	3.4	25.3	0.87	1.00	1.07	60.1
Approach		619	6.0	619	6.0	0.557	12.3	LOS B	3.8	28.3	0.89	1.00	1.07	59.8
West: SH16 W														
10	L2	33	6.0	33	6.0	0.680	12.7	LOS B	8.7	65.5	0.94	0.96	1.22	59.2
11	T1	1249	9.0	1249	9.0	0.680	14.2	LOS B	8.7	65.5	0.94	1.00	1.25	59.5
Approach		1282	8.9	1282	8.9	0.680	14.2	LOS B	8.7	65.5	0.94	1.00	1.25	59.5
All Vehicles		4259	8.1	4259	8.1	0.740	10.5	LOS B	12.7	96.0	0.64	0.71	0.77	61.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville-Riverhead Highway 100%sens2 2038 (Site Folder: Clause 23 Scenarios_Future_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1184	9.0	1184	9.0	0.529	6.4	LOS A	5.7	43.2	0.35	0.48	0.35	64.8
6	R2	449	6.0	449	6.0	0.529	12.3	LOS B	5.6	41.4	0.37	0.57	0.37	62.8
Approach		1633	8.2	1633	8.2	0.529	8.0	LOS A	5.7	43.2	0.36	0.50	0.36	64.2
North: Coatesville Riverhead Highway														
7	L2	978	6.0	978	6.0	0.953	40.4	LOS D	17.1	125.9	0.99	1.57	3.11	40.8
9	R2	58	6.0	58	6.0	0.953	50.8	LOS E	14.3	105.4	0.99	1.55	3.12	39.6
Approach		1036	6.0	1036	6.0	0.953	41.0	LOS D	17.1	125.9	0.99	1.57	3.12	40.8
West: SH16 W														
10	L2	25	6.0	25	6.0	0.634	9.4	LOS A	6.7	50.8	0.80	0.79	0.90	61.1
11	T1	1387	9.0	1387	9.0	0.634	10.6	LOS B	6.7	50.8	0.81	0.82	0.94	62.3
Approach		1412	8.9	1412	8.9	0.634	10.6	LOS B	6.7	50.8	0.81	0.82	0.94	62.3
All Vehicles		4081	7.9	4081	7.9	0.953	17.3	LOS B	17.1	125.9	0.68	0.88	1.26	55.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [SH16/Coatesville-Riverhead Highway 100%sens2 2038 (Site Folder: Clause 23 Scenarios_Future_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: SH16 E														
5	T1	1730	9.0	1730	9.0	0.758	6.5	LOS A	13.9	105.1	0.43	0.45	0.43	64.3
6	R2	686	6.0	686	6.0	0.758	12.4	LOS B	13.2	97.9	0.48	0.52	0.48	62.2
Approach		2416	8.1	2416	8.1	0.758	8.2	LOS A	13.9	105.1	0.44	0.47	0.44	63.6
North: Coatesville Riverhead Highway														
7	L2	615	6.0	615	6.0	0.608	12.8	LOS B	4.4	32.5	0.91	1.02	1.14	58.9
9	R2	39	6.0	39	6.0	0.608	20.0	LOS B	3.9	28.9	0.89	1.02	1.14	59.1
Approach		654	6.0	654	6.0	0.608	13.2	LOS B	4.4	32.5	0.91	1.02	1.14	58.9
West: SH16 W														
10	L2	33	6.0	33	6.0	0.724	15.0	LOS B	10.5	79.0	0.99	1.06	1.42	57.1
11	T1	1251	9.0	1251	9.0	0.724	16.8	LOS B	10.5	79.0	0.99	1.09	1.45	57.2
Approach		1284	8.9	1284	8.9	0.724	16.7	LOS B	10.5	79.0	0.99	1.09	1.45	57.2
All Vehicles		4354	8.1	4354	8.1	0.758	11.5	LOS B	13.9	105.1	0.67	0.74	0.84	60.9

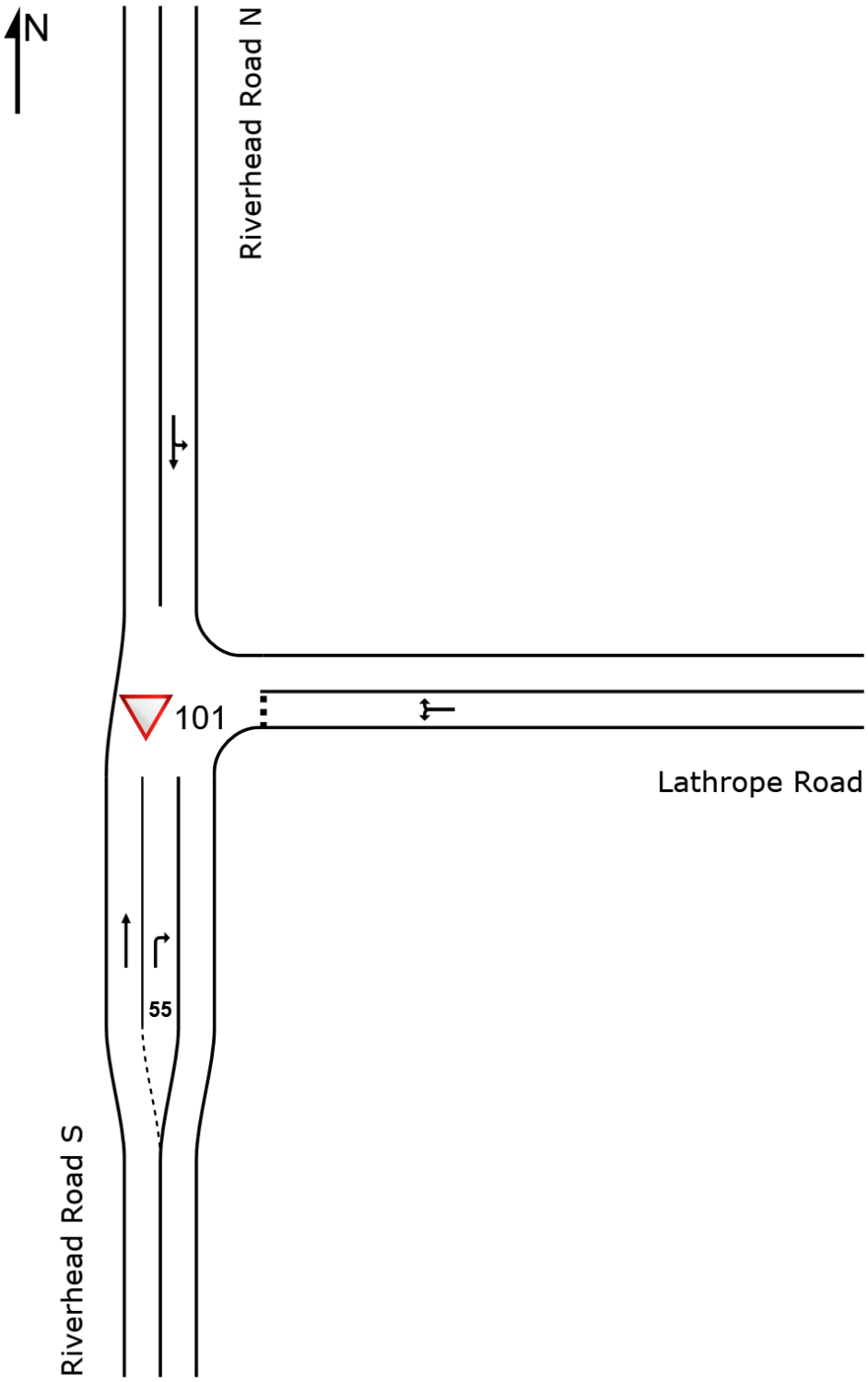
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Lathrope Road / Riverhead Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Lathrope Road / Riverhead Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Riverhead Road S														
2	T1	252	6.0	265	6.0	0.141	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	5	0.0	5	0.0	0.004	5.3	LOS A	0.0	0.1	0.34	0.52	0.34	45.5
Approach		257	5.9	271	5.9	0.141	0.1	NA	0.0	0.1	0.01	0.01	0.01	59.6
East: Lathrope Road														
4	L2	5	0.0	5	0.0	0.012	6.3	LOS A	0.0	0.3	0.41	0.60	0.41	52.1
6	R2	5	0.0	5	0.0	0.012	8.9	LOS A	0.0	0.3	0.41	0.60	0.41	51.6
Approach		10	0.0	11	0.0	0.012	7.6	LOS A	0.0	0.3	0.41	0.60	0.41	51.8
North: Riverhead Road N														
7	L2	5	0.0	5	0.0	0.131	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	58.0
8	T1	228	6.0	240	6.0	0.131	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
Approach		233	5.9	245	5.9	0.131	0.2	NA	0.0	0.0	0.00	0.01	0.00	59.5
All Vehicles		500	5.8	526	5.8	0.141	0.3	NA	0.0	0.3	0.01	0.02	0.01	59.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Lathrope Road / Riverhead Road (Site Folder: Base_PM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Riverhead Road S														
2	T1	282	6.0	297	6.0	0.158	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	5	0.0	5	0.0	0.003	5.1	LOS A	0.0	0.1	0.29	0.51	0.29	45.6
Approach		287	5.9	302	5.9	0.158	0.1	NA	0.0	0.1	0.01	0.01	0.01	59.6
East: Lathrope Road														
4	L2	5	0.0	5	0.0	0.012	6.1	LOS A	0.0	0.3	0.36	0.59	0.36	52.2
6	R2	5	0.0	5	0.0	0.012	8.7	LOS A	0.0	0.3	0.36	0.59	0.36	51.7
Approach		10	0.0	11	0.0	0.012	7.4	LOS A	0.0	0.3	0.36	0.59	0.36	51.9
North: Riverhead Road N														
7	L2	5	0.0	5	0.0	0.102	5.5	LOS A	0.0	0.0	0.00	0.02	0.00	57.9
8	T1	177	6.0	186	6.0	0.102	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	59.5
Approach		182	5.8	192	5.8	0.102	0.2	NA	0.0	0.0	0.00	0.02	0.00	59.4
All Vehicles		479	5.7	504	5.7	0.158	0.3	NA	0.0	0.3	0.01	0.02	0.01	59.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Lathrope Road / Riverhead Road (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Riverhead Road S														
2	T1	289	6.0	304	6.0	0.163	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	86	0.0	91	0.0	0.067	5.6	LOS A	0.3	2.1	0.39	0.59	0.39	45.4
Approach		375	4.6	395	4.6	0.163	1.3	NA	0.3	2.1	0.09	0.13	0.09	55.8
East: Lathrope Road														
4	L2	139	0.0	146	0.0	0.128	6.6	LOS A	0.5	3.7	0.39	0.62	0.39	52.4
6	R2	5	0.0	5	0.0	0.128	11.6	LOS B	0.5	3.7	0.39	0.62	0.39	51.9
Approach		144	0.0	152	0.0	0.128	6.8	LOS A	0.5	3.7	0.39	0.62	0.39	52.4
North: Riverhead Road N														
7	L2	5	0.0	5	0.0	0.159	5.6	LOS A	0.0	0.0	0.00	0.01	0.00	58.0
8	T1	278	6.0	293	6.0	0.159	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
Approach		283	5.9	298	5.9	0.159	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.6
All Vehicles		802	4.2	844	4.2	0.163	1.9	NA	0.5	3.7	0.11	0.18	0.11	56.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Lathrope Road / Riverhead Road (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Riverhead Road S														
2	T1	328	6.0	345	6.0	0.185	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
3	R2	108	0.0	114	0.0	0.079	5.4	LOS A	0.4	2.5	0.35	0.57	0.35	45.5
Approach		436	4.5	459	4.5	0.185	1.4	NA	0.4	2.5	0.09	0.14	0.09	55.5
East: Lathrope Road														
4	L2	75	0.0	79	0.0	0.070	6.3	LOS A	0.3	1.9	0.33	0.59	0.33	52.6
6	R2	5	0.0	5	0.0	0.070	11.3	LOS B	0.3	1.9	0.33	0.59	0.33	52.1
Approach		80	0.0	84	0.0	0.070	6.6	LOS A	0.3	1.9	0.33	0.59	0.33	52.6
North: Riverhead Road N														
7	L2	5	0.0	5	0.0	0.125	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	58.0
8	T1	218	6.0	229	6.0	0.125	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.5
Approach		223	5.9	235	5.9	0.125	0.2	NA	0.0	0.0	0.00	0.01	0.00	59.5
All Vehicles		739	4.4	778	4.4	0.185	1.6	NA	0.4	2.5	0.09	0.15	0.09	56.3

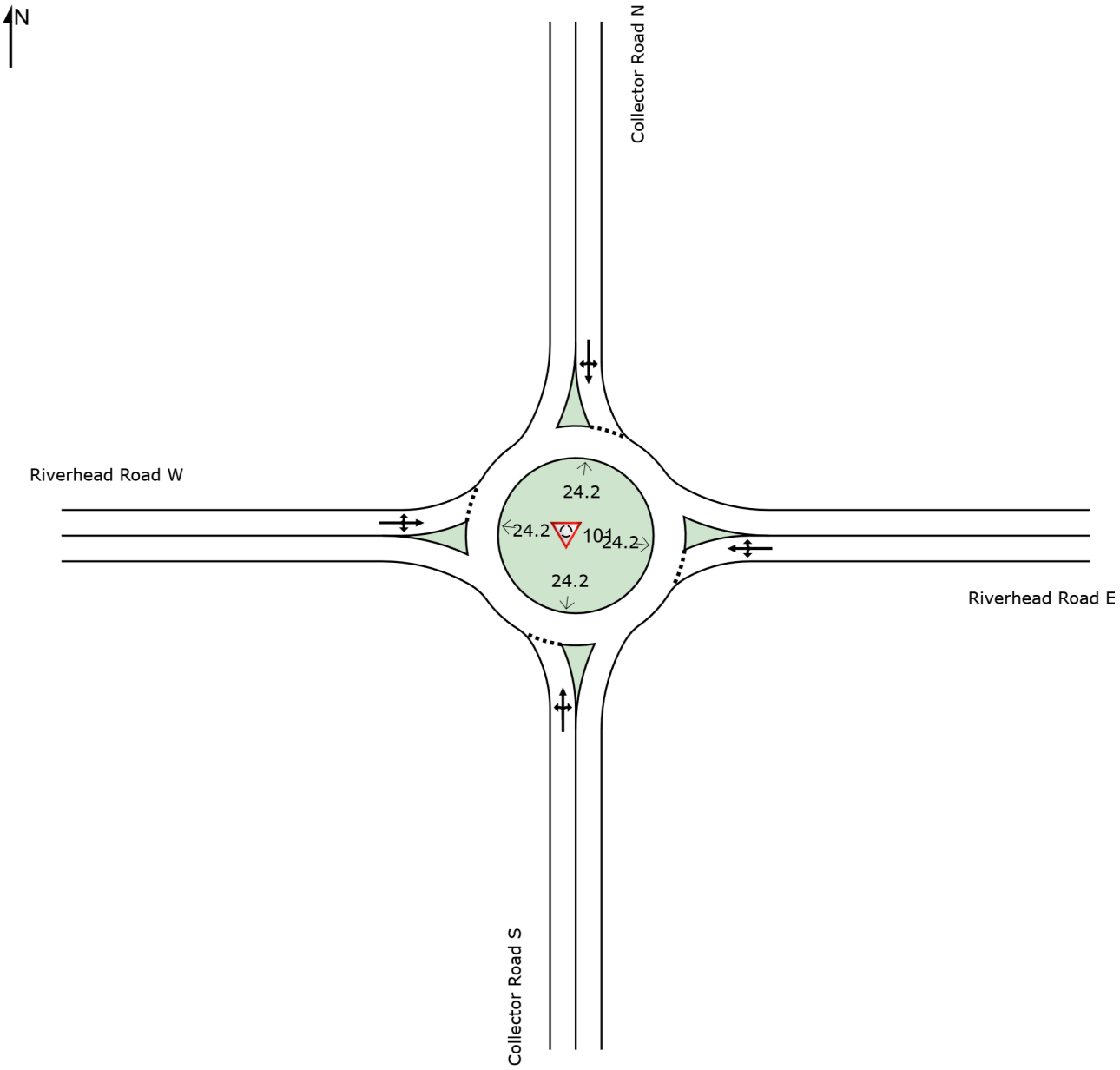
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and 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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Riverhead Road/Site collector road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Site collector road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Collector Road S														
1	L2	1	6.0	1	6.0	0.003	4.1	LOS A	0.0	0.1	0.44	0.46	0.44	46.3
2	T1	1	6.0	1	6.0	0.003	3.9	LOS A	0.0	0.1	0.44	0.46	0.44	47.5
3	R2	1	6.0	1	6.0	0.003	8.9	LOS A	0.0	0.1	0.44	0.46	0.44	47.8
Approach		3	6.0	3	6.0	0.003	5.6	LOS A	0.0	0.1	0.44	0.46	0.44	47.2
East: Riverhead Road E														
4	L2	1	6.0	1	6.0	0.203	2.6	LOS A	1.2	9.0	0.04	0.28	0.04	48.4
5	T1	323	6.0	340	6.0	0.203	2.5	LOS A	1.2	9.0	0.04	0.28	0.04	49.7
6	R2	1	6.0	1	6.0	0.203	7.4	LOS A	1.2	9.0	0.04	0.28	0.04	50.0
Approach		325	6.0	342	6.0	0.203	2.5	LOS A	1.2	9.0	0.04	0.28	0.04	49.7
North: Collector Road N														
7	L2	1	6.0	1	6.0	0.003	4.5	LOS A	0.0	0.1	0.49	0.48	0.49	46.1
8	T1	1	6.0	1	6.0	0.003	4.3	LOS A	0.0	0.1	0.49	0.48	0.49	47.3
9	R2	1	6.0	1	6.0	0.003	9.3	LOS A	0.0	0.1	0.49	0.48	0.49	47.6
Approach		3	6.0	3	6.0	0.003	6.1	LOS A	0.0	0.1	0.49	0.48	0.49	47.0
West: Riverhead Road W														
10	L2	1	6.0	1	6.0	0.251	2.6	LOS A	1.6	11.6	0.04	0.28	0.04	48.4
11	T1	402	6.0	423	6.0	0.251	2.5	LOS A	1.6	11.6	0.04	0.28	0.04	49.7
12	R2	1	6.0	1	6.0	0.251	7.4	LOS A	1.6	11.6	0.04	0.28	0.04	50.0
Approach		404	6.0	425	6.0	0.251	2.5	LOS A	1.6	11.6	0.04	0.28	0.04	49.7
All Vehicles		735	6.0	774	6.0	0.251	2.5	LOS A	1.6	11.6	0.04	0.28	0.04	49.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Site collector road (Site Folder: Base_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Collector Road S														
1	L2	1	6.0	1	6.0	0.003	4.4	LOS A	0.0	0.1	0.47	0.47	0.47	46.2
2	T1	1	6.0	1	6.0	0.003	4.2	LOS A	0.0	0.1	0.47	0.47	0.47	47.4
3	R2	1	6.0	1	6.0	0.003	9.2	LOS A	0.0	0.1	0.47	0.47	0.47	47.7
Approach		3	6.0	3	6.0	0.003	5.9	LOS A	0.0	0.1	0.47	0.47	0.47	47.1
East: Riverhead Road E														
4	L2	1	6.0	1	6.0	0.239	2.6	LOS A	1.5	11.0	0.04	0.28	0.04	48.4
5	T1	382	6.0	402	6.0	0.239	2.5	LOS A	1.5	11.0	0.04	0.28	0.04	49.7
6	R2	1	6.0	1	6.0	0.239	7.4	LOS A	1.5	11.0	0.04	0.28	0.04	50.0
Approach		384	6.0	404	6.0	0.239	2.5	LOS A	1.5	11.0	0.04	0.28	0.04	49.7
North: Collector Road N														
7	L2	1	6.0	1	6.0	0.003	4.5	LOS A	0.0	0.1	0.48	0.48	0.48	46.2
8	T1	1	6.0	1	6.0	0.003	4.3	LOS A	0.0	0.1	0.48	0.48	0.48	47.3
9	R2	1	6.0	1	6.0	0.003	9.3	LOS A	0.0	0.1	0.48	0.48	0.48	47.6
Approach		3	6.0	3	6.0	0.003	6.0	LOS A	0.0	0.1	0.48	0.48	0.48	47.0
West: Riverhead Road W														
10	L2	1	6.0	1	6.0	0.245	2.6	LOS A	1.5	11.4	0.04	0.28	0.04	48.4
11	T1	392	6.0	413	6.0	0.245	2.5	LOS A	1.5	11.4	0.04	0.28	0.04	49.7
12	R2	1	6.0	1	6.0	0.245	7.4	LOS A	1.5	11.4	0.04	0.28	0.04	50.0
Approach		394	6.0	415	6.0	0.245	2.5	LOS A	1.5	11.4	0.04	0.28	0.04	49.7
All Vehicles		784	6.0	825	6.0	0.245	2.5	LOS A	1.5	11.4	0.04	0.28	0.04	49.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Site collector road (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Collector Road S														
1	L2	10	6.0	11	6.0	0.333	5.3	LOS A	2.2	16.1	0.66	0.70	0.66	45.0
2	T1	104	6.0	109	6.0	0.333	5.2	LOS A	2.2	16.1	0.66	0.70	0.66	46.1
3	R2	186	6.0	196	6.0	0.333	10.1	LOS B	2.2	16.1	0.66	0.70	0.66	46.3
Approach		300	6.0	316	6.0	0.333	8.3	LOS A	2.2	16.1	0.66	0.70	0.66	46.2
East: Riverhead Road E														
4	L2	174	6.0	183	6.0	0.468	3.8	LOS A	3.9	28.5	0.53	0.46	0.53	46.6
5	T1	339	6.0	357	6.0	0.468	3.6	LOS A	3.9	28.5	0.53	0.46	0.53	47.8
6	R2	34	6.0	36	6.0	0.468	8.6	LOS A	3.9	28.5	0.53	0.46	0.53	48.1
Approach		547	6.0	576	6.0	0.468	4.0	LOS A	3.9	28.5	0.53	0.46	0.53	47.4
North: Collector Road N														
7	L2	103	6.0	108	6.0	0.348	7.2	LOS A	2.4	17.6	0.79	0.80	0.79	45.3
8	T1	118	6.0	124	6.0	0.348	7.0	LOS A	2.4	17.6	0.79	0.80	0.79	46.5
9	R2	34	6.0	36	6.0	0.348	12.0	LOS B	2.4	17.6	0.79	0.80	0.79	46.8
Approach		255	6.0	268	6.0	0.348	7.7	LOS A	2.4	17.6	0.79	0.80	0.79	46.0
West: Riverhead Road W														
10	L2	11	6.0	12	6.0	0.463	5.0	LOS A	3.5	25.4	0.68	0.57	0.68	46.0
11	T1	427	6.0	449	6.0	0.463	4.9	LOS A	3.5	25.4	0.68	0.57	0.68	47.2
12	R2	10	6.0	11	6.0	0.463	9.8	LOS A	3.5	25.4	0.68	0.57	0.68	47.5
Approach		448	6.0	472	6.0	0.463	5.0	LOS A	3.5	25.4	0.68	0.57	0.68	47.2
All Vehicles		1550	6.0	1632	6.0	0.468	5.7	LOS A	3.9	28.5	0.64	0.59	0.64	46.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Site collector road (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Collector Road S														
1	L2	10	6.0	11	6.0	0.220	5.8	LOS A	1.4	10.0	0.67	0.72	0.67	44.9
2	T1	64	6.0	67	6.0	0.220	5.6	LOS A	1.4	10.0	0.67	0.72	0.67	45.9
3	R2	108	6.0	114	6.0	0.220	10.6	LOS B	1.4	10.0	0.67	0.72	0.67	46.2
Approach		182	6.0	192	6.0	0.220	8.6	LOS A	1.4	10.0	0.67	0.72	0.67	46.0
East: Riverhead Road E														
4	L2	132	6.0	139	6.0	0.489	3.4	LOS A	4.1	30.4	0.43	0.43	0.43	46.7
5	T1	406	6.0	427	6.0	0.489	3.3	LOS A	4.1	30.4	0.43	0.43	0.43	47.9
6	R2	86	6.0	91	6.0	0.489	8.2	LOS A	4.1	30.4	0.43	0.43	0.43	48.2
Approach		624	6.0	657	6.0	0.489	4.0	LOS A	4.1	30.4	0.43	0.43	0.43	47.7
North: Collector Road N														
7	L2	51	6.0	54	6.0	0.172	5.9	LOS A	1.0	7.7	0.68	0.67	0.68	45.9
8	T1	69	6.0	73	6.0	0.172	5.7	LOS A	1.0	7.7	0.68	0.67	0.68	47.1
9	R2	17	6.0	18	6.0	0.172	10.7	LOS B	1.0	7.7	0.68	0.67	0.68	47.4
Approach		137	6.0	144	6.0	0.172	6.4	LOS A	1.0	7.7	0.68	0.67	0.68	46.7
West: Riverhead Road W														
10	L2	29	6.0	31	6.0	0.437	4.5	LOS A	3.1	23.1	0.59	0.51	0.59	46.3
11	T1	409	6.0	431	6.0	0.437	4.3	LOS A	3.1	23.1	0.59	0.51	0.59	47.5
12	R2	21	6.0	22	6.0	0.437	9.3	LOS A	3.1	23.1	0.59	0.51	0.59	47.8
Approach		459	6.0	483	6.0	0.437	4.6	LOS A	3.1	23.1	0.59	0.51	0.59	47.4
All Vehicles		1402	6.0	1476	6.0	0.489	5.0	LOS A	4.1	30.4	0.54	0.52	0.54	47.3

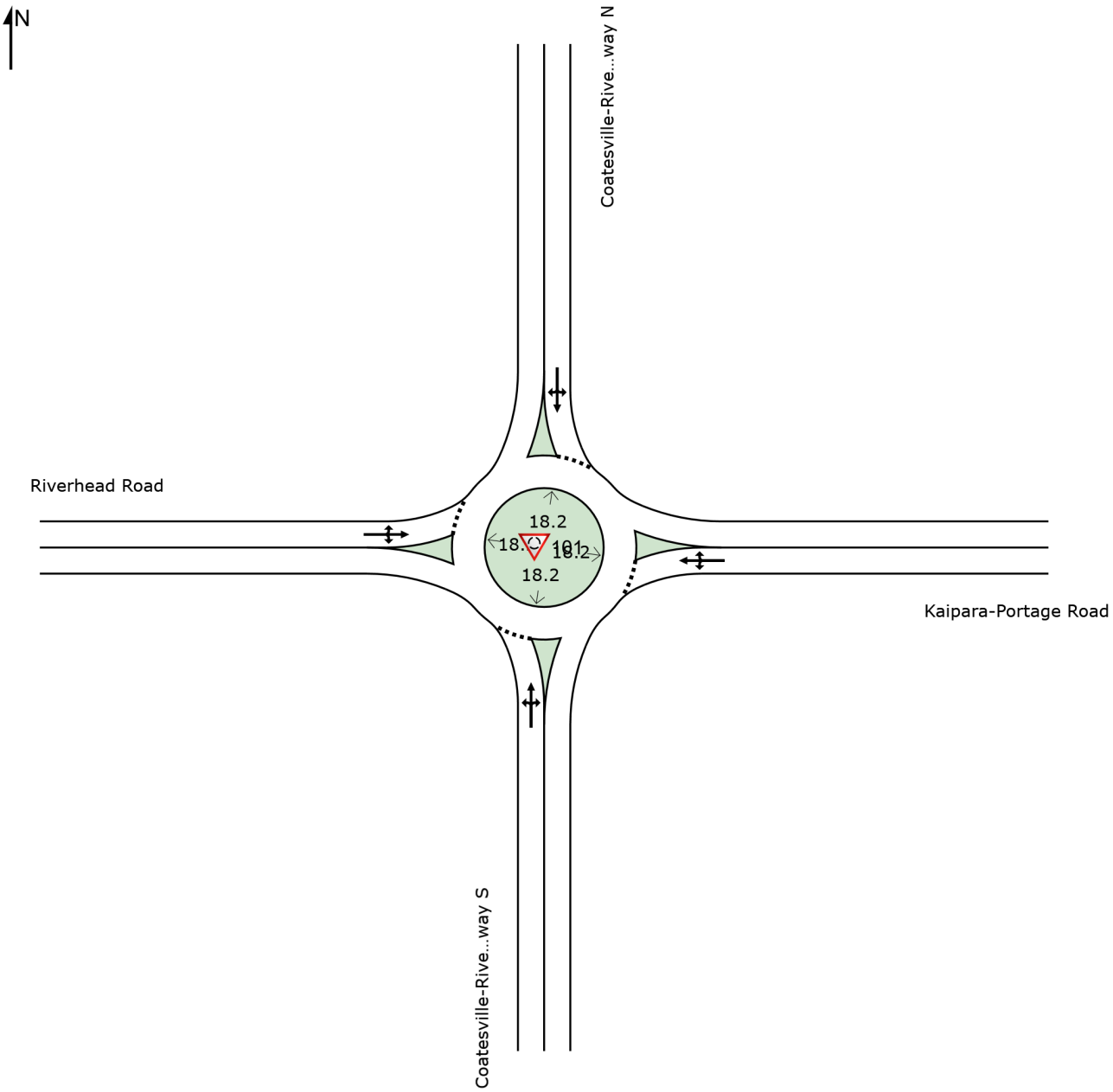
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Coatesville-Riverhead Highway/Riverhead Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	60	6.0	63	6.0	0.276	4.8	LOS A	1.7	12.5	0.53	0.59	0.53	45.8
2	T1	140	6.0	147	6.0	0.276	4.7	LOS A	1.7	12.5	0.53	0.59	0.53	46.8
3	R2	70	6.0	74	6.0	0.276	9.1	LOS A	1.7	12.5	0.53	0.59	0.53	46.9
Approach		270	6.0	284	6.0	0.276	5.9	LOS A	1.7	12.5	0.53	0.59	0.53	46.6
East: Kaipara-Portage Road														
4	L2	120	6.0	126	6.0	0.231	7.5	LOS A	1.5	10.8	0.75	0.77	0.75	45.2
5	T1	33	6.0	35	6.0	0.231	7.5	LOS A	1.5	10.8	0.75	0.77	0.75	46.2
6	R2	6	6.0	6	6.0	0.231	11.8	LOS B	1.5	10.8	0.75	0.77	0.75	46.3
Approach		159	6.0	167	6.0	0.231	7.7	LOS A	1.5	10.8	0.75	0.77	0.75	45.4
North: Coatesville-Riverhead Highway N														
7	L2	4	6.0	4	6.0	0.504	4.3	LOS A	3.9	29.0	0.51	0.56	0.51	45.6
8	T1	350	6.0	368	6.0	0.504	4.3	LOS A	3.9	29.0	0.51	0.56	0.51	46.6
9	R2	231	6.0	243	6.0	0.504	8.6	LOS A	3.9	29.0	0.51	0.56	0.51	46.7
Approach		585	6.0	616	6.0	0.504	6.0	LOS A	3.9	29.0	0.51	0.56	0.51	46.6
West: Riverhead Road														
10	L2	313	6.0	329	6.0	0.383	4.5	LOS A	2.7	19.6	0.53	0.58	0.53	46.3
11	T1	35	6.0	37	6.0	0.383	4.5	LOS A	2.7	19.6	0.53	0.58	0.53	47.3
12	R2	54	6.0	57	6.0	0.383	8.8	LOS A	2.7	19.6	0.53	0.58	0.53	47.4
Approach		402	6.0	423	6.0	0.383	5.1	LOS A	2.7	19.6	0.53	0.58	0.53	46.5
All Vehicles		1416	6.0	1491	6.0	0.504	5.9	LOS A	3.9	29.0	0.55	0.59	0.55	46.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Road (Site Folder: Base_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	51	6.0	54	6.0	0.317	5.3	LOS A	2.0	15.0	0.61	0.63	0.61	45.7
2	T1	190	6.0	200	6.0	0.317	5.3	LOS A	2.0	15.0	0.61	0.63	0.61	46.7
3	R2	50	6.0	53	6.0	0.317	9.6	LOS A	2.0	15.0	0.61	0.63	0.61	46.8
Approach		291	6.0	306	6.0	0.317	6.0	LOS A	2.0	15.0	0.61	0.63	0.61	46.5
East: Kaipara-Portage Road														
4	L2	95	6.0	100	6.0	0.191	7.0	LOS A	1.2	8.8	0.73	0.73	0.73	45.4
5	T1	35	6.0	37	6.0	0.191	7.0	LOS A	1.2	8.8	0.73	0.73	0.73	46.4
6	R2	5	6.0	5	6.0	0.191	11.3	LOS B	1.2	8.8	0.73	0.73	0.73	46.5
Approach		135	6.0	142	6.0	0.191	7.2	LOS A	1.2	8.8	0.73	0.73	0.73	45.7
North: Coatesville-Riverhead Highway N														
7	L2	10	6.0	11	6.0	0.504	4.6	LOS A	4.0	29.2	0.56	0.60	0.56	45.2
8	T1	250	6.0	263	6.0	0.504	4.5	LOS A	4.0	29.2	0.56	0.60	0.56	46.2
9	R2	296	6.0	312	6.0	0.504	8.9	LOS A	4.0	29.2	0.56	0.60	0.56	46.3
Approach		556	6.0	585	6.0	0.504	6.8	LOS A	4.0	29.2	0.56	0.60	0.56	46.2
West: Riverhead Road														
10	L2	249	6.0	262	6.0	0.389	4.8	LOS A	2.7	20.1	0.57	0.60	0.57	46.1
11	T1	89	6.0	94	6.0	0.389	4.7	LOS A	2.7	20.1	0.57	0.60	0.57	47.1
12	R2	54	6.0	57	6.0	0.389	9.1	LOS A	2.7	20.1	0.57	0.60	0.57	47.2
Approach		392	6.0	413	6.0	0.389	5.4	LOS A	2.7	20.1	0.57	0.60	0.57	46.5
All Vehicles		1374	6.0	1446	6.0	0.504	6.3	LOS A	4.0	29.2	0.59	0.62	0.59	46.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Road (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	159	6.0	159	6.0	0.678	9.8	LOS A	7.8	57.2	0.92	0.99	1.14	43.1
2	T1	140	6.0	140	6.0	0.678	9.8	LOS A	7.8	57.2	0.92	0.99	1.14	43.9
3	R2	273	6.0	273	6.0	0.678	14.1	LOS B	7.8	57.2	0.92	0.99	1.14	44.0
Approach		572	6.0	572	6.0	0.678	11.9	LOS B	7.8	57.2	0.92	0.99	1.14	43.7
East: Kaipara-Portage Road														
4	L2	340	6.0	340	6.0	0.888	47.8	LOS D	16.6	122.5	1.00	1.69	2.56	30.1
5	T1	36	6.0	36	6.0	0.888	47.7	LOS D	16.6	122.5	1.00	1.69	2.56	30.6
6	R2	35	6.0	35	6.0	0.888	52.1	LOS E	16.6	122.5	1.00	1.69	2.56	30.6
Approach		411	6.0	411	6.0	0.888	48.1	LOS D	16.6	122.5	1.00	1.69	2.56	30.2
North: Coatesville-Riverhead Highway N														
7	L2	29	6.0	29	6.0	0.899	23.8	LOS C	20.8	153.4	1.00	1.51	2.10	37.1
8	T1	350	6.0	350	6.0	0.899	23.8	LOS C	20.8	153.4	1.00	1.51	2.10	37.7
9	R2	383	6.0	383	6.0	0.899	28.1	LOS C	20.8	153.4	1.00	1.51	2.10	37.8
Approach		762	6.0	762	6.0	0.899	25.9	LOS C	20.8	153.4	1.00	1.51	2.10	37.7
West: Riverhead Road														
10	L2	464	6.0	464	6.0	0.815	14.2	LOS B	13.3	97.6	1.00	1.17	1.49	41.3
11	T1	43	6.0	43	6.0	0.815	14.2	LOS B	13.3	97.6	1.00	1.17	1.49	42.1
12	R2	192	6.0	192	6.0	0.815	18.5	LOS B	13.3	97.6	1.00	1.17	1.49	42.2
Approach		699	6.0	699	6.0	0.815	15.4	LOS B	13.3	97.6	1.00	1.17	1.49	41.6
All Vehicles		2444	6.0	2444	6.0	0.899	23.4	LOS C	20.8	153.4	0.98	1.32	1.78	38.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Road (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	178	6.0	187	6.0	0.693	10.8	LOS B	8.2	60.0	0.94	1.04	1.22	42.9
2	T1	190	6.0	200	6.0	0.693	10.8	LOS B	8.2	60.0	0.94	1.04	1.22	43.8
3	R2	164	6.0	173	6.0	0.693	15.1	LOS B	8.2	60.0	0.94	1.04	1.22	43.8
Approach		532	6.0	560	6.0	0.693	12.1	LOS B	8.2	60.0	0.94	1.04	1.22	43.5
East: Kaipara-Portage Road														
4	L2	224	6.0	236	6.0	0.603	15.8	LOS B	6.0	44.0	1.00	1.15	1.33	40.9
5	T1	42	6.0	44	6.0	0.603	15.8	LOS B	6.0	44.0	1.00	1.15	1.33	41.7
6	R2	30	6.0	32	6.0	0.603	20.1	LOS C	6.0	44.0	1.00	1.15	1.33	41.7
Approach		296	6.0	312	6.0	0.603	16.3	LOS B	6.0	44.0	1.00	1.15	1.33	41.1
North: Coatesville-Riverhead Highway N														
7	L2	38	6.0	40	6.0	0.803	13.5	LOS B	12.5	92.3	0.99	1.14	1.45	41.1
8	T1	250	6.0	263	6.0	0.803	13.5	LOS B	12.5	92.3	0.99	1.14	1.45	41.9
9	R2	396	6.0	417	6.0	0.803	17.8	LOS B	12.5	92.3	0.99	1.14	1.45	42.0
Approach		684	6.0	720	6.0	0.803	16.0	LOS B	12.5	92.3	0.99	1.14	1.45	41.9
West: Riverhead Road														
10	L2	333	6.0	351	6.0	0.695	9.3	LOS A	8.3	61.2	0.91	0.95	1.12	43.7
11	T1	93	6.0	98	6.0	0.695	9.3	LOS A	8.3	61.2	0.91	0.95	1.12	44.6
12	R2	165	6.0	174	6.0	0.695	13.6	LOS B	8.3	61.2	0.91	0.95	1.12	44.7
Approach		591	6.0	622	6.0	0.695	10.5	LOS B	8.3	61.2	0.91	0.95	1.12	44.1
All Vehicles		2103	6.0	2214	6.0	0.803	13.5	LOS B	12.5	92.3	0.96	1.06	1.28	42.8

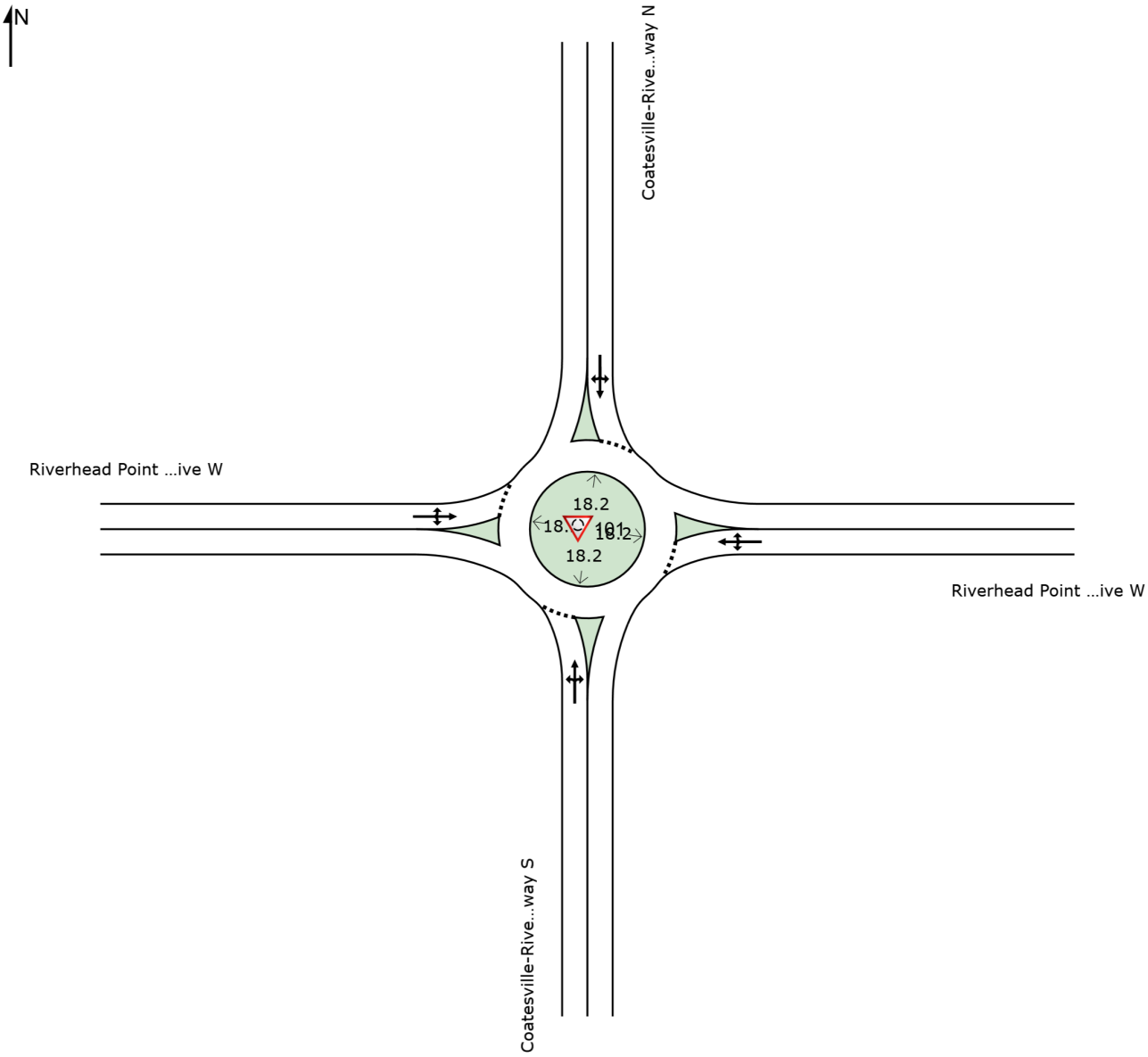
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Coatesville-Riverhead Highway/Riverhead Point Drive/Site collector road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Point Drive/Site collector road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	1	6.0	1	6.0	0.197	3.3	LOS A	1.2	9.1	0.25	0.40	0.25	46.8
2	T1	210	6.0	221	6.0	0.197	3.3	LOS A	1.2	9.1	0.25	0.40	0.25	47.8
3	R2	40	6.0	42	6.0	0.197	7.6	LOS A	1.2	9.1	0.25	0.40	0.25	47.9
Approach		251	6.0	264	6.0	0.197	4.0	LOS A	1.2	9.1	0.25	0.40	0.25	47.8
East: Riverhead Point Drive W														
4	L2	100	6.0	105	6.0	0.191	6.0	LOS A	1.1	8.0	0.62	0.70	0.62	45.2
5	T1	1	6.0	1	6.0	0.191	6.0	LOS A	1.1	8.0	0.62	0.70	0.62	46.2
6	R2	60	6.0	63	6.0	0.191	10.3	LOS B	1.1	8.0	0.62	0.70	0.62	46.3
Approach		161	6.0	169	6.0	0.191	7.6	LOS A	1.1	8.0	0.62	0.70	0.62	45.6
North: Coatesville-Riverhead Highway N														
7	L2	48	6.0	51	6.0	0.377	3.2	LOS A	2.6	19.5	0.21	0.35	0.21	47.2
8	T1	476	6.0	501	6.0	0.377	3.2	LOS A	2.6	19.5	0.21	0.35	0.21	48.3
9	R2	1	6.0	1	6.0	0.377	7.6	LOS A	2.6	19.5	0.21	0.35	0.21	48.4
Approach		525	6.0	553	6.0	0.377	3.2	LOS A	2.6	19.5	0.21	0.35	0.21	48.2
West: Riverhead Point Drive W														
10	L2	1	6.0	1	6.0	0.003	4.5	LOS A	0.0	0.1	0.45	0.48	0.45	45.9
11	T1	1	6.0	1	6.0	0.003	4.4	LOS A	0.0	0.1	0.45	0.48	0.45	47.0
12	R2	1	6.0	1	6.0	0.003	8.8	LOS A	0.0	0.1	0.45	0.48	0.45	47.0
Approach		3	6.0	3	6.0	0.003	5.9	LOS A	0.0	0.1	0.45	0.48	0.45	46.6
All Vehicles		940	6.0	989	6.0	0.377	4.2	LOS A	2.6	19.5	0.29	0.42	0.29	47.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Point Drive/Site collector road (Site Folder: Base_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	1	6.0	1	6.0	0.261	3.4	LOS A	1.7	12.5	0.28	0.46	0.28	46.3
2	T1	221	6.0	233	6.0	0.261	3.4	LOS A	1.7	12.5	0.28	0.46	0.28	47.4
3	R2	111	6.0	117	6.0	0.261	7.7	LOS A	1.7	12.5	0.28	0.46	0.28	47.4
Approach		333	6.0	351	6.0	0.261	4.8	LOS A	1.7	12.5	0.28	0.46	0.28	47.4
East: Riverhead Point Drive W														
4	L2	72	6.0	76	6.0	0.151	4.9	LOS A	0.8	6.2	0.52	0.63	0.52	45.5
5	T1	1	6.0	1	6.0	0.151	4.9	LOS A	0.8	6.2	0.52	0.63	0.52	46.5
6	R2	70	6.0	74	6.0	0.151	9.2	LOS A	0.8	6.2	0.52	0.63	0.52	46.6
Approach		143	6.0	151	6.0	0.151	7.0	LOS A	0.8	6.2	0.52	0.63	0.52	46.1
North: Coatesville-Riverhead Highway N														
7	L2	76	6.0	80	6.0	0.330	3.7	LOS A	2.1	15.7	0.35	0.42	0.35	46.8
8	T1	323	6.0	340	6.0	0.330	3.7	LOS A	2.1	15.7	0.35	0.42	0.35	47.8
9	R2	1	6.0	1	6.0	0.330	8.0	LOS A	2.1	15.7	0.35	0.42	0.35	47.9
Approach		400	6.0	421	6.0	0.330	3.7	LOS A	2.1	15.7	0.35	0.42	0.35	47.6
West: Riverhead Point Drive W														
10	L2	1	6.0	1	6.0	0.003	5.0	LOS A	0.0	0.1	0.51	0.50	0.51	45.7
11	T1	1	6.0	1	6.0	0.003	5.0	LOS A	0.0	0.1	0.51	0.50	0.51	46.7
12	R2	1	6.0	1	6.0	0.003	9.3	LOS A	0.0	0.1	0.51	0.50	0.51	46.8
Approach		3	6.0	3	6.0	0.003	6.4	LOS A	0.0	0.1	0.51	0.50	0.51	46.4
All Vehicles		879	6.0	925	6.0	0.330	4.7	LOS A	2.1	15.7	0.35	0.47	0.35	47.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Point Drive/Site collector road (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	89	6.0	89	6.0	0.455	6.2	LOS A	3.2	23.8	0.72	0.72	0.72	45.4
2	T1	281	6.0	281	6.0	0.455	6.1	LOS A	3.2	23.8	0.72	0.72	0.72	46.4
3	R2	40	6.0	40	6.0	0.455	10.5	LOS B	3.2	23.8	0.72	0.72	0.72	46.5
Approach		410	6.0	410	6.0	0.455	6.6	LOS A	3.2	23.8	0.72	0.72	0.72	46.2
East: Riverhead Point Drive W														
4	L2	100	6.0	100	6.0	0.722	26.6	LOS C	8.5	62.2	1.00	1.27	1.62	36.3
5	T1	117	6.0	117	6.0	0.722	26.6	LOS C	8.5	62.2	1.00	1.27	1.62	36.9
6	R2	89	6.0	89	6.0	0.722	30.9	LOS C	8.5	62.2	1.00	1.27	1.62	37.0
Approach		306	6.0	306	6.0	0.722	27.8	LOS C	8.5	62.2	1.00	1.27	1.62	36.7
North: Coatesville-Riverhead Highway N														
7	L2	73	6.0	73	6.0	0.845	11.9	LOS B	15.9	117.1	1.00	1.03	1.35	42.5
8	T1	589	6.0	589	6.0	0.845	11.8	LOS B	15.9	117.1	1.00	1.03	1.35	43.4
9	R2	220	6.0	220	6.0	0.845	16.2	LOS B	15.9	117.1	1.00	1.03	1.35	43.5
Approach		882	6.0	882	6.0	0.845	12.9	LOS B	15.9	117.1	1.00	1.03	1.35	43.3
West: Riverhead Point Drive W														
10	L2	203	6.0	203	6.0	0.513	6.6	LOS A	4.1	30.2	0.75	0.79	0.79	44.9
11	T1	106	6.0	106	6.0	0.513	6.6	LOS A	4.1	30.2	0.75	0.79	0.79	45.9
12	R2	158	6.0	158	6.0	0.513	10.9	LOS B	4.1	30.2	0.75	0.79	0.79	46.0
Approach		467	6.0	467	6.0	0.513	8.1	LOS A	4.1	30.2	0.75	0.79	0.79	45.5
All Vehicles		2065	6.0	2065	6.0	0.845	12.8	LOS B	15.9	117.1	0.89	0.95	1.14	43.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Riverhead Point Drive/Site collector road (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville-Riverhead Highway S														
1	L2	124	6.0	131	6.0	0.567	5.8	LOS A	4.8	35.4	0.70	0.70	0.73	45.4
2	T1	323	6.0	340	6.0	0.567	5.8	LOS A	4.8	35.4	0.70	0.70	0.73	46.4
3	R2	111	6.0	117	6.0	0.567	10.1	LOS B	4.8	35.4	0.70	0.70	0.73	46.4
Approach		558	6.0	587	6.0	0.567	6.7	LOS A	4.8	35.4	0.70	0.70	0.73	46.1
East: Riverhead Point Drive W														
4	L2	72	6.0	76	6.0	0.346	7.6	LOS A	2.4	17.5	0.81	0.83	0.81	44.3
5	T1	67	6.0	71	6.0	0.346	7.6	LOS A	2.4	17.5	0.81	0.83	0.81	45.3
6	R2	95	6.0	100	6.0	0.346	11.9	LOS B	2.4	17.5	0.81	0.83	0.81	45.3
Approach		234	6.0	246	6.0	0.346	9.4	LOS A	2.4	17.5	0.81	0.83	0.81	45.0
North: Coatesville-Riverhead Highway N														
7	L2	104	6.0	109	6.0	0.616	5.8	LOS A	5.7	42.1	0.71	0.68	0.74	45.3
8	T1	405	6.0	426	6.0	0.616	5.7	LOS A	5.7	42.1	0.71	0.68	0.74	46.3
9	R2	129	6.0	136	6.0	0.616	10.1	LOS B	5.7	42.1	0.71	0.68	0.74	46.4
Approach		638	6.0	672	6.0	0.616	6.6	LOS A	5.7	42.1	0.71	0.68	0.74	46.2
West: Riverhead Point Drive W														
10	L2	114	6.0	120	6.0	0.341	6.8	LOS A	2.3	16.8	0.75	0.78	0.75	44.9
11	T1	60	6.0	63	6.0	0.341	6.8	LOS A	2.3	16.8	0.75	0.78	0.75	45.8
12	R2	82	6.0	86	6.0	0.341	11.1	LOS B	2.3	16.8	0.75	0.78	0.75	45.9
Approach		256	6.0	269	6.0	0.341	8.2	LOS A	2.3	16.8	0.75	0.78	0.75	45.4
All Vehicles		1686	6.0	1775	6.0	0.616	7.3	LOS A	5.7	42.1	0.73	0.72	0.75	45.9

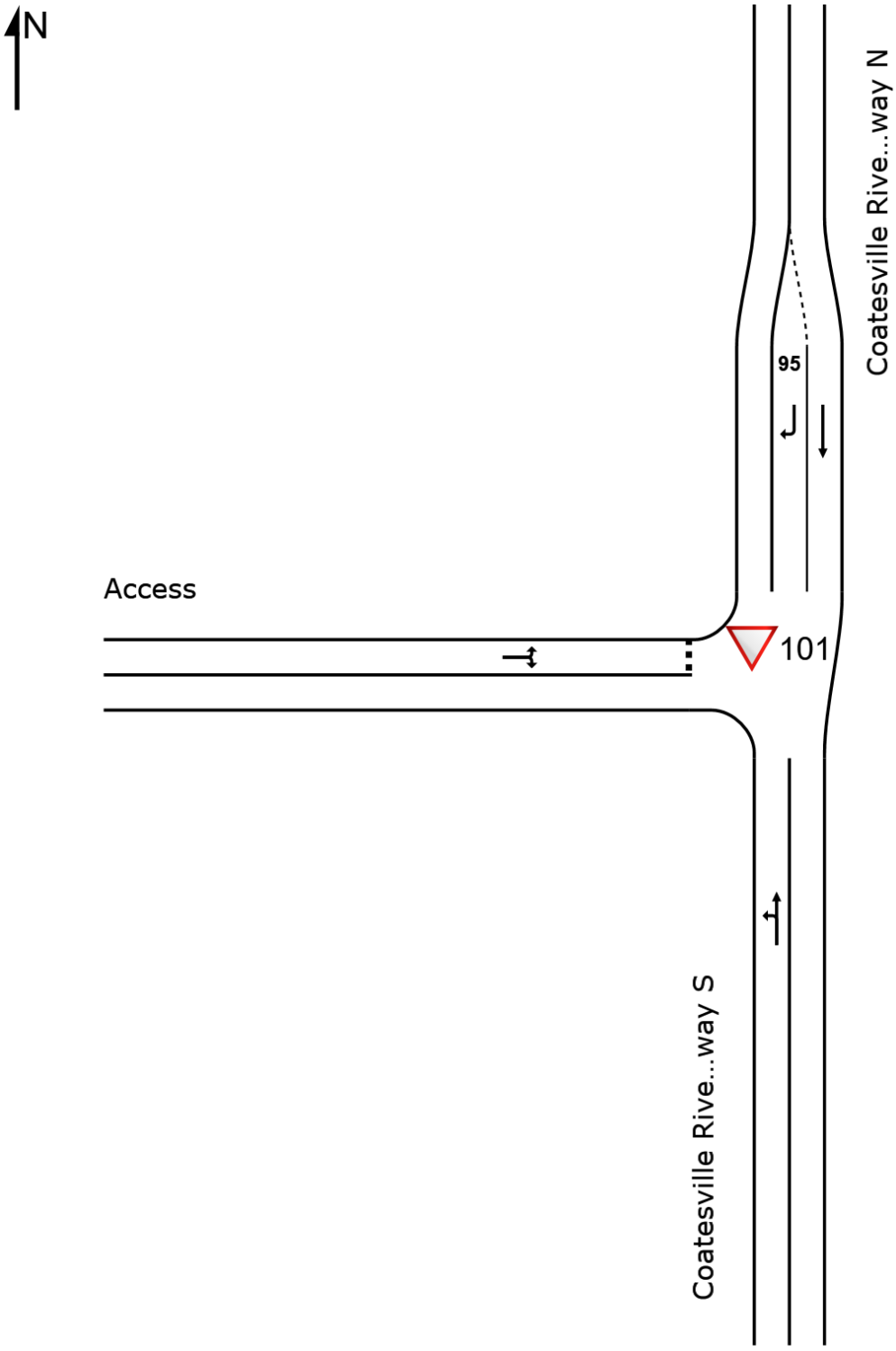
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Coatesville-Riverhead Highway/Site access (priority) (Site Folder: Base_AM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Site access (priority) (Site Folder: Base_AM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville Riverhead Highway S														
1	L2	1	6.0	1	6.0	0.141	4.7	LOS A	0.0	0.0	0.00	0.00	0.00	49.3
2	T1	250	6.0	263	6.0	0.141	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		251	6.0	264	6.0	0.141	0.1	NA	0.0	0.0	0.00	0.00	0.00	49.9
North: Coatesville Riverhead Highway N														
8	T1	576	6.0	606	6.0	0.323	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
9	R2	1	6.0	1	6.0	0.001	5.4	LOS A	0.0	0.0	0.36	0.50	0.36	45.3
Approach		577	6.0	607	6.0	0.323	0.1	NA	0.0	0.0	0.00	0.00	0.00	49.8
West: Access														
10	L2	1	6.0	1	6.0	0.004	5.5	LOS A	0.0	0.1	0.51	0.59	0.51	43.7
12	R2	1	6.0	1	6.0	0.004	14.0	LOS B	0.0	0.1	0.51	0.59	0.51	43.3
Approach		2	6.0	2	6.0	0.004	9.7	LOS A	0.0	0.1	0.51	0.59	0.51	43.5
All Vehicles		830	6.0	874	6.0	0.323	0.1	NA	0.0	0.1	0.00	0.00	0.00	49.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Site access (priority) (Site Folder: Base_PM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville Riverhead Highway S														
1	L2	1	6.0	1	6.0	0.187	4.7	LOS A	0.0	0.0	0.00	0.00	0.00	49.3
2	T1	332	6.0	349	6.0	0.187	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		333	6.0	351	6.0	0.187	0.1	NA	0.0	0.0	0.00	0.00	0.00	49.9
North: Coatesville Riverhead Highway N														
8	T1	395	6.0	416	6.0	0.222	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
9	R2	1	6.0	1	6.0	0.001	5.8	LOS A	0.0	0.0	0.42	0.51	0.42	45.2
Approach		396	6.0	417	6.0	0.222	0.1	NA	0.0	0.0	0.00	0.00	0.00	49.9
West: Access														
10	L2	1	6.0	1	6.0	0.004	5.8	LOS A	0.0	0.1	0.52	0.59	0.52	44.3
12	R2	1	6.0	1	6.0	0.004	11.5	LOS B	0.0	0.1	0.52	0.59	0.52	43.9
Approach		2	6.0	2	6.0	0.004	8.7	LOS A	0.0	0.1	0.52	0.59	0.52	44.1
All Vehicles		731	6.0	769	6.0	0.222	0.1	NA	0.0	0.1	0.00	0.00	0.00	49.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Site access (priority) (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville Riverhead Highway S														
1	L2	161	6.0	161	6.0	0.224	4.7	LOS A	0.0	0.0	0.00	0.21	0.00	48.2
2	T1	250	6.0	250	6.0	0.224	0.1	LOS A	0.0	0.0	0.00	0.21	0.00	48.7
Approach		411	6.0	411	6.0	0.224	1.9	NA	0.0	0.0	0.00	0.21	0.00	48.5
North: Coatesville Riverhead Highway N														
8	T1	847	6.0	847	6.0	0.451	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
9	R2	5	6.0	5	6.0	0.004	6.1	LOS A	0.0	0.1	0.45	0.56	0.45	45.2
Approach		852	6.0	852	6.0	0.451	0.2	NA	0.0	0.1	0.00	0.00	0.00	49.7
West: Access														
10	L2	5	6.0	5	6.0	0.751	28.0	LOS D	3.8	28.1	0.94	1.25	1.90	29.2
12	R2	122	6.0	122	6.0	0.751	52.2	LOS F	3.8	28.1	0.94	1.25	1.90	29.0
Approach		127	6.0	127	6.0	0.751	51.2	LOS F	3.8	28.1	0.94	1.25	1.90	29.0
All Vehicles		1390	6.0	1390	6.0	0.751	5.4	NA	3.8	28.1	0.09	0.18	0.17	46.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Coatesville-Riverhead Highway/Site access (priority) (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Coatesville Riverhead Highway S														
1	L2	225	6.0	237	6.0	0.319	4.7	LOS A	0.0	0.0	0.00	0.22	0.00	48.1
2	T1	332	6.0	349	6.0	0.319	0.1	LOS A	0.0	0.0	0.00	0.22	0.00	48.6
Approach		557	6.0	586	6.0	0.319	2.0	NA	0.0	0.0	0.00	0.22	0.00	48.4
North: Coatesville Riverhead Highway N														
8	T1	560	6.0	589	6.0	0.314	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.8
9	R2	5	6.0	5	6.0	0.006	7.2	LOS A	0.0	0.2	0.54	0.62	0.54	44.6
Approach		565	6.0	595	6.0	0.314	0.2	NA	0.0	0.2	0.00	0.01	0.00	49.8
West: Access														
10	L2	5	6.0	5	6.0	0.278	7.5	LOS A	1.0	7.5	0.82	0.95	0.94	38.6
12	R2	61	6.0	64	6.0	0.278	21.8	LOS C	1.0	7.5	0.82	0.95	0.94	38.3
Approach		66	6.0	69	6.0	0.278	20.7	LOS C	1.0	7.5	0.82	0.95	0.94	38.3
All Vehicles		1188	6.0	1251	6.0	0.319	2.2	NA	1.0	7.5	0.05	0.16	0.05	48.3

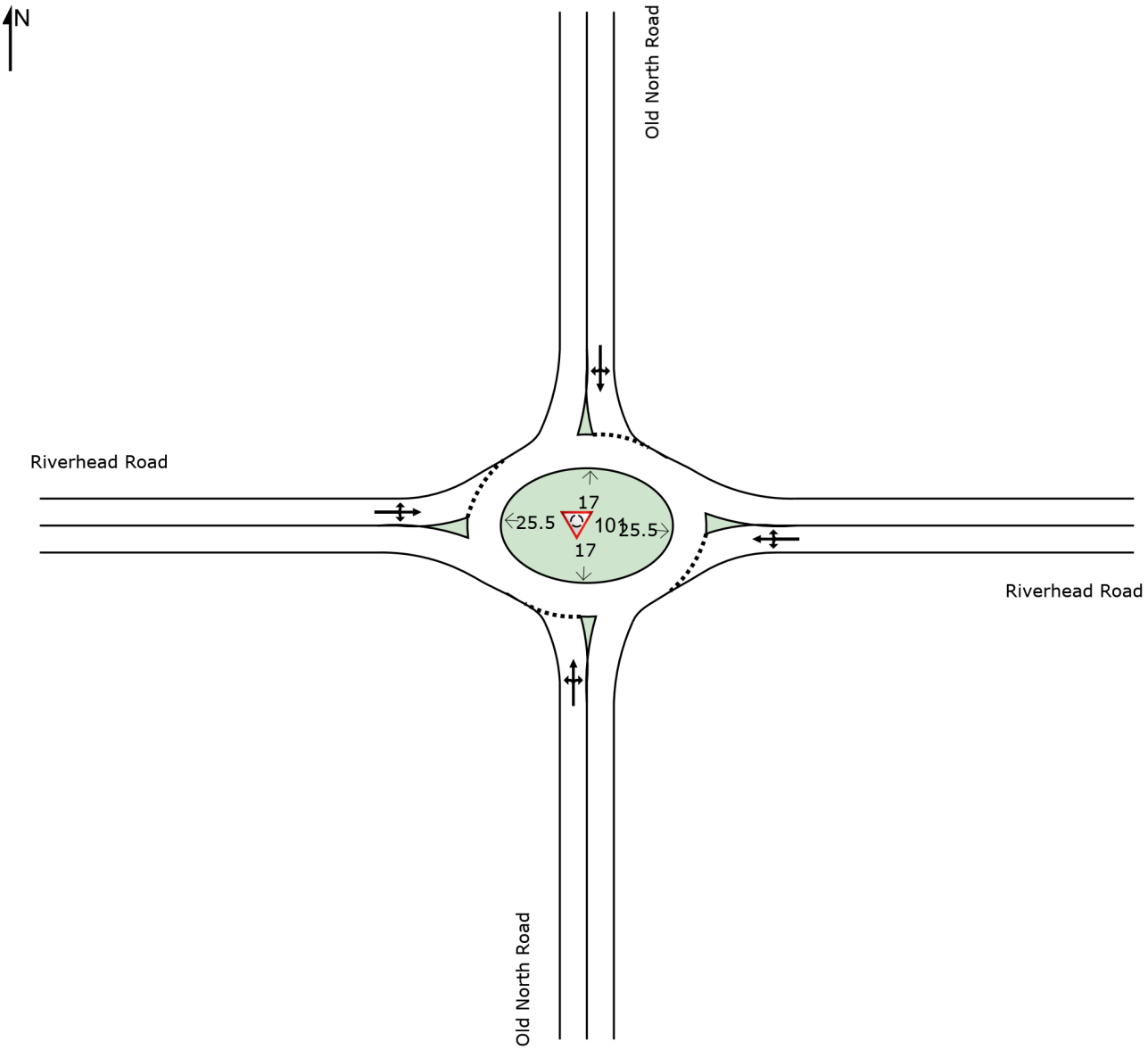
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and 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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Riverhead Road/Old North Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Old North Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	41	6.0	43	6.0	0.398	4.1	LOS A	3.0	22.2	0.48	0.50	0.48	45.9
2	T1	293	6.0	308	6.0	0.398	3.7	LOS A	3.0	22.2	0.48	0.50	0.48	47.2
3	R2	112	6.0	118	6.0	0.398	8.4	LOS A	3.0	22.2	0.48	0.50	0.48	47.2
Approach		446	6.0	469	6.0	0.398	4.9	LOS A	3.0	22.2	0.48	0.50	0.48	47.1
East: Riverhead Road														
4	L2	100	6.0	105	6.0	0.329	6.6	LOS A	2.3	17.1	0.80	0.78	0.80	45.7
5	T1	130	6.0	137	6.0	0.329	6.8	LOS A	2.3	17.1	0.80	0.78	0.80	46.6
6	R2	3	6.0	3	6.0	0.329	11.5	LOS B	2.3	17.1	0.80	0.78	0.80	47.0
Approach		233	6.0	245	6.0	0.329	6.8	LOS A	2.3	17.1	0.80	0.78	0.80	46.2
North: Old North Road														
7	L2	3	6.0	3	6.0	0.629	8.0	LOS A	6.3	46.2	0.80	0.82	0.93	45.1
8	T1	544	6.0	573	6.0	0.629	7.6	LOS A	6.3	46.2	0.80	0.82	0.93	46.3
9	R2	13	6.0	14	6.0	0.629	12.3	LOS B	6.3	46.2	0.80	0.82	0.93	46.3
Approach		560	6.0	589	6.0	0.629	7.7	LOS A	6.3	46.2	0.80	0.82	0.93	46.3
West: Riverhead Road														
10	L2	7	6.0	7	6.0	0.287	5.2	LOS A	1.8	13.4	0.64	0.63	0.64	46.0
11	T1	221	6.0	233	6.0	0.287	5.3	LOS A	1.8	13.4	0.64	0.63	0.64	46.8
12	R2	29	6.0	31	6.0	0.287	10.0	LOS B	1.8	13.4	0.64	0.63	0.64	47.2
Approach		257	6.0	271	6.0	0.287	5.8	LOS A	1.8	13.4	0.64	0.63	0.64	46.9
All Vehicles		1496	6.0	1575	6.0	0.629	6.4	LOS A	6.3	46.2	0.68	0.69	0.73	46.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Old North Road (Site Folder: Base_PM)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	35	6.0	37	6.0	0.544	3.9	LOS A	5.1	37.5	0.44	0.44	0.44	46.2
2	T1	559	6.0	588	6.0	0.544	3.5	LOS A	5.1	37.5	0.44	0.44	0.44	47.5
3	R2	92	6.0	97	6.0	0.544	8.1	LOS A	5.1	37.5	0.44	0.44	0.44	47.6
Approach		686	6.0	722	6.0	0.544	4.1	LOS A	5.1	37.5	0.44	0.44	0.44	47.5
East: Riverhead Road														
4	L2	103	6.0	108	6.0	0.219	5.4	LOS A	1.4	10.2	0.67	0.66	0.67	46.4
5	T1	74	6.0	78	6.0	0.219	5.5	LOS A	1.4	10.2	0.67	0.66	0.67	47.3
6	R2	5	6.0	5	6.0	0.219	10.2	LOS B	1.4	10.2	0.67	0.66	0.67	47.6
Approach		182	6.0	192	6.0	0.219	5.6	LOS A	1.4	10.2	0.67	0.66	0.67	46.8
North: Old North Road														
7	L2	4	6.0	4	6.0	0.484	6.1	LOS A	3.6	26.7	0.72	0.68	0.73	45.5
8	T1	404	6.0	425	6.0	0.484	5.8	LOS A	3.6	26.7	0.72	0.68	0.73	46.7
9	R2	11	6.0	12	6.0	0.484	10.4	LOS B	3.6	26.7	0.72	0.68	0.73	46.7
Approach		419	6.0	441	6.0	0.484	5.9	LOS A	3.6	26.7	0.72	0.68	0.73	46.7
West: Riverhead Road														
10	L2	18	6.0	19	6.0	0.405	7.8	LOS A	2.9	21.2	0.83	0.84	0.84	44.9
11	T1	221	6.0	233	6.0	0.405	7.9	LOS A	2.9	21.2	0.83	0.84	0.84	45.8
12	R2	48	6.0	51	6.0	0.405	12.6	LOS B	2.9	21.2	0.83	0.84	0.84	46.1
Approach		287	6.0	302	6.0	0.405	8.7	LOS A	2.9	21.2	0.83	0.84	0.84	45.8
All Vehicles		1574	6.0	1657	6.0	0.544	5.6	LOS A	5.1	37.5	0.61	0.60	0.62	46.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Old North Road (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	41	6.0	43	6.0	0.507	4.7	LOS A	4.3	31.7	0.63	0.58	0.63	45.3
2	T1	293	6.0	308	6.0	0.507	4.3	LOS A	4.3	31.7	0.63	0.58	0.63	46.6
3	R2	194	6.0	204	6.0	0.507	9.0	LOS A	4.3	31.7	0.63	0.58	0.63	46.6
Approach		528	6.0	556	6.0	0.507	6.1	LOS A	4.3	31.7	0.63	0.58	0.63	46.5
East: Riverhead Road														
4	L2	229	6.0	241	6.0	0.603	10.0	LOS B	6.1	45.0	0.94	1.02	1.16	44.1
5	T1	185	6.0	195	6.0	0.603	10.1	LOS B	6.1	45.0	0.94	1.02	1.16	44.9
6	R2	3	6.0	3	6.0	0.603	14.8	LOS B	6.1	45.0	0.94	1.02	1.16	45.2
Approach		417	6.0	439	6.0	0.603	10.1	LOS B	6.1	45.0	0.94	1.02	1.16	44.5
North: Old North Road														
7	L2	3	6.0	3	6.0	0.712	11.9	LOS B	8.5	62.9	0.92	1.05	1.25	43.0
8	T1	544	6.0	573	6.0	0.712	11.5	LOS B	8.5	62.9	0.92	1.05	1.25	44.2
9	R2	13	6.0	14	6.0	0.712	16.2	LOS B	8.5	62.9	0.92	1.05	1.25	44.2
Approach		560	6.0	589	6.0	0.712	11.7	LOS B	8.5	62.9	0.92	1.05	1.25	44.2
West: Riverhead Road														
10	L2	7	6.0	7	6.0	0.360	6.0	LOS A	2.5	18.3	0.74	0.72	0.74	45.6
11	T1	256	6.0	269	6.0	0.360	6.1	LOS A	2.5	18.3	0.74	0.72	0.74	46.5
12	R2	29	6.0	31	6.0	0.360	10.8	LOS B	2.5	18.3	0.74	0.72	0.74	46.8
Approach		292	6.0	307	6.0	0.360	6.5	LOS A	2.5	18.3	0.74	0.72	0.74	46.5
All Vehicles		1797	6.0	1892	6.0	0.712	8.8	LOS A	8.5	62.9	0.81	0.85	0.96	45.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Riverhead Road/Old North Road (Site Folder: Future_PM - 2038 100%)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	35	6.0	37	6.0	0.659	4.4	LOS A	7.2	53.1	0.61	0.51	0.61	45.5
2	T1	559	6.0	588	6.0	0.659	4.0	LOS A	7.2	53.1	0.61	0.51	0.61	46.8
3	R2	196	6.0	206	6.0	0.659	8.6	LOS A	7.2	53.1	0.61	0.51	0.61	46.8
Approach		790	6.0	832	6.0	0.659	5.2	LOS A	7.2	53.1	0.61	0.51	0.61	46.7
East: Riverhead Road														
4	L2	180	6.0	189	6.0	0.359	5.7	LOS A	2.5	18.6	0.74	0.71	0.74	46.2
5	T1	108	6.0	114	6.0	0.359	5.8	LOS A	2.5	18.6	0.74	0.71	0.74	47.1
6	R2	5	6.0	5	6.0	0.359	10.6	LOS B	2.5	18.6	0.74	0.71	0.74	47.5
Approach		293	6.0	308	6.0	0.359	5.9	LOS A	2.5	18.6	0.74	0.71	0.74	46.6
North: Old North Road														
7	L2	4	6.0	4	6.0	0.563	9.2	LOS A	5.1	37.3	0.85	0.91	1.00	44.5
8	T1	404	6.0	425	6.0	0.563	8.8	LOS A	5.1	37.3	0.85	0.91	1.00	45.6
9	R2	11	6.0	12	6.0	0.563	13.4	LOS B	5.1	37.3	0.85	0.91	1.00	45.7
Approach		419	6.0	441	6.0	0.563	8.9	LOS A	5.1	37.3	0.85	0.91	1.00	45.6
West: Riverhead Road														
10	L2	18	6.0	19	6.0	0.559	12.4	LOS B	5.3	39.0	0.96	1.08	1.21	42.6
11	T1	266	6.0	280	6.0	0.559	12.5	LOS B	5.3	39.0	0.96	1.08	1.21	43.4
12	R2	48	6.0	51	6.0	0.559	17.2	LOS B	5.3	39.0	0.96	1.08	1.21	43.7
Approach		332	6.0	349	6.0	0.559	13.2	LOS B	5.3	39.0	0.96	1.08	1.21	43.4
All Vehicles		1834	6.0	1931	6.0	0.659	7.6	LOS A	7.2	53.1	0.75	0.74	0.83	45.8

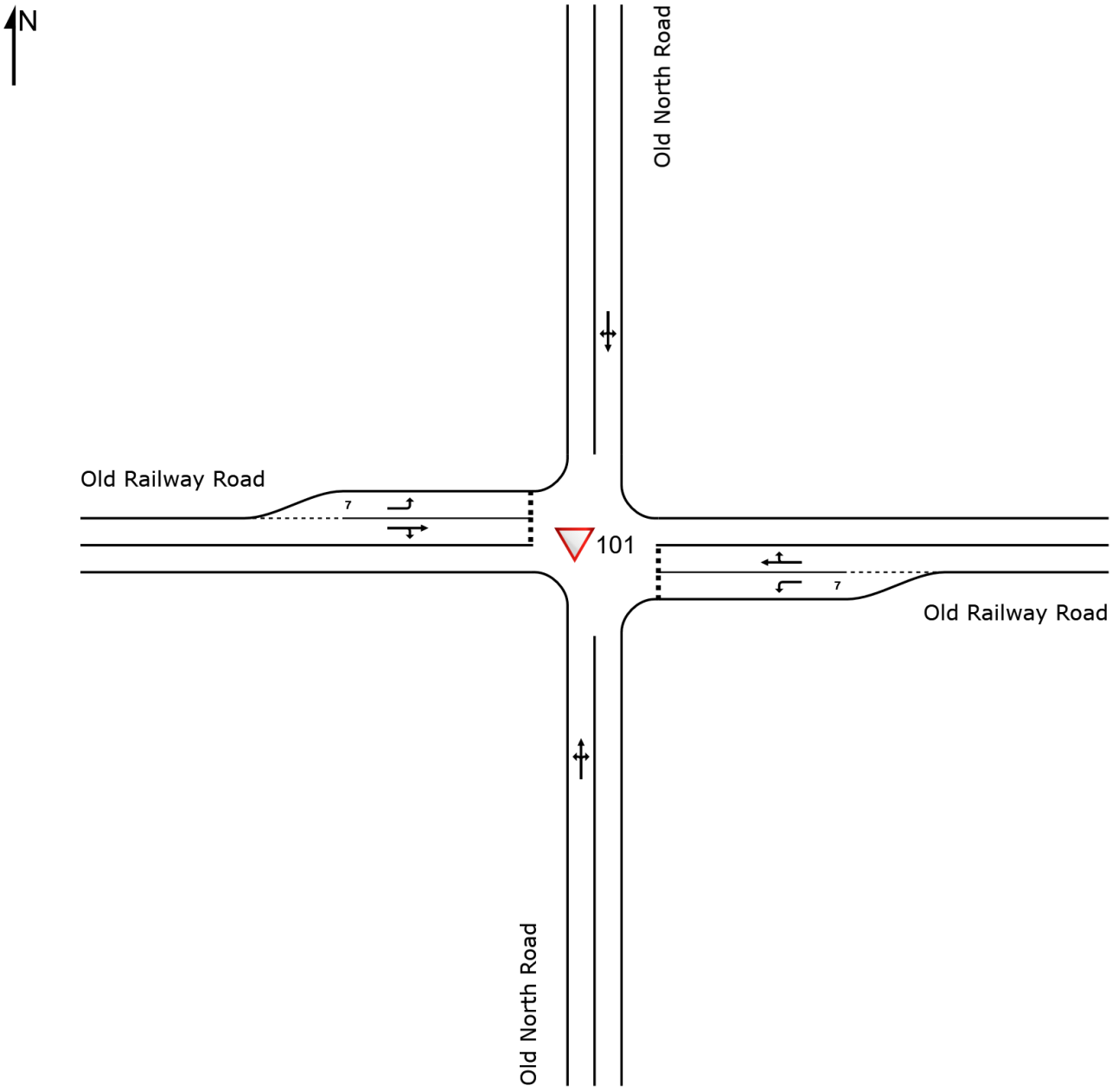
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

SITE LAYOUT

Site: 101 [Old North Road/Old Railway Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: 101 [Old North Road/Old Railway Road (Site Folder: Base_AM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	3	6.0	3	6.0	0.257	8.9	LOS A	0.1	1.0	0.03	0.01	0.03	57.2
2	T1	442	6.0	465	6.0	0.257	0.1	LOS A	0.1	1.0	0.03	0.01	0.03	69.4
3	R2	5	6.0	5	6.0	0.257	10.0	LOS A	0.1	1.0	0.03	0.01	0.03	56.9
Approach		450	6.0	474	6.0	0.257	0.3	NA	0.1	1.0	0.03	0.01	0.03	69.1
East: Old Railway Road														
4	L2	6	6.0	6	6.0	0.009	9.2	LOS A	0.0	0.2	0.57	0.69	0.57	50.7
5	T1	7	6.0	7	6.0	0.045	15.7	LOS C	0.1	1.0	0.81	0.91	0.81	40.8
6	R2	3	6.0	3	6.0	0.045	21.7	LOS C	0.1	1.0	0.81	0.91	0.81	42.8
Approach		16	6.0	17	6.0	0.045	14.4	LOS B	0.1	1.0	0.72	0.83	0.72	44.5
North: Old North Road														
7	L2	4	6.0	4	6.0	0.378	5.4	LOS A	0.0	0.2	0.00	0.00	0.00	57.5
8	T1	668	6.0	703	6.0	0.378	0.0	LOS A	0.0	0.2	0.00	0.00	0.00	69.8
9	R2	1	6.0	1	6.0	0.378	7.9	LOS A	0.0	0.2	0.00	0.00	0.00	57.2
Approach		673	6.0	708	6.0	0.378	0.1	NA	0.0	0.2	0.00	0.00	0.00	69.7
West: Old Railway Road														
10	L2	1	6.0	1	6.0	0.001	6.4	LOS A	0.0	0.0	0.46	0.53	0.46	45.5
11	T1	7	6.0	7	6.0	0.056	15.8	LOS C	0.2	1.2	0.82	0.91	0.82	39.8
12	R2	5	6.0	5	6.0	0.056	21.0	LOS C	0.2	1.2	0.82	0.91	0.82	39.4
Approach		13	6.0	14	6.0	0.056	17.1	LOS C	0.2	1.2	0.79	0.88	0.79	40.0
All Vehicles		1152	6.0	1213	6.0	0.378	0.5	NA	0.2	1.2	0.03	0.03	0.03	68.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Old North Road/Old Railway Road (Site Folder: Base_PM)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	7	6.0	7	6.0	0.398	8.2	LOS A	0.3	2.1	0.04	0.01	0.05	57.1
2	T1	680	6.0	716	6.0	0.398	0.2	LOS A	0.3	2.1	0.04	0.01	0.05	69.2
3	R2	10	6.0	11	6.0	0.398	9.4	LOS A	0.3	2.1	0.04	0.01	0.05	56.8
Approach		697	6.0	734	6.0	0.398	0.4	NA	0.3	2.1	0.04	0.01	0.05	68.8
East: Old Railway Road														
4	L2	27	6.0	28	6.0	0.034	8.2	LOS A	0.1	0.9	0.52	0.70	0.52	51.4
5	T1	10	6.0	11	6.0	0.086	19.7	LOS C	0.3	1.9	0.86	0.93	0.86	38.9
6	R2	5	6.0	5	6.0	0.086	26.9	LOS D	0.3	1.9	0.86	0.93	0.86	40.7
Approach		42	6.0	44	6.0	0.086	13.2	LOS B	0.3	1.9	0.64	0.78	0.64	46.4
North: Old North Road														
7	L2	8	6.0	8	6.0	0.312	5.7	LOS A	0.0	0.3	0.01	0.01	0.01	57.4
8	T1	546	6.0	575	6.0	0.312	0.0	LOS A	0.0	0.3	0.01	0.01	0.01	69.6
9	R2	1	6.0	1	6.0	0.312	10.7	LOS B	0.0	0.3	0.01	0.01	0.01	57.1
Approach		555	6.0	584	6.0	0.312	0.1	NA	0.0	0.3	0.01	0.01	0.01	69.4
West: Old Railway Road														
10	L2	1	6.0	1	6.0	0.002	8.2	LOS A	0.0	0.0	0.57	0.60	0.57	44.5
11	T1	12	6.0	13	6.0	0.098	19.7	LOS C	0.3	2.1	0.86	0.93	0.86	38.2
12	R2	5	6.0	5	6.0	0.098	27.1	LOS D	0.3	2.1	0.86	0.93	0.86	37.8
Approach		18	6.0	19	6.0	0.098	21.1	LOS C	0.3	2.1	0.85	0.91	0.85	38.4
All Vehicles		1312	6.0	1381	6.0	0.398	1.0	NA	0.3	2.1	0.06	0.05	0.06	67.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Old North Road/Old Railway Road (Site Folder: Future_AM - 2038 100%)]

New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	3	6.0	3	6.0	0.305	11.6	LOS B	0.2	1.5	0.04	0.01	0.04	57.2
2	T1	524	6.0	552	6.0	0.305	0.2	LOS A	0.2	1.5	0.04	0.01	0.04	69.3
3	R2	5	6.0	5	6.0	0.305	12.9	LOS B	0.2	1.5	0.04	0.01	0.04	56.9
Approach		532	6.0	560	6.0	0.305	0.4	NA	0.2	1.5	0.04	0.01	0.04	69.0
East: Old Railway Road														
4	L2	6	6.0	6	6.0	0.012	10.7	LOS B	0.0	0.3	0.66	0.76	0.66	49.7
5	T1	7	6.0	7	6.0	0.072	24.1	LOS C	0.2	1.5	0.89	0.95	0.89	37.0
6	R2	3	6.0	3	6.0	0.072	32.7	LOS D	0.2	1.5	0.89	0.95	0.89	38.6
Approach		16	6.0	17	6.0	0.072	20.7	LOS C	0.2	1.5	0.80	0.88	0.80	41.3
North: Old North Road														
7	L2	4	6.0	4	6.0	0.451	5.9	LOS A	0.0	0.3	0.00	0.00	0.01	57.5
8	T1	797	6.0	839	6.0	0.451	0.0	LOS A	0.0	0.3	0.00	0.00	0.01	69.8
9	R2	1	6.0	1	6.0	0.451	9.5	LOS A	0.0	0.3	0.00	0.00	0.01	57.2
Approach		802	6.0	844	6.0	0.451	0.1	NA	0.0	0.3	0.00	0.00	0.01	69.7
West: Old Railway Road														
10	L2	1	6.0	1	6.0	0.001	6.9	LOS A	0.0	0.0	0.50	0.55	0.50	45.2
11	T1	7	6.0	7	6.0	0.090	24.3	LOS C	0.3	1.9	0.89	0.95	0.89	36.0
12	R2	5	6.0	5	6.0	0.090	32.3	LOS D	0.3	1.9	0.89	0.95	0.89	35.7
Approach		13	6.0	14	6.0	0.090	26.0	LOS D	0.3	1.9	0.86	0.92	0.86	36.4
All Vehicles		1363	6.0	1435	6.0	0.451	0.7	NA	0.3	1.9	0.03	0.02	0.04	68.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Old North Road/Old Railway Road (Site Folder: Future_PM - 2038 100%)]

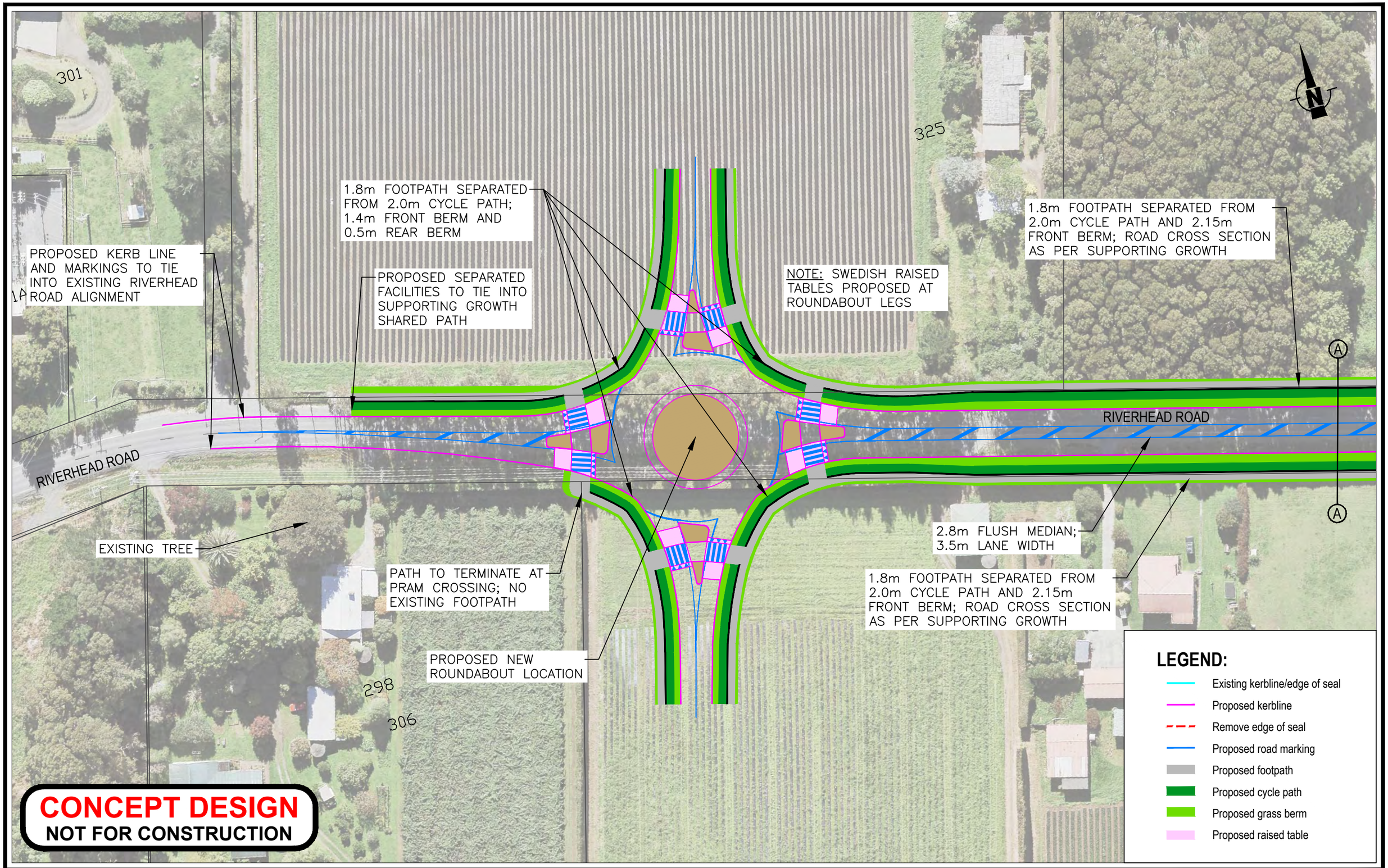
New Site
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Old North Road														
1	L2	7	6.0	7	6.0	0.457	9.7	LOS A	0.4	2.8	0.04	0.01	0.06	57.1
2	T1	784	6.0	825	6.0	0.457	0.2	LOS A	0.4	2.8	0.04	0.01	0.06	69.1
3	R2	10	6.0	11	6.0	0.457	11.3	LOS B	0.4	2.8	0.04	0.01	0.06	56.8
Approach		801	6.0	843	6.0	0.457	0.4	NA	0.4	2.8	0.04	0.01	0.06	68.8
East: Old Railway Road														
4	L2	27	6.0	28	6.0	0.038	8.9	LOS A	0.1	1.0	0.55	0.74	0.55	50.9
5	T1	10	6.0	11	6.0	0.132	29.0	LOS D	0.4	2.7	0.91	0.96	0.91	35.1
6	R2	5	6.0	5	6.0	0.132	38.9	LOS E	0.4	2.7	0.91	0.96	0.91	36.5
Approach		42	6.0	44	6.0	0.132	17.3	LOS C	0.4	2.7	0.68	0.82	0.68	44.1
North: Old North Road														
7	L2	8	6.0	8	6.0	0.356	6.4	LOS A	0.1	0.4	0.01	0.01	0.01	57.4
8	T1	623	6.0	656	6.0	0.356	0.0	LOS A	0.1	0.4	0.01	0.01	0.01	69.6
9	R2	1	6.0	1	6.0	0.356	13.4	LOS B	0.1	0.4	0.01	0.01	0.01	57.1
Approach		632	6.0	665	6.0	0.356	0.1	NA	0.1	0.4	0.01	0.01	0.01	69.4
West: Old Railway Road														
10	L2	1	6.0	1	6.0	0.002	9.4	LOS A	0.0	0.0	0.65	0.64	0.65	43.9
11	T1	12	6.0	13	6.0	0.151	29.3	LOS D	0.4	3.1	0.92	0.96	0.92	34.3
12	R2	5	6.0	5	6.0	0.151	40.0	LOS E	0.4	3.1	0.92	0.96	0.92	34.1
Approach		18	6.0	19	6.0	0.151	31.2	LOS D	0.4	3.1	0.90	0.94	0.91	34.7
All Vehicles		1493	6.0	1572	6.0	0.457	1.1	NA	0.4	3.1	0.06	0.04	0.07	67.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX C Road layout plans



CONCEPT DESIGN
NOT FOR CONSTRUCTION

0 32 m

01 of 15 sheets

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revision:	D	date: 13/12/2022	checked: TC

rev	status	issued
A	First Issue- Draft Issue to AT	03/11/2021
B	Issue to Fletchers	14/02/2022
C	Revised Issue	29/09/2022
D	Issue for TA	13/12/2022

Riverhead Plan Change
Pedestrian & Cycle facilities Concept Design

flow
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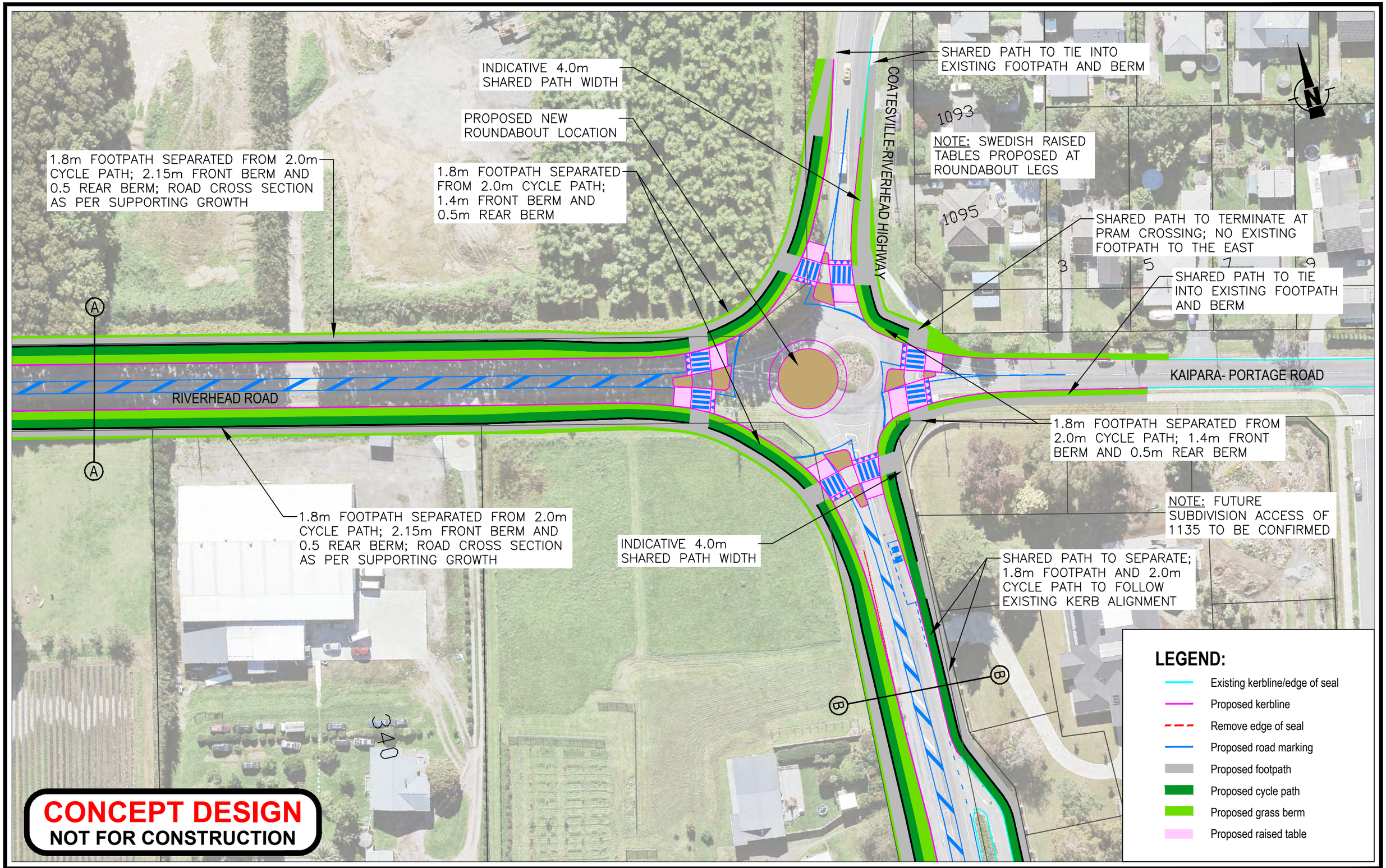

CONCEPT DESIGN
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02 of 15 sheets

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revision: D	date: 13/12/2022	checked:	TC

rev	status	issued
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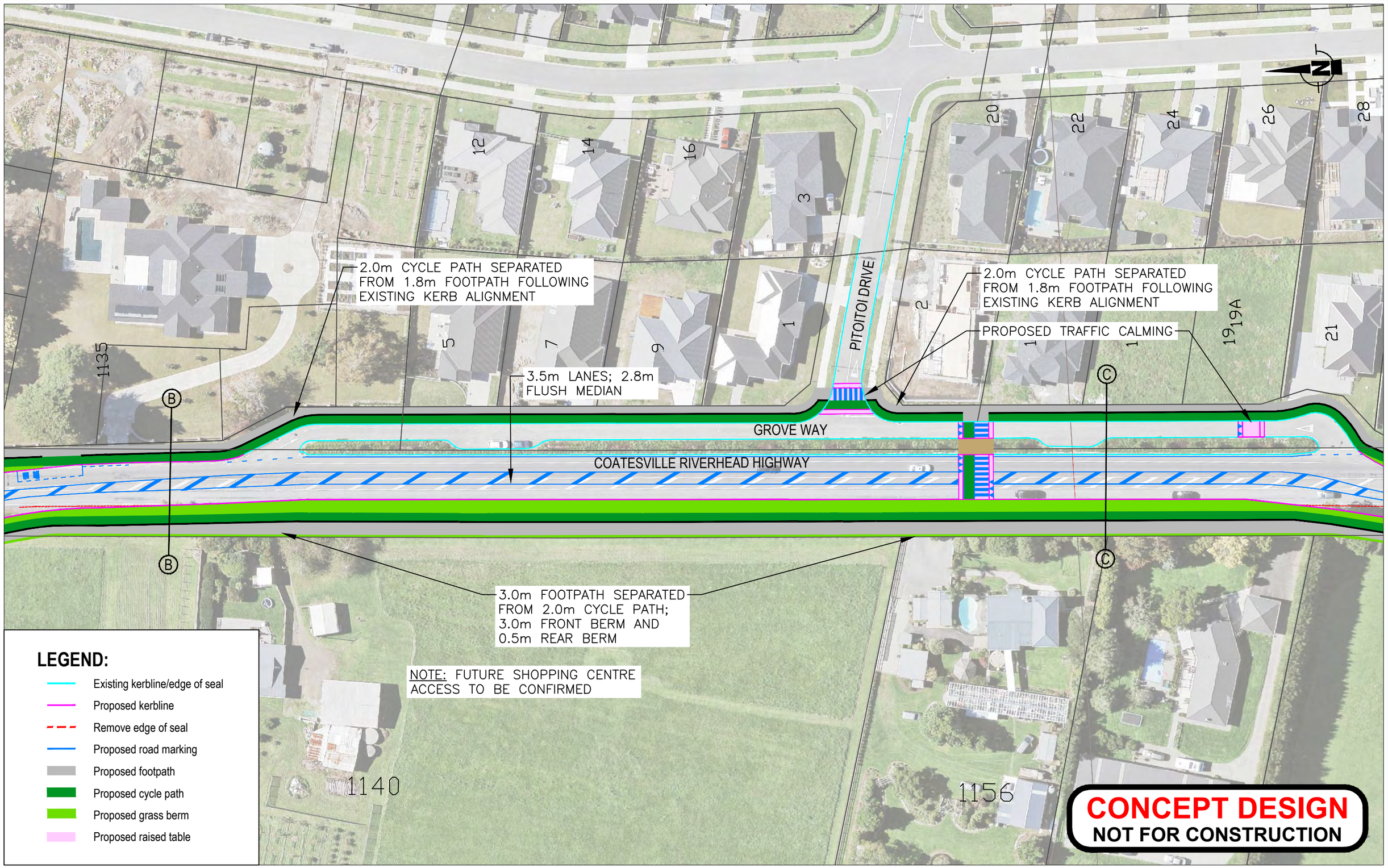

LEGEND:

- Existing kerbline/edge of seal
- Proposed kerbline
- Remove edge of seal
- Proposed road marking
- Proposed footpath
- Proposed cycle path
- Proposed grass berm
- Proposed raised table

CONCEPT DESIGN
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0 32 m

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scale:	1:800A3	design:	CS
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rev	status	issued
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PROPOSED MULTI–MODAL ZEBRA CROSSING LOCATION

1.8m FOOTPATH SEPARATED FROM 2.0m CYCLE PATH; 1.4m FRONT BERM AND 0.5m REAR BERM

CYCLEPATH AND FOOTHPATH TO TRANSITION AND FORM 3.0m SHARED PATH

SHARED PATH TO TIE INTO EXISTING FOOTPATH AND BERM

RELOCATE BUS STOP AND INSTALL HARDSTAND AND BUS SIGN

PROPOSED FOOTPATH TO TIE INTO EXISTING FOOTPATH; EXISTING KERB LINE TO BE RETAINED

1.8m FOOTPATH SEPARATED FROM 2.0m CYCLE PATH; 0.5m FRONT BERM AND 0.5m REAR BERM

NOTE: SWEDISH RAISED TABLES PROPOSED AT ROUNDABOUT LEGS

RIVERHEAD POINT DRIVE

GROVE WAY

COATESVILLE RIVERHEAD HIGHWAY

3.0m FOOTPATH SEPARATED FROM 2.0m CYCLE PATH; 3.0m FRONT BERM AND 0.5m REAR BERM

1.8m FOOTPATH SEPARATED FROM 2.0m CYCLE PATH; 1.4m FRONT BERM AND 0.5m REAR BERM

SEPARATED FACILITIES TO TRANSITION TO 1.8m FOOTPATH

PROPOSED NEW ROUNDABOUT LOCATION

FRONT BERM TO TRANSITION TO 2.15m

1.8m FOOTPATH SEPARATED FROM 2.0m CYCLE PATH; 1.4m FRONT BERM AND 0.5m REAR BERM

SEPARATED FACILITIES TO TRANSITION TO 3.0m SHARED PATH

CONCEPT DESIGN
NOT FOR CONSTRUCTION

LEGEND:

- Existing kerbline/edge of seal
- Proposed kerbline
- Remove kerbline/edge of seal
- Proposed road marking
- Proposed footpath
- Proposed cycle path
- Proposed grass berm
- Proposed raised table

0 32 m

04 of 15 sheets

scale:	1:800A3	design:	CS
ref:	FRLX015-D-010	drawn:	CS
revision:	D	date: 13/12/2022	checked: TC

rev	status	issued
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Riverhead Plan Change
Pedestrian & Cycle facilities Concept Design

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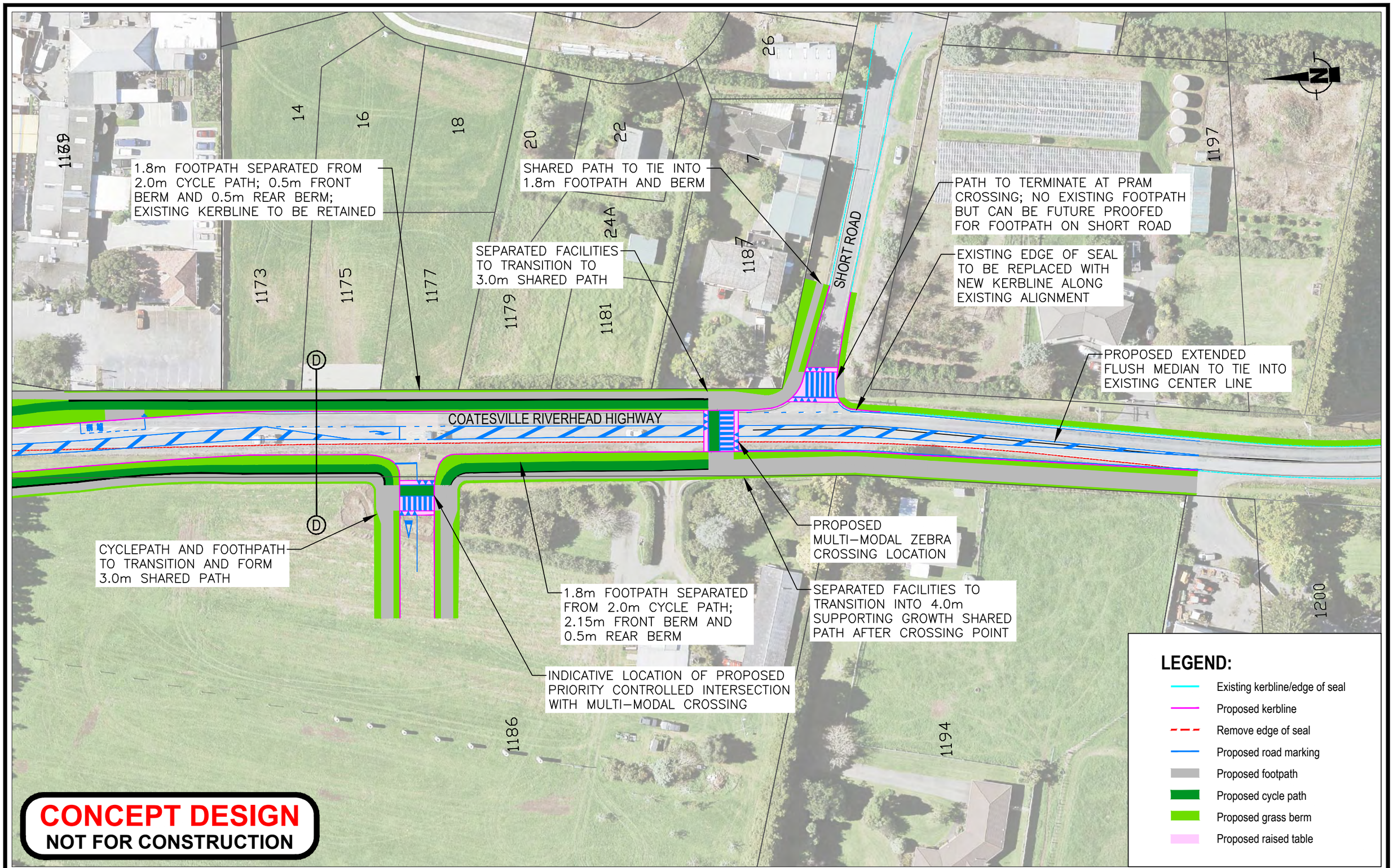

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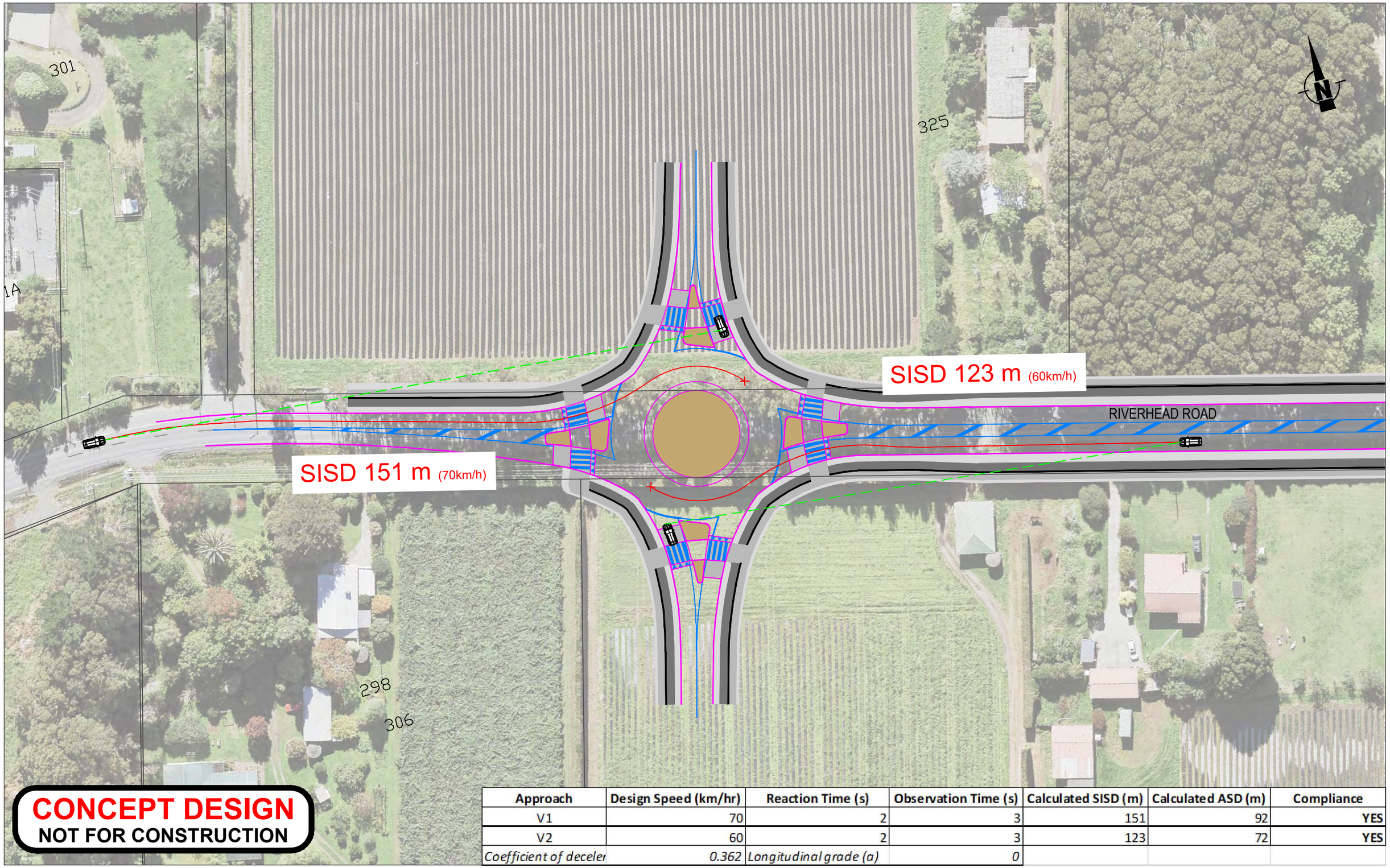

CONCEPT DESIGN
NOT FOR CONSTRUCTION

Approach	Design Speed (km/hr)	Reaction Time (s)	Observation Time (s)	Calculated SISD (m)	Calculated ASD (m)	Compliance
V1	70	2	3	151	92	YES
V2	60	2	3	123	72	YES
Coefficient of deceler	*0.362*	*Longitudinal grade (a)*	*0*			

0 32 m

06 of 15 sheets

scale:	1:800A3	design:	CS
ref:	FRLX015-D-010	drawn:	CS
revision:	D	date:	13/12/2022	checked:	TC

rev	status	issued
A	First Issue- Draft Issue to AT	03/11/2021
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C	Revised Issue	29/09/2022
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Riverhead Plan Change
Riverhead Road Roundabout SISD

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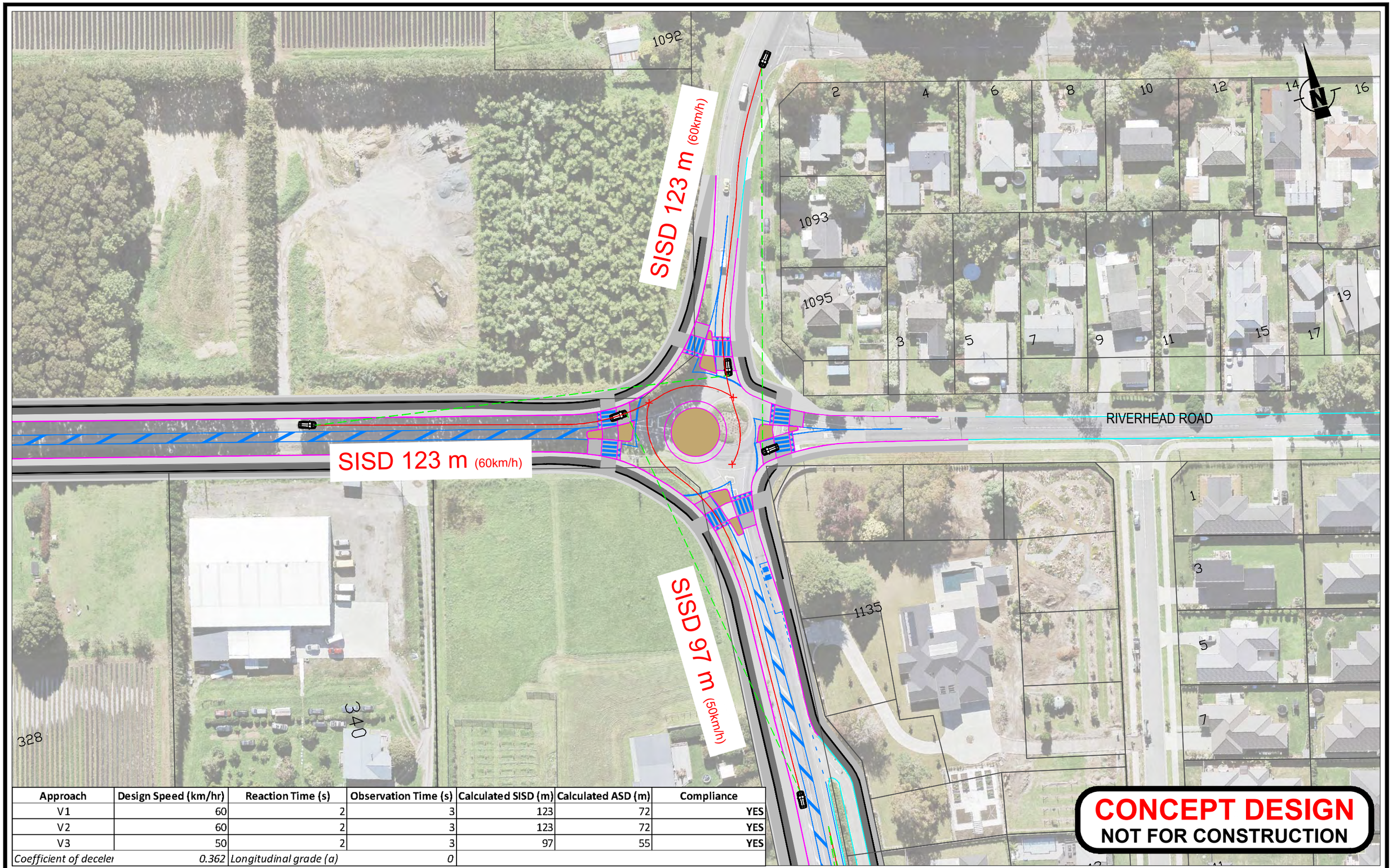

Approach	Design Speed (km/hr)	Reaction Time (s)	Observation Time (s)	Calculated SISD (m)	Calculated ASD (m)	Compliance
V1	60	2	3	123	72	YES
V2	60	2	3	123	72	YES
V3	50	2	3	97	55	YES
Coefficient of decele	*0.362*	*Longitudinal grade (a)*	*0*			

CONCEPT DESIGN
NOT FOR CONSTRUCTION

0 32 m

07 of 15 sheets

scale: 1:800A3 design: CS
ref: FRLX015-D-010 drawn: CS
revision: D date: 13/12/2022 checked: TC

rev	status	issued
A	First Issue- Draft Issue to AT	03/11/2021
B	Issue to Fletchers	14/02/2022
C	Revised Issue	29/09/2022
D	Issue for TA	13/12/2022

Riverhead Plan Change
CVR Highway and Riverhead Road SISD

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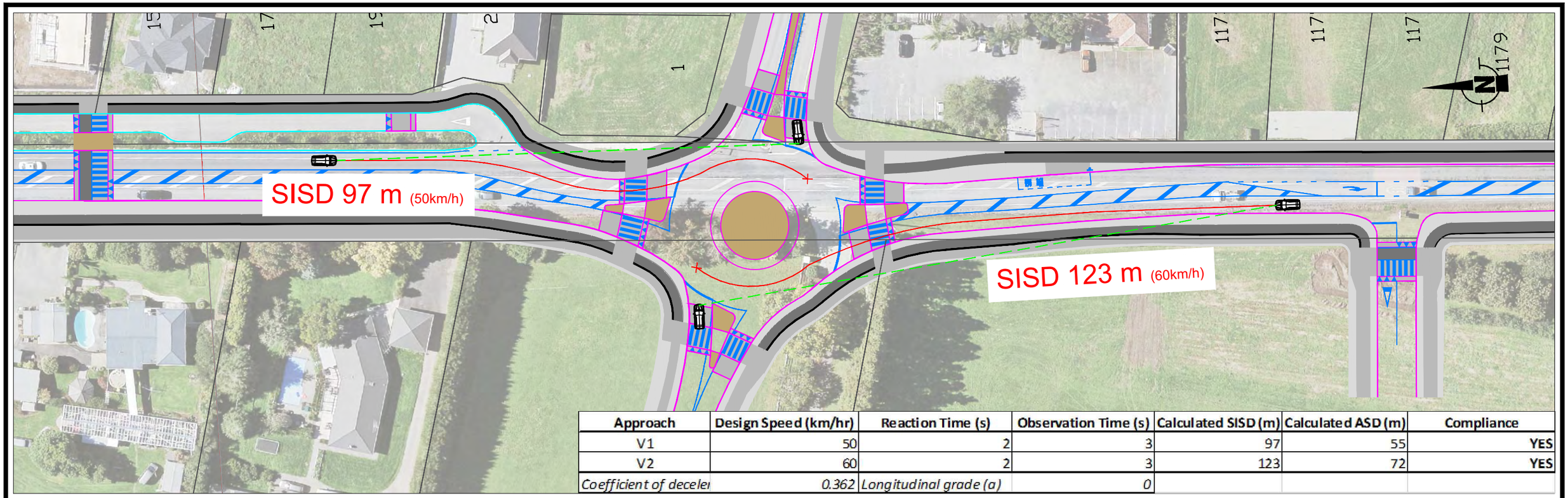
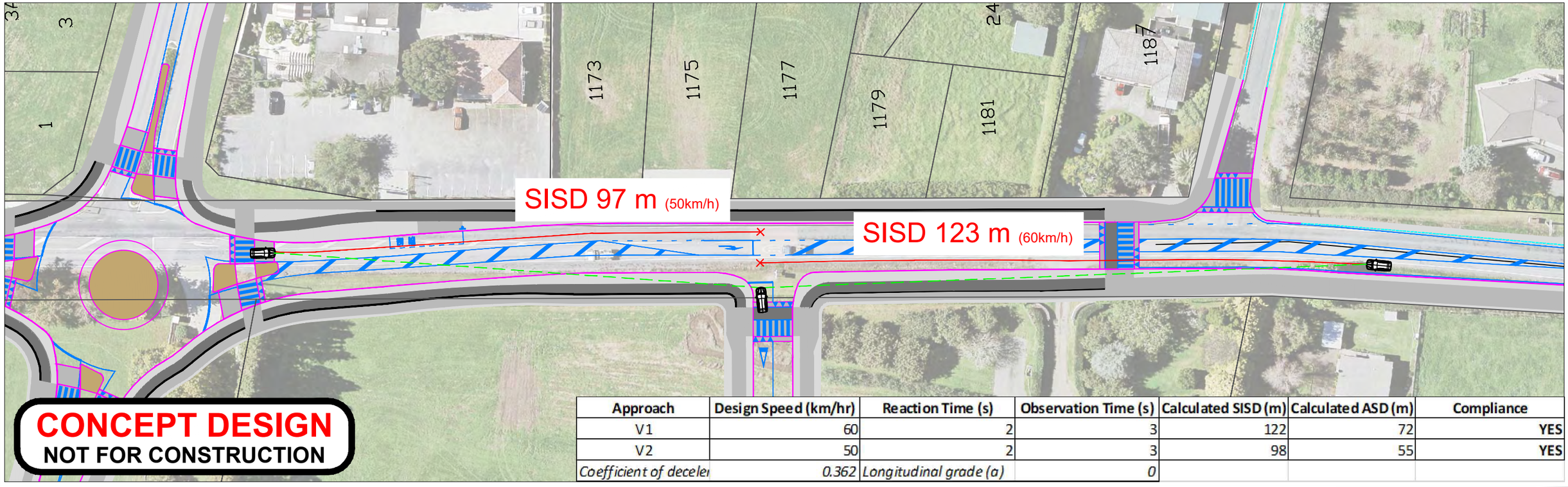


Approach	Design Speed (km/hr)	Reaction Time (s)	Observation Time (s)	Calculated SISD (m)	Calculated ASD (m)	Compliance
V1	50	2	3	97	55	YES
V2	60	2	3	123	72	YES
Coefficient of decele	*0.362*	*Longitudinal grade (a)*	*0*			



Approach	Design Speed (km/hr)	Reaction Time (s)	Observation Time (s)	Calculated SISD (m)	Calculated ASD (m)	Compliance
V1	60	2	3	122	72	YES
V2	50	2	3	98	55	YES
Coefficient of decele	*0.362*	*Longitudinal grade (a)*	*0*			

CONCEPT DESIGN
NOT FOR CONSTRUCTION

0 32 m

08 of 15 sheets

scale: 1:800A3 design: CS
ref: FRLX015-D-010 drawn: CS
revision: D date: 13/12/2022 checked: TC

rev	status	issued
A	First Issue- Draft Issue to AT	03/11/2021
B	Issue to Fletchers	14/02/2022
C	Revised Issue	29/09/2022
D	Issue for TA	13/12/2022

Riverhead Plan Change
CVR Highway Intersection SISD

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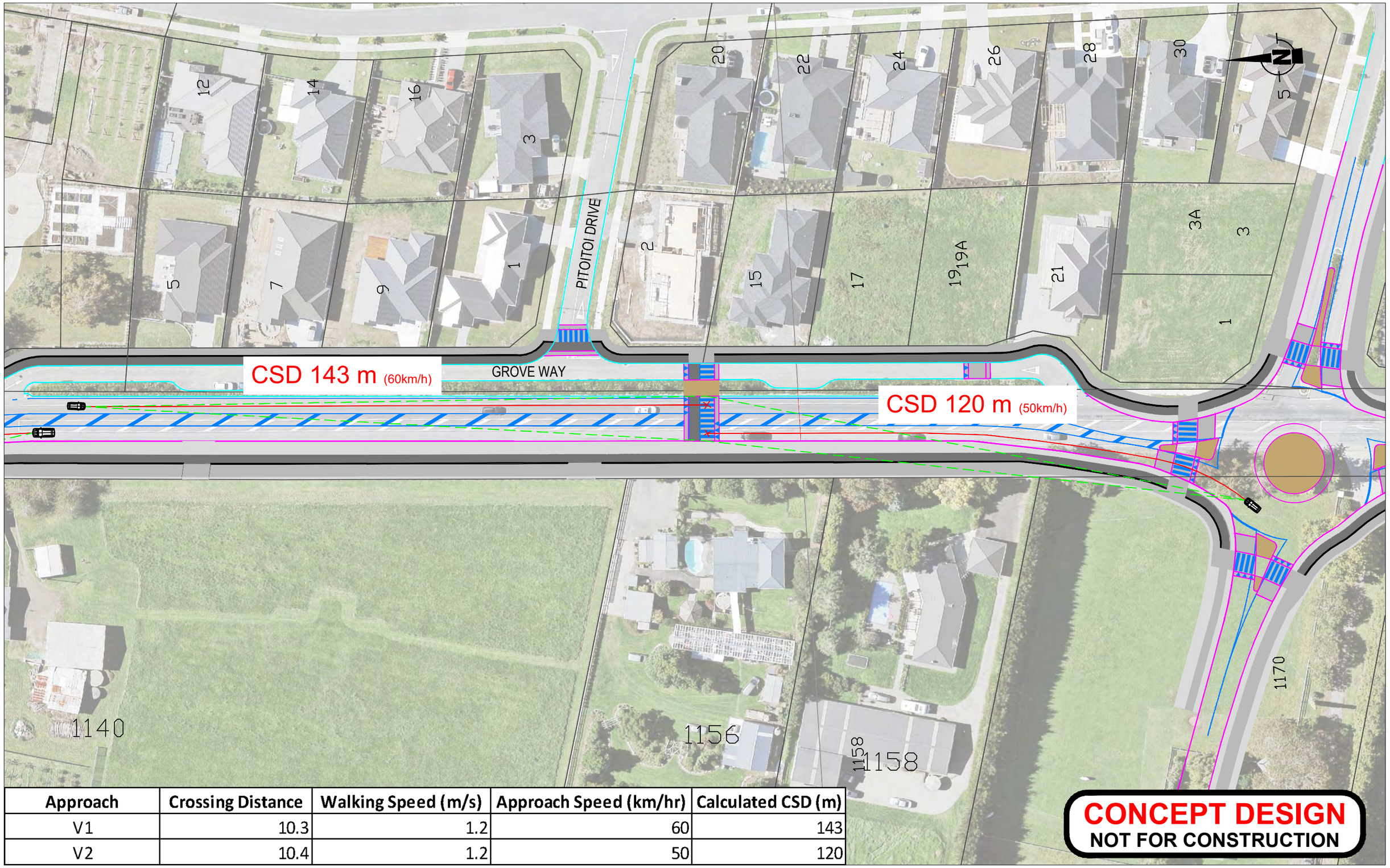

Approach	Crossing Distance	Walking Speed (m/s)	Approach Speed (km/hr)	Calculated CSD (m)
V1	10.3	1.2	60	143
V2	10.4	1.2	50	120

CONCEPT DESIGN
NOT FOR CONSTRUCTION

0 32 m

09 of 15 sheets

scale: 1:800A3 design: CS
ref: FRLX015-D-010 drawn: CS
revision: D date: 13/12/2022 checked: TC

rev	status	issued
A	First Issue- Draft Issue to AT	03/11/2021
B	Issue to Fletchers	14/02/2022
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Riverhead Plan Change
Pedestrian Crossing Sight Distance (CSD)

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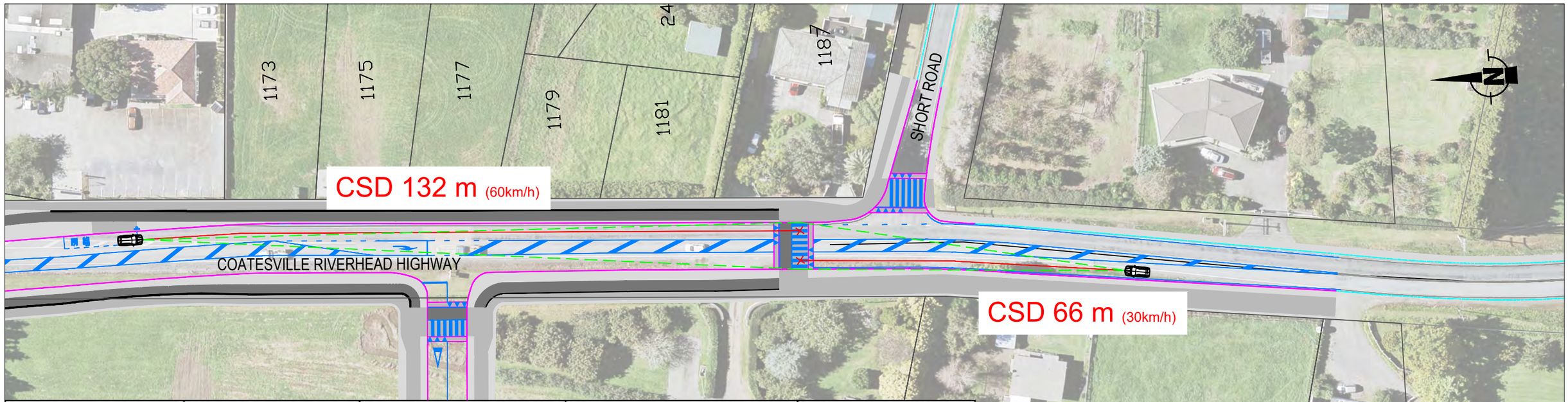
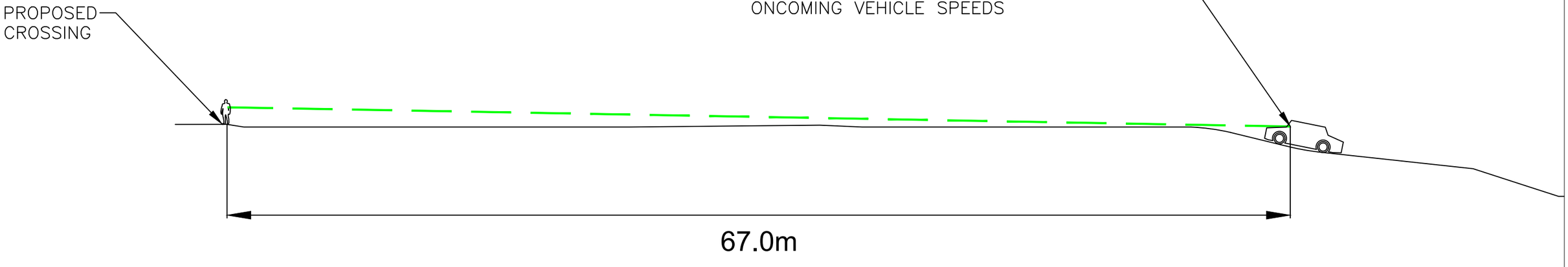


Approach	Crossing Distance	Walking Speed (m/s)	Approach Speed (km/hr)	Calculated CSD (m)
V1	9.5	1.2	60	132
V2	9.5	1.2	30	66

VERTICAL PROFILE OF COATESVILLE RIVERHEAD HIGHWAY

CSD FOR 30km/hr IS AVAILABLE DUE TO THE STEEP NATURE OF COATESVILLE RIVERHEAD HIGHWAY; FUTURE GATEWAY TREATMENT IS EXPECTED TO PROVIDE VERTICAL SPEED TREATMENT, REDUCING ONCOMING VEHICLE SPEEDS



CONCEPT DESIGN
NOT FOR CONSTRUCTION

0 32 m

10 of 15 sheets

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ref: FRLX015-D-010 drawn: CS
revision: D date: 13/12/2022 checked: TC

rev	status	issued
A	First Issue- Draft Issue to AT	03/11/2021
B	Issue to Fletchers	14/02/2022
C	Revised Issue	29/09/2022
D	Issue for TA	13/12/2022

Riverhead Plan Change
Pedestrian Crossing Sight Distance (CSD)

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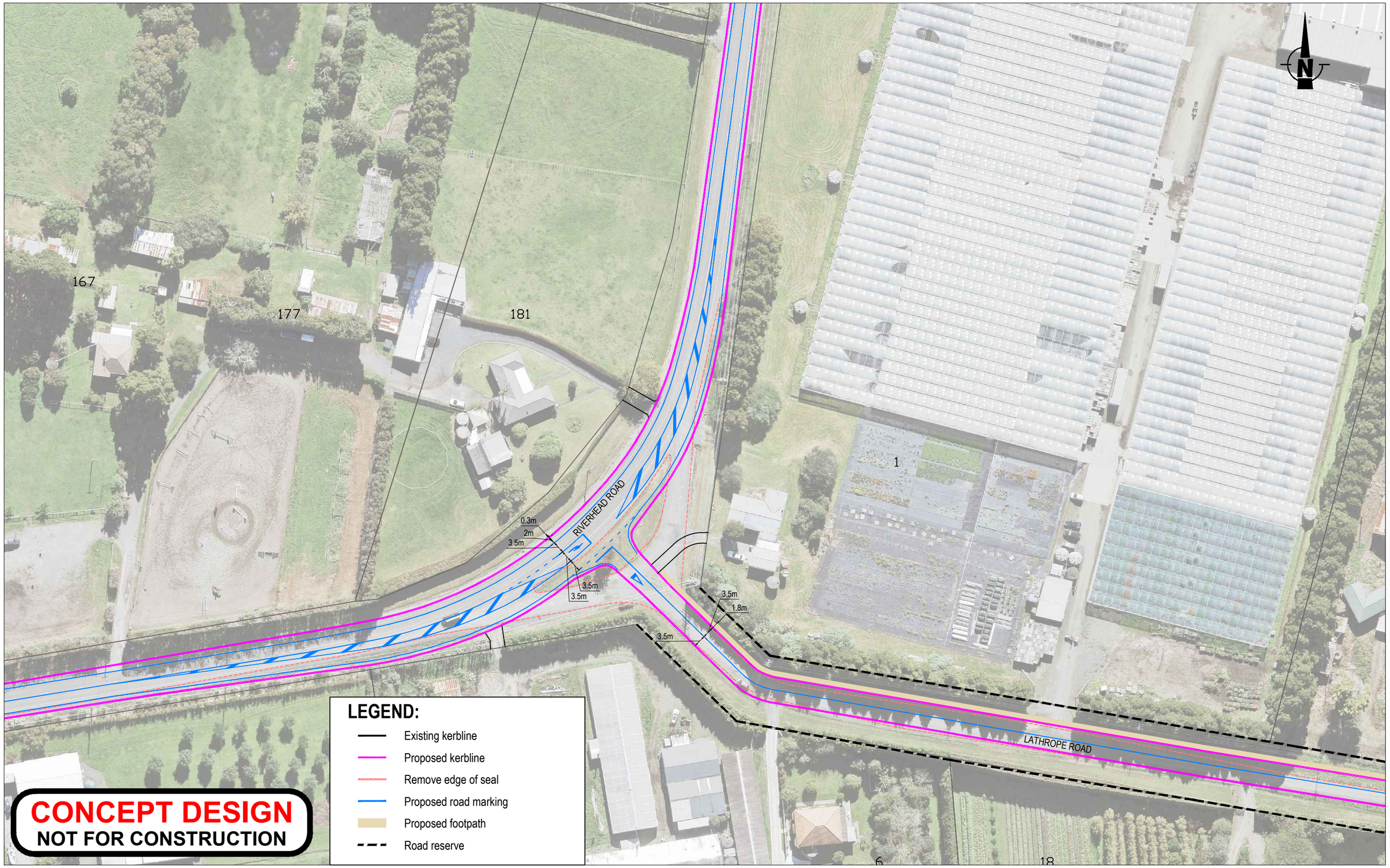

0 20m

11 of 15 sheets

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revision:	B	checked:	HS

rev	status	issued
A	First Issue	01/03/2022
B	Second Issue	13/12/2022

Riverhead Plan Change
Lathrope Road Intersection Concept Design

flow
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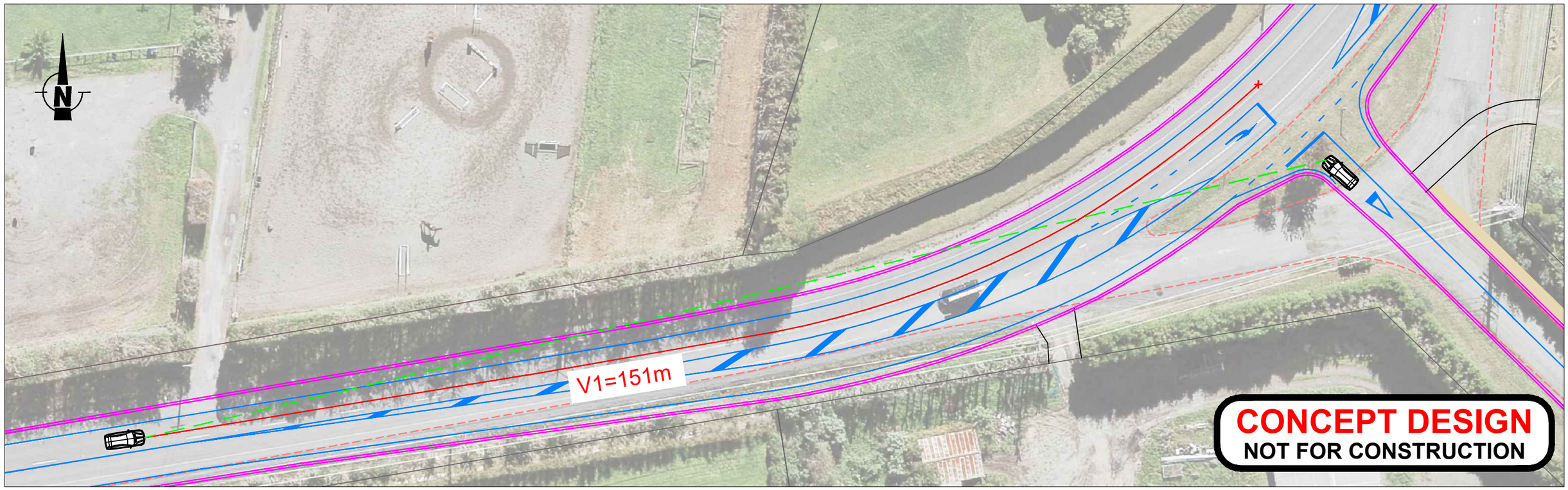

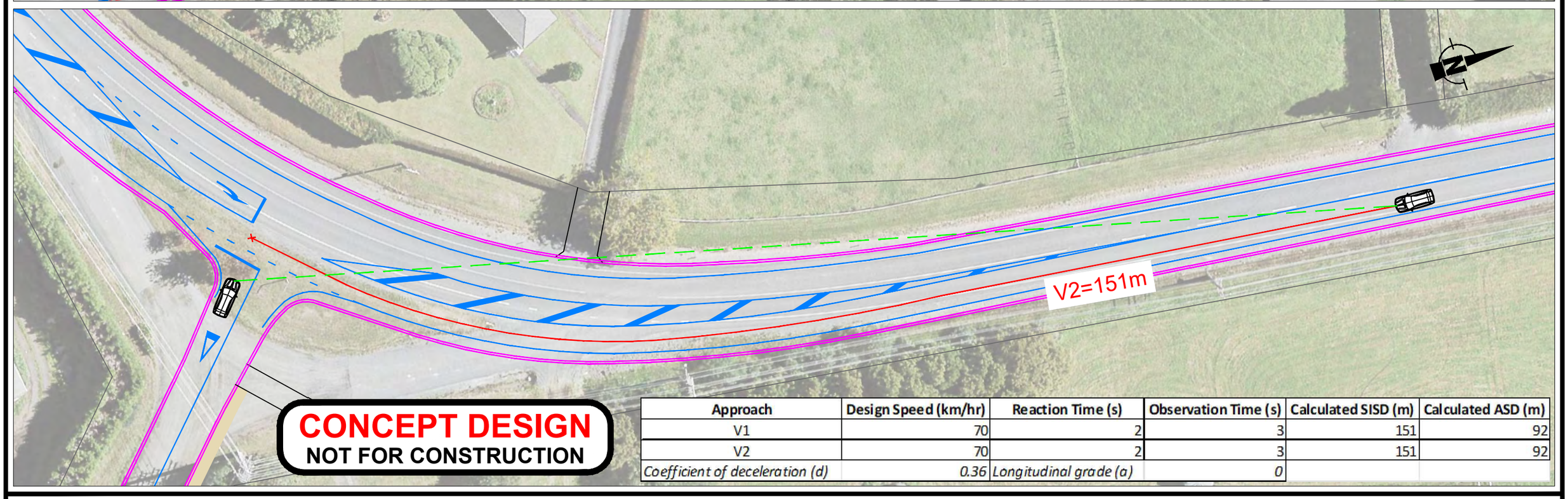

Approach	Design Speed (km/hr)	Reaction Time (s)	Observation Time (s)	Calculated SISD (m)	Calculated ASD (m)
V1	70	2	3	151	92
V2	70	2	3	151	92
Coefficient of deceleration (d)	*0.36*	*Longitudinal grade (a)*	*0*		

0 20m

12 of 15 sheets

scale: 1:500 @A3 design: CS
ref: FRLX015-D-004 drawn: CS
revision: B checked: HS

rev	status	issued
A	First Issue	01/03/2022
B	Second Issue	13/12/2022

Riverhead Plan Change
Lathrope Road Intersection Concept Design

flow
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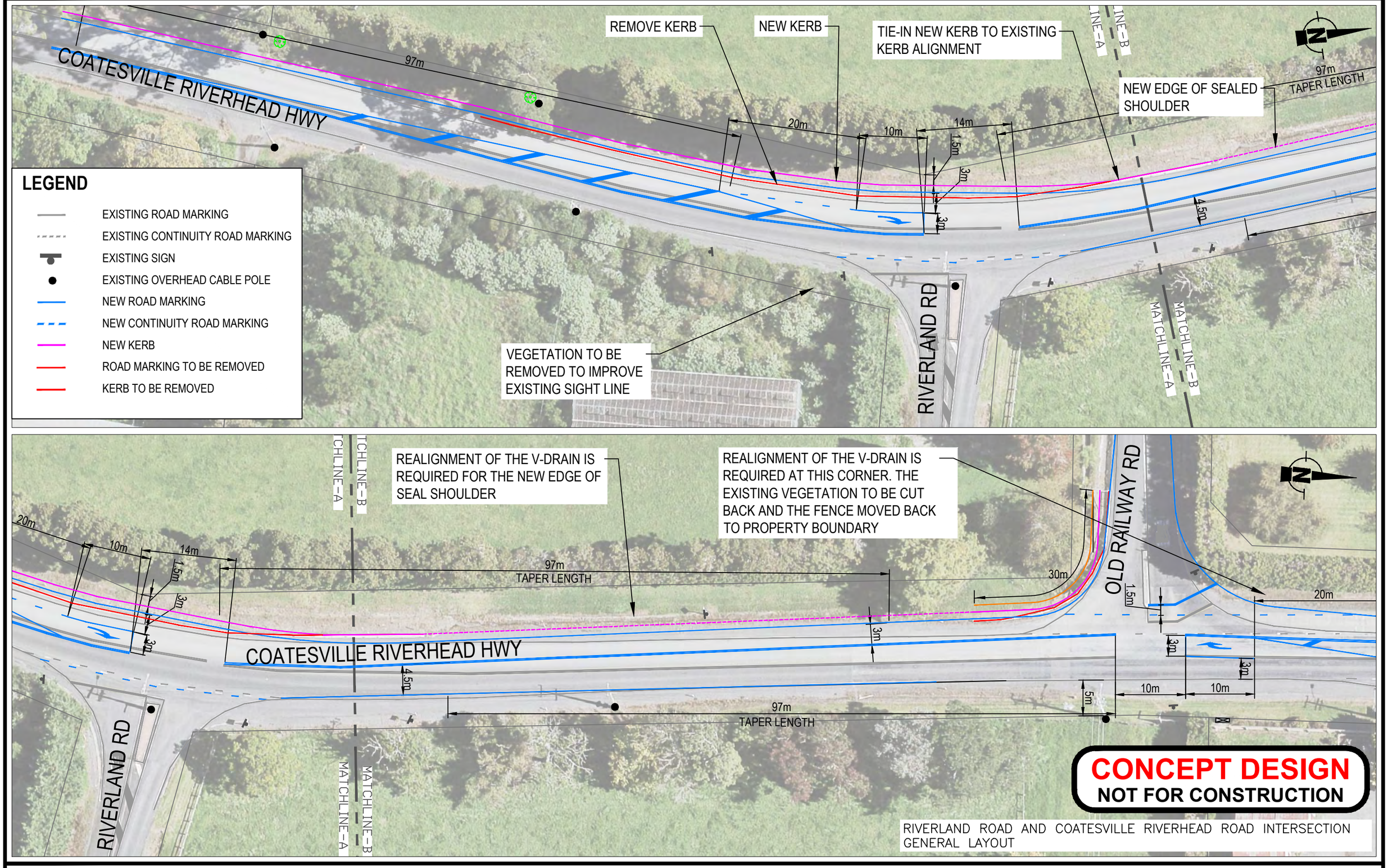

RIVERLAND ROAD AND COATESVILLE RIVERHEAD ROAD INTERSECTION GENERAL LAYOUT

0 40m

RevA

13 of 15 sheets

scale:	1:1,000 @A3	design:	MK
ref:	FRLX15-RIV-CD-02	drawn:	MK
revision:	A	checked:	SC

rev	status	issued
A	First Issue	13/12/2022

Riverhead Plan Change
Riverland Rd and Old Railway Rd Right Turn Bay

flow
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RELOCATE WOODEN FENCE TO HERE

TIE-IN TO EXISTING LINE MARKING AND EDGE OF SEAL

REALIGNMENT OF THE V-DRAIN IS REQUIRED AT THIS CORNER. THE EXISTING VEGETATION TO BE CUT BACK AND THE FENCE MOVED BACK TO PROPERTY BOUNDARY

OLD RAILWAY RD

COATESVILLE RIVERHEAD HWY

MATCHLINE-A

MATCHLINE-B

MATCHLINE-C

MATCHLINE-D

97m TAPER LENGTH

97m TAPER LENGTH

30m

1.5m

20m

15m

3m

4.5m

5m

10m

10m

2.5m

82m

LEGEND

- EXISTING ROAD MARKING
- EXISTING CONTINUITY ROAD MARKING
- EXISTING SIGN
- EXISTING OVERHEAD CABLE POLE
- NEW ROAD MARKING
- NEW CONTINUITY ROAD MARKING
- NEW KERB
- ROAD MARKING TO BE REMOVED
- KERB TO BE REMOVED

CONCEPT DESIGN
NOT FOR CONSTRUCTION

OLD RAILWAY ROAD AND COATESVILLE RIVERHEAD ROAD INTERSECTION
GENERAL LAYOUT

0 40m

RevA

14 of 15 sheets

scale:	1:1,000 @A3	design:	MK
ref:	FRLX15-RIV-CD-03	drawn:	MK
revision:	A	checked:	SC

rev	status	issued
A	First Issue	13/12/2022

Riverhead Plan Change
Riverland Rd and Old Railway Rd Right Turn Bay

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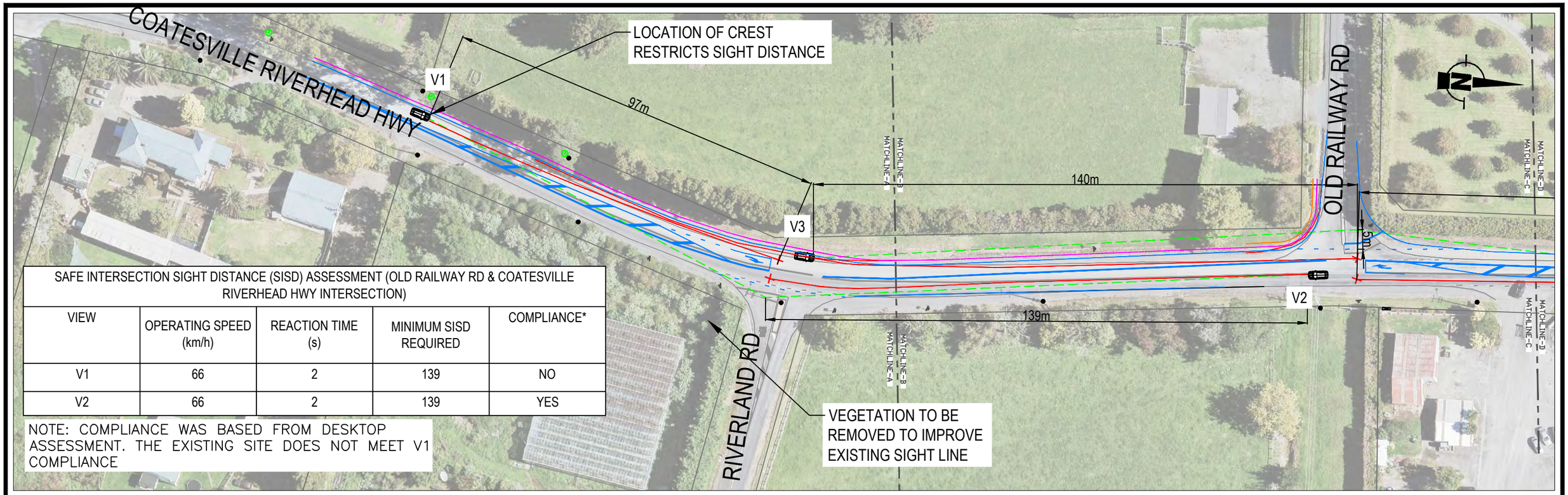
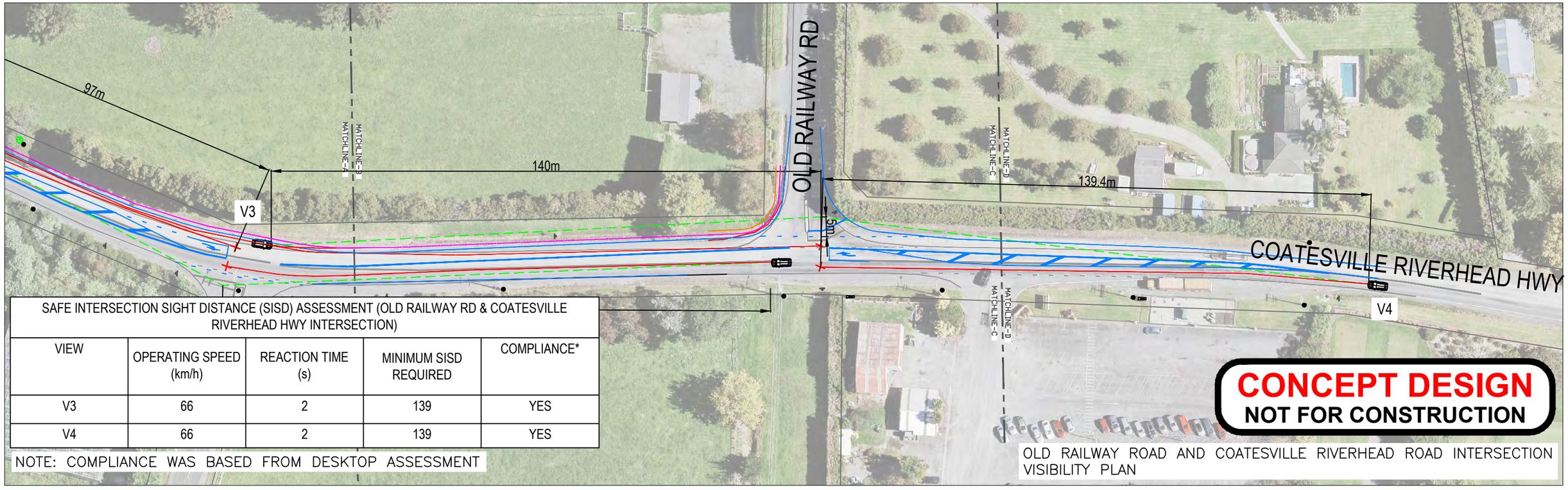


SAFE INTERSECTION SIGHT DISTANCE (SISD) ASSESSMENT (OLD RAILWAY RD & COATESVILLE RIVERHEAD HWY INTERSECTION)

VIEW	OPERATING SPEED (km/h)	REACTION TIME (s)	MINIMUM SISD REQUIRED	COMPLIANCE*
V1	66	2	139	NO
V2	66	2	139	YES

NOTE: COMPLIANCE WAS BASED FROM DESKTOP ASSESSMENT. THE EXISTING SITE DOES NOT MEET V1 COMPLIANCE



SAFE INTERSECTION SIGHT DISTANCE (SISD) ASSESSMENT (OLD RAILWAY RD & COATESVILLE RIVERHEAD HWY INTERSECTION)

VIEW	OPERATING SPEED (km/h)	REACTION TIME (s)	MINIMUM SISD REQUIRED	COMPLIANCE*
V3	66	2	139	YES
V4	66	2	139	YES

NOTE: COMPLIANCE WAS BASED FROM DESKTOP ASSESSMENT

OLD RAILWAY ROAD AND COATESVILLE RIVERHEAD ROAD INTERSECTION VISIBILITY PLAN

0 40m

RevA

15 of 15 sheets

scale: 1:1,000 @A3 design: MK
ref: FRLX15-RIV-CD-04 drawn: MK
revision: A checked: SC

rev	status	issued
A	First Issue	13/12/2022

Riverhead Plan Change
Riverland Rd and Old Railway Rd Right Turn Bay

flow
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APPENDIX D Coatesville-Riverhead Highway right turn bay assessment

flow TRANSPORTATION SPECIALISTS

technical note

PROJECT	**RIVERHEAD PRIVATE PLAN CHANGE**
SUBJECT	**RIGHT TURN BAY TREATMENT REQUIREMENT**
TO	**KELSEY BERGIN, DARREN SOO (FLETCHERS)**
FROM	SHARMIN CHOUDHURY
REVIEWED BY	TERRY CHURCH
DATE	18 NOVEMBER 2022

1 PURPOSE OF NOTE

The Riverhead Landowner Group (RLG) is proposing a Private Plan Change that covers the Future Urban Zoned land in Riverhead. To respond to feedback received from Auckland Transport, Flow has reviewed the requirements for intersection upgrades to include right-turn bays at the Riverland Road intersection and the Old Railway Road intersection.

We have outlined, in this technical paper, the guidelines and criteria we use to determine the requirement for right-turn bays at intersections as well as indicated if the intersection upgrades are required now according to the current volumes using the intersection (that is, prior to any development within Riverhead), at the 60% development phase and at the 100% development phase.

2 SAFETY ISSUE

2.1 Safety issues with turning movements

Rear-ending crashes and side-impact crashes are the two typical crash types that take place when turning left and right at priority controlled intersections.

When vehicles slow down to turn, there is a risk that the following vehicle hits the rear of the turning vehicle (rear-ending crashes). The severity of these crashes increase as traffic volumes increase or the approach speed of the vehicle behind increases.

When vehicles turn right, there is a risk of the right-turning vehicle getting hit on the side, by a vehicle in the opposing direction (right-turn-against or side-impact crashes). Again, the severity of side-impact crashes increases in response to an increase in traffic volumes, or as the approach speed of the oncoming vehicle increases.

2.1.1 Crashes at the Riverland Road intersection and the Old Railway Road intersection

The crash records of the past 5 years (2016 to 2021) indicate there have been 4 rear-end crashes involving vehicles turning right from Coatesville-Riverhead Highway into Old Railway Road, and 1 rear-end crash involving a vehicle turning right from Coatesville-Riverhead Highway into Riverland Road. Two of the rear-end crashes at the Old Railway Road intersection resulted in serious injuries.

From the crash records, we note the following

- **Right-turning** - All crashes that are related to turning movements from Coatesville-Riverhead Highway to either Riverland Road or Old Railway Road involved vehicles wanting to turn right into the side road
- **Left-turning** - There has been no record of rear-end crashes for vehicles turning left into Riverland Road or Old Railway Road
- **Side-impact crashes** - There have been no side-impact crashes at either intersection
- **Speed limit lowered** - There have been no turning movement crashes since the speed limit on Coatesville-Riverhead Highway (between SH16 and Riverhead village) was reduced to 60km/h.

Based on the above, we conclude the following

- **Rear-end crashes for left and right turning movements**. At the time of the crashes at the Riverland Road intersection and the Old Railway Road intersection, the posted speed limit on Coatesville-Riverhead Highway was higher (at 80km/h) which worsened the severity of the crashes. As the speed limit on Coatesville-Riverhead Highway adjacent to the intersections is now reduced to 60km/h, we expect that the frequency and severity of rear-end crashes will reduce and should they occur, will have a reduced severity.
- **Side impact crashes for right-turning movements**. When the traffic volumes increase along the Coatesville-Riverhead Highway (as a result of development), there is a risk that vehicles waiting to turn right, in trying not to cause further delay to the vehicles behind, would make unsafe right turn manoeuvres when there may be insufficient gaps within oncoming traffic. The angle of the crash, and the operational speed of around 65-70km/h, means there is a risk of a high severity of side-impact crashes.

With no inherent safety concern existing for left turning traffic, **our focus in this technical note is only on right-turn movements** with the objective to determine the requirement and timing for right-turn treatment at the Riverland Road intersection and the Old Railway Road intersection.

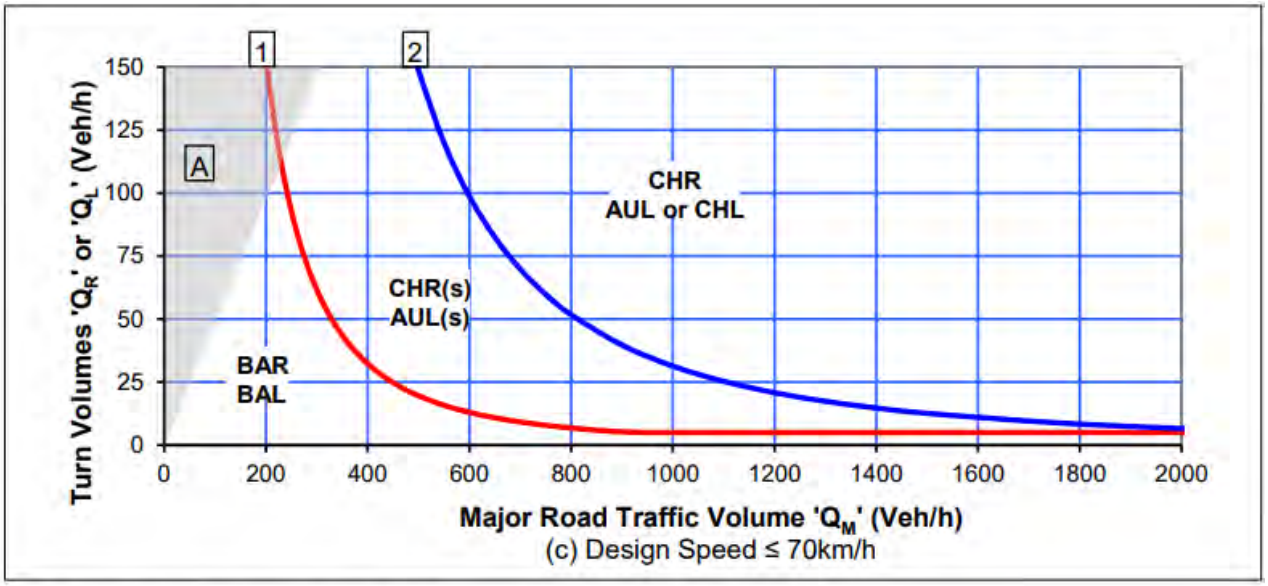
3 WARRANT FOR RIGHT TURN BAY TREATMENT

We refer to the Austroads' Guide to Traffic Management Part 6 which provides the warrants we use to determine the requirement for turn treatments at intersections. The warrants are for both urban and rural roads and apply to turning movements from the major road only (the road with priority) which in this case, is Coatesville-Riverhead Highway.

The warrants are typically based on the construction of intersections on new roads, however, they are also used as a reference for intervention levels when upgrading existing intersection turn treatments although it is also recognised that many existing intersections (particularly those on low-volume lower-order roads) are of a lower standard.

Considering the current speed limit is 60km/h along the Coatesville-Riverhead Highway, we have assumed a design speed of 70km/h. The warrant for turn treatments on roads at a design speed of 70km/h is shown in Figure 1.

Figure 1 – Warrant for turn treatments



Note: the minimum right-turn treatment for multilane roads is a CHR(s).

Source: TMR (2016a).

The warrant in the above figure above considers three types of right-turn treatments

- A basic right-turn treatment (BAR) provides a widened shoulder on the major road that allows through-movement vehicles, having slowed, to pass to the left of turning vehicles
- A channelised right-turn treatment with short lane (CHR(s)) separates the conflicting vehicle travel paths and provides a short length for the deceleration lane by assuming there is a 20% speed reduction at the start of the taper[1]
- A channelised right-turn treatment (CHR) provides a full-length deceleration lane by assuming no speed change across the intersection.

In the above figure, curve 1 (red) represents the boundary between a BAR and a (CHR(S)) turn treatment on two-lane two-way roads. Curve 2 (blue) represents the boundary between a CHR(S) and a CHR turn treatment.

[1] Austroads 2021: Guide to Road Design Part 4A: Unsignalised and Signalised Intersections, Section 5.2.1

4 PROPOSED DEVELOPMENT

4.1 Intersection assessment

The two intersections Auckland Transport has requested a safety assessment for and the location of both relative to the Riverhead Private plan Change are shown in Figure 2.

Figure 2 – Private plan change site and location of intersections under consideration

4.2 The intersections

Old Railway Road and Riverland Road intersect with Coatesville-Riverhead Highway and are located south of the Private Plan Change site. Each intersection currently operate as stop-controlled T-intersections with no medians, shoulder widening, or right turn bays on Coatesville-Riverhead Highway, as shown in Figure 3.

Figure 3 – Existing Layout of intersections

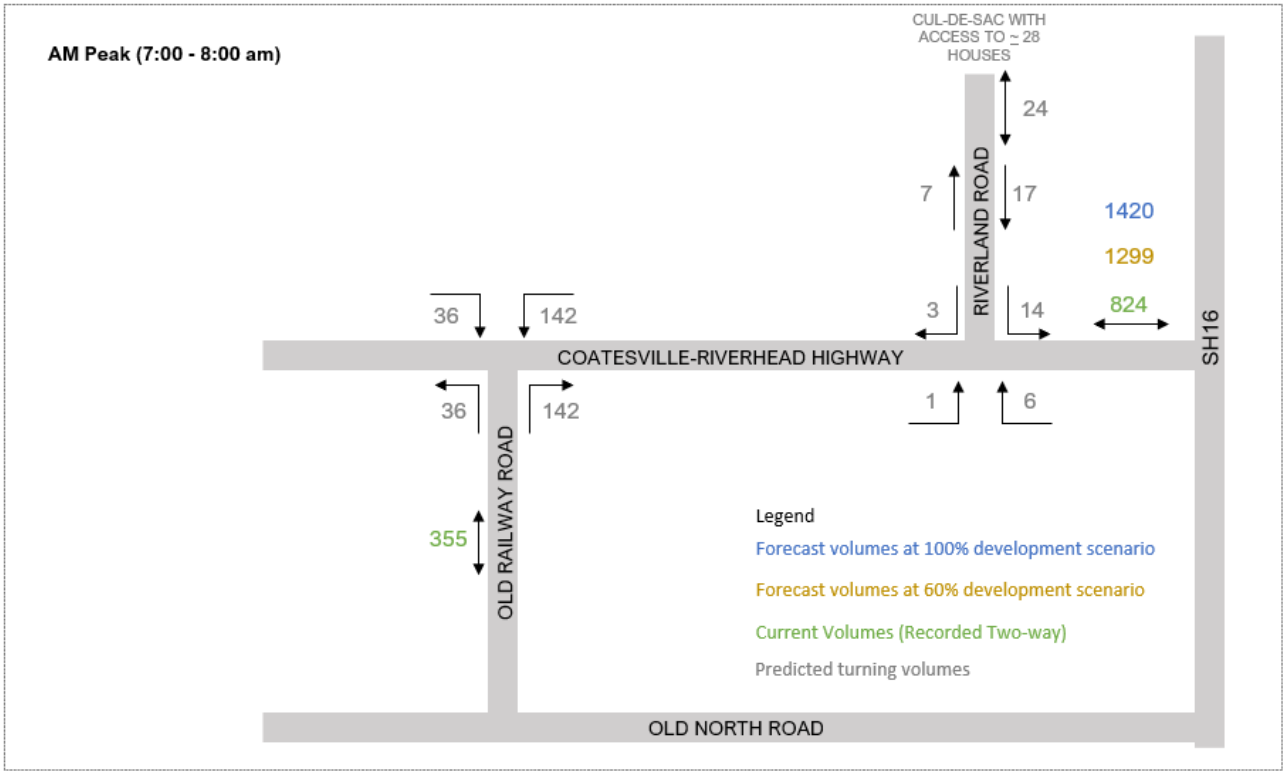
Old Railway Road intersection

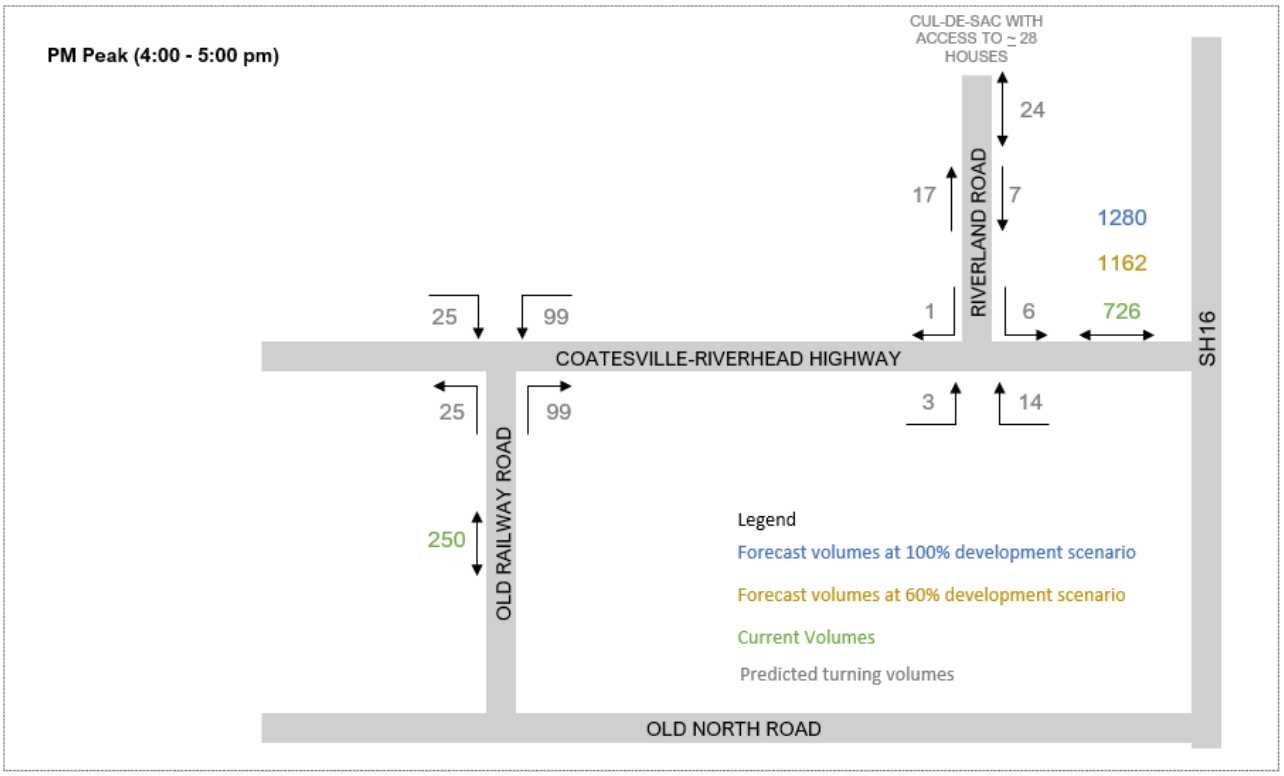
Riverland Road intersection

4.3 Traffic flows

The existing traffic flows along Coatesville-Riverhead Highway in the existing scenario, the 60% development phase, and the 100% development phase have been mapped in Figure 4 below.

Figure 4 – Peak hour traffic flows per scenario





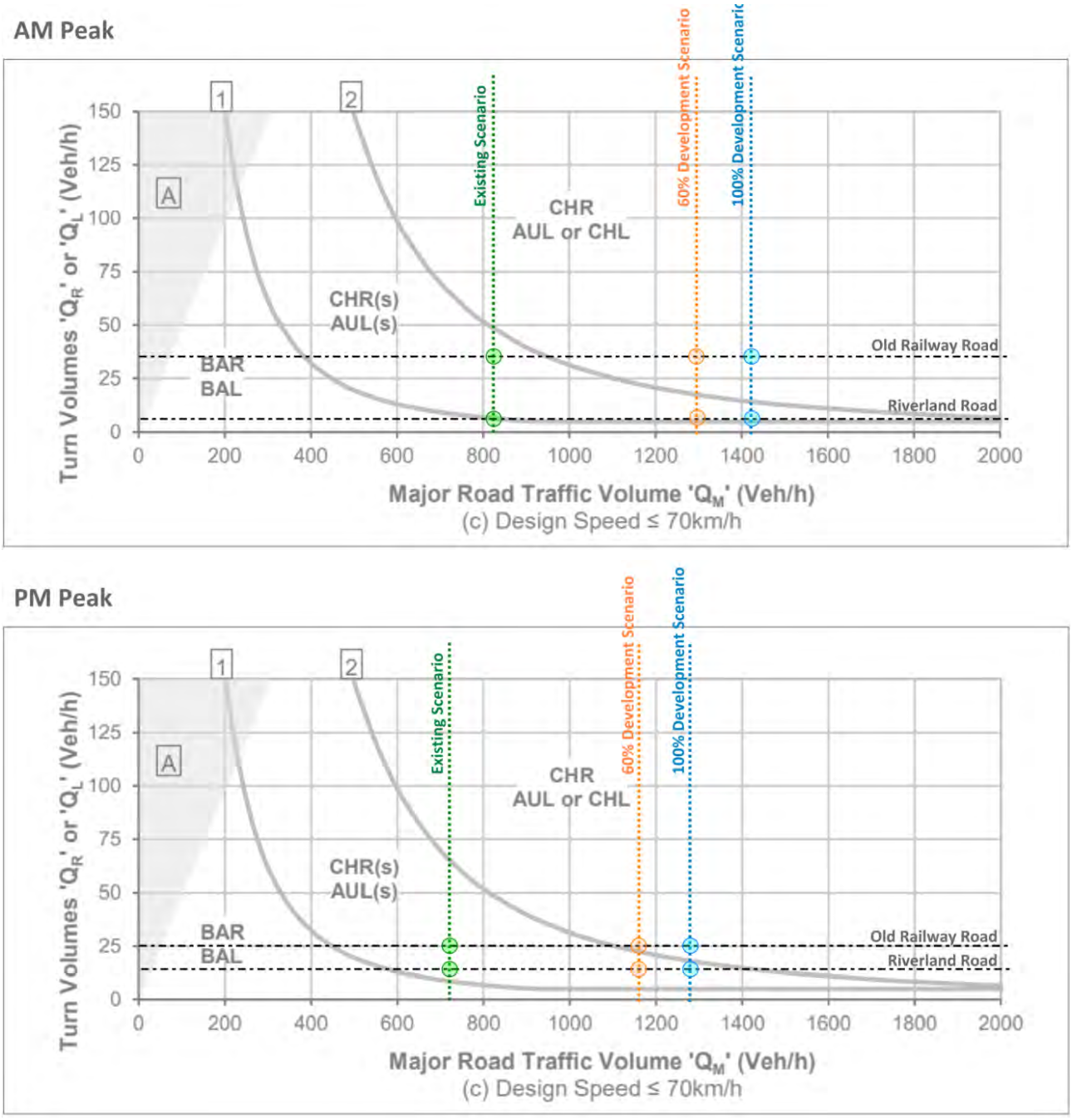
We have based the traffic volumes shown in the figure above on the following assumptions:

- Coatesville-Riverhead Highway volumes are based on Auckland Transport's traffic count data in May 2022, with forecast volumes being based on development yields associated with the Private Plan Change
- Old Railway Road volumes are based on Auckland Transport's traffic count data in March 2021 for Old Railway Road between Old North Road and Coatesville Riverhead Highway
- Volumes for Riverland assume a trip rate of 0.85 per dwelling. We have estimated 24 dwellings
- A 50% directional split is assumed along Old Railway Road and Riverland Road
- Riverland Road will experience 70% of its traffic going towards Coatesville-Riverhead Highway in the AM peak and vice-versa in the PM peak
- 80% of vehicles from the side roads will turn towards SH16 and the remainder will turn towards Riverhead.

4.4 The warrant for turn treatments

The current and predicted traffic volumes for each scenario (current, 60% development and 100% development) have been mapped onto the warrant as shown in Figure 5.

Figure 5 – Warrant maps for each scenario for both intersections



The warrant indicates that

- for the existing scenario, there is a requirement for a channelised turn treatment at the intersection with Riverland Road albeit the traffic demand is very low. There is however a high demand for a channelised treatment at the Old Railway Road intersection
- when increasing traffic volumes on Coatesville-Riverhead Highway (resulting from the uptake of development), the demand for a channelised turn treatment significantly increases.

5 SUMMARY

We have reviewed the requirement for right-turn bay treatments at the Coatesville-Riverhead Highway intersections with Old Railway Road and Riverland Road. Our review is based on the Austroads' Guide to Traffic Management Part 6 which provides the warrants for both urban and rural roads. The warrants are typically based on the construction of intersections on new roads, (greenfield sites) however, they are also used as a reference for intervention levels when upgrading existing intersection turn treatments. The guide recognises that many existing intersections are of a lower standard.

We reviewed the crashes involving traffic turning right or left, as well as the traffic flows and volumes for the existing scenario (no development), a 60% development scenario, and a 100% development scenario against the warrant and find the following

- At the Riverland Road intersection, the warrant indicates there is some demand for a channelised turn treatment in the existing scenario however the crash record indicates the current demand for it is low
- At the Old Railway Road intersection, the warrant indicates that the demand for a channelised turn treatment is high in the existing scenario
- In both the 60% development scenario and the 100% development scenario, the predicted increase in traffic flows indicate a high demand for channelised turn treatments at both intersections
- The increase in traffic using Coatesville-Riverhead Highway may also lead to an increase in delays experienced by turning vehicles and therefore an increase in risk to vehicles turning into the side roads.

Therefore, to achieve safe outcomes for each intersection, right-turn bays are recommended for the Old Railway Road intersection pre-development but for the Riverland Road intersection, right-turn bays may be provided at the 60% development scenario.

This technical note is focused solely on the safety implications due to the planned development, for right turn movements from Coatesville-Riverhead Highway to Old Railway Road and Riverland Road.

Reference: P:\frlx\015 Fletchers Riverhead Masterplan and Private Plan Change\Reporting\TN6A221118_Right turn bay assessment.docx - Sharmin Choudhury