York Heavy Vehicle Bypass Alignment Definition Report (DRAFT Final)

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Approvals

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1 Executive Summary and Recommendations

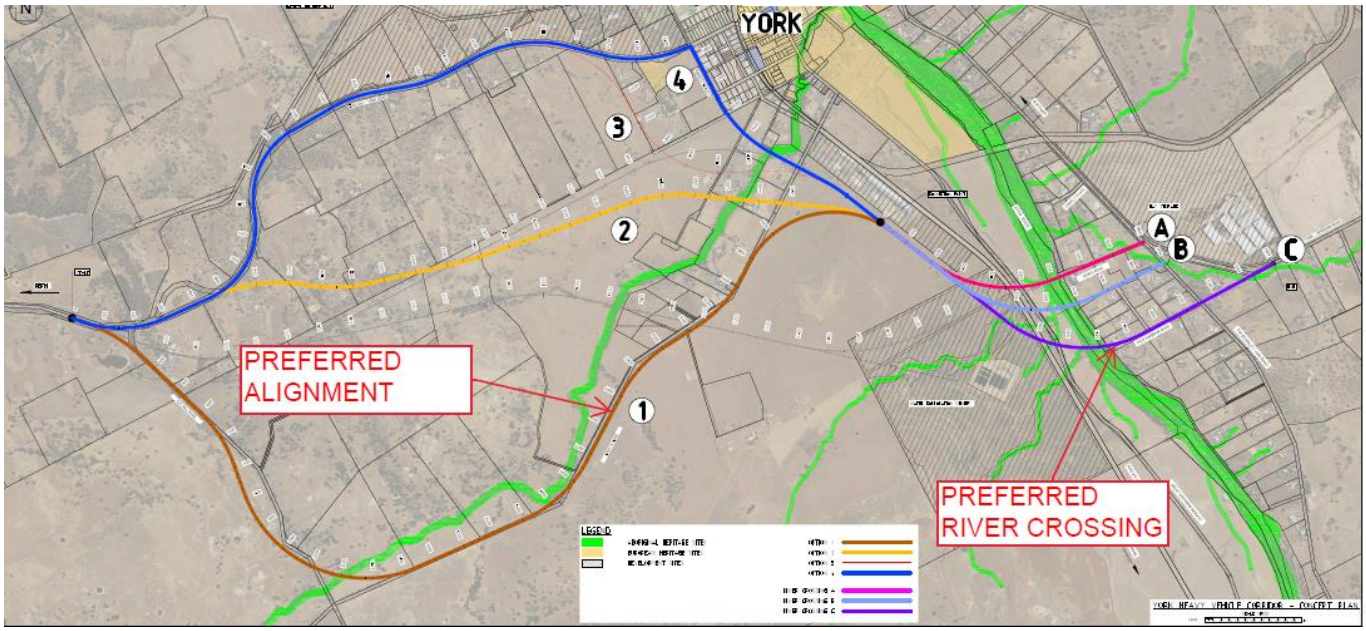
1.1. Executive Summary

The York Heavy Vehicle Bypass Alignment Selection Study was funded by the Wheatbelt Development Commission (WDC) on behalf of the Shire of York. The WDC requested Main Roads Western Australia (Main Roads) investigate and identify heavy vehicle bypass options to provide York with a reliable, safe and efficient road network system into the future. The study will assist the Shire of York to develop their Local Planning Strategy and Local Planning Scheme.

A previous planning study by the Department of Planning and Infrastructure was undertaken in 2006. The report considered potential heavy vehicle bypass options around the York town site with a focus on improving road safety, addressing concerns of vibration created by heavy vehicles passing through the Blandstown Heritage Precinct and identifying future industrial land development.

Presently, heavy vehicles use the town centre either through the Balladong Street Bridge or the South Street Bridge. Consequently, a number of heritage buildings adjacent to these routes are being exposed to vibration from passing heavy vehicles. With expected increase in the movement of commodities such as grain and hay, it is considered that heavy vehicles are likely to increase in volume and possibly be longer and heavier in sizes. There is an increasing risk of damage to the heritage listed buildings in terms of structural integrity. Heavy vehicles also create uninviting environments for pedestrians due to errant vehicle movement.

In 2017, Main Roads identified and investigated various heavy vehicle bypass alignment options. This report will be referred to as the Alignment Selection Report (ASR). The scope of study included investigation and assessment of the most viable bypass alignment based upon a multi-criteria assessment (MCA), which considered social, environmental, economic, heritage, engineering, and network performance impacts. The study was split into two sections to the south of York. The study identified western options (Option 1, 2, 3 and 4) between the Great Southern Highway (Chidlow York Road) and CBH grain facility and eastern river crossing options between the Quairading York Road and CBH grain facility (Options A, B and C). Out of these options, western Option 1 and eastern river crossing Option C was recommended as the preferred heavy vehicle bypass alignment.



The Shire of York, WDC, and Main Roads have worked together to ensure all stakeholders including businesses and community members have been able to give meaningful input into this assessment. Relevant stakeholders were also consulted, including Water Corporation, CBH, Gilmac Hay, PTA and ARC Infrastructure.

The report outcome including the MCA can be found in the previous report attached in Appendix L.

The report recommended:

- additional assessment to culminate and refine river crossing routes
- associated traffic impact assessment including level crossing closures
- economic impact of heritage and tourism vs haulage route
- investigate staging and cost of options

The Shire of York and WDC accepted the report and agreed to complete further investigation and assessments to refine and conclude the study.

This report is titled “Alignment Definition Report” (ADR). The report has concluded that the optimum bypass alignment is western Option 1 and eastern river crossing Option C, which validates the findings of the previous study. The ADR has been prepared to provide a sufficient level of detail to define a road corridor suitable for the development of the recommended Options 1 and C.

It is noted that the existing ground for the proposed heavy vehicle bypass alignment is rolling and hilly in nature and therefore the proposed corridor will require significant cut and fill earthworks in various locations to facilitate the road construction. The road alignment is typified by rolling hills vegetated primarily with grassed fields, with isolated groups of trees, particularly at crests of hills and along drainage alignments. The proposed bypass alignment impacts rivers and waterways which are listed as aboriginal heritage sites. Therefore approval from the relevant government agencies will be required to facilitate construction.

To identify potential environmental, social, and engineering constraints preliminary desktop assessments, site inspections and data interrogation has been completed.

Additional traffic counts and origin-destination surveys were conducted to estimate the re-distribution of traffic for future years. Appropriate intersection treatments for each of the side roads have been determined based on anticipated traffic volumes and delays. The analysis confirms each of the intersections are projected to operate well in traffic operational and efficiency terms. There are four key intersections to be introduced along the bypass network namely Great Southern Highway (Chidlow York Road) to York Bypass intersection, Knotts Road to York Bypass intersection, Great Southern Highway (Northam Cranbrook Road) to York Bypass roundabout and Top Beverly York Road to York Bypass roundabout. In addition to the assessment of traffic capacity within the town, further traffic assessments have been conducted of the proposed intersections for future years 2031, 2036 and 2041. The exercise found that in the AM and PM peak periods, the proposed intersections are projected to operate well under capacity and with minimal average delays. Even by future year 2041, drivers are estimated to experience no more than 10 seconds of delay on average at each intersection during the peak hours of a typical day.

Meetings with PTA and ARC Infrastructure were held in July 2019. The discussion focused on the comparison between level and grade (bridge) crossing treatments and the relevant approaches. PTA and Arc Infrastructure do not support the rail/road level crossing treatment, consistent with current policy. A grade separated option has also been developed to determine the constraints, impacts, constructability and high level construction cost. The decision regarding the crossing (level crossing v grade separated) is subject for review of the railway authority and relevant state and government agencies.

The road alignment geometry has been proposed and developed meeting Austroads and Main Roads standards for RAV 7 vehicles (36.5m road trains). The intent of the vertical alignment design is to tie into the existing topography as much as possible, to minimise the cut and fill quantities throughout the site. A high-level drainage assessment was completed and considered in the proposed alignment. A site walkover has also been carried out in addition to the desktop assessment of supplied geotechnical information. A preliminary concept for the bridge crossing over the Avon River has been developed for at grade rail/road crossing and grade separated options. A high-level construction cost estimate of the preferred alignment has been determined based on previous projects similar in nature for both at grade level rail/road level crossing and grade separated options.

1.2. Recommendation

- Based on the Alignment Selection Report completed in 2017 (Refer Appendix L) and the Alignment Definition study 2019 (this report); western Option 1 and eastern river crossing Option C is the recommended alignment.

2 Introduction

2.1. Project Background

The town of York was first settled in 1831 and is situated on the Avon River, 100km east of Perth in the Wheatbelt Region. Below is the map location shown in Figure 2.1.

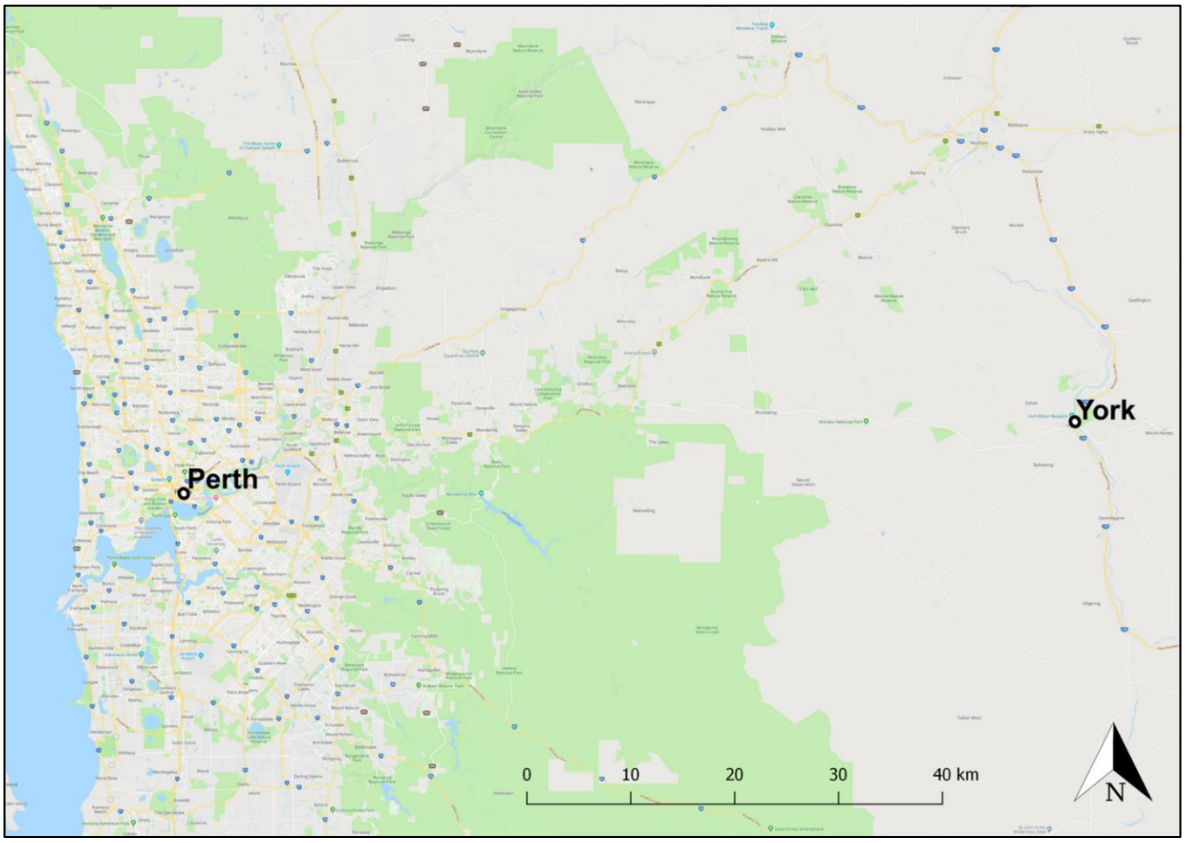


Figure 2.1 Location Map

York is listed as **historic** on the Register of the **National Estate of the Commonwealth of Australia** and supports local agricultural activities as well as tourism and light industrial enterprises. The town has key receival sites for locally harvested hay (Gilmac Hay) and grain (CBH). York CBH is amongst the top 100 sites to be operationally maintained into the future under its current strategy. CBH has indicated that the volume of grain coming into the York CBH facility is likely to double in the coming years.

Presently, to cross the Avon River, heavy vehicles use either the Balladong Street Bridge or South Street Bridge. As a result a number of heritage listed buildings are being subjected to vibration from passing heavy vehicles which may eventually undermine their structural integrity. In addition, there is an increasing risk of vehicle strike and associated damage to these buildings from errant vehicle movement.

York fulfils an important tourism role for WA and has a town centre, town hall, regular events and other amenities which create pedestrian traffic activity. This movement results in higher conflict between local and through traffic and strengthens the need for a heavy vehicle bypass to preserve the town's character and to support the growing economy. The vehicle volumes and composition of traffic can often create uninviting environments for pedestrians.

Both residential and industrial sectors are expected to expand as the town's population increases. This growth will

lead to an increase in the volume of both light and heavy vehicles.

In February 2018, the Shire of York published the latest Local Planning Strategy, Local Planning Scheme and launched a number of scenario plans to seek community and key stakeholder input. Under the scenario plan for "Infrastructure Ideas" a reference is made to planning for the York Bypass.

2.2. Purpose of Study

In 2017, Main Roads in collaboration with the Shire of York and the Wheatbelt Development Commission, investigated various road alignment options for a bypass. The bypass is intended to encourage and accommodate the future growth of York by providing a reliable level of service and efficient road network system. The previous study identified the most viable alignment based on a MCA, which covered aspects such social, environmental, road safety, economic, heritage, engineering, and network performance.

The purpose of this report is therefore to:

- confirm the preferred alignment option as identified in the Alignment Selection Study (2017) from an engineering, land and environmental impact perspective
- provide details on the constraints, opportunities and considerations for planning
- identify a corridor and associated land requirements
- identify local and state government endorsements required for the preferred route
- collaborate and seek endorsement from stakeholders such as CBH, Water Corporation, PTA, and Arc Infrastructure

The York Bypass is intended to provide better road connectivity for heavy vehicles from the Great Southern Highway (Chidlow York Road) on the western corridor of York to the York Quairading Road, Top Beverly York Road, and the Great Southern Highway (Northam Cranbrook Road) on the eastern corridor. The York Bypass will enable traffic to travel without the need to pass through the town of York whilst also providing safer connectivity into the town for local access.

This report is focused on the culmination of technical investigations and public and stakeholder consultation. It has been prepared to provide sufficient level of detail to define a road corridor suitable for the construction of the future York Bypass.

2.3. Planning Objectives

As York is one of the oldest inland towns in Western Australia it attracts visitors for its beauty, history, and provides tourism opportunities to showcase the heritage buildings.

York has an approximate population of 3,500 people. A major geographical feature of York is the Avon River. This river runs in a generally north-south direction through the middle of York providing limited access between the east and west. As previously mentioned, access is managed with one major bridge crossing (Balladong Street) and one minor bridge crossing (South Street).

With York's long-standing history and various local planning strategies over the last 185 years, several heritage listed buildings are now located close to the road edge. These buildings are subject to excessive vibration due to heavy vehicles moving past them regularly as well as the additional seasonal freight movements during carting periods. This excessive vibration may have a detrimental effect on these buildings by introducing cracking and undermining the structural integrity of the buildings.

The current alignment of the major roads into York do not present any opportunity to travel through the area without passing through the town. A number of crashes between heavy and light vehicles have been recorded and it was recognised that the project could contribute to lowering the rate of killed and serious injury (KSI) crashes on the Great Southern Highway (Chidlow York Road) by diverting traffic onto a heavy vehicle bypass.

The projected growth rate of York is expected to be within the range of 1.8-3.3% over the next 10 years (Shire of York – WA Tomorrow Series 2012). Combined population growth, grain and hay activities, and heavy vehicle movements through the town are expected to increase, leading to the potential for more conflict between light and heavy vehicles as well as local and through traffic. The Town Planning Scheme for York has listed a proposed residential area along the Great Southern Highway (Chidlow York Road) entrance to the town.

Aspirations of the WDC is to support the Shire of York's local planning scheme to make informed decisions to enable improved town planning, specifically to assist in identifying appropriate land for industrial zoning.

Considering the anticipated regional growth, the heavy vehicle bypass will potentially contribute to:

- Future growth of light industrial activity
- Promote York as a lifestyle village (encourage residential growth)
- Promote York as a tourist destination and increase tourism

The above will also assist with local business development opportunities.

In order to address the future needs of the town and to promote York as a tourist destination in the Wheatbelt Region, preserving the heritage buildings is necessary and as such a heavy vehicle bypass is required as part of a long-term plan to achieve this. Benefits of the provision of a bypass include but are not limited to:

- Assist the Shire of York to identify appropriate land and infrastructure for industrial zoning
- Address road safety concerns in and around town of York
- Protect and promote areas and buildings of historic and cultural significance
- Contribute to address safety concerns on the Great Southern Highway (Chidlow York Road)
- Reduce the likelihood of traffic congestion in the town
- Identify, develop and promote the environment
- Improve road network efficiency, particularly around CBH and Gilmac Hay
- Provide a road suitable for future heavy vehicle configurations and volumes (36.5m road trains)
- Provide a direct road network for through traffic
- Consistency with Main Roads heavy vehicle access strategy within the Wheatbelt Region

2.4. Proposed Alignment

The Alignment Selection Report undertaken by Main Roads considered four possible options on the western side of the Avon River and three options for the bridge crossings as shown in Figure 2.2. The previous study identified the preferred and recommended option not only from an engineering point of view but also from public consultation and deliberation between Main Roads, Shire of York, WDC and design consultants.

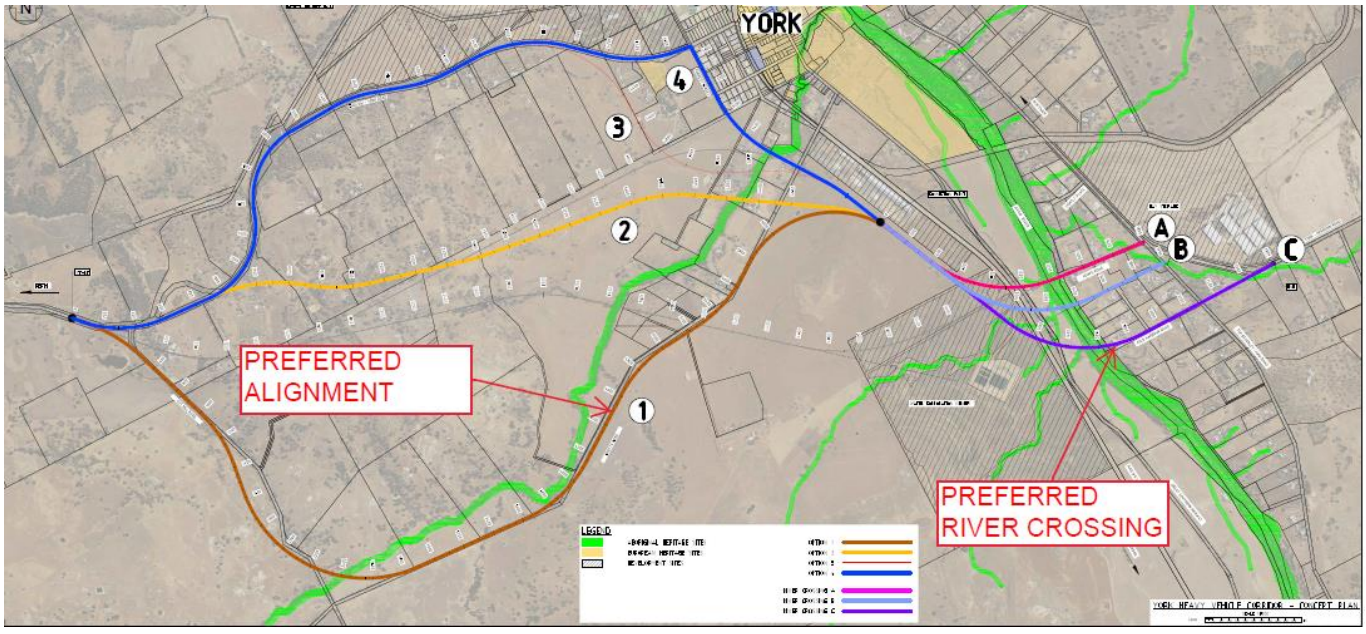


Figure 2.2 – Road Alignment Options (March 2017 Study)

The Alignment Definition Report has re-assessed these alignments to confirm that the preferred option is the best alignment. This included reviewing the four possible routes for the western corridor and the three river crossings for the eastern corridor. The criteria for re-assessment focused on social, environmental, economic, land and heritage impacts, road safety, constructability and better connection with the existing road network.

After thorough investigation, it was confirmed that the outcome and recommendations from the previous study are valid and therefore this is the focus of the study. The preferred alignment (Option 1) is preferred over the others due to the following key considerations:

- It will separate the light and heavy vehicles entering/exiting York and therefore defines a true bypass
- It will accommodate long term traffic demands as a result of future town development and increase in hay and grain transportation
- Minimal traffic disruption, in particular on Great Southern Highway
- The road geometry has less steep grades compared to other options which better accommodates heavy vehicles
- The alignment provides better connectivity to the existing road network
- The community preferred this route based on feedback from public consultation

The preferred eastern river crossing (Option C) provides better geometry in comparison to the other options as it ties in with the existing Quairading York Road on a straight alignment and is perpendicular to the existing Top Beverley York Road. This provides a better alignment for a roundabout treatment (refer to Appendix G). In this scenario the existing 3-way intersection of the Quairading York Road and Top Beverly York Road will be removed, which will reduce the number of conflict points. In addition, the Option C alignment runs within the existing Cold Harbour Road which would reduce impacts on landowners.

From the three river crossing options, Option C is the only option that satisfies the rail/road requirement to accommodate the 1,196m train length buffer (stacking distance) for the level crossing option.

It is acknowledged that the combination alignment of western Option 1 and river crossing Option C is not the cheapest option from a construction point of view. However, there are many factors that need to be considered such as constructability, engineering constraints, environmental, economic and social impact.

Preferred Option

The preferred heavy vehicle bypass alignment is approximately 9.7km long. It connects the existing Great Southern Highway (Chidlow York Road) (immediately south of Cut Hill Road) on the western corridor and Quairading York Road on the eastern corridor (approximately 650m east from the existing Quairading York Road/Top Beverly York Road intersection).

The proposed road alignment follows the existing Knotts Road and Cut Hill Road alignment as closely as possible. There are several existing driveways along the proposed alignment which have been given consideration in this report. The estimated construction cost of the preferred option is noted in Section 5.6 of this report.

2.5. Report Outline

This Alignment Definition Report considers the following;

- Section 1 – Executive Summary
- Section 2 – Introduction
- Section 3 – Context
- Section 4 – Constraints
- Section 5 – Development of the Planning Design Concept
- Section 6 – Traffic and Safety Assessment
- Section 7 – Land Requirements
- Section 8 – Consultation and Endorsements
- Section 9 – Conclusion
- Section 10 – References
- Section 11 – Appendices

Please note, no further environmental and heritage surveys have been carried out for this report.

2.6. Glossary

Term	Description
DoS	degree of saturation
DWER	Department of Water and Environment Regulation
LoS	level of service
Main Roads	Main Roads Western Australia
PSP	principal shared path
PTA	Public Transport Authority
RAV	restricted access vehicles
vpd	vehicles per day
vph	vehicles per hour
WAPC	Western Australia Planning Commission
ASR/ADR	alignment selection report/alignment definition report
DPI	Department of Planning and Infrastructure

3 Context

3.1. Background

York's significant historical and heritage attractions have identified the town as a district service centre in the Avon region of WA.

Three regional roads pass through the York town site: the Great Southern Highway, split into two roads, Chidlow York Road and Northam Cranbrook Road and the Quairading York Road.

The roads are frequently used by heavy vehicles transporting grain to the York CBH facility from various sites surrounding York. CBH has indicated that the volume of grain coming into the York CBH facility is likely to double in the coming years. The Shire of York is concerned about the volume of freight traffic through the Blandstown Heritage Precinct, which is shown in Figure 3.1.

Figure 3.1 Blandstown Heritage Precinct

The Department of Planning and Infrastructure (DPI) completed a planning study in May 2006, which identified potential improvements to the road network in York to cater for future road freight demand and to reduce the impact of heavy vehicles through the town site. Improvement options varied from upgrading existing roads through to the longer-term construction of a bypass. In the shorter term, it was proposed that upgrading Gwambygine East Road would bring significant benefits. In order for RAV operations to be permitted on this road, a number of significant improvements would need to take place:

- Major upgrade and reconstruction of the Great Southern Highway (Northam Cranbrook)/Gwambygine East Road intersection to improve sight distance from both directions
- Widening and strengthening of Gwambygine bridge
- Realignment and reconstruction of both road approaches to the bridge

Due to the high costs associated with these improvements, Main Roads undertook preliminary investigations into other options for crossing the Avon River closer to York and to the Quairading York Road/Top Beverley York Road intersection. This planning study also recommended that the long-term priority should be the construction of a western bypass to reduce heavy vehicle traffic through the Blandstown Heritage Precinct. It was also recommended that further work would be required to determine the economic, social and environmental benefits and costs before a decision can be made on whether or not a bypass should be planned.

3.2. Literature Review

The following literature has been reviewed as part of this study.

- York Heavy Vehicle Bypass - Alignment Selection Report (Main Roads, 2017)
- York Heavy Vehicle Bypass - Traffic Study Technical Report (Main Roads, 2013)
- York Freight Bypass - Road Network Review Study (Main Roads, 2012)
- Shire of York – Local Planning Strategy (2007)
- Department of Planning and Infrastructure (DPI) completed a planning study (May 2006)
- Shire of York – Town Planning Scheme No. 2 (1996)

3.3. Existing Road Network

The town of York is part of the strategic road transport network servicing the Wheatbelt Region. It provides an alternative to the Western Eastern States corridor and it forms part of an oversize freight route linking the Central Wheatbelt and Goldfields areas to the ports. Figure 3.2 illustrates the town of York and the surrounding road network that may be affected by the proposed bypass.

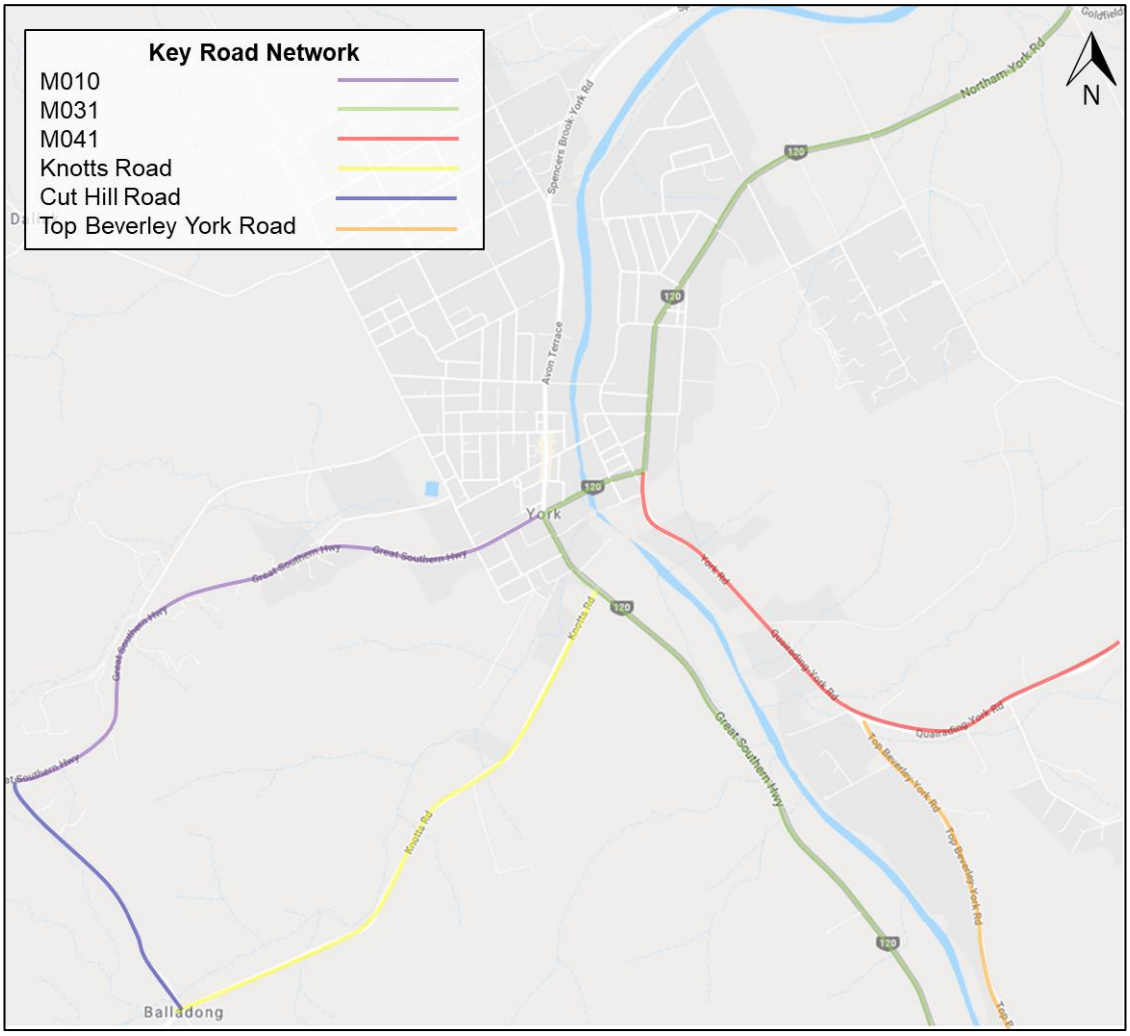


Figure 3.2 Existing Road Network

Commentary on each road is provided below:

- The Great Southern Highway (Northam Cranbrook Road) is identified as a strategic inter-regional route between the Wheatbelt and Great Southern regions. It is a primary distributor north-south link that provides inter-town access between Northam and Cranbrook including the towns of York, Beverley, Brookton, Pingelly, Cuballing, Narrogin and Wagin within the Wheatbelt region.
- The Great Southern Highway (Chidlow York Road) is an important primary distributor link to the Metropolitan area from the eastern and south-eastern Wheatbelt. It is an alternative to the Great Eastern Highway for eastbound over weight and over width traffic and carries grain, fertiliser, general freight and tourist traffic.
- Quairading York Road (part of the York Merredin Road) provides inter-town access between York, Quairading, Bruce Rock and Merredin. This primary distributor road links significant wheat producing areas and Perth. The route is also recognised as an important freight route as it provides an alternative to the Western Eastern States corridor and it forms part of an oversize freight route linking the Central Wheatbelt and Goldfields areas to ports.
- Knotts Road and Talbot Road are local access roads located south-west of the town. The roads service

CBH and a number of dwellings. Knotts Road provides a direct link between Talbot Road and York.

- Cut Hill Road is a local access road located south-west of the town and is used to connect the Great Southern Highway (Chidlow York Road) and Knotts Road. Cut Hill Road has a number of driveways on the eastern side of the road.
- Top Beverley York Road is a north-south local distributor road that currently intersects with Quairading York Road to the north and Great Southern Highway (Northam Cranbrook Road) to the south. The link provides an alternative route to Great Southern Highway (Northam Cranbrook Road) and can be used to connect York and Beverley.

The speed limits in the study area varies as illustrated in Figure 3.3.

In summary, the primary distributor roads further out of the York town centre have a speed limit of 110km/hr. The speed limit gradually reduces in increments of 20-30km/hr to a speed of 50-60km/hr through the town centre. The local distributor and access roads currently have a speed limit of 90km/hr and 50 km/hr respectively.

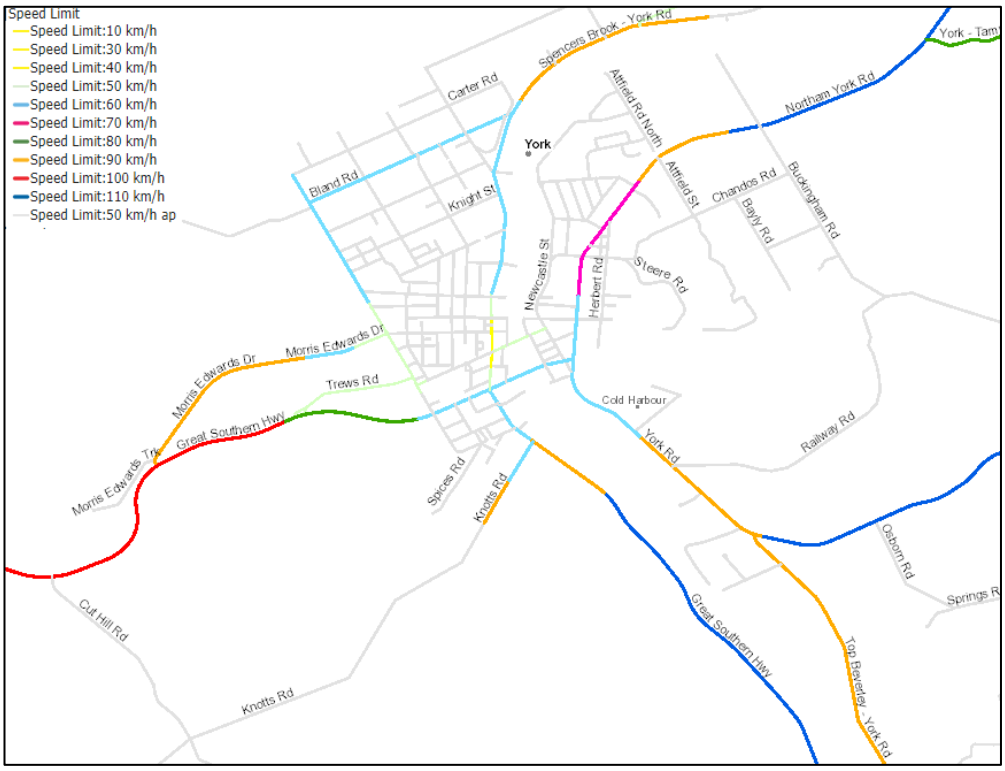


Figure 3.3 Existing Speed Limits

3.4. Existing Road Conditions

3.4.1. Existing Mid-Block Road Conditions

As shown in Table 3.1, the existing traffic volumes surveyed in 2017 to 2019 on the arterial roads surrounding York have been collated from the Main Roads traffic map website. At most, Great Southern Highway (Chidlow York Road), west of Cut Hill Road, accommodates 1,643 vehicles per day (vpd). This is relatively low, as a two-lane single carriageway has a theoretical capacity of approximately 30,000 vpd. Heavy vehicle percentages are high, accounting for approximately 25% of total vehicles. In summary, the existing roads have excess capacity due to low existing traffic volumes.

Table 3.1 Existing mid-block traffic counts

Road	Total vehicles per Day	Percentage Heavy
Great Southern Hwy (Chidlow York Road), west of Cut Hill Road	1,643	23%
Great Southern Hwy (Northam Cranbrook Road), south of Radnor Road	1,395	24%
Quairading York Road, east of Top Beverley York Road	737	31%
Cut Hill Road	81	28%
Knotts Road	166	25%

3.4.2. Existing Intersection Conditions

A traffic assessment was previously conducted on a number of priority intersections in the Alignment Selection Report. The assessment assumed the worst-case conditions since it was based upon traffic volumes which did not include turning counts at intersections. However, to provide certainty around the intersection forms and operation, and to quantify the potential traffic reduction through the town, additional intersection surveys were conducted in July 2019.

A traffic assessment of the key intersections was conducted in SIDRA and the existing condition results are summarised in Table 3.2 and Table 3.3 for the AM and PM peak hours respectively. The full SIDRA reports for each intersection are contained in Appendix A.

Table 3.2 AM Peak Hour Existing Intersection Performance

Intersection	Overall Degree of Saturation (DoS)	Overall Average Delay (sec)
Great Southern Hwy (Chidlow York Road)/Cut Hill Road	0.035	1.0
Great Southern Hwy (Chidlow York Road)/Forrest Street	0.059	3.8
Great Southern Hwy (Chidlow York Road)/Avon Terrace	0.075	6.1
Great Southern Hwy (Northam Cranbrook Road)/Balladong St/Quairading-York Road	0.046	5.4
Quairading York Road/Top Beverley York Road	0.032	3.2

Table 3.3 PM Peak Hour Existing Intersection Performance

Intersection	Overall Degree of Saturation (DoS)	Overall Average Delay (sec)
Great Southern Hwy (Chidlow York Road)/Cut Hill Road	0.049	0.4
Great Southern Hwy (Chidlow York Road)/Forrest Street	0.063	3.1
Great Southern Hwy (Chidlow York Road)/Avon Terrace	0.102	5.9

Great Southern Hwy (Northam Cranbrook Road)/Balladong St/Quairading-York Road	0.081	5.6
Quairading York Road/Top Beverley York Road	0.031	2.7

In summary, the analysis of the above intersections confirms that each operates well under capacity and within the practical maximum degree of saturation (DoS) of 0.85, with minimal average delays. The low DoS and delays are consistent with the existing mid-block road conditions described in Section 3.4.1.

3.5. Planned Road Network

The Quairading York Road has recently been widened in sections to increase the seal/formation width to 9/10m. Remaining sections will be completed pending government funding allocations.

Safety upgrades were undertaken on Great Southern Highway (Chidlow York Road) to address safety concerns. These measures included reducing the speed limit from 110km/hr to 100km/hr and improved signage, delineation and road marking.

Main Roads has developed a strategy to improve the Great Southern Highway (Northam Cranbrook Road) between Northam and Brookton. A planning study has also been completed for the Great Southern Highway (Chidlow York Road).

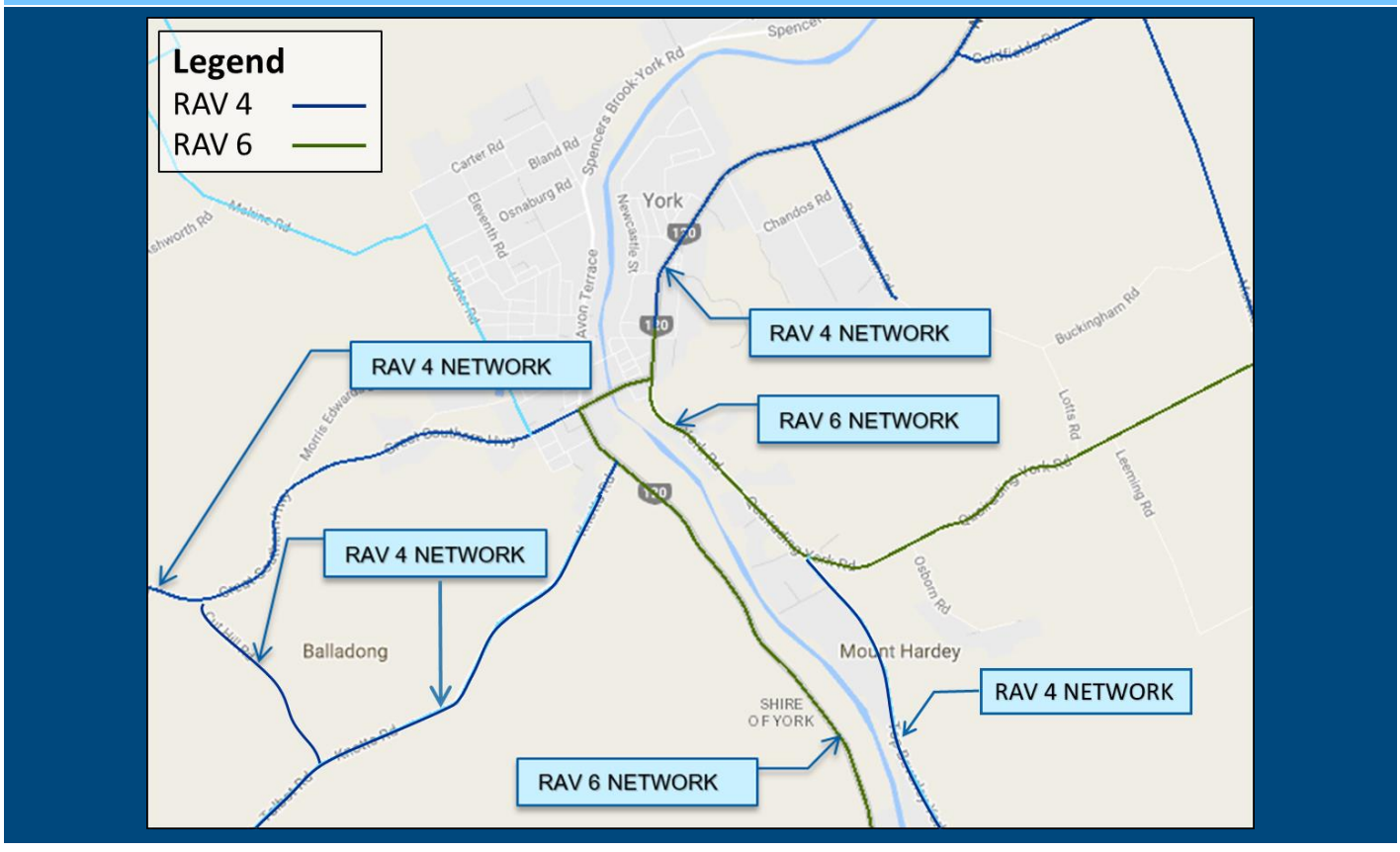
3.6. RAV Network

3.6.1. Existing RAV Network

The existing RAV network within the study area accommodates RAV 4 vehicles (27.5m road trains) with a section of the Great Southern Highway (Northam Cranbrook Road) that permits for RAV 6 vehicles (36.5m road trains). The RAV network has been summarised below:

Table 3.4 RAV Network (Main Roads HVS Network Map)

RAV Network



Road Name	Start SLK	End SLK	RAV Classification	Additional conditions
Great Southern Hwy (Chidlow – York Road)	0	46	4	No
Great Southern Hwy (Northam York Road)	0	34	4	No
Great Southern Hwy (between York Beverley)	34	66	6	No
Quairading York Road	0	10	6	Yes
Knotts Road	0	4.68	4	Yes
Cut Hill Road	0	2.16	4	No

3.6.2. Future RAV Network

There are currently no known plans to upgrade the existing RAV network around York. There have been a number of requests from industry for the Great Southern Highway (Northam Cranbrook Road) between York and Northam to be upgraded to a RAV 6 route, however no assessments have been completed at this time. It is likely that future planning for the York area would include upgrading either Northam Cranbrook Road or Great Southern Highway (Chidlow York Road) to RAV 6 or potentially upgrading the Northam Cranbrook Road to a RAV 7 (36.5m road trains) to complete the link from Northam through to Brookton.

3.7. Public Transport and Non-Motorised Transport Network

3.7.1. Public Transport Network

A coach service operated by the Public Transport Authority is available to access Perth to Albany and stops on Joaquina Street within the town of York.

York no longer has a passenger rail service with the former rail master's house and station being decommissioned and placed into freehold. The AvonLink in Northam provides the nearest passenger rail service, with a connecting bus service to York.

There is no future planning for additional public transport to and within York.

3.7.2. Cycling

There are no principal shared paths around York and cyclists are required to cycle on road or in the road reserve.

3.7.3. Pedestrians

Pedestrian footpaths are limited.

4 Constraints

4.1. Environmental Constraints

A preliminary desktop environmental assessment of the proposed bypass was conducted in June 2019.

4.1.1. Reserves, Conservation Areas and Regional Parks

No impacts on any conservation areas are expected.

4.1.2. Wetlands

No wetlands or Ramsar (wetland of international importance) sites are mapped in the vicinity of the proposed works.

The footprint of the proposed alignment goes across mapped watercourses in a number of places. A Bed and Banks Permit will be required to disturb these watercourses in accordance with the **Rights in Water and Irrigation Act 1914.** Impacts on the Avon River should be minimised as much as possible and assessed in accordance with Main Roads Water Protection Guideline and Water Quality Protection Note 44: Roads near sensitive water resources (Department of Water 2006). Comment from the relevant section of the Department of Water and Environmental Regulation (DWER) is required in relation to design in the proximity to the Avon River.
If dewatering is required during construction, a dewatering licence from the DWER will also be required.

4.1.3. Threatened Ecological Communities (TECs)

A site inspection undertaken on 5 June 2019 identified the potential for the Critically Endangered **Eucalypt Woodlands of the WA Wheatbelt** TEC present within the project footprint. It is likely that the project will also impact the Priority 1 listed Ecological Community **Pools of the Avon and Dale Rivers.** Further advice is currently being sought from the DBCA as to the implications of this Priority 1 species for the project. A spring biological survey will be required to confirm the vegetation values that are likely to be impacted by the project and the scale of the impacts.

4.1.4. Vegetation and Flora

The assessment highlighted that a large part of the project footprint occurs within historically cleared areas, however some clearing of native vegetation is likely to be required. A spring biological survey will be required to confirm the vegetation values that are likely to be impacted by the project and the scale of the impacts.

During the site inspection undertaken on 5 June 2019, it was observed that most of the vegetation along the Knotts Road section of the proposal footprint occurs on the northern side of the road. It is suggested that the project footprint be shifted slightly south of Knotts Road in this section where practicable in order to minimise clearing of native vegetation.

It is also worth noting that the project occurs in a dieback susceptible area, however it is likely that the majority of the area would be uninterpretable due to agricultural clearing and lack of indicator species. If construction works are scheduled to occur outside of dry conditions, then a dieback survey and management plan is likely to be required.

4.1.5. Fauna

The assessment highlighted that a number of records of threatened and priority fauna species exist within the vicinity of the project (Figure A.1 of Appendix B). The project occurs in the mapped distribution of two of the federally listed black cockatoo species; Carnaby Black Cockatoo and the Forest Red-Tailed Black Cockatoo, occurring less than 2 km from a confirmed black cockatoo roost site. The project footprint therefore has the potential to contain habitat for threatened and priority listed fauna species.

The site inspection undertaken confirmed the presence of potential black cockatoo breeding trees inside the project footprint. A biological survey will be required to determine the potential impacts to fauna resulting from the project. A spring survey will also be required to confirm the vegetation values to be impacted and the presence of any threatened or priority flora.

4.1.6. Acid Sulphate Soils (ASS)

The assessment highlighted that the project intersects areas classified as having a high risk of ASS occurrence. ASS investigations will be required as well as development and implementation of an ASS management plan to manage potential ASS impacts during construction.

4.1.7. Contaminated Areas

In summary, a search of the DWER contaminated sites database undertaken on 31 May 2019 identified that the nearest known contaminated site is located approximately 400m from the project footprint (Figure A.1 of Appendix B). Based on the scale and location of the project, a preliminary site investigation (PSI) is recommended to determine the contamination risks associated with the project. Depending on the outcomes of the PSI, a detailed site investigation may be required.

4.1.8. Public Drinking Water

The project area does not occur in the vicinity of any public drinking water source areas.

4.2. Social Constraints

4.2.1. Indigenous Heritage

A preliminary indigenous heritage desktop assessment of the proposed bypass was conducted in June 2019. The assessment highlighted that the project footprint crosses the Swan River (Site ID 3536) registered aboriginal site at a number of locations (Figure A.1 of Appendix B). A Section 18 heritage approval under the Aboriginal Heritage Act 1972 will be required prior to any works being undertaken within this registered site. Disturbance of the river and tributaries should be minimised where practicable.

4.2.2. Non Indigenous Heritage

A preliminary desktop non indigenous heritage assessment of the proposed bypass was conducted in June 2019. The assessment highlighted that the project footprint partly intersects or occurs in close proximity to a number of municipal and State heritage listed non-indigenous heritage sites in the vicinity of York town site.

The desktop assessment identified that the project has the potential to impact the following sites listed on the State Heritage Register (Figure A.2 of Appendix B):

- Balladong Farm (State Heritage Register Place no. 2867) – the listing relates to the buildings within the boundary of the site.
- Blandstown Heritage Precinct (State Heritage Register Place No. 2864) – currently being assessed by the State Heritage Office.

The desktop assessment identified that the project also has the potential to intersect the following municipal heritage sites:

- Balladong Farm (Municipal Inventory Place No. 2867)
- Blandstown Heritage Precinct (Municipal Inventory Place No. 2864)
- Bygraves House and Shop (Municipal Inventory Place No. 2875).

If the municipal heritage sites are to be disturbed by the project, consent will need to be obtained from the State Heritage Officer and/or the Shire of York prior to undertaking any works in their vicinity. Direct disturbance to the buildings within the State and Municipal heritage sites should be avoided where practicable. Indirect impacts on these buildings resulting from construction (i.e. vibration impacts) will need be managed during construction.

In summary, the project footprint is likely to avoid direct disturbance to any buildings located within State or Municipal listed heritage places. However, it is possible that the project footprint will intersect the boundary of at least one State or Municipal heritage place. As a result, consent for disturbance of these sites will be required from the State Heritage Office and/or Local Government. Based on the assumption that no direct disturbance to heritage listed buildings will occur, it is anticipated that this approval process will take approximately three months.

4.2.3. Property Impact – Severance and Access

Access into private property will be impacted along Knotts Road and Cut Hill Road as the proposed bypass will separate sections of these roads. Similarly, the bypass will also separate the existing Water Corporation Sewerage access way. Access to the road network will need to be further considered.

4.2.4. Noise and Vibration

A preliminary noise and vibration desktop assessment of the proposed York Bypass was conducted in June 2019. The assessment highlighted that the project footprint occurs in close proximity to several dwellings. Based on the scale of the project, noise and vibration impact assessments may be required as part of the project environmental impact assessment.

4.2.5. Air Quality

A preliminary air quality desktop assessment of the proposed York Bypass was conducted in June 2019. The assessment highlighted that the project footprint occurs in close proximity to several dwellings. Based on the scale

of the project, air quality impact assessments may be required as part of the project environmental impact assessment.

4.2.6. Disruption of Local Travel Routes

To minimise the disruption on local travel routes, access ways will be required onto the proposed bypass to allow connectivity from the bypass and Great Northern Highway (Northam Cranbrook Road). Similarly, local traffic on Cut Hill Road will no longer have direct access onto Knotts Road and will need to be further considered.

The existing network has one route from Quairading York Road into the town centre and the proposed bypass will introduce another connection from Quairading York Road via Great Southern Highway (Northam Cranbrook Road). Local travel routes may be affected due to the additional route choice.

4.3. Engineering Constraints

4.3.1. Topography and Hydrology

The existing ground for the proposed York Bypass is undulating and mountainous in nature. As a result of unfavourable topography, the proposed road will require deep cuts and significant fill in some locations to facilitate the road construction. Consequently, the required road corridor in some locations will need to be wider to contain the batter extents within the road reserve boundary.

According to the high level geotechnical assessment the existing ground formation consists mainly of solid rock which is a challenge for road construction and will increase construction cost. Removal of huge volumes of rock may require blasting which would require approval from DWER and relevant authorities.

The proposed road alignment was optimised to follow the existing terrain wherever possible. It did not consider the maximum road grades allowed for the heavy vehicle for the speed at which the road is designed.

4.3.2. Drainage

An impact assessment was undertaken for the existing natural water ways crossing the proposed road. The majority of the crossing points were over tributaries to the Swan River which is an aboriginal heritage site.

A catchment analysis has been undertaken to determine the natural drainage flow paths and road crossings to estimate the peak flow rates for each sub-catchment.

The drainage crossing points have been marked on the catchment plan attached in Appendix C of this report. The flow rates for each road crossing has been estimated using the rational method based on the Australian Rainfall & Runoff 1987 (AR&R) Volume IV for the Wheatbelt Region. Accordingly, the required number of pipe/s and size have been determined and included in the design drawings included in this report.

Three natural waterways have been identified crossing the proposed bypass that would require significant fill due to the difference in level between the proposed road and the existing ground surface.

The bypass may potentially impact two existing dams.

4.3.3. Geotechnical Engineering

No geotechnical investigations have been done for this Alignment Definition report. A geotechnical investigation will be required to understand foundation and excavation requirements. The following scope is suggested as a minimum:

- A detailed investigation at each bridge site, including a minimum of one investigation location per bridge pier/abutment, within 10m of the actual location of each structure. For every 10m width of the bridge, an additional investigation location is required. This should be completed as per the “Guidelines for Geotechnical Investigation of Bridge Structures” (Report No. 2009-8M), AS1726 – 2017, AS2159 and AS5100. This should include sites within the river bed, which will be difficult to access.
- Investigation along the road alignment as per “Guidelines for Geotechnical Investigation of Road Works” (Report No. 2011-01M). This should include test pits or boreholes at a maximum spacing of 500m through the embankment sections, test pits or boreholes at a maximum spacing of 100m through cut sections, and

potential costean or dozer ripping trials for excavatability assessment where required. The larger cuts may require angled boreholes to assess defects in the rock mass. Testing will generally be required to a minimum of 1.5m below the formation level.

It should be noted that additional investigation may be required if the conditions are different from expectations. Expectation for geotechnical conditions are discussed in Section 5.7.

4.3.4. Services

Due to the magnitude of the proposed road, the service locations will need to be identified.

4.3.5. Infrastructure

The proposed Avon River Bridge will require the construction of three or four span bridge depending on the preference, which may impact the river and tributaries (known aboriginal heritage site). In addition, the road/river crossings and drainage diversion requirement will need an approval from the relevant approving agencies to facilitate road construction.

5 Development of the Planning Design Concept

5.1. Design Standards

The following design standards have been adopted, generally giving precedence to the documents in the order listed below:

- Main Roads Standard Drawings, available from the website
- Main Roads supplements to AustRoads Guide to Road Design Guidelines
- Main Roads Horizontal Curve Tables (2017)
- Austroads Guide to Road Design Part 1 to 8

5.1.1. Design Speeds

The following design speeds have been adopted in the development of the bypass.

Table 5.1: Design Speeds

Road Element	Design Speed (km/h)	Posted Speed (km/h)
York Heavy Vehicle Bypass Road (CH 0 to CH 4800)	110	110
York Heavy Vehicle Bypass Road (CH 4800 to CH 9783)	90	90
Great Southern Highway at CH 600	70	60
Great Southern Highway at CH 8350	70	60

5.1.2. Design Criteria

The following design criteria has been adapted in the development of the road network.

Table 5.2: Design Criteria

Criteria	York heavy vehicle bypass road	Great Southern Highway (at the intersection approach)
Design Speed (km/h)	110 & 90	70
SSD Reaction time (seconds)	2.5	2.5
Coefficient of deceleration	0.36	0.36
SSD (m) **car – h1 = 1.1m, object height = 0.2m**	209 (110km/h) & 151 (90km/h)	81
SSD (m) **truck – h1 = 2.4m, object height = 0.2m**	241 (110km/h) & 172 (90km/h)	91
ASD (m) **car - h1 = 1.1m, object height = 0m**	209 (110km/h) & 151 (90km/h)	81
SISD (m) **car - h1 = 1.1m, object height = 1.25m**	300 (110km/h) & 226 (90km/h)	131
Min Vertical Clearance (m)	5.4	5.4
Min Vertical Grade (Lined drains) (%)	0.3%	0.3%
Min Vertical Grade (Unkerbed) (%)	0%	0%
Max Vertical Grade (%)	5%	5%
Min tangent (between reverse VC) = 0.2V (m)	22	12
Min tangent (between compound VC) = 0.4V (m)	44	24
Desirable Min K for car SSD (crest VC) for S < L h1 = 1.1, h2 = 0.2 h1 = 1.1, h2 = 0.0	97.3 (110km/h) & 51 (90km/h) 198 (110km/h) & 103.7 (90km/h)	51 29.9
Min K value for sag curve	84 (110km/h) & 43 (90km/h)	16
Min Vertical Curve Length (m)	100 (110km/h) & 80 (90km/hr)	40
General	Main Roads Curve tables adopted in the design	
f (des max) for cars	0.12 & 0.13	0.24
Min R for 3% adverse cross fall (m)	3000 (110km/h) & 1700 (90km/h)	600
Min R for emax (3%) (m)	1100 (110km/h) & 680 (90km/h)	190
Lane width (m)	3.5	3.5
Cross fall (%)	3%	3%
Cut batters (Desirable)	1 in 4	1 in 4
Fill batters (Desirable)	1 in 6	1 in 6

5.1.3. Design Vehicle

The bypass has been designed for a RAV 7, 36.5m B-double prime mover. The roundabout of the bypass and Great Southern Highway (Northam Cranbrook Road) on the eastern corridor has been designed to accommodate a RAV 7 vehicle in all directions. This will maintain the vehicle access to CBH from the proposed roundabout and vice versa. The heavy vehicle movement will be up Knotts Road to access CBH and will be restricted towards the town.

The existing Cut Hill Road intersection will be re-aligned and designed to accommodate service vehicles and the school bus leading to town. Heavy vehicles will not be permitted to enter the town.

The proposed roundabout leg towards town for the Top Beverly York Road/Bypass Road roundabout is designed for service vehicles and the school bus.

5.2. Typical Cross Sections

5.2.1. Cross Section

The proposed road cross section used in the design is consistent with Main Roads 2031 Safe Systems Cross sections for the Wheatbelt Region. The cross section consists of the following formation:

Table 5.3 Cross Section

	West of Avon River	East of Avon River
Lane width (m)	3.5	3.5
Sealed shoulder (m)	2.0	1.5
Unsealed shoulder (m)	-	-
Formation width (m)	11.0	10.0
Pavement batter and Table drain slope	1 in 6	1 in 6*
Back slopes	1 in 4	1 in 4

***1:4 batter has been adopted for the grade separated option for the rail crossing and associated road re-alignment for the Great Southern Highway**

There has been no pavement design undertaken as part of the Alignment Definition Study. However, a 350mm pavement thickness has been adopted in the road design which consists of 200mm base course and 150mm subbase, which is consistent with most of the previous road constructed in the region.

5.2.2. Horizontal Design

The proposed alignment used in the design has been based on Options 1 and C. A road centreline refinement has been made to conform to Austroads and Main Roads supplement to Austroads Guide to Road Design (AGRD) Part 3 – Geometric Design.

The horizontal curve radii adopted in the design has been based on Main Roads Horizontal Curve Table adopting 3% superelevation.

The horizontal alignment and extents have been developed through an iterative process in collaboration with Main Roads and in consultation with the public and relevant stakeholders such as Water Corporation, CBH, and PTA. The horizontal alignment follows the existing Knotts Road on the western side of the Avon River and Cold Harbour Road on the eastern side as much as feasible to minimise cut and fill, land requirements and reduce vegetation clearing. Moreover, the horizontal alignment gives due consideration to the natural water ways that have been identified as aboriginal heritage sites. The following key constraints have been taken into account to minimise impacts where possible:

- The existing ground for the proposed York Bypass alignment is undulating with the majority of the formation consists of solid rock. The horizontal alignment follows the contours that avoid sudden change of elevation to minimise cut/fill wherever possible
- The alignment has been optimised to minimise impact to existing properties
- There are a number of existing accesses along the proposed bypass that will be impacted
- The proposed road offset from the existing CBH land boundary has been minimised to limit the land impact
- The section of road that passes through Water Corporation land has been minimised as much as practical to limit the land impact whilst achieving a compliant design

The above constraints form the basis for the initial design development of the road alignments and the position of the bridge over the Avon River.

Key things to note about the horizontal design:

- The Great Southern Highway (Chidlow York Road) and the proposed bypass intersection on the western corridor including the traffic movement and vehicle restriction entering and exiting from the town of York
- Modification to the existing Knotts Road including access to the existing properties and heavy vehicle movement for CBH facility
- Rail/Road level crossing and the proposed roundabout intersection on the southern side of CBH
- Road re-alignment of the existing Top Beverly York Road and York and Quairading York Road intersection

including the proposed bypass and Top Beverly York Road roundabout.

- Riverside court and the proposed York Bypass intersection
- Road re-alignment and intersection modification of the existing Talbot Road and Arnold Park Road
- Potential option to maintain section of the existing Cut Hill Road to maintain the existing property access

5.2.3. Vertical Design

The key objective in designing the vertical alignment (where unconstrained) was to match the existing topography closely as possible, to minimise the cut and fill quantities throughout the site. Where possible the design ensures that the proposed design limits the amount of reconstruction and earthworks. The vertical alignment has also been coordinated with the horizontal alignment to provide a safer driving environment for road users in accordance with best road design practice.

The vertical profile of the Avon River Bridge has been designed to allow 1.0m freeboard above the peak recorded flood level for the 100yr ARI, which is at RL176.6m (AHD71) as per the Department of Water Flood Assessment Map printed in June 2016.

Vertical alignment throughout the proposed bypass has been developed in accordance with **Main Roads Supplement to Austroads Guide to Road Design Part 3** and Austroads Part 3 for the corresponding design speed.

5.2.4. Intersections

The design selected for all the intersections was as outlined in Section 5.1.3. The turning movements for each of the design vehicles at all intersections have been reviewed and are lane correct. The horizontal alignment, vertical alignment and sight distances at intersections have been designed in accordance with Main Roads standards 'Geometric Design; Intersections, Roundabouts & Interchanges' and Main Roads supplement to Austroads Guide to Road Design – 4A: Unsignalised and Signalised Intersections.

The following intersections were highlighted as being the key intersections within the network.

- Great Southern Highway (Chidlow York Road)/York Bypass intersection at CH 600,
- Knotts Road/York Bypass intersection at CH 2850,
- Great Southern Highway (Northam Cranbrook Road)/York Bypass roundabout intersection at CH 8350,
- Top Beverly York Road/York Bypass roundabout intersection at CH 9250, and
- Removal of the existing Quairading York Road/Top Beverly York Road intersection.

5.2.5. Sight Distance Analysis

Sight distance analysis for a given design speed has been carried out to identify potential sight distance issues for all the proposed intersections and existing road re-alignment including the proposed bypass. The proposed road geometry and associated intersections satisfy Austroads and Main Roads requirements as summarised in the design criteria discussed in Sections 5.2.5.

5.3. Design Concept

5.3.1. Access Strategy

The proposed bypass will spur off west of Cut Hill Road on Great Southern Highway (Chidlow York Road) and follow the existing alignment of Cut Hill Road and Knotts Road. The alignment will pass CBH to the west before crossing a rail line and the Avon River north of the Water Corporation sewerage facility. The bypass will follow the existing alignment of Cold Harbour Road and eventually connect to Quairading York Road. The proposed alignment will affect several accesses on the following roads:

- **Cut Hill Road**

The bypass alignment will run parallel to Cut Hill Road before spurring east onto Knotts Road. This results in severing Cut Hill Road, north of Knotts Road and therefore resulting in a cul-de-sac. A T-intersection access will be proposed on Great Southern Highway (Northam Cranbrook Road). A traffic assessment of this intersection has not

been considered as part of this study, however it will likely operate within capacity due to low traffic volumes.

- **Knotts Road**

The bypass alignment runs along Knotts Road and therefore severs local access roads at various locations. It has been proposed that there will be several accesses onto the bypass from private properties. A traffic assessment of this intersection has not been considered as part of this study, however it will likely operate within capacity due to low traffic volumes.

- **CBH**

The bypass will not impact the access into CBH.

- **Water Corporation**

The bypass will sever the existing Water Corporation access. It has been proposed that there will be an access from the bypass. A traffic assessment of this intersection has not been considered as part of this study, however it will likely operate within capacity due to low traffic volumes.

- **Cold Harbour Road**

Riverside Court currently intersects with Cold Harbour Road at a prioritised T-intersection and this will be retained as an access point. A traffic assessment of this intersection has not been considered as part of this study, however it will likely operate within capacity due to the low traffic volumes.

5.3.2. Cycling and Pedestrians

The proposed bypass is primarily designed to provide better connectivity for heavy haulage vehicles and not for cyclist or pedestrians. Therefore, principal shared paths or footpaths will not be included along the bypass. However, shoulders at a minimum of 1.5m wide will be provided at each side. A four-rail regular performance level barrier with a height of 1.4 m could be installed on any structure to provide compliant safety from falling for cyclists. With the 0.3 m barrier off-set from the front face of the kerb this would result in 1.8 m clearance from the edge of the traffic lanes to the front face of the barrier.

5.3.3. Public Transport

The proposed bypass will not affect the existing coach service operated by the Public Transport Authority.

5.3.4. RAV Network

The proposed bypass is designed for RAV Network 7 (36.5m road trains). The connecting roads towards York will be limited to light and service vehicles only. Heavy vehicle access towards the town will need a permit for special purposes and conditions.

5.3.1. Rail/Road Crossing

The proposed bypass alignment intersect with the existing Line 31 railway currently operated by Arc Infrastructure. All the train movements for Line 31 are currently from CBH with approximately two trains per day with seasonal fluctuations.

Due to the current policy of the Office of National Rail Safety Regulator (ONRCR) to restrict new level crossing supported by PTA and Arc Infrastructure, a grade separated option has been developed to determine constraints, impacts, constructability and high level construction cost.

- **Rail/Road Grade Separated Crossing Option**

PTA and Arc Infrastructure supports the rail/road grade separated crossing consistent with the ONRCR policy for no new level crossings.

PTA and Arc requires 7.3m head clearance from the top of rail to the underside of the lowest beam/girder of the bridge structure. The estimated depth of the bridge structure is 2.06m including the 60mm (approx.) pavement nominal thickness. The horizontal clearance between piers/abutment is 30m (corridor boundary to corridor boundary).

The existing Great Southern Highway (Northam Cranbrook Road) is located on the eastern side, in close proximity of the existing railway, approximately 70m from centre of rail to centre of road. The bridge over rail grade separated option will impact significantly the existing road. Consequently, the proposed four leg roundabout intersection treatment for the York Bypass / Great Southern Highway (Northam Cranbrook Road) will need to be raised by approximately 9.7m to accommodate the bridge over rail crossing. As a consequence, significant fill is required to elevate the road with a wider road corridor boundary to contain the batter spill. This will also greatly impact on the existing drainage into the river and tributaries (aboriginal heritage site). The following are the advantages and disadvantages of this option:

Advantages
- No conflict between the existing rail and proposed road which eliminate the risk for potential accidents.
- Traffic delays would be avoided as the traffic will move freely while the train is approaching the intersection.
- More efficient road network due to less obstruction.
- Long safety benefit as it allows future growth without the need to upgrade the rail/road crossing.

Disadvantages
- A physical bridge structure will be required for a grade separated treatment.
- Significant fill will be required to accommodate the proposed bridge elevation and the associated connecting roads.
- More land would be required to facilitate construction.
- Higher construction cost compare to at grade crossing treatment.
- Significant impact to natural waterways and increased impacts on the river and tributaries (aboriginal heritage site).

The proposed Avon River Bridge will also need to be raised to align with the proposed road geometry. The grade separated option drawings are attached in Appendix G.

- **Rail / Road Level Crossing Option**

The at grade crossing option is not supported by PTA and Arc Infrastructure. However, as part of the design development, this option has been developed to demonstrate to all relevant parties that every possible opportunity has been explored to assist and support the decision for the proposed rail/road crossing. This option will also provide the greatest opportunity for relevant parties to express their feedback and requirements. This will give an early indication of the limitations of this option compared with the grade separated option. The following are the advantages and disadvantages of this option but might not be limited to:

Advantages
- Lower construction cost in comparison to grade separated option.
- Reduced land requirement. The natural waterways can be maintained and therefore there would be less impact on the aboriginal heritage site.

Disadvantages
- Constitute a significant safety concern for the public.
- The at grade crossing is not in line with the Office of National Rail Safety Regulator (ONRCR) policy. This may require upgrade in the future to accommodate future growth to CBH, the town of York, and the nearby towns. In addition, it may be required to be demolished in the future to support the “no level crossing” policy.
- Higher maintenance cost for the rail/road safety traffic controls.

The at grade level crossing option will need to be furthered assessed for vehicle stacking distance, safety risk, safety benefit against cost and other requirements as deemed relevant to demonstrate that this option satisfies all the criteria, before it becomes subject for consideration by PTA and Arc.

The at grade rail/road level crossing will allow the construction of the proposed Great Southern Highway (Northam Cranbrook Road)/York Bypass roundabout intersection treatment at natural ground level. The proposed Avon River bridge structure can be constructed with minimal lift from the natural ground but above the 100 year flood level.

5.3.2. Structure Options

At-grade

To stay clear of the 100-year ARI flood horizontal spread, including an allowance of a 500 mm freeboard, the bridge over the Avon River will require a total length of just over 150m between abutment centrelines. With the proposed road surface level, the bridge superstructure depth is limited to approximately 650 mm. Main Roads prestressed concrete deck plank with a depth of 450 mm and 200 mm thick cast in-situ concrete slab would be a suitable option. This would result in a 12-span bridge with a total length of 151.2 m overall length. 11 blade piers 1.4 m thick will need to be installed in the river to support the superstructure.

It is understood that a dedicated cycle or pedestrian path is not required. However, it is proposed to install a Main Roads approved four-rail barrier with a top-rail height of 1.4 m above road surface level. This would provide sufficient safety should a cyclist fall off a bike than a regular performance containment level barrier. For a bridge of this length a width between kerbs of 8.2 m would be sufficient in accordance with Table 11 of the Bridge Branch Design Information Manual. This would result in two 3.5 m wide traffic lanes and 0.6 m shoulders each side. However, it is proposed to provide wider shoulders to allow full formation width of 10.0 m between kerbs over the bridge. This would provide 1.5 m wide shoulders which would allow a safer crossing for cyclists and would result in a total bridge width of approximately 11.8 m to suit the precast deck plank width (based on 17 deck planks per span).

Grade Separated

To stay clear of the 100-year flood horizontal spread, the bridge over Avon River will require a total length of 170 m between abutment centrelines. Due to the road level required to cross the rail line with sufficient clearance, the difference from the road surface level to the 100-year flood level would require a structure with longer spans. This would reduce the permanent structures needing to be installed in the Avon River and the impact on the environment. Therefore, predominately longer span structures have been reviewed.

It is understood that a dedicated cycle or pedestrian path is not required. However, it is proposed to install a Main Roads approved four-rail barriers with a top-rail height of 1.4 m above road surface level. This would provide sufficient safety should a cyclist fall off a bike than a regular performance containment level barrier. For a bridge of this length, a bridge width between kerbs of 8.2 m would be sufficient in accordance with Table 11 of the Bridge Branch Design Information Manual. This would result in two 3.5 m wide traffic lanes and 0.6 m shoulders each side. However, it is proposed to provide wider shoulders to allow a full formation width of 10.0 m between kerbs over the bridge. This would provide 1.5 m wide shoulders which would allow a safer crossing for cyclists and would result in a total bridge width of approximately 11.6 m.

For a 3-span or 4-span bridge with a total length of 170 m a twin girder composite superstructure is very cost effective. For a bridge structure of this length the incremental launch method is commonly used to install the superstructure economically. Ideally the majority of the concrete deck is installed in the launching bed to reduce the risks of working at height and contamination of the river with fresh concrete.

A 3-span configuration could consist of 47.5 m side spans and a 75.0 m centre span. This would result in a superstructure with a constant depth of approximately 2.9 m comprising 2.6 m steel welded I-beams and a 0.3 m thick concrete deck. Should the incremental launch method be used to install the superstructure one temporary pier is required in the centre span to reduce the cantilever of the superstructure during installation.

A 4-span configuration could consist of 36 m side spans and two 49.0 m centre spans. This would result in a superstructure with a constant depth of approximately 2.2 m comprising 1.9 m steel welded I-beams and a 0.3 m thick concrete deck. Should the incremental launch method be used to install the superstructure two temporary piers are required in the two centre spans to reduce the cantilever of the superstructure during installation. For the 3-span option a steel concrete composite box could be an alternative. The superstructure depth would be slightly less with a 2.5 m deep steel box and a 0.3 m thick concrete deck. However, steel boxes are usually more expensive due to the more complex bracing requirements as thinner steel plates are used.

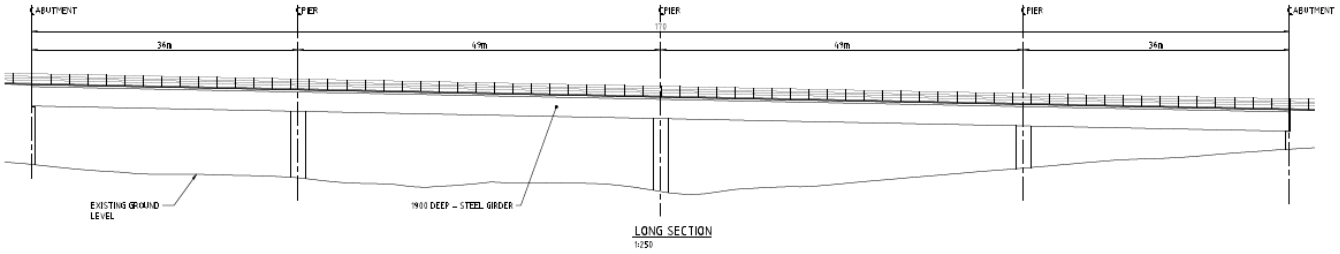


Figure 5.1 Avon River Bridge Crossing Option 1

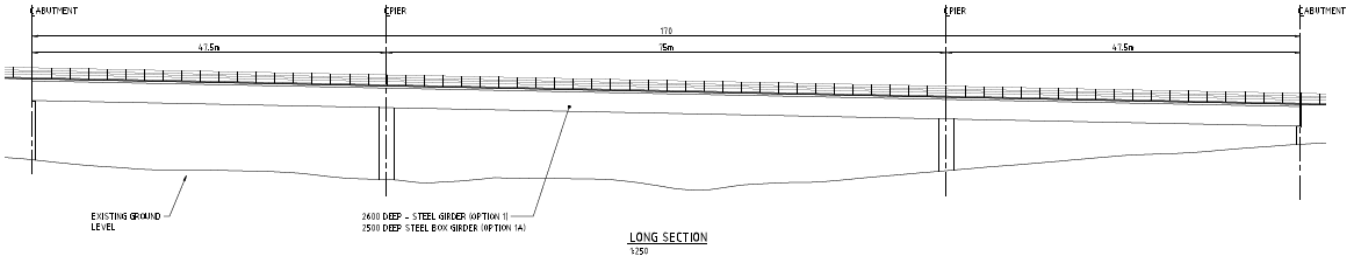


Figure 5.2 Avon River Bridge Crossing Option 2

Rail Crossing

The grade separated rail crossing requires a total clearance envelope of 7.3 m vertical (from top of rail) and 30.0 m horizontal (between abutment retaining walls). With the proposed road alignment, this results in a skewed rail overbridge with an angle of ~38° normal to the road centreline. As a minimum a regular performance level is required for bridges over rail. Therefore, a Main Roads approved four rail barrier with a top-rail height of 1.4 m above road surface level is proposed.

With the proposed full formation width of 11.0 m between kerbs this results in a total bridge width of approximately 12.6 m. It proposed to retain the embankment fill using mechanical stabilised earth (MSE) walls. The bridge superstructure will be simply supported on reinforced concrete abutments consisting of headstocks and columns installed behind the MSE wall. The bridge superstructure could be constructed with 3 1.8 m deep prestressed concrete T-roff beams, 4.2 m wide and a 200 mm thick cast in situ concrete deck. However, recent issues have resulted in Main Roads limiting T-roff beams to a maximum skew angle of 30°.

Alternatively, a steel concrete composite superstructure could be constructed. Due to the skew angle and the relative short span length steel boxes are not regarded to provide an economical solution. As the aesthetics at this bridge location are not the highest priority, a steel concrete composite superstructure with I-beams will be a cost-effective alternative. Minimum 4 welded steel I-sections with a depth of 1.7 m and a reinforced concrete deck of minimum 270 mm depth are proposed for this option if traditional construction methodologies are used. This means installation of a braced pair of steel girders followed by transfloor permanent formwork panels to cast the in situ concrete deck. Steel concrete composite decks can also be installed by pre-casting the concrete deck partially, creating the composite action before installation. The cast in situ concrete is then used to stitch the individual beams using concrete to concrete to composite design similar to T-roff beam design. However, this usually results in slightly thicker concrete decks which is offset by a reduced steel section depth due to earlier composite action.

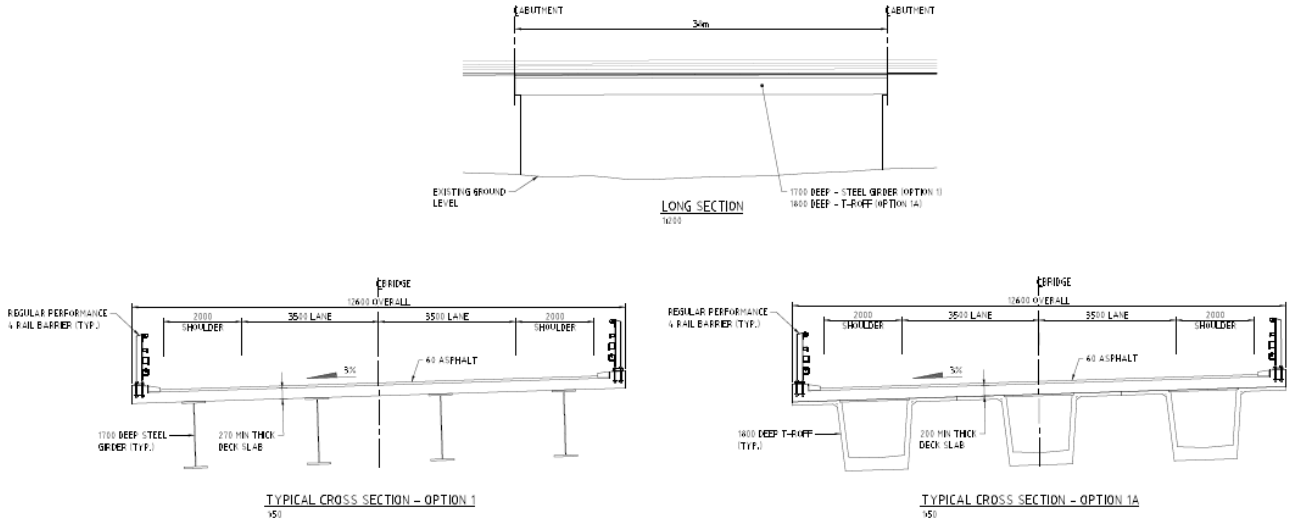


Figure 5.3 Bridge Over Rail

Detailed bridge structure drawings can be found in Appendix H.

5.4. Economic Assessment

5.4.1. Construction Costs

A high level estimatesbelow for the entire road alignment including the rail/road at grade level crossing and grade separated option.

ROAD ALIGNMENT OPTION	OPINION OF PROBABLE COST
Rail / Road Level Crossing	$ 45,500,000.00
Grade Separated Crossing	$ 65,500,000.00

There is a risk that rock, as excavated, may be unsuitable for reuse deeming it outside of a suitable fill specification. This may occur due to difficulties in controlling materials from drill and blast and the lack of information around the ground conditions. Consideration should be given for the potential need to dispose of the excess unsuitable material and import additional fill.

The high level estimates are based on previous experience of similar projects and are subject to a significant variation. Once information becomes available from a feature survey, geotechnical investigation, structures design, environmental surveys and land and heritage requirements, a more realistic estimate can be calculated.

There will be additional cost implications for potential existing service relocations which include the Water Corporation pipe network. A detailed breakdown of the construction cost can be found in Appendix I – Construction Estimates.

It is recommended that the construction estimate be validated by a registered quantity surveyor.

5.4.2. Land Acquisition Compensation Considerations

Land will need to be acquired to provide a road reserve for the Bypass and at this stage there is only an indicative road corridor availalble. Based on available information it is estimated that land acquisition costs including compensation payable to landowners for land acquired from their properties and and land survey costs may be around $3.5M.

5.4.3. Network Benefits

The proposed York Bypass will help alleviate heavy vehicle movement within the town of York which is thought to be causing vibration and potentially damaging the existing heritage buildings. The York Bypass will improve the road connectivity and traffic movement in the east-west corridor and as such the efficiency of the road network system. It will bring a reliable level of service that supports the growing economy in the region, not only for the farming industry, but also for tourism and local businesses within the town of York.

There are also tangible benefits for the proposed bypass which include travel time savings for vehicles travelling through the east-west corridor. In addition, vehicle operating costs would be reduced, emissions would be reduced due to efficient road connectivity and road safety improvements by preventing the mixture of heavy and light vehicles around town of York.

Moreover, the proposed bypass will give an opportunity for industrial and residential development. It will provide more efficient road network system not only for the town of York but for the entire region.

5.5. Stakeholder Engagement

Formal consultation with PTA/ARC Infrastructure, CBH, and Water Corporation has been undertaken to gain a better understanding of their requirements, expectations and the potential impact as a result of the proposed bypass.

5.5.1. CBH

A meeting with CBH was held on 9 July 2019. Main Roads tabled the different alignment options from the previous Alignment Selection Study conducted in 2017. CBH expressed that river crossing alignment Option C is their preferred option for the rail/road level crossing as this is will provide adequate distance to accommodate a 1,196m train. The location of the level crossing on the southern side is 1,235m (approx.) from the CBH grain bin which is 40m from last wagon to the rail/road crossing.

It was discussed that with the bypass alignment, the CBH access will be via Knotts Road and Great Southern Highway (Northam Cranbrook Road). A heavy vehicle will be restricted to enter the town of York and the existing Knotts Road (south) will be turned into a cul-de-sac at the end to facilitated access to existing properties. Heavy vehicles from the CBH facility will not be connected to the proposed bypass through Knotts Road. CBH has advised that the design vehicle for CBH facility is RAV4 and has no plan to change or upgrade in the future.

CBH advise that they are looking to upgrade the Great Southern Highway (Northam Cranbrook Road)/Knotts Road intersection to accommodate heavy vehicles to pass side by side and widen the portion of the existing Knotts Road to improve traffic movements within the CBH facility.

At the time of CBH consultation there has been no discussion regarding the rail/road grade separated option.

5.5.2. Water Corporation

A meeting with Water Corporation was held on 18 July 2019. An overview of the proposed alignment through Water Corporation property was given to provide them a better understanding of the impact within their land. The key points raised during the consultation are summarised below:

- Maintaining access to Water Corporation treatment facility and managing safety 24 hours 7 days a week is paramount. The future safe access and egress needs to be addressed
- The existing waste water treatment facility is scheduled to be upgraded in 2023. Consequential effects on in ground pipes running through proposed crossover and general area will need to be considered
- Approximately 12 hectares of Water Corporation land would be affected and Water Corporation would require safe ongoing access to the portion severed by the road which includes a dam
- Monitoring bores that are in place would be affected by the bypass road
- Water Corporation would need to consider the effect of the loss of land (reducing available irrigation area) for the proposed bypass on long term water treatment land requirements to support the growth of York

- Discussed whether it might be possible to acquire additional farming land for amalgamation into Water Corporation land. Modelling of flow forecasts would be required
- A road is considered a compatible use in the water treatment buffer area, but not any future residential use off the new road which could result in odour complaints that are expensive to resolve
- Advised by Main Roads that it is understood the Shire of York has no intention to support future residential along the new road if constructed, however may consider such as an industrial area. Confirmed by Water Corporation that this would not be an issue
- Advised by Water Corporation that negotiations are in progress with third parties as to sandalwood future use
- Water Corporation would require visual screening of the actual treatment site from road users. As per the discussion with Water Corporation this could be fencing or possibly a vegetation buffer
- Compensation issues would include land value for Water Corporation and third-party interests in the sandalwood (which could include financial loss of future use)
- Water Corporation development services portal sets out processes and steps for engineering review

5.5.3. PTA and ARC

A meeting with PTA and ARC Infrastructure was held on 22 July 2019 at the PTA office in East Perth.

Main Roads tabled the preliminary rail/road level crossing and intersection treatment for the proposed York Bypass/Great Southern Highway (Northam Cranbrook) interface. As stated previously, this was based on the recommendation from the previous route Alignment Selection Study. The following key points have been highlighted for consideration:

- PTA stated that a policy of no net increase in the number of level crossing is in place including the rural areas consistent with the Office of National Rail Safety Regulator (ONRCR) policy which encourages governments and industry to commit to a firm policy of ‘no new level crossings’. The policy is also supported by ARC Infrastructure.
- It was advised that approval of a level crossing contrary to policy would only be considered over a grade separated crossing if high level criteria of State benefit (including safety) are met.
- PTA requires stacking distance assessments be made before being able to consider new level crossings’ approach. This is subject for demonstration to relevant government agencies and the railway authority that a level crossing option is proportionate to cost against long term safety benefits. Stacking distance assessments are not required if it is conclusive that a grade separated crossing option prevails.
- Safety shall be fully assessed regardless of rail/road level crossing or grade separated treatments.

It was agreed at the meeting that PTA be kept inform as the project progresses.

Based on the above comments made by PTA and ARC Infrastructure, a grade separated option will need to be developed to identify constraints, impacts, challenges, constructability and associated construction cost.

5.6. Construction and Staging

As the proposed bypass is off line to the Great Southern Highway which is the primary distributor road, the disruption to local travel routes would be minimal during construction. The only disruption would be at points of access to the construction area/site, which may be subject to reduced speed limits or warnings of heavy vehicles entering/exiting the site.

The works may be staged in such a way that the majority of the bypass may be constructed without impacting on the existing road network. The biggest impact would be during the construction of the new intersections (tie ins) with the Great Southern Highway/York Bypass. In the western corridor, the roads leading to the new roundabout will be impacted by the project. The surrounding road network offers alternative routes for travelling public should diversions be necessary.

The most impacted road users would be those people residing and accessing Cut Hill Road and Knotts Road.

The construction can be staged depending on level of priority and allocated construction budget.

5.7. Geotechnical Design

Geotechnical design requirements have been assessed based on a desktop study and site visit. This section describes the encountered surface, likely subsurface conditions, general expectations for geotechnical design and requirements for further design.

5.7.1. Site Conditions

5.7.1.1 Regional Geology

The regional geology of the York area is dominated by plutonic (intrusive) igneous and metamorphosed igneous rocks (Granite and Migmatite) and are shown on the 1:250,000 Geological Map Series Perth Sheet (SH-15). Where the proposed route crosses the Avon River there is quaternary alluvium overlying the local bedrock.

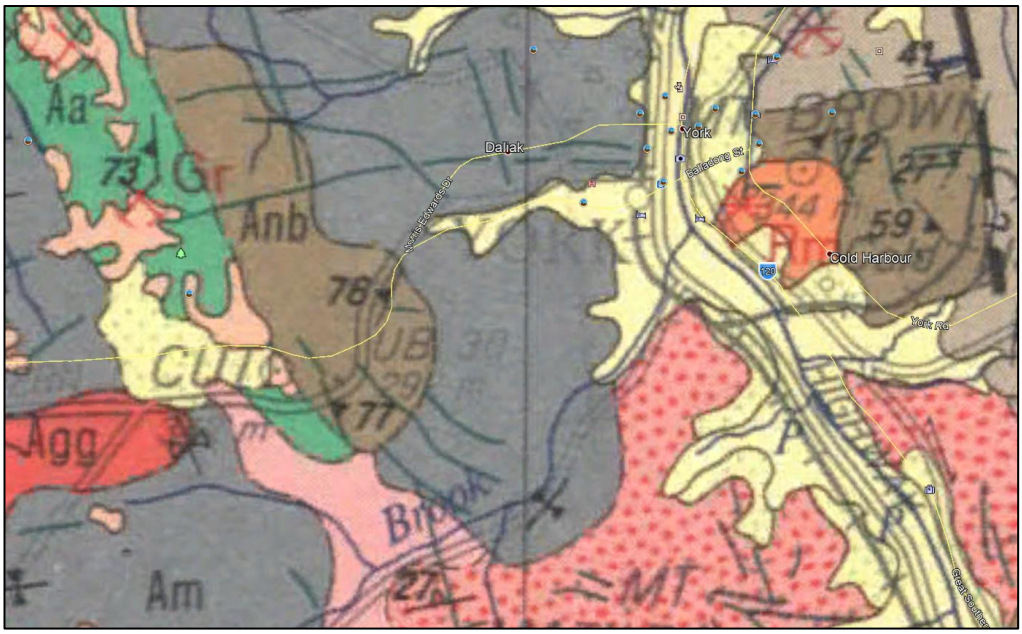


Figure 5.4 Extract from 1:250,000 Geological Map Series Perth Sheet (SH-15)

5.7.1.2 Site Observations

A site visit was undertaken on 8 April 2019. The purpose of the site visit was to assess the surface conditions along the road alignment, to observe the conditions at potential bridge sites, and the conditions of other bridges within the site. The site visit was undertaken in fine weather conditions with temperatures around 25˚C.

The road alignment is typified by rolling hills vegetated primarily with grassed fields, with isolated groups of trees particularly at crests of hills and along drainage alignments. This area is predominantly farmland, with some commercial activities (CBH facility and waste water facility) closer to the Avon River and town site. A small area of residential properties is present to the east of the Avon River.

The key drainage features along the alignment are a series of creeks which drain into the valleys and toward the Avon River. These creeks pass underneath existing roads in either box or pipe culverts.

Surface conditions along the road alignment are typified by surficial clays and sands. The most significant features present are the rock outcrops, which are predominantly large, smooth and round boulders. The extrusions at the surface were observed to be greater than 50 m in size (see Figure 5.5) and are typical of a granitic landscape. These surface boulders were more prevalent on the western end of the alignment, near Cut Hill Road and the western end of Knotts Road.

Figure 5.5 Surface rock to the south of Knotts Road

A site walkover of the potential sites for bridges over the Avon River was also undertaken. The river basin is approximately 100 m wide. Conditions at the ground surface were typical of alluvial riverbeds, with a sandy bottom to the river beds and sand and clay at the surface through the river banks. The river banks are heavily vegetated with both grasses and trees (see Figure 5.6). At the time of assessment, the river was essentially dry, with the water level appearing to be at approximately the level of the river base. The sand at the surface is loose, coarse and wet.

Figure 5.6 Avon River at potential crossing location

Brief visual inspection was also made of the two existing bridges within the York town site. Both these bridges are supported on piled foundations. Numerous repairs to both the bridge deck and supporting piles appear to have been completed. Of note is the flood level, which appears to rise significantly above the base of the river.

5.7.1.3 Subsurface Conditions

Subsurface conditions at the bridge site and surface were assessed based on publicly available information and information provided by Main Roads. Note that estimated depths have not been included as no existing geotechnical information was available at either the bridge site nor along the road alignment.

Table 5.4: Subsurface conditions along road alignment

Unit	Description of material
Topsoil	**Topsoil**: typically, sandy, with some areas of gravel at the surface
Colluvium or Residual Soils	**SAND/CLAY**: surface soils of varying depths. Is not present in all locations, where rock head is exposed at surface.
Bedrock	**GRANITE and MIGMATITE**: igneous and metamorphic rocks of the Archean age. Exposed at the surface in many locations along the road alignment. Likely to be both durable and of high strength, with limited defects.

Table 5.5: Subsurface conditions at bridge site

Unit	Description of material
River Sand	Coarse river sand present at base of the river
Clay/ Sandy Clay	**CLAY/SANDY CLAY:** Grey/brown, of alluvial or residual soil origin.
Bedrock	Consistency of bedrock is unknown, though likely to be igneous and metamorphic rocks similar to what is observed along the road alignment. Likely to be more than 10 m below the base of river based on information available at Gwambygine East Road and bridge sites within York town site. Sandstone may be present overlying the bedrock in some areas.

5.7.1.4 Groundwater

The only observed groundwater was at the river level, where the water appears to be at or near the surface of the riverbed around the potential bridge site. In the York town site, the river retains water above the surface of the riverbed, however this is likely to be due to variation in the ground elevation.

A report by the Department of Agriculture and Food (2014) presents a study of the groundwater at the York town site. This study shows that, in general, the groundwater levels are relatively shallow within the valley (within three to four meters of the ground surface). This is generally to be expected considering the regional drainage. It is noted that the depth to the groundwater table increases progressively at higher elevations.

5.7.2. Engineering Assessment

The engineering assessment has been separated into two sections. One addressing the portion of works consisting predominantly of roadworks and embankment construction (from the intersection of Great Southern Highway (Northam Cranbrook Road) through to the rail crossing near Cold Harbour), and the other addressing the rail crossing, Great Southern Highway (Northam Cranbrook Road) crossing and river crossing near Cold Harbour.

5.7.2.1 Roadworks – Great Southern Highway to Cold Harbour

Effect of Groundwater

It is unlikely that groundwater will significantly influence the road works from the Great Southern Highway to the road and rail crossing near Cold Harbour Road.

For the majority of the road alignment it is expected that the groundwater table will be significantly below the existing ground level. It is expected that any excavations required will not intersect the water table and will not cause significant issues for the development.

Excavatability

Excavatability of material along the road alignment will vary and will include areas that will not be able to be excavated by conventional earthwork equipment. The site walkover identified areas where either a granite rock head and/or a granite boulder could be observed at the surface. Where granite is present within cut sections it is likely that drilling and blasting will be required to excavate to the road levels. Consideration for excavation conditions of service trenches and culverts will be required in these areas as well. Areas likely to feature difficult excavation would need to be investigated as part of future design.

Excavation of materials other than the near surface granite should be possible with conventional earthwork equipment, noting the possibility for large granite boulders to be encountered. In the regions adjacent to the Avon River the depth of soil will be significant (greater than 5 m) and should be readily excavatable.

Embankments and Cut Slopes

Significant fill embankments and cut slopes are likely to be required along the alignment, with cut/fill heights in excess of 4 m. These areas will require significant investigation during future design stages.

In general, low embankments will typically require batter slopes no steeper than 1V:6H to meet vehicle safety requirements. Where steeper batters are required (such as near culverts), embankment batters could be steepened to between 1V:3H and 1V:2.5H depending on the type of fill material and subject to assessment for safety barriers.

The higher cut slopes are likely to be predominantly rock excavations. Excavations in rock will typically be able to be cut to 1H:1V or steeper. Allowable cut slopes in natural soils will be between 1V:3H and 1V2.5H, depending on the type of soil.

It is expected that material recovered from excavations and surficial soils will be reusable as fill for embankment constructions. Neighbouring the Avon River, it is expected that more clayey soils may be encountered, which may not be suitable for reuse as structural fill.

5.7.2.2 Road, Rail and River Crossings at Cold Harbour Road

The river, road and rail crossing at Cold Harbour Road have two general configurations:

- Level crossing of road and rail, then a bridge across the Avon River to join with Cold Harbour Road.
- Bridge crossing over the rail and either a bridge crossing or a raised roundabout at Great Southern Highway (Northam Cranbrook Road), and a bridge across the Avon River to connect to Cold Harbour Road.

The level crossing option is expected to require only limited changes to road elevations whilst for the bridge crossing over the rail line, embankments up to 9 m in height will be required.

Groundwater

Groundwater is likely to be shallow near the river, within 5 m of the ground level. Groundwater will need to be considered as part of planning for foundation installation, however this is typical for bridge construction and will be unlikely to significantly affect the development. Shallow trenches for services, culverts and other components are unlikely to be affected.

The water level in the river also varies seasonally, which is also likely to alter the groundwater adjacent to the river sites.

Bridge Foundations

Foundation types for the bridge structures will need to be assessed following detailed site investigation.

For the Avon River crossing it is likely that piled foundations will be required. It is expected that the piles will be greater than 10 m in depth and founded on the bedrock.

If shallow rock is present similar to the areas to the west of the Avon River, the use of shallow foundations may be possible for the rail and/or road bridge. If piled foundations are required for the rail and/or road bridge, pile depths are likely to be less than 10 m.

Embankments and Retaining Walls

As mentioned before, if a bridge over the rail is constructed, approach embankments up to 9 m in height may be required. There are some risks associated with high embankments. If significant areas of loose sand or soft clay are encountered, large settlements may occur that necessitate ground improvement or other methods to manage this issue.

The large embankment will also require retaining walls or mechanically stabilised earth walls at the bridge abutments. Any settlement of the embankments will influence these structures therefore detailed investigation and analysis are recommended.

5.7.3. Detailed Design Stage Investigation

- A geotechnical investigation will be required to inform the next phase of design. The following scope is suggested as a minimum: A detailed investigation at each bridge site. To include a minimum of one investigation location per bridge pier/abutment, this within 10m of the actual location of each structure. For every 10 m width of the bridge, an additional investigation location is required. This should be completed as per the "Guidelines for Geotechnical Investigation of Bridge Structures" (Report No. 2009-8M), AS1726 – 2017, AS2159 and AS5100. This should include sites within the river bed, which will be difficult to access as the investigation is along the road alignment as per "Guidelines for Geotechnical Investigation of Road Works" (Report No. 2011-01M). This should include test pits or boreholes at a maximum spacing of 500 m through the embankment sections, test pits or boreholes at a maximum spacing of 100m through cut sections, and potential costean or dozer ripping trials for Excavatability assessment where required. The larger cuts may require angled boreholes to assess defects in the rock mass. Testing will generally be required to a minimum of 1.5 m below the formation level.

It should be noted that additional investigation may be required if the conditions are different from those expected.

6 Traffic and Safety Assessment

6.1. Safety Assessment / Crash Report

Crash data for 2014 to 2018 has been gathered from Main Roads reporting centre and have been summarised in Table 6.1. It can be summarised from the crash data below that heavy vehicles are involved in a disproportionate amount in crashes occurring on Northam Cranbrook Road when compared to the average heavy vehicle percentage of existing traffic (currently around 25%).

Table 6.1 Crash Report – 2014 to 2018

	Crash Severity							
Road	Fatal	Hospital	Medical	PDO Major	PDO Minor	Other/Unknown	Total	% involving HV
Great Southern Hwy (Chidlow York Road) (SLK 40-46)	1*	0	3	6	1	0	11	27%
Great Southern Hwy (Northam Cranbrook Road, Northam to York) (SLK 30-56)	1*	3	1	5**	1	0	11	55%
Quairading York Road (SLK 0-8)	0	0	0	1**	0	0	1	100%

*Great Southern Hwy (Chidlow York Road) and Great Southern Hwy (Northam Cranbrook Road) share one of the fatalities as it was an intersection collision

**Northam Cranbrook Road (Great Southern Hwy) and Quairading York Road share one of the PDO major as it was an intersection collision

In addition to the above crash statistics for the major road links in and around York, details of crashes recorded as occurring at intersections within the study area have been obtained from Main Roads A summary of all the intersection crashes within the study area between 2014 to 2018 is detailed in

Table 6.2.

Table 6.2 Intersection Crash Report - 2014 to 2018

	Crash Severity							
Intersection	Fatal	Hospital	Medical	PDO Major	PDO Minor	Other/Unknown	Total	% involving HV
Great Southern Hwy (Chidlow York Road)/Forrest Street	0	0	0	1	0	0	1	0%
Great Southern Hwy (Chidlow York Road)/Avon Terrace	1	0	1	1	0	0	3	67%
Northam Cranbrook Road/ Quairading York Road	0	1	0	1	0	0	2	0%
Northam Cranbrook Road/ Radnor Road	0	1	0	0	0	0	1	0%

It can be seen from the data summarised above that the number of crashes occurring at each intersection is relatively low. The intersection of Great Southern Highway (Chidlow York Road)/Avon Terrace recorded three crashes over this period with two of the crashes involving a heavy vehicle. It is considered the proposed bypass would potentially reduce the number of heavy vehicle related crashes.

Overall, there are no evident crash trends at any of the intersections assessed. The crash data has been spatially mapped in Figure 6.1 and the full crash data obtained from Main Roads is contained at Appendix D.

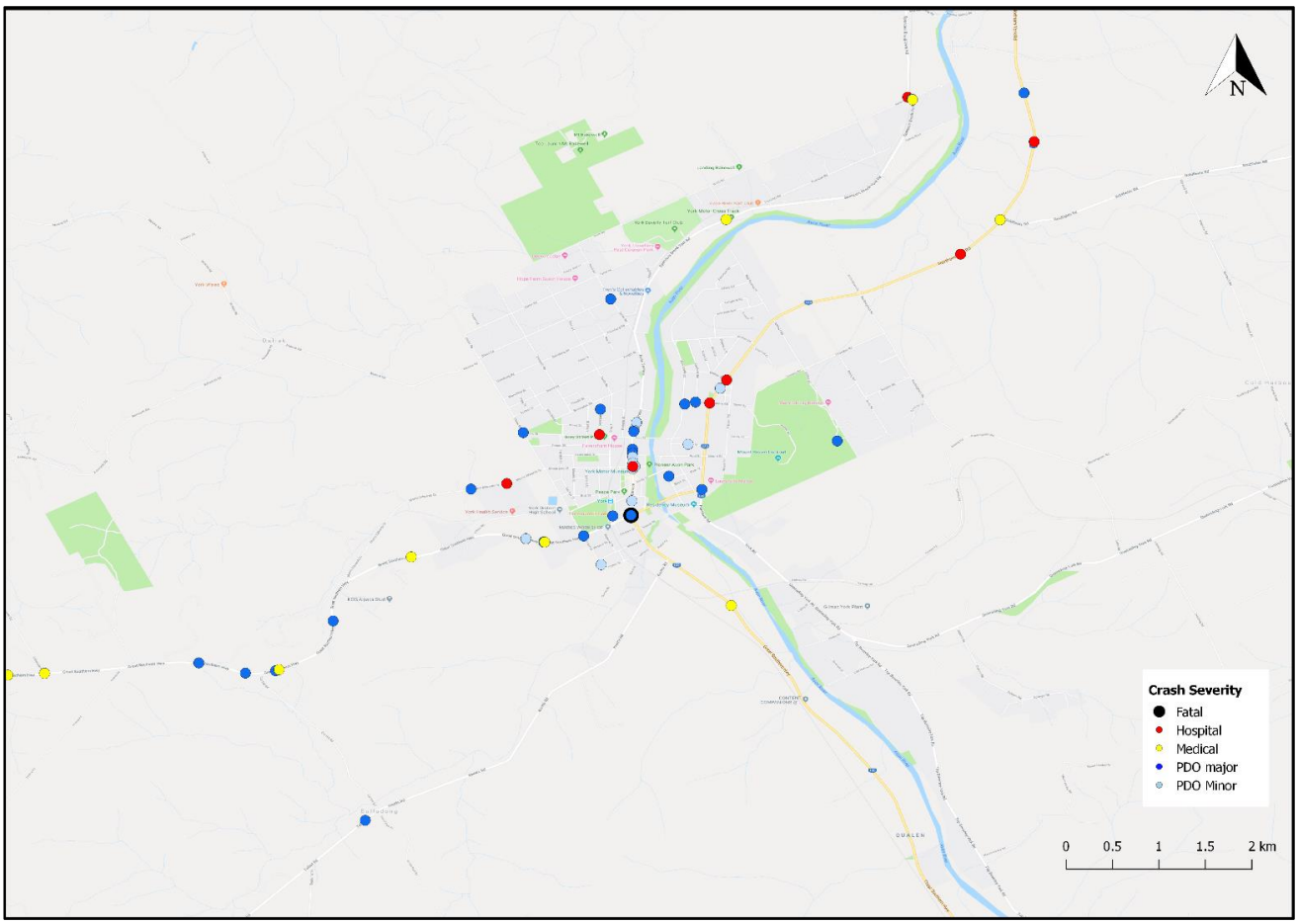


Figure 6.1 Crash severity map

As shown in the figure above, the majority of the crashes occurred along Great Southern Hwy (Chidlow York Road) and Northam Cranbrook Road (between Northam and York). It may be assumed that the predicted reduction of heavy vehicles and general traffic passing through these existing roads and intersections due to a new bypass, may reduce the potential for the recorded types of crashes to occur.

The diversion for heavy vehicles may make it possible for authorities to pursue downgrading the major roads in the immediate vicinity of York within the Main Road's Road Hierarchy. As a result, measures such as speed reductions and traffic calming features may be more easily achievable. This in keeping with access roads or local distributors in close proximity to the centre of a tourist destination and town such as York.

6.2. Forecast Traffic Flows

6.2.1. Overview

The Alignment Selection Report considered the alignment options based on a number of assumptions, due to the limited data provided as part of the traffic assessment. The traffic assessment has been redone by collecting traffic count surveys and origin-destination surveys to inform a robust assessment. In July 2019, additional traffic surveys were conducted. Although it was not during the peak grain season and therefore traffic may be lower than a typical peak season. Findings from the updated traffic surveys are as follows:

- 40% of all vehicles that travels towards York town centre have the town as a destination, the remaining 60% travel through.
- Approximately 50% of light vehicles (Austroads Class 1) travel through the town centre.
- More than 60% of medium vehicles (Austroads Class 2-5) travel through the town centre.
- More than 85% of heavy vehicles (Austroads Class 6-12) travel through the town centre.

Based on the origin-destination data, it is evident that the majority of the medium and heavy vehicles travel through the town centre and are likely to divert to a bypass should it be provided, therefore reducing the number of heavy vehicles in and through the town.

6.2.2. Growth Rate and Future Year Scenarios

To forecast future traffic flows, a growth rate needs to be adopted and applied to the existing traffic flows. The Alignment Selection Report assumed an annual growth rate of 2%, however as tabulated in Table 6.3, historical data shows a steady decline in traffic (2013 to 2019).

Table 6.3 Historical Data (Main Roads)

Road	2013/14	2014/15	2015/16	2016/17	2017/18	2018/19
Northam York Road (South of Radnor Road)	1,505	-	-	-	1,436	1,395
Great South Highway (Chidlow York Road) (South of Henrietta Street)	-	1431	1422	-	1362	-
Quairading York Road (East of Osborn Road)	-	-	-	-	737	751

Regardless, a conservative growth assumption of 2% per annum will be applied for future year traffic demand. This will subsequently aid in balancing the possible underestimation of the existing traffic counts collected during the off-peak season.

Traffic data has been modelled for 2031, 2036 and 2041 see Appendix F.

6.2.3. Traffic Redistribution

The analysis of the proposed bypass includes applying the 2% growth factor to the existing counts and redistributing traffic from the local road network due to the construction of the bypass. The forecasted traffic flows will be used as part of the traffic analysis component of this project. The proposed alignment option introduces routing options and the following assumptions have been made:

- Existing origin and destination patterns will remain the same after the construction of the bypass.
- All vehicles on Great Southern Hwy (Chidlow York Road) travelling to and from Northam Cranbrook Road (Northam York Road), Quairading-York Road and Top Beverley-York Road will access the bypass.
- All vehicles travelling to and from Talbot Road will access the bypass.
- All heavy vehicles on Northam York Road travelling to and from Great Southern Highway (Chidlow-York Road) and Great Southern Highway (Northam Cranbrook Road) will access the bypass via Quairading York Road.
- Approximately 50% of vehicles travelling into town from Quairading York Road and Top Beverley York Road will access the town centre via Great Southern Highway (Northam Cranbrook Road). The remaining 50% will use Quairading York Road.
- Existing traffic composition proportions are assumed to be the same in the future.

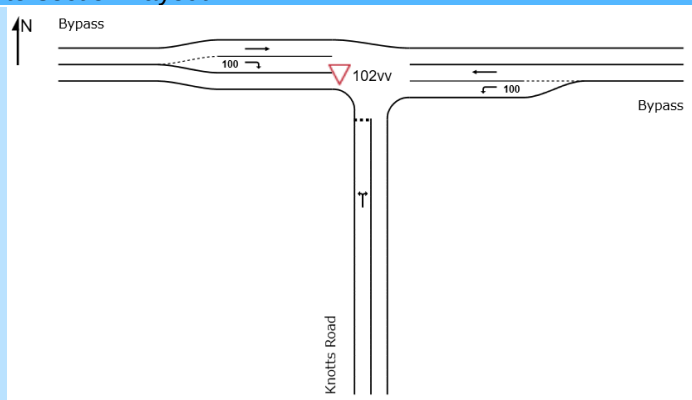
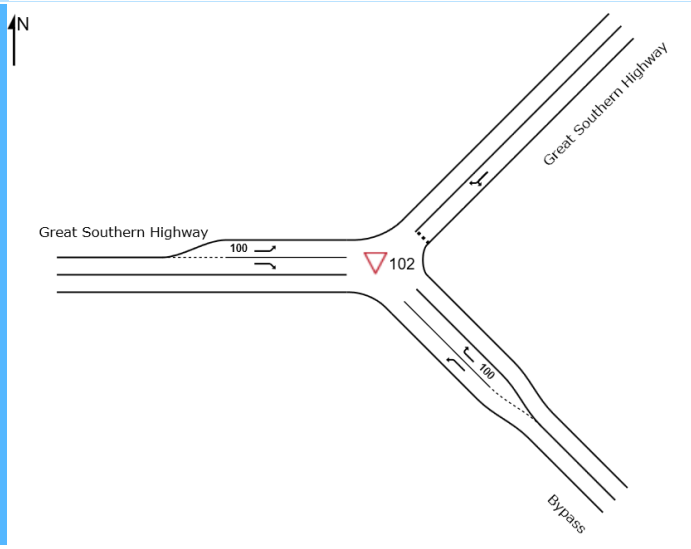
6.3. Intersection Layouts

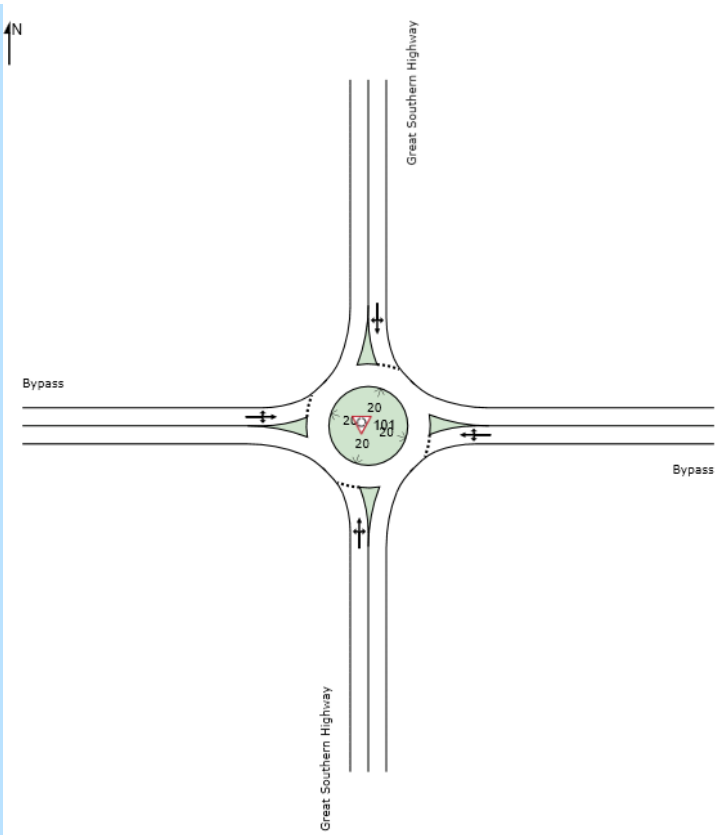
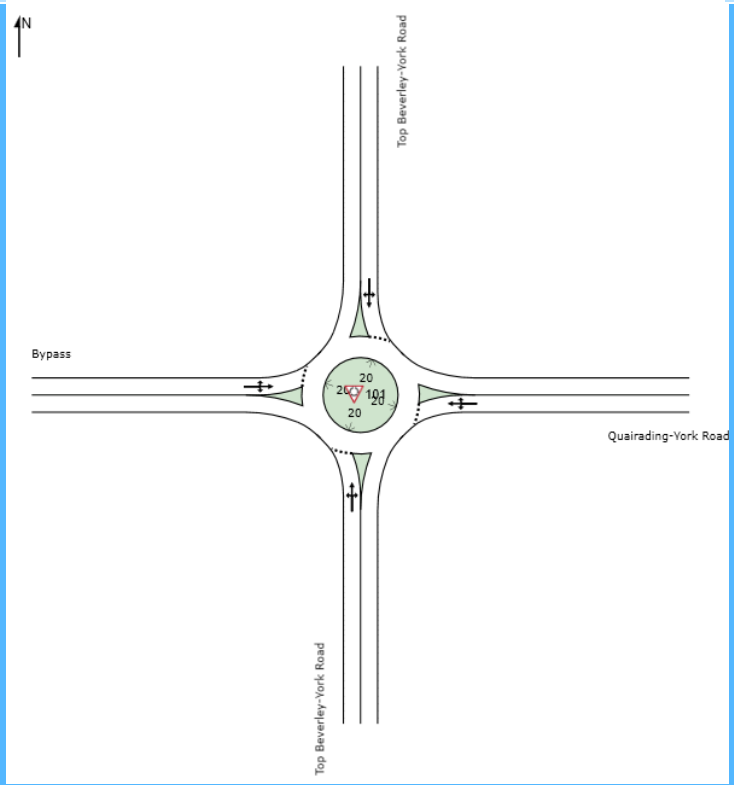
The proposed road alignment follows the existing alignment of Cut Hill Road and Knotts Road and passes to the west of the CBH facility. This alignment would require reconstructing the existing local road to meet the required road geometry to accommodate the design vehicle (which is a RAV 7 category) with a posted speed of 90km/hr (this would be confirmed at the detailed design phase). Given the current road geometry and condition of the pavement of these local roads, it is unlikely they would provide any value with the extent of the upgrades required.

The river crossing has the total length of approximately 2.80 km and has relatively flat grade on the eastern side of

the Avon River, with a maximum grade of 3.46% on the western side of the river. The proposed road alignment on the eastern side follows the existing Cold Harbour Road and onto Quairading York Road. Four key intersections along the bypass have been identified and assessed as part of this study and Table 6.4 illustrates possible treatment options to link the existing road to the proposed alignment.

Table 6.4 Proposed Intersection Layout

	Proposed Intersection	
Intersection Name	Intersection Type	Intersection Layout
Proposed Bypass/Knotts Road Connection	T-intersection	
Proposed Bypass/Great Southern Highway (Chidlow-York Road)	T-intersection	

Proposed Bypass/Great Southern Highway (Northam Cranbrook)	Roundabout	
Proposed Bypass/ Top Beverley York Road	Roundabout	

* Two design options have been presented for the proposed bypass/Great Southern Highway (Northam Cranbrook) intersection, which includes an at-grade rail crossing option and a grade separated option. The intersection treatment for these options will be the same (roundabout), however the at-grade rail crossing option will likely result in queues back to the roundabout. Further details of the two options are detailed in Section 5.2.4.

In addition, it should be noted that other intersections on smaller access ways have not been considered as part of

this study.

6.4. Traffic Analysis

To assess the potential impacts of the bypass, SIDRA 8 was used to analyse the network. The model was developed to replicate the peak hour periods shown below:

- AM Peak Hour: 08:00 – 09:00
- PM Peak Hour: 14:00 – 15:00

A base year model was calibrated and validated to ensure that it replicates the existing conditions. Pedestrians were not observed during the site visit and therefore were not included in the model. Once the model was calibrated and validated, the future year models were developed with the proposed bypass. Future year option models were developed for 2031, 2036 and 2041. For comparative purposes, each future year scenario consisted of a do-nothing option, where traffic demands increase to the respective future year without the proposed bypass. The following scenarios have been developed for both the AM and PM peak period:

- 2019 Base Year
- 2031 Do-nothing
- 2031 Proposed Option with Bypass
- 2036 Do-nothing
- 2036 Proposed Option with Bypass
- 2041 Do-nothing
- 2041 Proposed Option with Bypass

Results from the model for all scenarios will be shown for comparative purposes to determine the impacts of the bypass and to inform intersection design.

6.4.1. Modelling Results

AM Peak Period

The AM peak period average delay and degree of saturation results are shown in Table 6.5 and Table 6.6 respectively. In summary, the AM peak analysis of the proposed intersections confirms that each operate well under capacity and within the practical maximum DoS of 0.85 and with minimal average delays. The intersection of Great Southern Highway (Chidlow York Road)/Avon Terrace is projected to perform worse with the proposed bypass and this is likely attributed to the assumption that 50% of vehicles travelling into town from Quairading-York Road and Top Beverley-York Road will access the town centre via Great Southern Highway (Northam Cranbrook). This assumption introduces additional through traffic on the minor road of Avon Terrace and therefore delays are anticipated to marginally increase even with the reduction of heavy vehicles along Great Southern Hwy (Chidlow York Road).

Table 6.5 AM Peak Average Delay (seconds)

Intersection Name	2031		2036		2041	
	Do-nothing	Bypass	Do-nothing	Bypass	Do-nothing	Bypass
Great Southern Hwy (Chidlow York Rd)/ Avon Tce	6.3	6.8	6.4	6.9	6.5	7.0
Balladong St/Panmure Rd	5.5	4.5	5.6	4.5	5.6	4.5
Proposed Bypass/Knotts Rd Access	-	1.8	-	1.9	-	2.0

Proposed Bypass/Great Southern Hwy (Chidlow York Rd)	-	8.0	-	8.0	-	8.0
Proposed Bypass/Great Southern Hwy (Northam Cranbrook)	-	5.2	-	5.3	-	5.3
Proposed Bypass/ Top Beverley York Rd/Quairading York Rd	3.2	5.8	3.2	5.8	3.3	5.9

Table 6.6 AM Peak Degree of Saturation

Intersection Name	2031		2036		2041	
	Do-nothing	Bypass	Do-nothing	Bypass	Do-nothing	Bypass
Great Southern Hwy (Chidlow York Rd)/Avon Tce	0.100	0.110	0.116	0.125	0.134	0.143
Balladong St/Panmure Rd	0.060	0.029	0.065	0.031	0.071	0.036
Proposed Bypass/Knotts Rd Access	-	0.021	-	0.023	-	0.024
Proposed Bypass/Great Southern Hwy (Chidlow York Rd)	-	0.049	-	0.054	-	0.060
Proposed Bypass/ Great Southern Hwy (Northam Cranbrook)	-	0.048	-	0.054	-	0.059
Proposed Bypass/ Top Beverley York Rd/ Quairading York Rd	0.041	0.058	0.045	0.064	0.049	0.070

PM Peak Period

The PM peak period average delay and DoS results are shown in
Table 6.7 and Table 6.8 respectively. Similar to the AM peak period, the PM peak analysis of the proposed intersections is estimated to operate well under capacity and with minimal average delays. The proposed bypass alignment is projected to reduce delays due to the reduction of traffic on Great Southern Highway (Chidlow York Road). In summary, the analysis confirms each of the intersections are projected to operate well in traffic operational and efficiency terms. Detailed modelling results are shown in Appendix F.

Table 6.7 PM Peak Average Delay (seconds)

Intersection Name	2031		2036		2041	
	Do-nothing	Bypass	Do-nothing	Bypass	Do-nothing	Bypass
Great Southern Hwy (Chidlow York Rd)/ Avon Tce	6.1	6.0	6.2	6.1	6.5	6.3
Balladong St/Panmure Rd	5.7	4.5	5.8	4.5	5.8	4.5
Proposed Bypass/ Knotts Rd Access	-	0.7	-	0.7	-	0.8
Proposed Bypass/Great Southern Hwy (Chidlow York Rd)	-	8.1	-	8.1	-	8.2
Proposed Bypass/Great Southern Hwy (Northam Cranbrook)	-	5.6	-	5.7	-	5.7

Proposed Bypass/ Top-Beverley York Rd/ Quairading York Rd	2.7	6.0	2.7	6.1	2.8	6.2

Table 6.8 PM Peak Degree of Saturation

Intersection Name	2031		2036		2041	
	Do-nothing	Bypass	Do-nothing	Bypass	Do-nothing	Bypass
Great Southern Hwy (Chidlow York Rd)/ Avon Tce	0.138	0.149	0.158	0.170	0.188	0.197
Balladong St/Panmure Rd	0.106	0.047	0.121	0.053	0.135	0.060
Proposed Bypass/Knotts Rd Access	-	0.023	-	0.026	-	0.030
Proposed Bypass/Great Southern Hwy (Chidlow York Rd)	-	0.072	-	0.079	-	0.090
Proposed Bypass/ Great Southern Hwy (Northam Cranbrook)	-	0.061	-	0.068	-	0.075
Proposed Bypass/ Top Beverley York Rd/ Quairading York Rd	0.039	0.063	0.044	0.071	0.048	0.078

7 Land Requirements

7.1. Land Requirements

As the preferred alignment is refined it will be important to consult with potentially affected landowners. There is however no intention to commence any land acquisition for a road corridor in association with this planning study. As stated in the Shire of York Local Planning Strategy document dated June 2018, there are no current funds to acquire the land required to provide the bypass through property acquisition, and construction may be years away (it is unknown when or if future government funding may be made available).

Land within the alignment is not proposed to be reserved by the Shire of York under the Local Planning Scheme until future funding is available for the project, including land acquisition.

8 Consultation and Endorsements

8.1. Consultation

Consultation with CBH, Water Corporation, PTA and Arc Infrastructure provided the stakeholders with an opportunity for early input to the planning stage process in developing the alignment definition for the proposed bypass.

Individuals that would be affected by the proposed bypass have been consulted in the previous Alignment Selection Study. No consultation has taken place with individual land owners as part of the current study Alignment Definition Report.

9 Conclusion

The Alignment Definition Report validates the preferred route alignment from the Alignment Selection Report conducted by Main Roads in 2017. Relevant stakeholders have been further consulted, including Water Corporation, CBH, PTA and ARC Infrastructure. Their feedback has been considered in developing the design as much as possible.

The road alignment is typified by rolling hills vegetated primarily with grassed fields, with isolated groups of trees, particularly at crests of hills and along drainage alignments. This area is predominantly farmland, with some commercial activities (CBH facility and waste water facility) closer to the Avon River and York town site. A small area of residential properties is present to the east of the Avon River.

The proposed road geometry has been developed in accordance with Austroads and Main Roads standards for RAV 7 vehicles (36.5m road trains). This includes the high-level drainage assessments for all the drainage crossings and drainage diversions. There are two existing irrigation dams identified that will be impacted. The stormwater runoff from the upstream catchment would no longer be directed towards the existing dam due to the proposed road and therefore this will severe the existing dam.

Appropriate intersection treatments for each of the intersecting side roads have been determined based on anticipated traffic volumes and delays. The proposed intersections associated with the re-alignment have been assessed from a traffic operational performance perspective for future years 2031, 2036 and 2041. In order to conduct the analysis, additional traffic counts and origin-destination surveys were conducted to estimate the re-distribution of traffic for each of the future years. In summary, the analysis confirms each of the intersections are projected to operate well in traffic operational and efficiency terms.

PTA and Arc Infrastructure do not support the rail/road level crossing treatment, consistent with the Office of National Rail Safety Regulator (ONRSR) policy. Therefore, a grade separated option has been developed to determine the constraints, impacts, constructability and high level construction cost. A decision for the level crossing or grade separated option to be adopted is subject for review of the railway authority and relevant approving state and government agencies.

The high level estimates are based on previous experience of similar projects and are subject to a significant variation. Once information becomes available from a feature survey, geotechnical investigation, structures design, environmental surveys and land and heritage requirements, a more realistic estimate can be calculated.
Rock, as excavated, may be unsuitable for reuse due to being outside of a suitable fill specification. This may be due to difficulties in controlling materials from drill, blast and the existing lack of information around the ground conditions. Consideration should be given for the potential need to dispose of the excess unsuitable material and import additional fill. There will be additional cost implication for potential existing services relocation which include the Water Corporation pipe network. It is recommended that the construction estimate is validated by a registered quantity surveyor.

The proposed bypass alignment would impact the Avon River and its tributaries which is an aboriginal heritage site. The majority of the crossing points that were identified were located over tributaries. This is based on a desktop indigenous heritage assessment undertaken in June 2019 for the proposed York Bypass. Approval from the relevant government agencies is required to facilitate construction.

Surface conditions along the road alignment are typified by surficial clays and sands. The most significant feature present are the rock outcrops, which are predominantly large, smooth, and round boulders. The extrusions at the surface were observed to be greater than 50 m in size (see Figure 5.5) and are typical of a granitic landscape. These surface boulders were more prevalent on the western end of the alignment, near Cut Hill Road and the western end of Knotts Rd.

A preliminary concept for the bridge crossing over the Avon River has been developed and suited for level crossing of rail/road and grade separated options.

9.1. Next Stage Considerations

The following are recommended to develop further as part of the next phase of design development:

- Decision regarding appropriate crossing treatment for the rail/road crossing are to be sought from relevant state and government agencies.
- Detailed feature survey is required to validate roads and drainage design. Refinement of the current geometry is required to minimise earthworks whilst meeting the design standards.
- Intersections and roundabout treatments are to be detailed at the next stage once the feature survey is made available.
- Confirmation of the land resumption and affected properties including driveways/access to existing properties.
- Agreement in principle with the relevant stakeholders such as Water Corporation, CBH, and other agencies as appropriate.
- A detailed geotechnical assessment and investigation is required to confirm the existing ground formation for bridge structures pavement design, embankment construction, and earthworks.
- A bridge design is required for further developed based on the preliminary concept design.
- A detailed bill of quantities and construction cost is to be assessed and validate by a registered quantity surveyor.
- Refinement of the Environmental, Aboriginal and non Aboriginal heritage assessment.
- Collection of traffic data during peak harvest season should be undertaken to verify if the results of this study area are still relevant for peak season. Relevant data should also be obtained on the expected future commercial operations and activities of CBH, Gilmac Hay and the livestock facility in order to accurately estimate the likely trend in heavy vehicles in the long term. It is essential that these exercises be undertaken to validate the findings of this report prior to the project progressing into the detailed design stage and confirming intersection treatments shall operate within acceptable capacity limits.

10 References

York Heavy Vehicle Bypass - Alignment Selection Report (Main Roads 2017)

York Bypass Options Report (Main Roads 2016)

York Heavy Vehicle Bypass - Traffic Study Technical Report (Main Roads 2013)

York Freight Bypass - Road Network Review Study (Main Roads 2012)

Shire of York – Local Planning Strategy (2007)

Shire of York – Town Planning Scheme No. 2 (1996)

Operational Modelling Guideline (Main Roads 2018)

Main Roads Standard Drawings, available from the Main Roads website

Main Roads supplements to Austroads Guide to Road Design Guidelines

Main Roads Horizontal Curve Tables (2017)

Austroads Guide to Road Design Part 1 to Part 8

- 1:250,000 Geology Series Map Perth (SH 50 -14), Geological Survey of Western Australia
- AS1726 - 2017, Geotechnical Site Investigations
- AS2159 – 2009, Piling – Design and Installation
- Crossley, Edward K. (2004), Groundwater Study of the York Townsite, Department of Agriculture.
- AS5100 – 2017 – Bridge Design

11 Appendices

Appendix A – Existing Intersection Performance

Chidlow-York Road (M010)/ Cut Hill Road – Existing AM Peak Period

MOVEMENT SUMMARY

Site: 102 [Base AM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	6	0.0	0.004	8.3	LOS A	0.0	0.1	0.14	0.61	0.14	76.6
3	R2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.21	0.60	0.21	76.3
Approach		7	0.0	0.004	8.3	LOS A	0.0	0.1	0.15	0.61	0.15	76.5
East: Great Southern Highway												
4	L2	3	0.0	0.035	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	87.7
5	T1	57	8.8	0.035	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	98.8
Approach		60	8.3	0.035	0.4	NA	0.0	0.0	0.00	0.03	0.00	98.2
West: Great Southern Highway												
11	T1	32	15.6	0.022	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	2	0.0	0.001	7.8	LOS A	0.0	0.0	0.15	0.60	0.15	76.5
Approach		34	14.7	0.022	0.5	NA	0.0	0.0	0.01	0.04	0.01	98.2
All Vehicles		101	9.9	0.035	1.0	NA	0.0	0.1	0.01	0.07	0.01	96.3

Chidlow-York Road (M010)/ Cut Hill Road – Existing PM Peak Period

MOVEMENT SUMMARY

Site: 102 [Base PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	2	0.0	0.001	8.4	LOS A	0.0	0.0	0.17	0.60	0.17	76.4
3	R2	2	50.0	0.003	10.6	LOS B	0.0	0.1	0.31	0.62	0.31	55.9
Approach		4	25.0	0.003	9.5	LOS A	0.0	0.1	0.24	0.61	0.24	64.6
East: Great Southern Highway												
4	L2	1	0.0	0.049	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.4
5	T1	74	18.9	0.049	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.6
Approach		75	18.7	0.049	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.5
West: Great Southern Highway												
11	T1	68	7.4	0.039	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.18	0.59	0.18	76.3
Approach		69	7.2	0.039	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.5
All Vehicles		148	13.5	0.049	0.4	NA	0.0	0.1	0.01	0.03	0.01	98.1

Chidlow York Road (M010))/Forrest Street – Existing AM Peak Period

MOVEMENT SUMMARY

Site: 102v [Base AM]

2. Great Southern Highway and Forrest Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Forrest Street												
1	L2	2	0.0	0.001	7.6	LOS A	0.0	0.0	0.15	0.89	0.15	47.9
2	T1	5	20.0	0.011	9.6	LOS A	0.0	0.4	0.28	1.00	0.28	44.0
3	R2	3	33.3	0.011	10.2	LOS B	0.0	0.4	0.28	1.00	0.28	45.1
Approach		10	20.0	0.011	9.4	LOS A	0.0	0.4	0.26	0.98	0.26	45.1
East: Great Southern Highway												
4	L2	1	100.0	0.059	6.3	LOS A	0.2	1.8	0.08	0.24	0.08	50.2
5	T1	58	10.3	0.059	0.1	LOS A	0.2	1.8	0.08	0.24	0.08	57.6
6	R2	39	12.8	0.059	5.8	LOS A	0.2	1.8	0.08	0.24	0.08	51.3
Approach		98	12.2	0.059	2.4	NA	0.2	1.8	0.08	0.24	0.08	54.8
North: Forrest Street												
7	L2	24	8.3	0.019	8.1	LOS A	0.1	0.6	0.10	0.96	0.10	47.4
8	T1	15	6.7	0.016	8.2	LOS A	0.1	0.4	0.24	0.97	0.24	44.6
9	R2	1	0.0	0.016	7.7	LOS A	0.1	0.4	0.24	0.97	0.24	47.6
Approach		40	7.5	0.019	8.1	LOS A	0.1	0.6	0.16	0.96	0.16	46.3
West: Great Southern Highway												
10	L2	3	0.0	0.020	5.6	LOS A	0.0	0.1	0.03	0.09	0.03	53.1
11	T1	26	19.2	0.020	0.0	LOS A	0.0	0.1	0.03	0.09	0.03	58.9
12	R2	2	0.0	0.020	5.7	LOS A	0.0	0.1	0.03	0.09	0.03	52.9
Approach		31	16.1	0.020	0.9	NA	0.0	0.1	0.03	0.09	0.03	57.8
All Vehicles		179	12.3	0.059	3.8	NA	0.2	1.8	0.10	0.41	0.10	52.5

Chidlow York Road (M010))/Forrest Street – Existing PM Peak Period

MOVEMENT SUMMARY

Site: 102v [Base PM]

2. Great Southern Highway and Forrest Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Forrest Street												
1	L2	2	100.0	0.002	10.8	LOS B	0.0	0.1	0.22	0.99	0.22	44.8
2	T1	8	0.0	0.015	8.0	LOS A	0.1	0.4	0.29	0.90	0.29	44.7
3	R2	6	0.0	0.015	8.1	LOS A	0.1	0.4	0.29	0.90	0.29	47.5
Approach		16	12.5	0.015	8.4	LOS A	0.1	0.4	0.28	0.91	0.28	45.7
East: Great Southern Highway												
4	L2	4	50.0	0.063	6.4	LOS A	0.2	1.4	0.09	0.17	0.09	50.5
5	T1	72	19.4	0.063	0.1	LOS A	0.2	1.4	0.09	0.17	0.09	57.9
6	R2	26	3.8	0.063	5.8	LOS A	0.2	1.4	0.09	0.17	0.09	52.0
Approach		102	16.7	0.063	1.8	NA	0.2	1.4	0.09	0.17	0.09	56.0
North: Forrest Street												
7	L2	28	17.9	0.023	8.7	LOS A	0.1	0.8	0.17	0.95	0.17	46.8
8	T1	6	16.7	0.010	9.1	LOS A	0.0	0.3	0.29	0.95	0.29	44.3
9	R2	3	0.0	0.010	8.0	LOS A	0.0	0.3	0.29	0.95	0.29	47.5
Approach		37	16.2	0.023	8.7	LOS A	0.1	0.8	0.20	0.95	0.20	46.4
West: Great Southern Highway												
10	L2	7	14.3	0.045	6.2	LOS A	0.0	0.3	0.02	0.07	0.02	52.8
11	T1	62	11.3	0.045	0.1	LOS A	0.0	0.3	0.02	0.07	0.02	59.3
12	R2	1	100.0	0.045	7.9	LOS A	0.0	0.3	0.02	0.07	0.02	51.0
Approach		70	12.9	0.045	0.9	NA	0.0	0.3	0.02	0.07	0.02	58.4
All Vehicles		225	15.1	0.063	3.1	NA	0.2	1.4	0.10	0.32	0.10	54.0

Chidlow York Road (M010)/Avon Terrace – AM Peak Period

MOVEMENT SUMMARY

Site: 102v [Base AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	15	13.3	0.012	9.0	LOS A	0.0	0.4	0.15	0.94	0.15	50.7
2	T1	32	9.4	0.057	9.3	LOS A	0.2	1.8	0.31	0.97	0.31	50.6
3	R2	15	26.7	0.057	10.8	LOS B	0.2	1.8	0.31	0.97	0.31	49.0
Approach		62	14.5	0.057	9.6	LOS A	0.2	1.8	0.27	0.96	0.27	50.3
East: Balladong Street												
4	L2	13	30.8	0.061	6.1	LOS A	0.2	1.7	0.11	0.26	0.11	53.0
5	T1	52	17.3	0.061	0.1	LOS A	0.2	1.7	0.11	0.26	0.11	57.1
6	R2	31	6.5	0.061	5.8	LOS A	0.2	1.7	0.11	0.26	0.11	54.8
Approach		96	15.6	0.061	2.8	NA	0.2	1.7	0.11	0.26	0.11	55.8
North: Avon Terrace												
7	L2	16	31.3	0.013	10.0	LOS B	0.1	0.5	0.12	1.00	0.12	49.4
8	T1	32	12.5	0.075	9.5	LOS A	0.3	2.3	0.31	0.97	0.31	50.4
9	R2	29	17.2	0.075	10.0	LOS B	0.3	2.3	0.31	0.97	0.31	49.7
Approach		77	18.2	0.075	9.8	LOS A	0.3	2.3	0.27	0.97	0.27	49.9
West: Great Southern Highway												
10	L2	26	15.4	0.051	5.9	LOS A	0.1	1.3	0.10	0.30	0.10	53.9
11	T1	31	22.6	0.051	0.1	LOS A	0.1	1.3	0.10	0.30	0.10	56.7
12	R2	14	35.7	0.051	6.4	LOS A	0.1	1.3	0.10	0.30	0.10	51.9
Approach		71	22.5	0.051	3.5	NA	0.1	1.3	0.10	0.30	0.10	54.7
All Vehicles		306	17.6	0.075	6.1	NA	0.3	2.3	0.18	0.59	0.18	52.8

Chidlow York Road (M010)/Avon Terrace – PM Peak Period

MOVEMENT SUMMARY

Site: 102v [Base PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	16	12.5	0.013	9.0	LOS A	0.0	0.4	0.16	0.93	0.16	50.8
2	T1	27	3.7	0.072	9.2	LOS A	0.3	2.8	0.38	0.96	0.38	50.4
3	R2	18	38.9	0.072	14.1	LOS B	0.3	2.8	0.38	0.96	0.38	47.5
Approach		61	16.4	0.072	10.6	LOS B	0.3	2.8	0.33	0.95	0.33	49.6
East: Balladong Street												
4	L2	24	25.0	0.071	6.1	LOS A	0.2	1.6	0.12	0.25	0.12	53.5
5	T1	60	18.3	0.071	0.1	LOS A	0.2	1.6	0.12	0.25	0.12	57.1
6	R2	26	3.8	0.071	5.9	LOS A	0.2	1.6	0.12	0.25	0.12	55.0
Approach		110	16.4	0.071	2.8	NA	0.2	1.6	0.12	0.25	0.12	55.8
North: Avon Terrace												
7	L2	20	15.0	0.016	9.2	LOS A	0.1	0.5	0.16	0.94	0.16	50.6
8	T1	46	10.9	0.102	9.7	LOS A	0.4	3.1	0.35	0.97	0.35	50.4
9	R2	36	13.9	0.102	10.0	LOS A	0.4	3.1	0.35	0.97	0.35	49.9
Approach		102	12.7	0.102	9.7	LOS A	0.4	3.1	0.31	0.96	0.31	50.3
West: Great Southern Highway												
10	L2	38	5.3	0.067	5.7	LOS A	0.1	0.9	0.06	0.26	0.06	55.2
11	T1	57	17.5	0.067	0.1	LOS A	0.1	0.9	0.06	0.26	0.06	57.2
12	R2	11	18.2	0.067	6.1	LOS A	0.1	0.9	0.06	0.26	0.06	53.8
Approach		106	13.2	0.067	2.7	NA	0.1	0.9	0.06	0.26	0.06	56.1
All Vehicles		379	14.5	0.102	5.9	NA	0.4	3.1	0.19	0.56	0.19	53.2

Northam-York Road/Balladong St/Quairading-York Road – Existing AM Peak Period

MOVEMENT SUMMARY

Site: 102 [Base AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	69	17.4	0.046	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.2
2	T1	9	11.1	0.006	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		78	16.7	0.046	5.1	NA	0.0	0.0	0.00	0.51	0.00	53.0
North: Panmure Road												
8	T1	10	20.0	0.006	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	31	16.1	0.026	6.1	LOS A	0.1	0.9	0.20	0.55	0.20	51.5
Approach		41	17.1	0.026	4.6	NA	0.1	0.9	0.15	0.41	0.15	53.3
West: Balladong Street												
10	L2	31	19.4	0.027	5.9	LOS A	0.1	0.9	0.05	0.55	0.05	51.9
12	R2	29	34.5	0.039	7.0	LOS A	0.2	1.7	0.25	0.56	0.25	49.9
Approach		60	26.7	0.039	6.4	LOS A	0.2	1.7	0.15	0.56	0.15	50.9
All Vehicles		179	20.1	0.046	5.4	NA	0.2	1.7	0.08	0.50	0.08	52.4

Northam-York Road/Balladong St/Quairading-York Road – Existing PM Peak Period

MOVEMENT SUMMARY

Site: 102 [Base PM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	61	14.8	0.043	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.4
2	T1	9	11.1	0.005	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		70	14.3	0.043	5.0	NA	0.0	0.0	0.00	0.50	0.00	53.3
North: Panmure Road												
8	T1	13	23.1	0.010	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	40	27.5	0.037	6.3	LOS A	0.1	1.5	0.20	0.55	0.20	50.6
Approach		53	26.4	0.037	4.8	NA	0.1	1.5	0.15	0.42	0.15	52.6
West: Balladong Street												
10	L2	26	19.2	0.022	5.9	LOS A	0.1	0.7	0.05	0.55	0.05	51.9
12	R2	61	19.7	0.081	6.9	LOS A	0.3	3.5	0.28	0.58	0.28	51.0
Approach		87	19.5	0.081	6.6	LOS A	0.3	3.5	0.21	0.57	0.21	51.3
All Vehicles		210	19.5	0.081	5.6	NA	0.3	3.5	0.12	0.51	0.12	52.3

Quairading-York Road/Top Beverley-York Road – Existing AM Peak Period

MOVEMENT SUMMARY

Site: 102 [Base AM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	24	4.2	0.014	8.3	LOS A	0.0	0.0	0.00	0.62	0.00	69.4
3	R2	1	0.0	0.001	8.0	LOS A	0.0	0.0	0.23	0.57	0.23	69.3
Approach		25	4.0	0.014	8.3	LOS A	0.0	0.0	0.01	0.62	0.01	69.4
East: Quairading-York Road												
4	L2	2	100.0	0.004	9.2	LOS A	0.0	0.0	0.00	0.65	0.00	52.1
5	T1	47	23.4	0.032	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		49	26.5	0.032	0.4	NA	0.0	0.0	0.00	0.03	0.00	87.4
West: Quairading-York Road												
11	T1	21	38.1	0.019	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	16	25.0	0.013	8.3	LOS A	0.1	0.5	0.16	0.60	0.16	60.1
Approach		37	32.4	0.019	3.6	NA	0.1	0.5	0.07	0.26	0.07	74.0
All Vehicles		111	23.4	0.032	3.2	NA	0.1	0.5	0.02	0.24	0.02	78.1

Quairading-York Road/Top Beverley-York Road – Existing PM Peak Period

MOVEMENT SUMMARY

Site: 102 [Base PM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	12	0.0	0.006	8.2	LOS A	0.0	0.0	0.00	0.62	0.00	71.0
3	R2	1	0.0	0.001	8.1	LOS A	0.0	0.0	0.25	0.57	0.25	69.2
Approach		13	0.0	0.006	8.2	LOS A	0.0	0.0	0.02	0.62	0.02	70.9
East: Quairading-York Road												
4	L2	2	50.0	0.002	8.6	LOS A	0.0	0.0	0.00	0.65	0.00	53.3
5	T1	41	22.0	0.031	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		43	23.3	0.031	0.4	NA	0.0	0.0	0.00	0.03	0.00	87.2
West: Quairading-York Road												
11	T1	36	25.0	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	22	22.7	0.021	8.5	LOS A	0.1	1.0	0.16	0.60	0.16	60.2
Approach		58	24.1	0.030	3.2	NA	0.1	1.0	0.06	0.23	0.06	75.7
All Vehicles		114	21.1	0.031	2.7	NA	0.1	1.0	0.03	0.20	0.03	79.0

Appendix B – Environment and Heritage Map

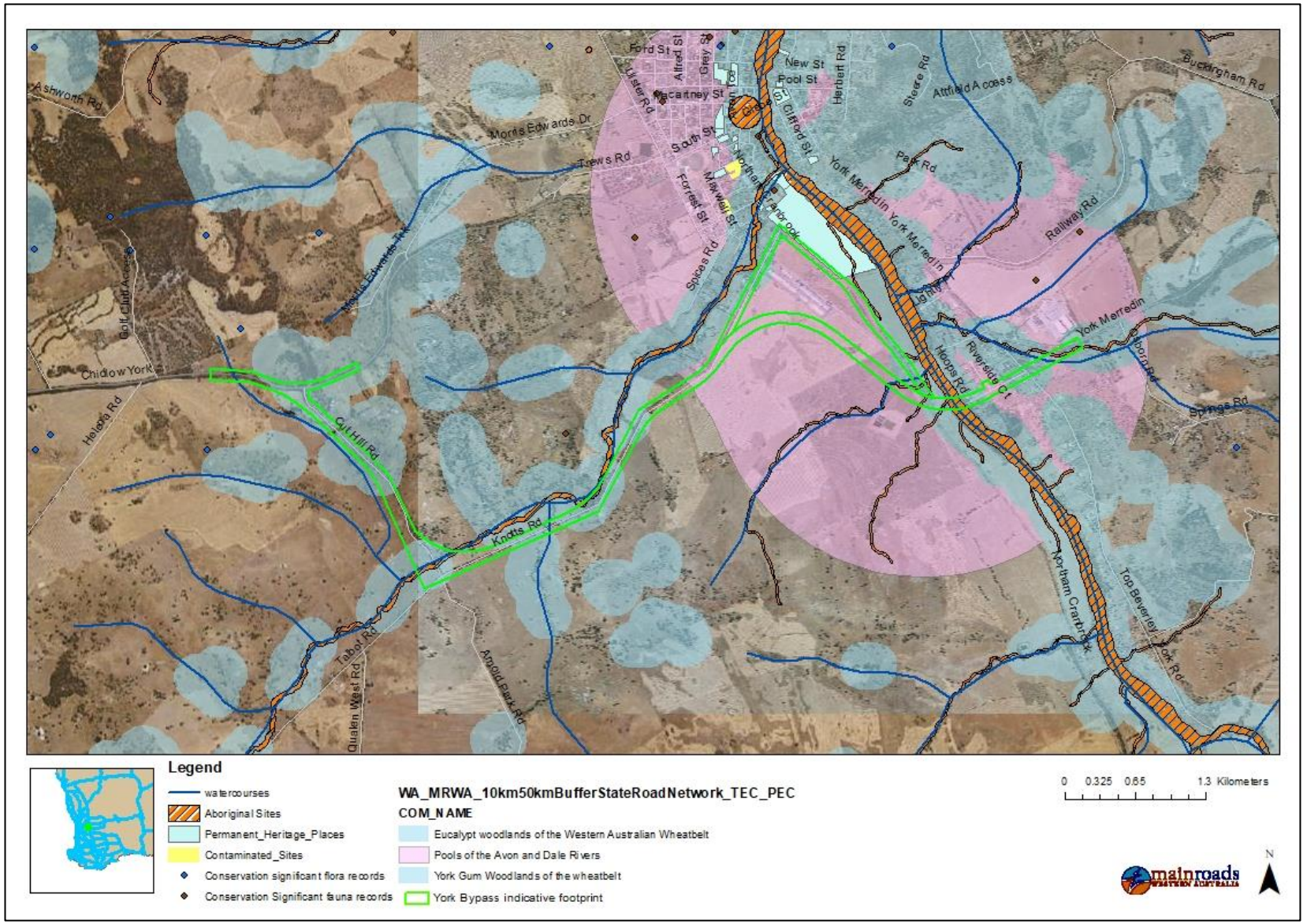


Figure A.1 Environmental and Heritage Constraints

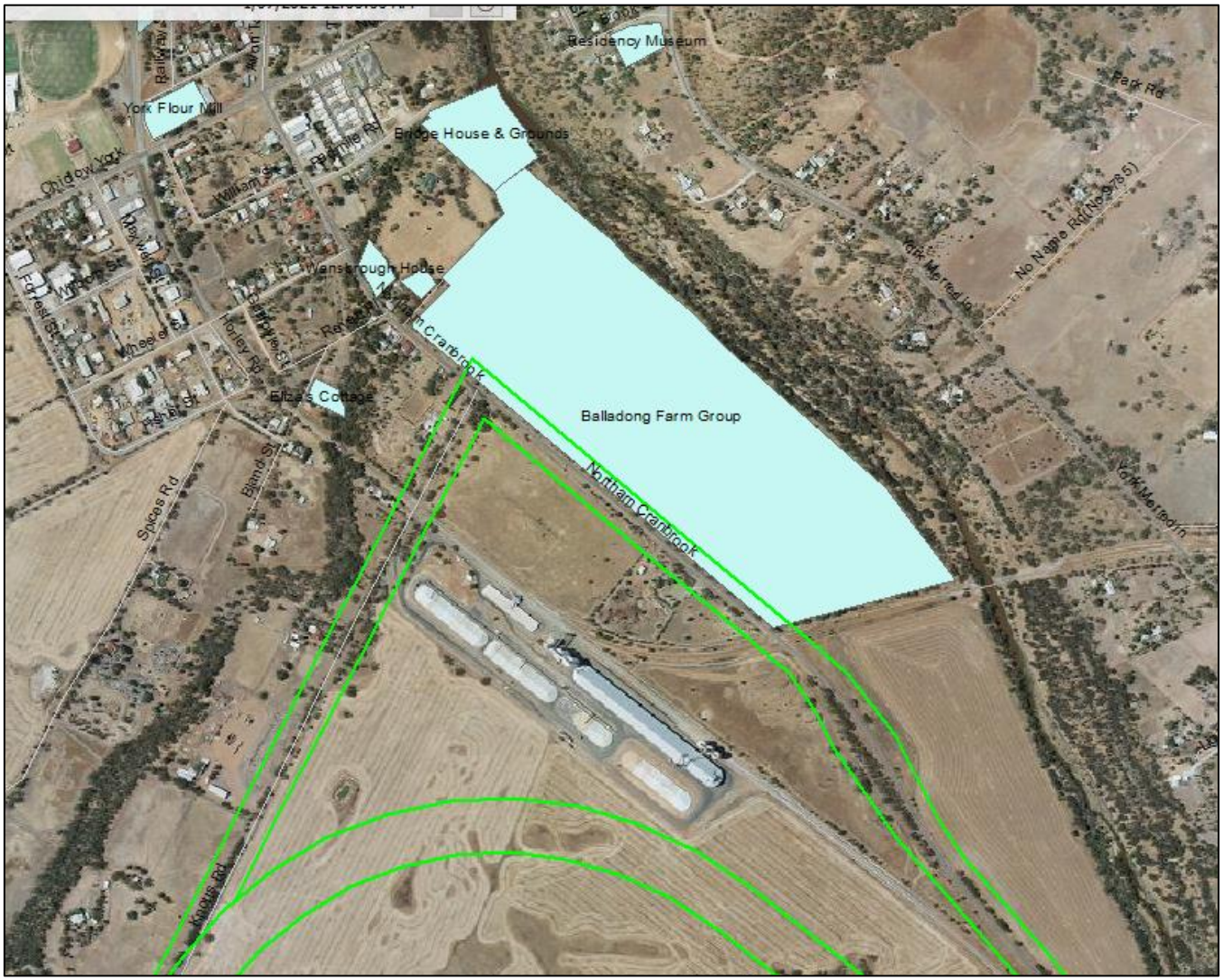


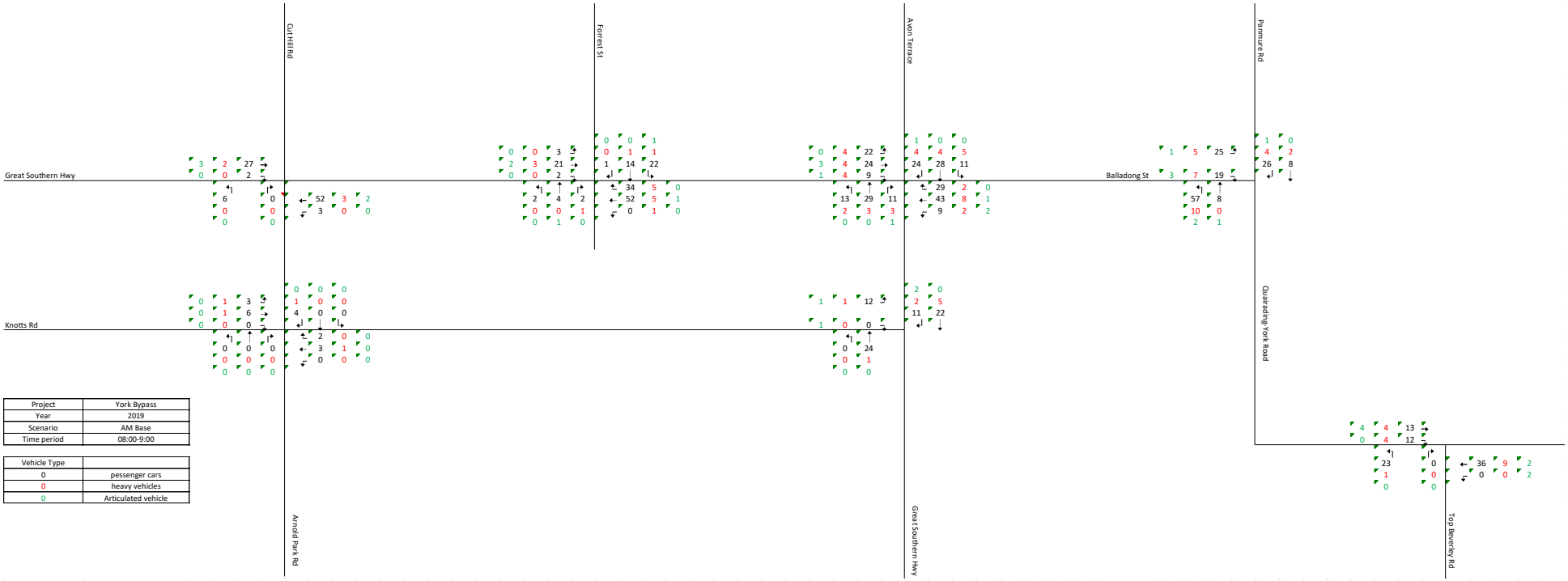
Figure A.2 Location of nearby State Heritage listed sites

Appendix C – Drainage

Appendix D – Crash Data

Appendix E – Traffic Flow Estimation

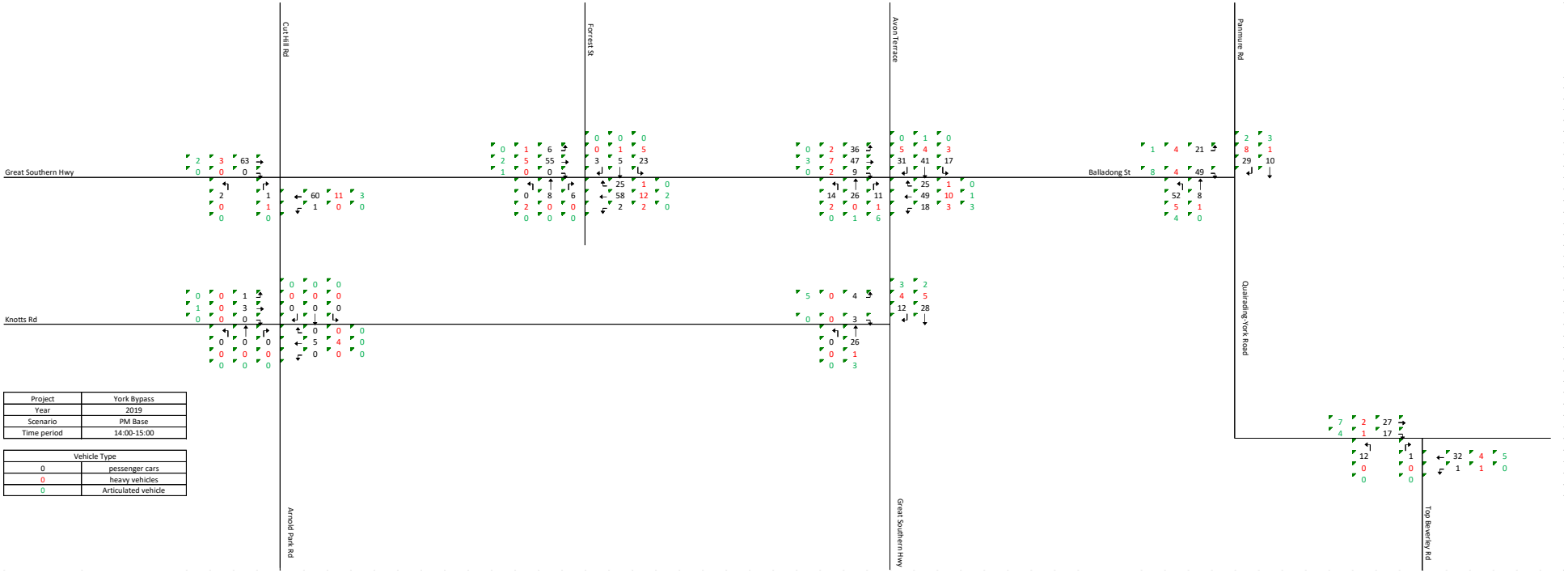
AM Peak Period 2019



Project	York Bypass
Year	2019
Scenario	AM Base
Time period	08:00-9:00

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

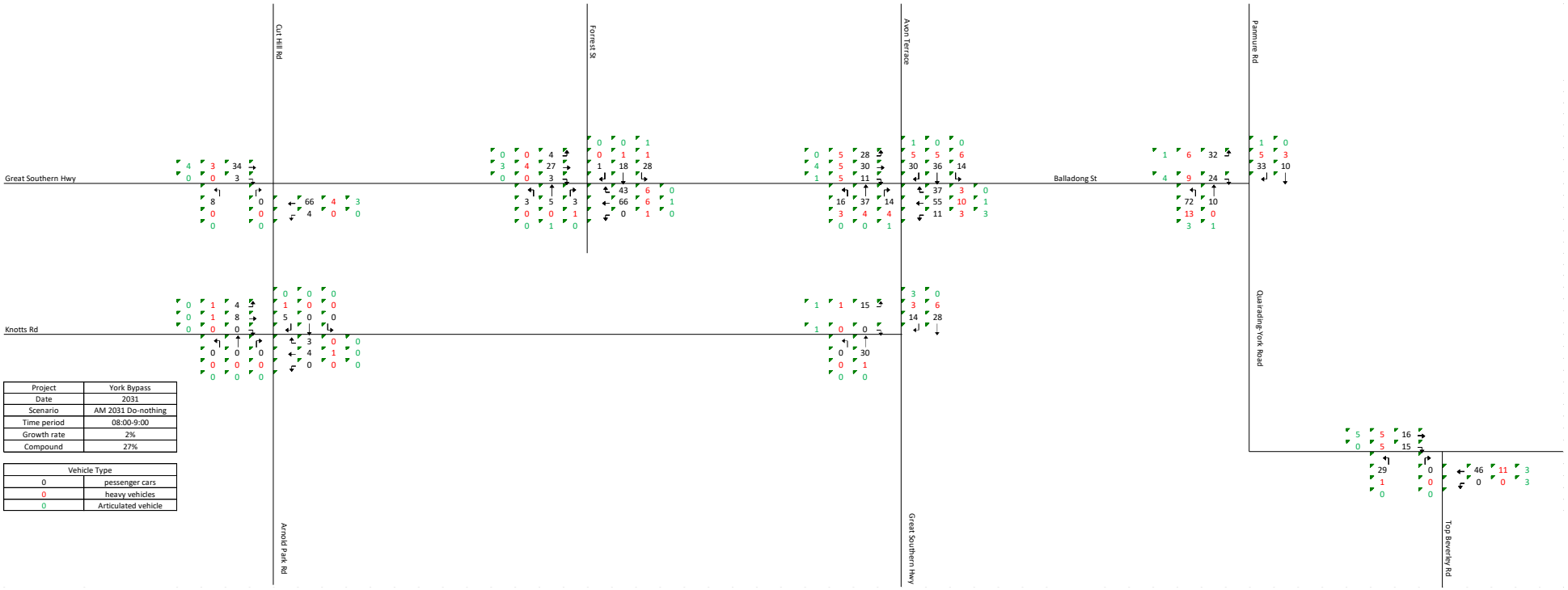
PM Peak Period 2019



Project	York Bypass
Year	2019
Scenario	PM Base
Time period	14:00-15:00

Vehicle Type	
0	passenger cars
0	heavy vehicles
0	Articulated vehicle

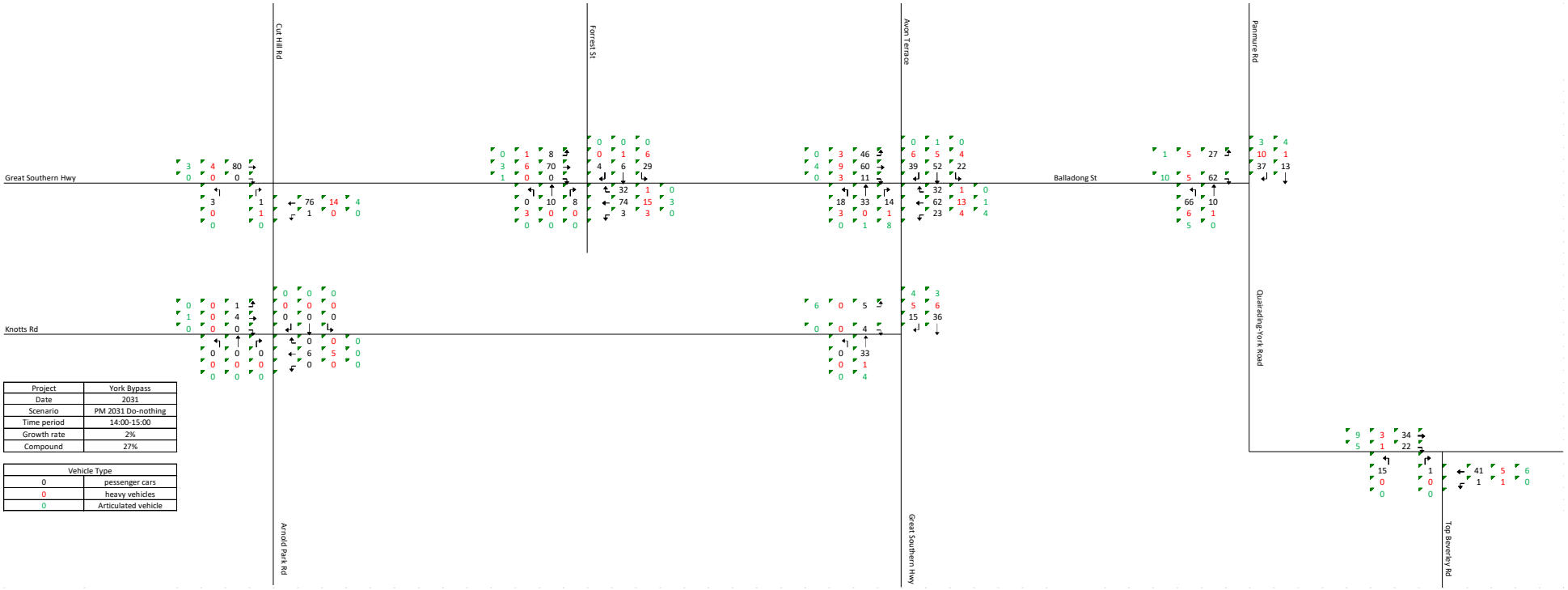
AM Peak Period 2031 – Do-nothing



Project	York Bypass
Date	2031
Scenario	AM 2031 Do-nothing
Time period	08:00-9:00
Growth rate	2%
Compound	27%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

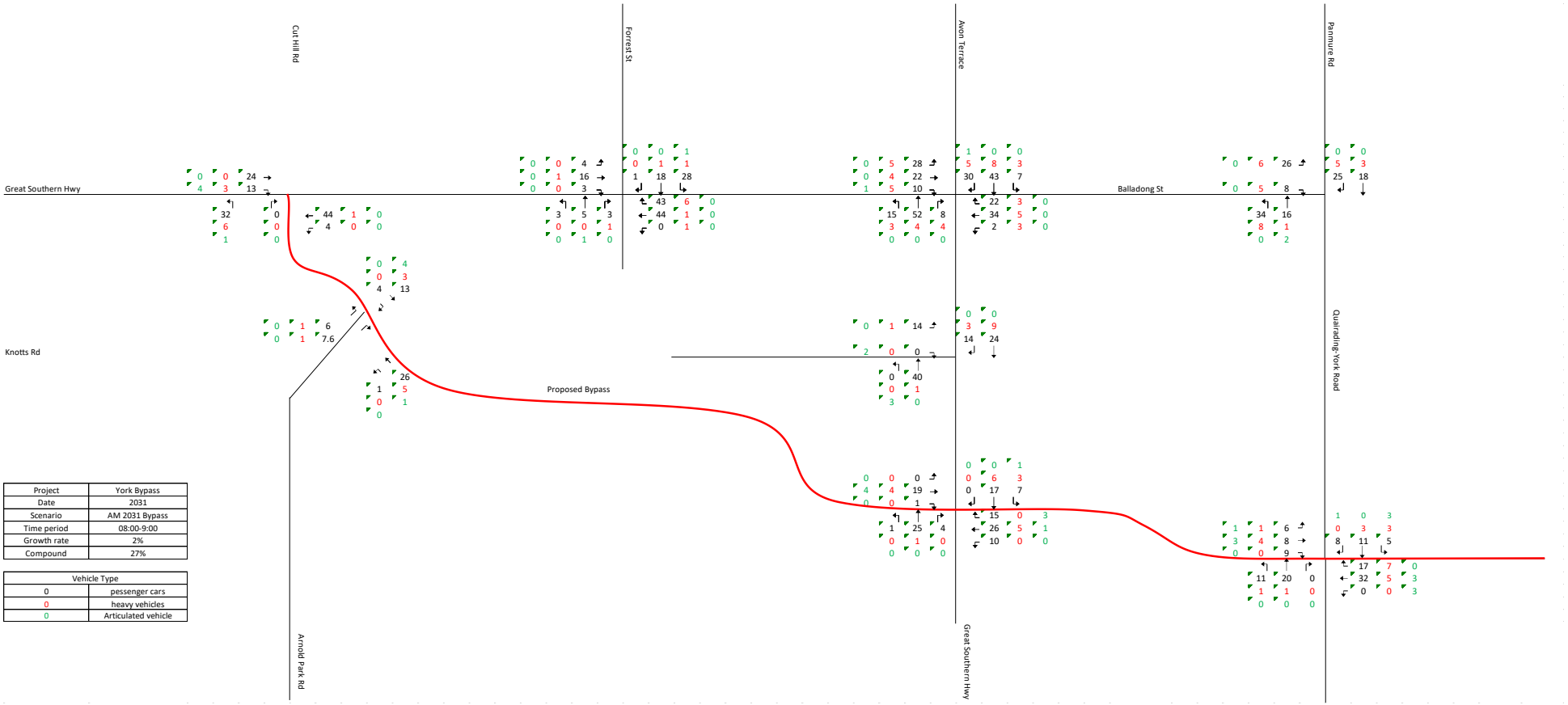
PM Peak Period 2031 – Do-nothing



Project	York Bypass
Date	2031
Scenario	PM 2031 Do-nothing
Time period	14:00-15:00
Growth rate	2%
Compound	27%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

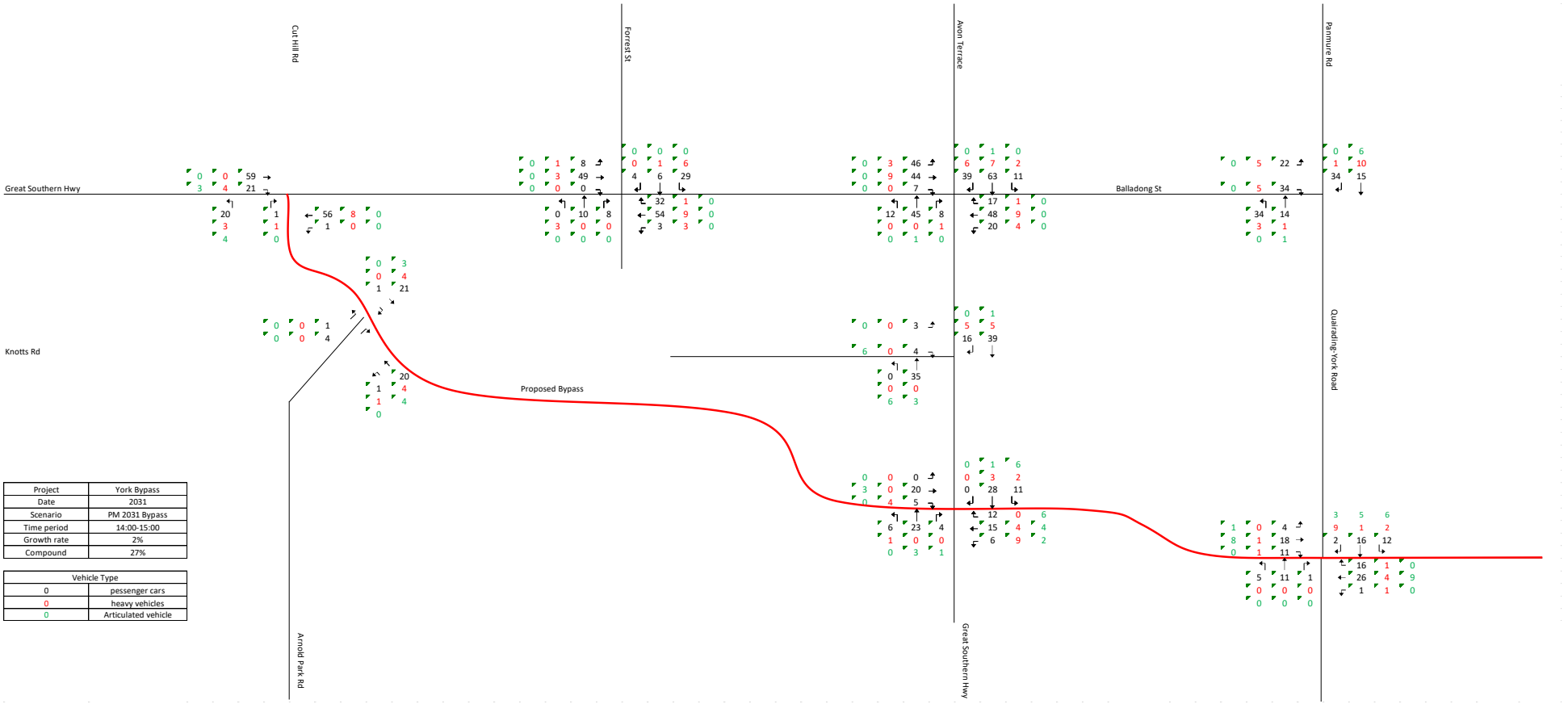
AM Peak Period 2031 – With Proposed Bypass



Project	York Bypass
Date	2031
Scenario	AM 2031 Bypass
Time period	08:00-9:00
Growth rate	2%
Compound	27%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

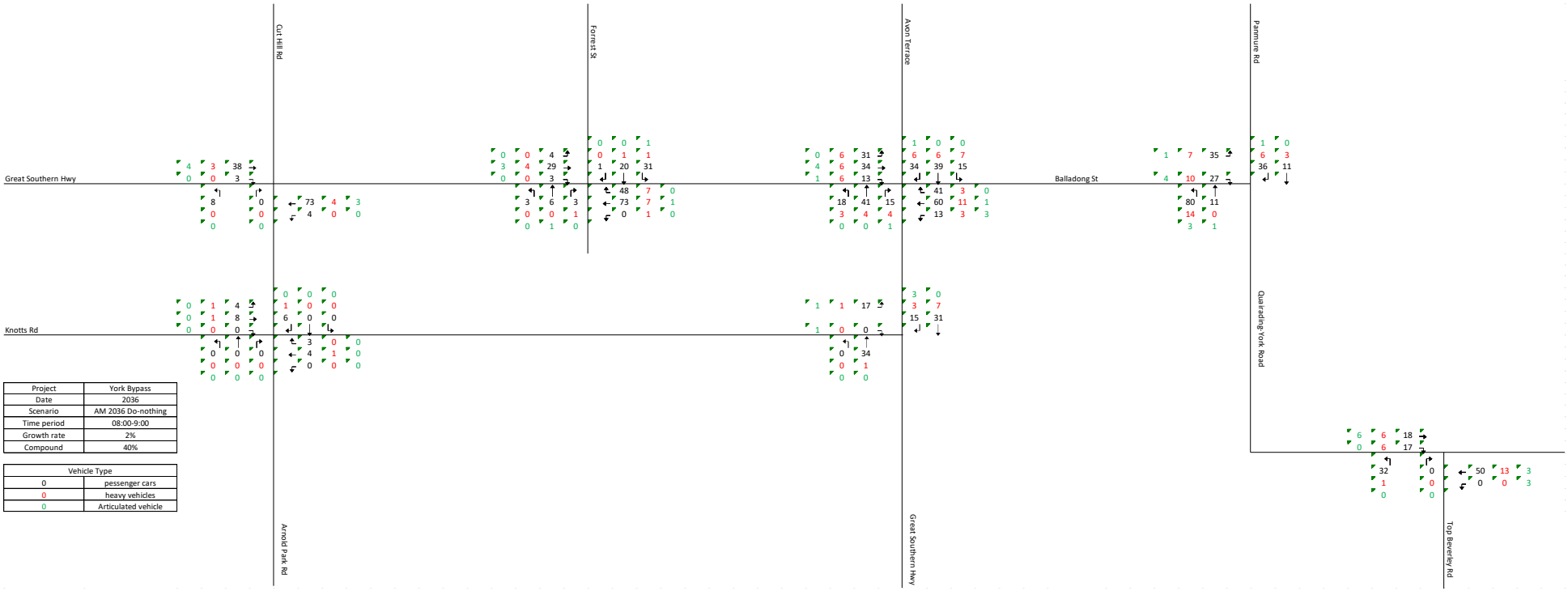
PM Peak Period 2031 – With Proposed Bypass



Project	York Bypass
Date	2031
Scenario	PM 2031 Bypass
Time period	14:00-15:00
Growth rate	2%
Compound	27%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

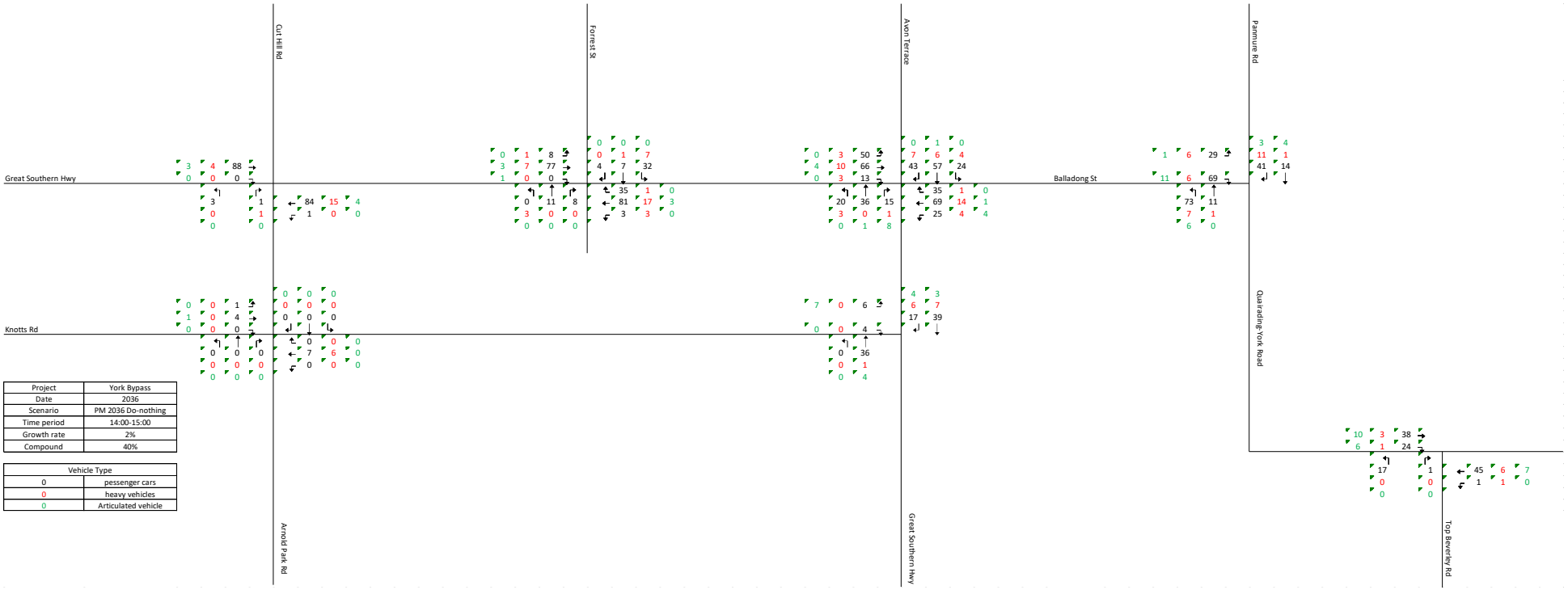
AM Peak Period 2036 – Do-nothing



Project	York Bypass
Date	2036
Scenario	AM 2036 Do-nothing
Time period	08:00-9:00
Growth rate	2%
Compound	40%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

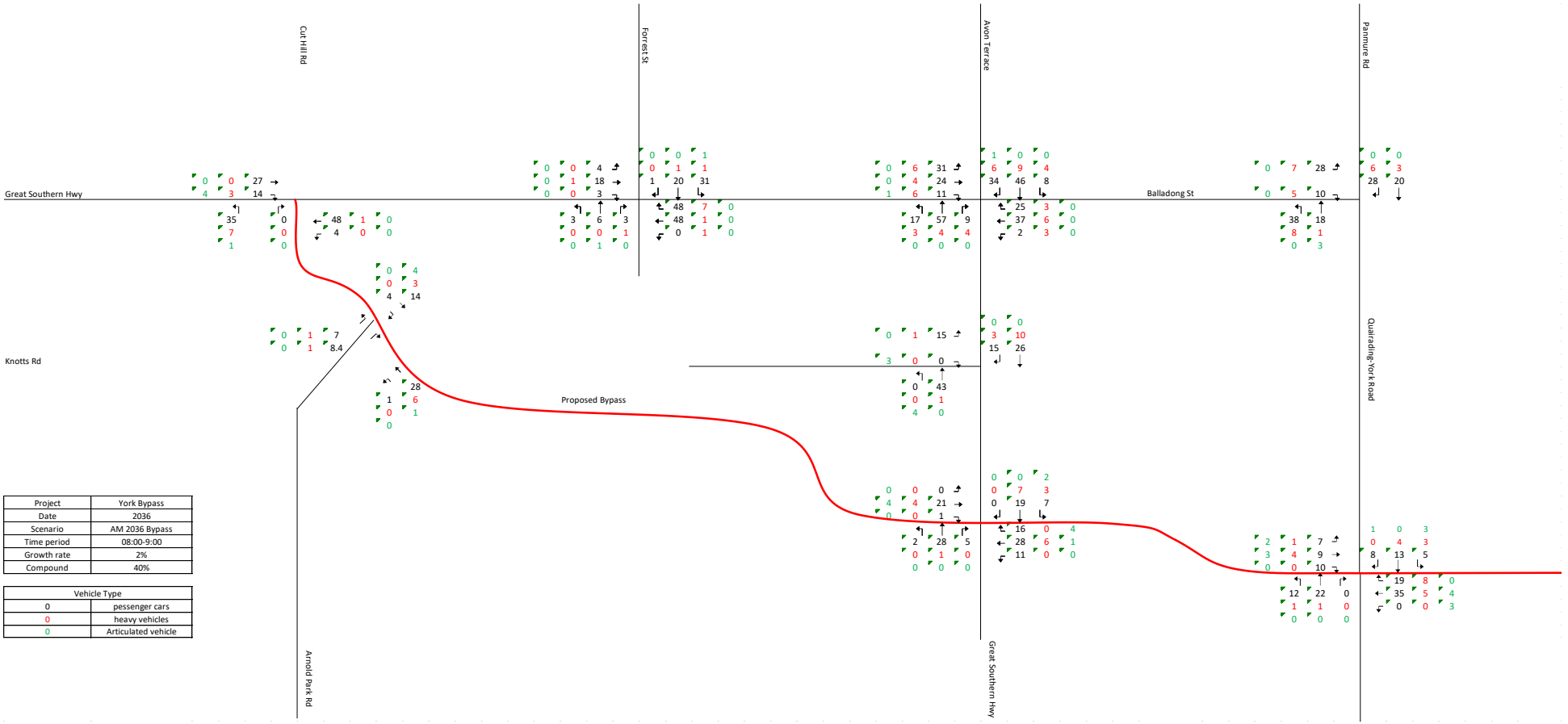
PM Peak Period 2036 – Do-nothing



Project	York Bypass
Date	2036
Scenario	PM 2036 Do-nothing
Time period	14:00-15:00
Growth rate	2%
Compound	40%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

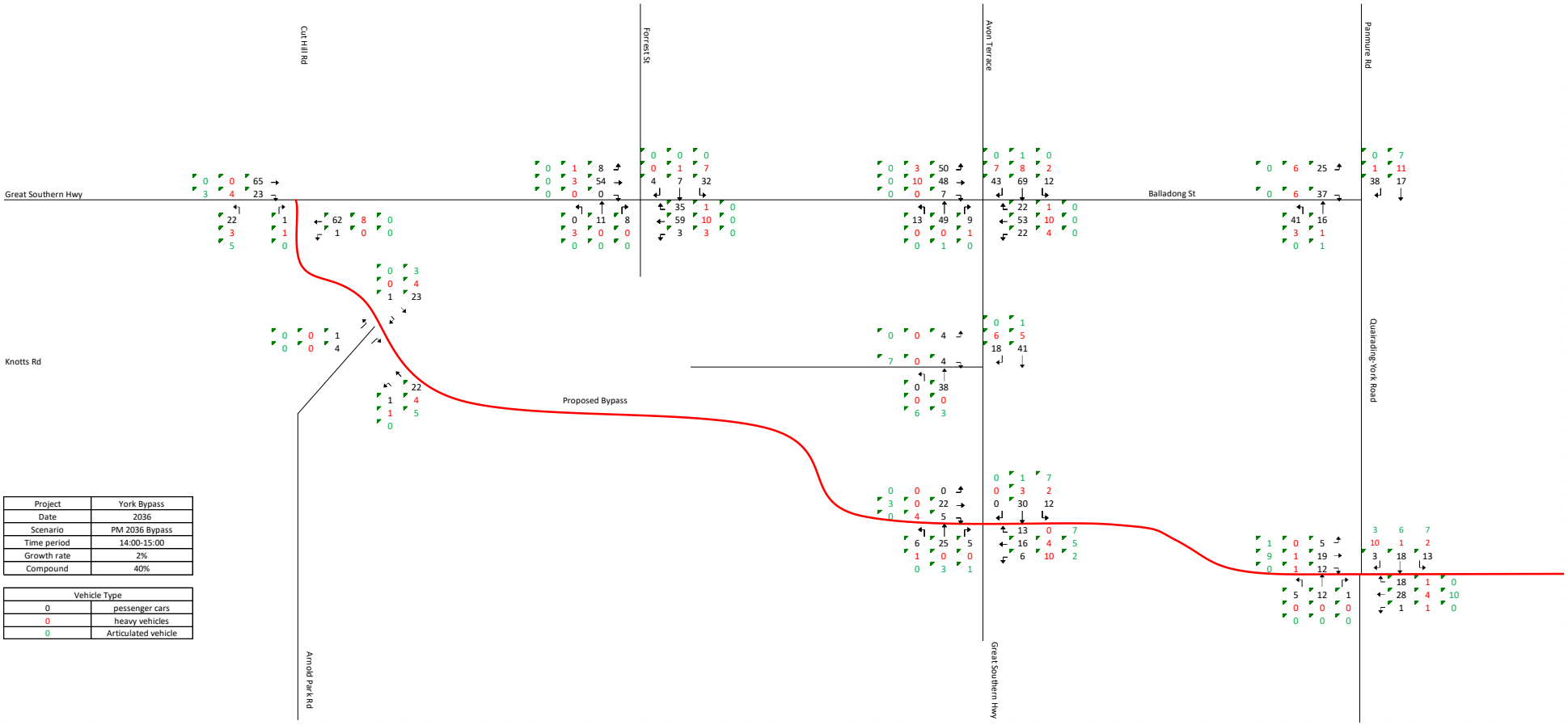
AM Peak Period 2036 – With Proposed Bypass



Project	York Bypass
Date	2036
Scenario	AM 2036 Bypass
Time period	08:00-9:00
Growth rate	2%
Compound	40%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

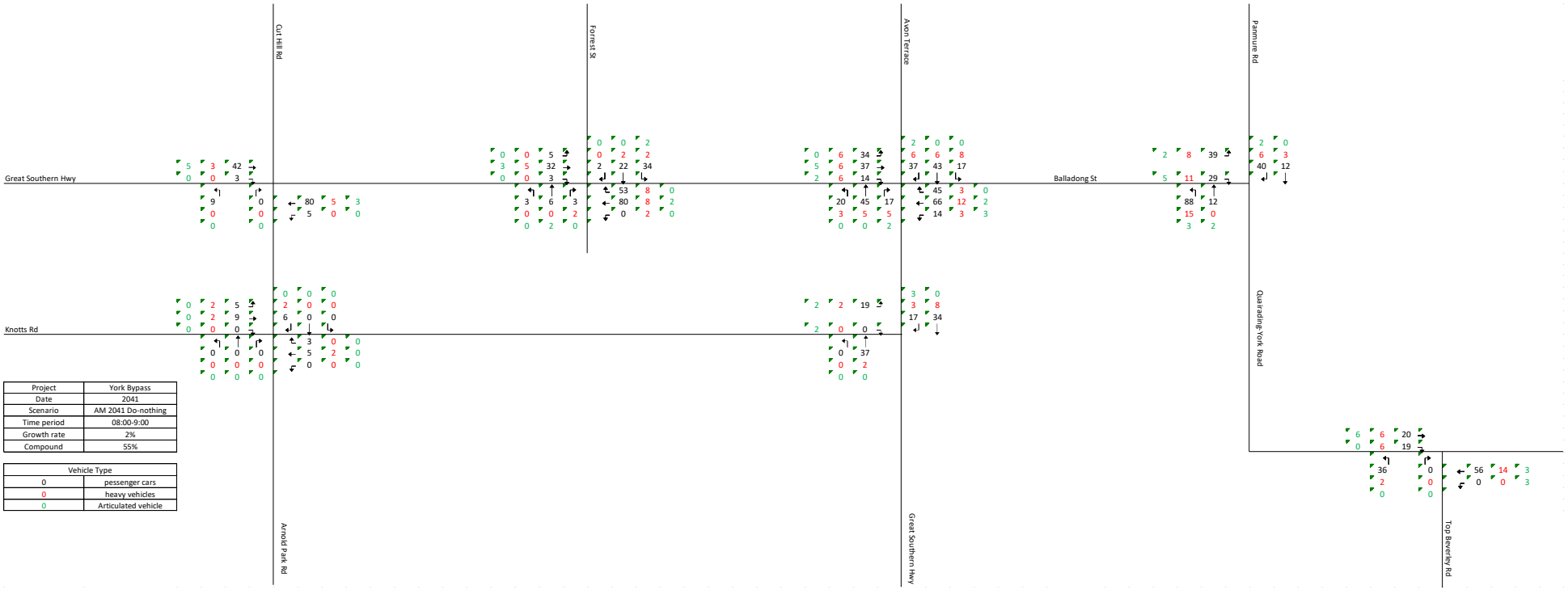
PM Peak Period 2036 – With Proposed Bypass



Project	York Bypass
Date	2036
Scenario	PM 2036 Bypass
Time period	14:00-15:00
Growth rate	2%
Compound	40%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

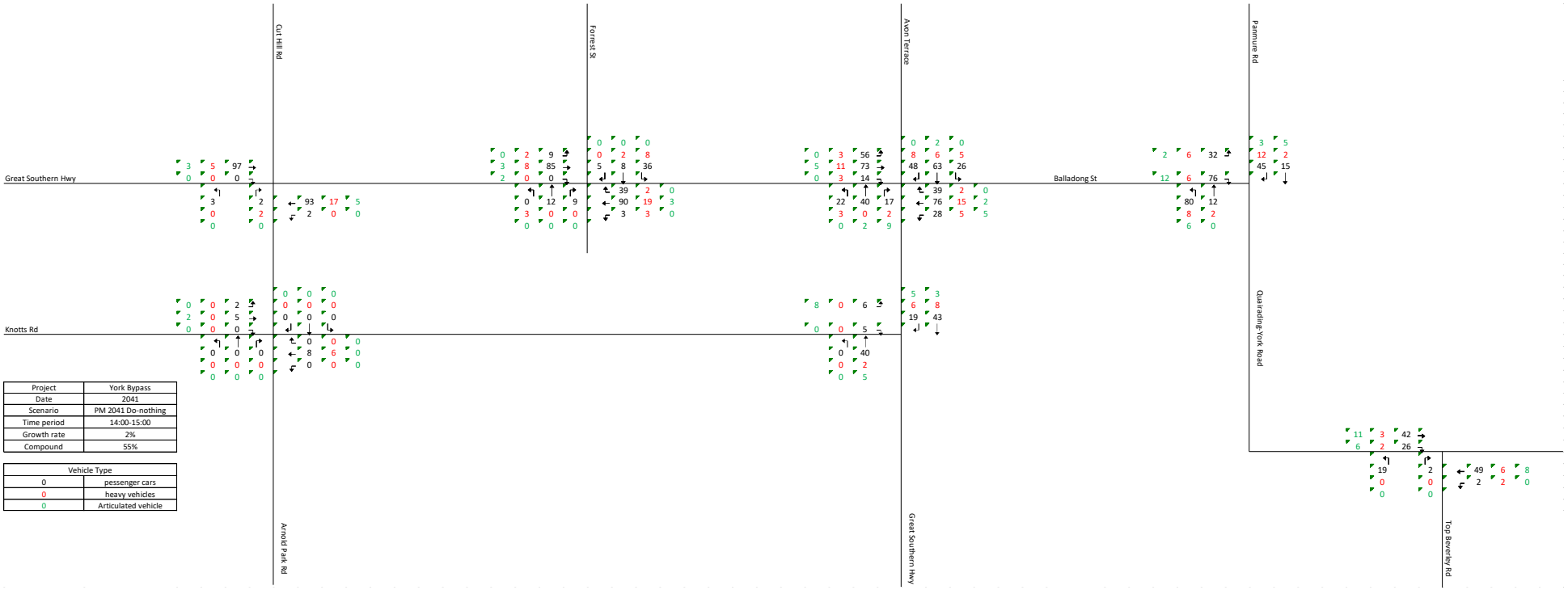
AM Peak Period 2041– Do-nothing



Project	York Bypass
Date	2041
Scenario	AM 2041 Do-nothing
Time period	08:00-9:00
Growth rate	2%
Compound	55%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

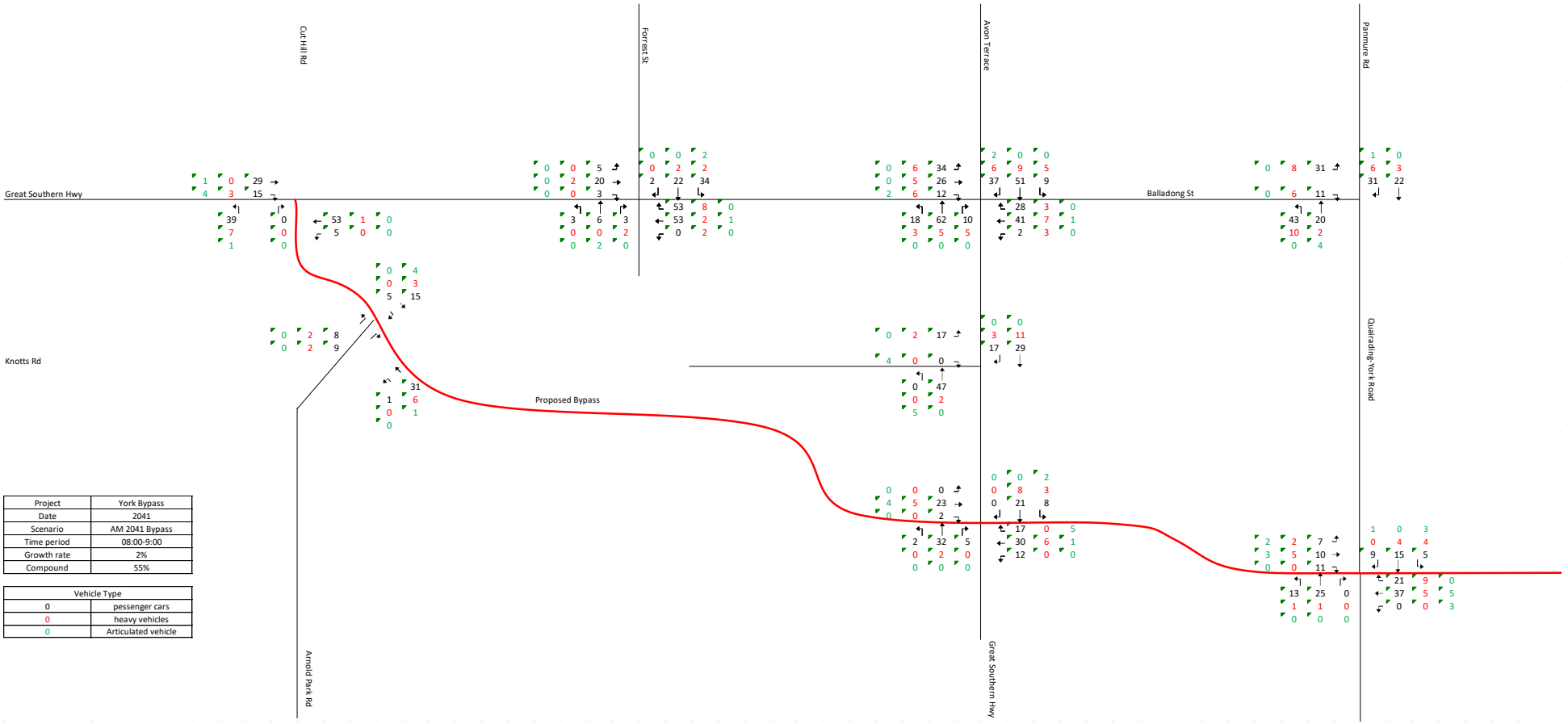
PM Peak Period 2041– Do-nothing



Project	York Bypass
Date	2041
Scenario	PM 2041 Do-nothing
Time period	14:00-15:00
Growth rate	2%
Compound	55%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

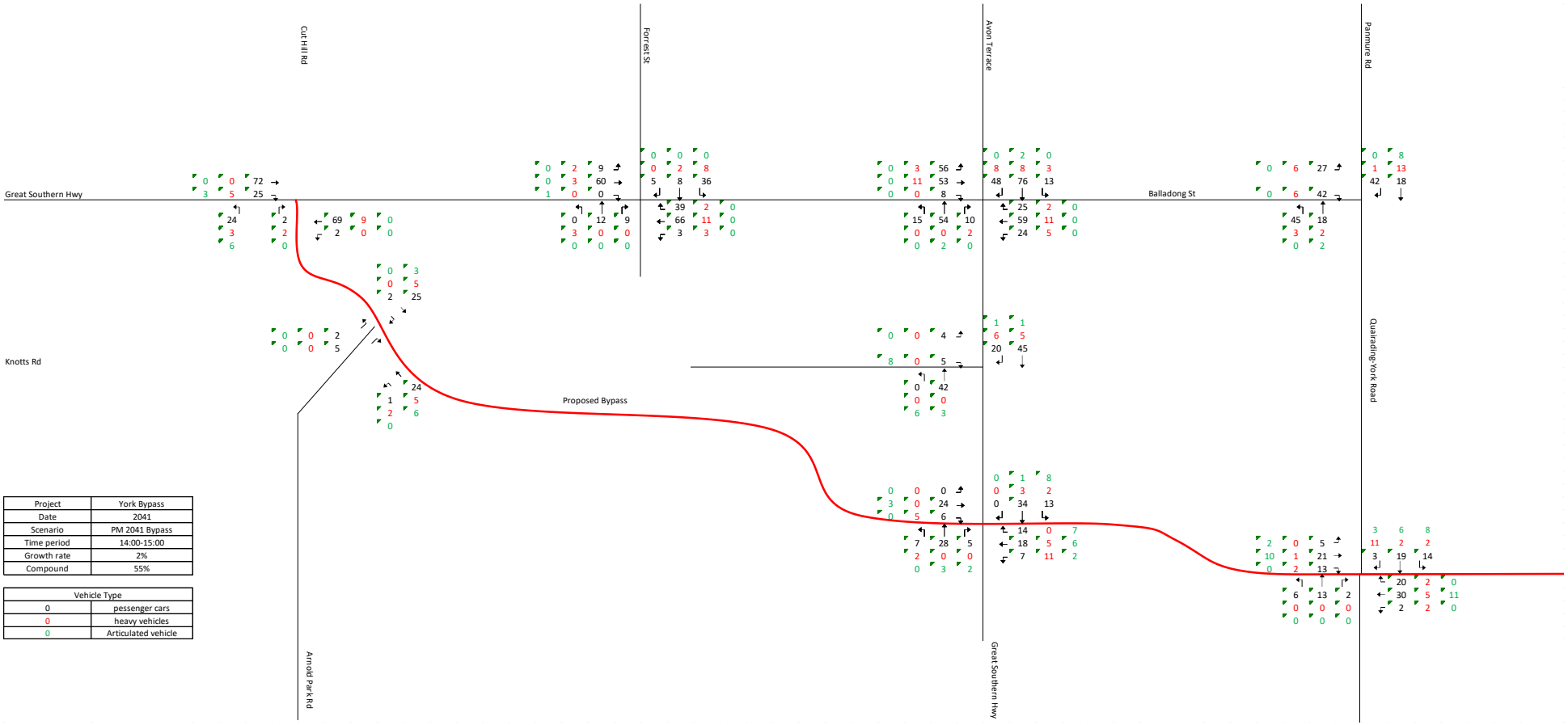
AM Peak Period 2041– With Proposed Bypass



Project	York Bypass
Date	2041
Scenario	AM 2041 Bypass
Time period	08:00-9:00
Growth rate	2%
Compound	55%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

PM Peak Period 2041– With Proposed Bypass



Project	York Bypass
Date	2041
Scenario	PM 2041 Bypass
Time period	14:00-15:00
Growth rate	2%
Compound	55%

Vehicle Type	
0	pessenger cars
0	heavy vehicles
0	Articulated vehicle

Appendix F – Traffic Assessment Outputs

Chidlow-York Road (M010)/ Avon Tce

2031 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102v [2031 Do-Nothing AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	19	15.8	0.015	9.2	LOS A	0.1	0.5	0.17	0.93	0.17	50.6
2	T1	41	9.8	0.077	9.6	LOS A	0.3	2.4	0.36	0.97	0.36	50.4
3	R2	19	26.3	0.077	11.3	LOS B	0.3	2.4	0.36	0.97	0.36	48.8
Approach		79	15.2	0.077	9.9	LOS A	0.3	2.4	0.31	0.96	0.31	50.1
East: Balladong Street												
4	L2	17	35.3	0.079	6.3	LOS A	0.3	2.3	0.13	0.26	0.13	52.6
5	T1	66	16.7	0.079	0.1	LOS A	0.3	2.3	0.13	0.26	0.13	57.1
6	R2	40	7.5	0.079	5.9	LOS A	0.3	2.3	0.13	0.26	0.13	54.6
Approach		123	16.3	0.079	2.9	NA	0.3	2.3	0.13	0.26	0.13	55.6
North: Avon Terrace												
7	L2	20	30.0	0.017	10.0	LOS A	0.1	0.6	0.14	0.99	0.14	49.5
8	T1	41	12.2	0.100	9.8	LOS A	0.4	3.1	0.36	0.97	0.36	50.2
9	R2	36	16.7	0.100	10.5	LOS B	0.4	3.1	0.36	0.97	0.36	49.6
Approach		97	17.5	0.100	10.1	LOS B	0.4	3.1	0.32	0.97	0.32	49.8
West: Great Southern Highway												
10	L2	33	15.2	0.064	6.0	LOS A	0.2	1.6	0.12	0.30	0.12	53.9
11	T1	39	23.1	0.064	0.2	LOS A	0.2	1.6	0.12	0.30	0.12	56.6
12	R2	17	35.3	0.064	6.5	LOS A	0.2	1.6	0.12	0.30	0.12	51.9
Approach		89	22.5	0.064	3.5	NA	0.2	1.6	0.12	0.30	0.12	54.6
All Vehicles		388	17.8	0.100	6.3	NA	0.4	3.1	0.21	0.59	0.21	52.7

2031 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102v [2031 Proposed AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	19	16.7	0.015	9.2	LOS A	0.1	0.5	0.13	0.96	0.13	50.5
2	T1	59	7.1	0.079	9.0	LOS A	0.3	2.4	0.29	0.97	0.29	50.9
3	R2	13	33.3	0.079	10.9	LOS B	0.3	2.4	0.29	0.97	0.29	48.6
Approach		91	12.8	0.079	9.3	LOS A	0.3	2.4	0.25	0.97	0.25	50.5
East: Balladong Street												
4	L2	5	60.0	0.045	6.5	LOS A	0.2	1.3	0.12	0.24	0.12	50.9
5	T1	41	12.8	0.045	0.1	LOS A	0.2	1.3	0.12	0.24	0.12	57.4
6	R2	26	12.0	0.045	5.9	LOS A	0.2	1.3	0.12	0.24	0.12	54.5
Approach		73	15.9	0.045	2.7	NA	0.2	1.3	0.12	0.24	0.12	55.8
North: Avon Terrace												
7	L2	11	30.0	0.009	9.9	LOS A	0.0	0.3	0.10	1.01	0.10	49.5
8	T1	54	15.7	0.110	9.6	LOS A	0.4	3.5	0.30	0.98	0.30	50.2
9	R2	38	16.7	0.110	10.1	LOS B	0.4	3.5	0.30	0.98	0.30	49.8
Approach		102	17.5	0.110	9.8	LOS A	0.4	3.5	0.28	0.99	0.28	50.0
West: Great Southern Highway												
10	L2	35	15.2	0.053	5.8	LOS A	0.2	1.4	0.09	0.35	0.09	53.7
11	T1	27	15.4	0.053	0.1	LOS A	0.2	1.4	0.09	0.35	0.09	56.4
12	R2	17	37.5	0.053	6.3	LOS A	0.2	1.4	0.09	0.35	0.09	51.5
Approach		79	20.0	0.053	3.9	NA	0.2	1.4	0.09	0.35	0.09	54.1
All Vehicles		344	16.5	0.110	6.8	NA	0.4	3.5	0.20	0.68	0.20	52.2

2036 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102v [2036 Do-Nothing AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	21	14.3	0.017	9.2	LOS A	0.1	0.6	0.18	0.92	0.18	50.7
2	T1	45	8.9	0.085	9.7	LOS A	0.3	2.6	0.38	0.97	0.38	50.4
3	R2	20	25.0	0.085	11.5	LOS B	0.3	2.6	0.38	0.97	0.38	48.9
Approach		86	14.0	0.085	10.0	LOS B	0.3	2.6	0.33	0.96	0.33	50.1
East: Balladong Street												
4	L2	19	31.6	0.086	6.2	LOS A	0.3	2.5	0.14	0.26	0.14	52.8
5	T1	72	16.7	0.086	0.2	LOS A	0.3	2.5	0.14	0.26	0.14	57.0
6	R2	44	6.8	0.086	5.9	LOS A	0.3	2.5	0.14	0.26	0.14	54.6
Approach		135	15.6	0.086	2.9	NA	0.3	2.5	0.14	0.26	0.14	55.6
North: Avon Terrace												
7	L2	22	31.8	0.019	10.1	LOS B	0.1	0.7	0.15	0.99	0.15	49.4
8	T1	45	13.3	0.116	10.1	LOS B	0.4	3.6	0.39	0.98	0.39	50.0
9	R2	41	17.1	0.116	10.8	LOS B	0.4	3.6	0.39	0.98	0.39	49.4
Approach		108	18.5	0.116	10.4	LOS B	0.4	3.6	0.34	0.98	0.34	49.6
West: Great Southern Highway												
10	L2	37	16.2	0.072	6.0	LOS A	0.2	1.9	0.13	0.30	0.13	53.8
11	T1	44	22.7	0.072	0.2	LOS A	0.2	1.9	0.13	0.30	0.13	56.6
12	R2	20	35.0	0.072	6.5	LOS A	0.2	1.9	0.13	0.30	0.13	51.9
Approach		101	22.8	0.072	3.6	NA	0.2	1.9	0.13	0.30	0.13	54.6
All Vehicles		430	17.7	0.116	6.4	NA	0.4	3.6	0.23	0.59	0.23	52.6

2036 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102v [2036 Proposed AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	21	15.0	0.016	9.1	LOS A	0.1	0.5	0.13	0.95	0.13	50.6
2	T1	64	6.6	0.087	9.1	LOS A	0.3	2.6	0.31	0.97	0.31	50.9
3	R2	14	30.8	0.087	10.9	LOS B	0.3	2.6	0.31	0.97	0.31	48.8
Approach		99	11.7	0.087	9.3	LOS A	0.3	2.6	0.27	0.97	0.27	50.6
East: Balladong Street												
4	L2	5	60.0	0.049	6.5	LOS A	0.2	1.5	0.13	0.24	0.13	50.9
5	T1	45	14.0	0.049	0.1	LOS A	0.2	1.5	0.13	0.24	0.13	57.3
6	R2	29	10.7	0.049	5.9	LOS A	0.2	1.5	0.13	0.24	0.13	54.6
Approach		80	15.8	0.049	2.7	NA	0.2	1.5	0.13	0.24	0.13	55.8
North: Avon Terrace												
7	L2	13	33.3	0.011	10.1	LOS B	0.0	0.4	0.11	1.01	0.11	49.3
8	T1	58	16.4	0.125	9.7	LOS A	0.5	4.1	0.32	0.98	0.32	50.0
9	R2	43	17.1	0.125	10.4	LOS B	0.5	4.1	0.32	0.98	0.32	49.7
Approach		114	18.5	0.125	10.0	LOS B	0.5	4.1	0.30	0.99	0.30	49.8
West: Great Southern Highway												
10	L2	39	16.2	0.059	5.9	LOS A	0.2	1.6	0.10	0.36	0.10	53.5
11	T1	29	14.3	0.059	0.1	LOS A	0.2	1.6	0.10	0.36	0.10	56.4
12	R2	19	38.9	0.059	6.3	LOS A	0.2	1.6	0.10	0.36	0.10	51.4
Approach		87	20.5	0.059	4.0	NA	0.2	1.6	0.10	0.36	0.10	54.0
All Vehicles		380	16.6	0.125	6.9	NA	0.5	4.1	0.21	0.68	0.21	52.1

2041 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102v [2041 Do-Nothing AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	23	13.0	0.019	9.1	LOS A	0.1	0.6	0.19	0.92	0.19	50.8
2	T1	50	10.0	0.105	10.0	LOS B	0.4	3.4	0.41	0.98	0.41	50.1
3	R2	24	29.2	0.105	12.5	LOS B	0.4	3.4	0.41	0.98	0.41	48.3
Approach		97	15.5	0.105	10.4	LOS B	0.4	3.4	0.36	0.97	0.36	49.8
East: Balladong Street												
4	L2	20	30.0	0.095	6.2	LOS A	0.3	2.8	0.15	0.25	0.15	52.9
5	T1	80	17.5	0.095	0.2	LOS A	0.3	2.8	0.15	0.25	0.15	57.0
6	R2	48	6.3	0.095	5.9	LOS A	0.3	2.8	0.15	0.25	0.15	54.7
Approach		148	15.5	0.095	2.9	NA	0.3	2.8	0.15	0.25	0.15	55.6
North: Avon Terrace												
7	L2	25	32.0	0.021	10.2	LOS B	0.1	0.8	0.16	0.98	0.16	49.4
8	T1	49	12.2	0.134	10.2	LOS B	0.5	4.3	0.42	0.98	0.42	49.9
9	R2	45	17.8	0.134	11.4	LOS B	0.5	4.3	0.42	0.98	0.42	49.1
Approach		119	18.5	0.134	10.7	LOS B	0.5	4.3	0.36	0.98	0.36	49.5
West: Great Southern Highway												
10	L2	40	15.0	0.081	6.0	LOS A	0.2	2.3	0.14	0.30	0.14	53.8
11	T1	48	22.9	0.081	0.2	LOS A	0.2	2.3	0.14	0.30	0.14	56.5
12	R2	22	36.4	0.081	6.7	LOS A	0.2	2.3	0.14	0.30	0.14	51.7
Approach		110	22.7	0.081	3.6	NA	0.2	2.3	0.14	0.30	0.14	54.5
All Vehicles		474	17.9	0.134	6.5	NA	0.5	4.3	0.24	0.59	0.24	52.5

2041 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102v [2041 Proposed AM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	22	14.3	0.017	9.1	LOS A	0.1	0.6	0.15	0.94	0.15	50.7
2	T1	71	7.5	0.100	9.3	LOS A	0.4	3.0	0.33	0.97	0.33	50.8
3	R2	16	33.3	0.100	11.4	LOS B	0.4	3.0	0.33	0.97	0.33	48.5
Approach		108	12.6	0.100	9.5	LOS A	0.4	3.0	0.29	0.97	0.29	50.4
East: Balladong Street												
4	L2	5	60.0	0.056	6.6	LOS A	0.2	1.7	0.14	0.24	0.14	50.9
5	T1	52	16.3	0.056	0.1	LOS A	0.2	1.7	0.14	0.24	0.14	57.3
6	R2	33	9.7	0.056	5.9	LOS A	0.2	1.7	0.14	0.24	0.14	54.6
Approach		89	16.5	0.056	2.6	NA	0.2	1.7	0.14	0.24	0.14	55.9
North: Avon Terrace												
7	L2	15	35.7	0.013	10.3	LOS B	0.0	0.5	0.12	1.01	0.12	49.1
8	T1	63	15.0	0.143	9.8	LOS A	0.5	4.7	0.35	0.98	0.35	50.0
9	R2	47	17.8	0.143	10.9	LOS B	0.5	4.7	0.35	0.98	0.35	49.5
Approach		125	18.5	0.143	10.3	LOS B	0.5	4.7	0.32	0.99	0.32	49.7
West: Great Southern Highway												
10	L2	42	15.0	0.067	5.9	LOS A	0.2	1.9	0.11	0.35	0.11	53.6
11	T1	33	16.1	0.067	0.2	LOS A	0.2	1.9	0.11	0.35	0.11	56.3
12	R2	21	40.0	0.067	6.4	LOS A	0.2	1.9	0.11	0.35	0.11	51.3
Approach		96	20.9	0.067	4.1	NA	0.2	1.9	0.11	0.35	0.11	53.9
All Vehicles		419	17.1	0.143	7.0	NA	0.5	4.7	0.23	0.68	0.23	52.0

2031 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102v [2031 Do-Nothing PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	21	14.3	0.017	9.2	LOS A	0.1	0.6	0.19	0.92	0.19	50.7
2	T1	34	2.9	0.102	9.6	LOS A	0.4	4.0	0.45	0.98	0.45	49.9
3	R2	23	39.1	0.102	15.8	LOS C	0.4	4.0	0.45	0.98	0.45	46.9
Approach		78	16.7	0.102	11.3	LOS B	0.4	4.0	0.38	0.96	0.38	49.2
East: Balladong Street												
4	L2	31	25.8	0.091	6.2	LOS A	0.2	2.2	0.14	0.25	0.14	53.3
5	T1	76	18.4	0.091	0.2	LOS A	0.2	2.2	0.14	0.25	0.14	57.0
6	R2	33	3.0	0.091	6.0	LOS A	0.2	2.2	0.14	0.25	0.14	55.0
Approach		140	16.4	0.091	2.9	NA	0.2	2.2	0.14	0.25	0.14	55.7
North: Avon Terrace												
7	L2	26	15.4	0.021	9.3	LOS A	0.1	0.7	0.19	0.93	0.19	50.6
8	T1	58	10.3	0.138	10.2	LOS B	0.5	4.2	0.41	0.98	0.41	50.1
9	R2	45	13.3	0.138	10.6	LOS B	0.5	4.2	0.41	0.98	0.41	49.6
Approach		129	12.4	0.138	10.1	LOS B	0.5	4.2	0.36	0.97	0.36	50.1
West: Great Southern Highway												
10	L2	49	6.1	0.086	5.8	LOS A	0.1	1.2	0.08	0.26	0.08	55.1
11	T1	73	17.8	0.086	0.1	LOS A	0.1	1.2	0.08	0.26	0.08	57.2
12	R2	14	21.4	0.086	6.3	LOS A	0.1	1.2	0.08	0.26	0.08	53.5
Approach		136	14.0	0.086	2.8	NA	0.1	1.2	0.08	0.26	0.08	56.0
All Vehicles		483	14.7	0.138	6.1	NA	0.5	4.2	0.22	0.56	0.22	53.1

2031 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102v [2031 Proposed PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	13	0.0	0.009	8.2	LOS A	0.0	0.3	0.15	0.89	0.15	51.8
2	T1	48	2.2	0.066	9.0	LOS A	0.2	1.9	0.33	0.95	0.33	51.2
3	R2	9	11.1	0.066	10.0	LOS A	0.2	1.9	0.33	0.95	0.33	50.2
Approach		71	3.0	0.066	9.0	LOS A	0.2	1.9	0.30	0.94	0.30	51.2
East: Balladong Street												
4	L2	25	16.7	0.063	5.9	LOS A	0.1	1.2	0.11	0.23	0.11	54.4
5	T1	60	15.8	0.063	0.1	LOS A	0.1	1.2	0.11	0.23	0.11	57.3
6	R2	19	5.6	0.063	5.9	LOS A	0.1	1.2	0.11	0.23	0.11	55.1
Approach		104	14.1	0.063	2.6	NA	0.1	1.2	0.11	0.23	0.11	56.1
North: Avon Terrace												
7	L2	14	15.4	0.011	9.2	LOS A	0.0	0.4	0.15	0.94	0.15	50.6
8	T1	75	11.3	0.149	9.7	LOS A	0.6	4.7	0.35	0.97	0.35	50.4
9	R2	47	13.3	0.149	10.1	LOS B	0.6	4.7	0.35	0.97	0.35	49.9
Approach		136	12.4	0.149	9.8	LOS A	0.6	4.7	0.33	0.97	0.33	50.2
West: Great Southern Highway												
10	L2	52	6.1	0.067	5.7	LOS A	0.1	0.5	0.04	0.29	0.04	55.0
11	T1	56	17.0	0.067	0.0	LOS A	0.1	0.5	0.04	0.29	0.04	57.0
12	R2	7	0.0	0.067	5.8	LOS A	0.1	0.5	0.04	0.29	0.04	55.3
Approach		115	11.0	0.067	2.9	NA	0.1	0.5	0.04	0.29	0.04	56.0
All Vehicles		425	10.9	0.149	6.0	NA	0.6	4.7	0.19	0.60	0.19	53.3

2036 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102v [2036 Do-Nothing PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	23	13.0	0.019	9.2	LOS A	0.1	0.6	0.20	0.91	0.20	50.8
2	T1	37	2.7	0.112	9.7	LOS A	0.4	4.3	0.47	0.98	0.47	49.7
3	R2	24	37.5	0.112	16.3	LOS C	0.4	4.3	0.47	0.98	0.47	46.9
Approach		84	15.5	0.112	11.5	LOS B	0.4	4.3	0.39	0.96	0.39	49.2
East: Balladong Street												
4	L2	33	24.2	0.099	6.2	LOS A	0.3	2.4	0.15	0.25	0.15	53.4
5	T1	84	17.9	0.099	0.2	LOS A	0.3	2.4	0.15	0.25	0.15	57.0
6	R2	36	2.8	0.099	6.0	LOS A	0.3	2.4	0.15	0.25	0.15	55.0
Approach		153	15.7	0.099	2.8	NA	0.3	2.4	0.15	0.25	0.15	55.7
North: Avon Terrace												
7	L2	28	14.3	0.023	9.2	LOS A	0.1	0.8	0.20	0.92	0.20	50.7
8	T1	64	10.9	0.158	10.4	LOS B	0.6	4.9	0.43	0.98	0.43	49.9
9	R2	50	14.0	0.158	10.9	LOS B	0.6	4.9	0.43	0.98	0.43	49.4
Approach		142	12.7	0.158	10.4	LOS B	0.6	4.9	0.38	0.97	0.38	49.9
West: Great Southern Highway												
10	L2	53	5.7	0.094	5.8	LOS A	0.2	1.3	0.08	0.26	0.08	55.2
11	T1	80	17.5	0.094	0.1	LOS A	0.2	1.3	0.08	0.26	0.08	57.1
12	R2	16	18.8	0.094	6.3	LOS A	0.2	1.3	0.08	0.26	0.08	53.7
Approach		149	13.4	0.094	2.8	NA	0.2	1.3	0.08	0.26	0.08	56.0
All Vehicles		528	14.2	0.158	6.2	NA	0.6	4.9	0.23	0.56	0.23	53.0

2036 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102v [2036 Proposed PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	14	0.0	0.010	8.3	LOS A	0.0	0.3	0.16	0.89	0.16	51.8
2	T1	53	2.0	0.074	9.1	LOS A	0.3	2.1	0.35	0.95	0.35	51.1
3	R2	11	10.0	0.074	10.1	LOS B	0.3	2.1	0.35	0.95	0.35	50.2
Approach		77	2.7	0.074	9.1	LOS A	0.3	2.1	0.32	0.94	0.32	51.1
East: Balladong Street												
4	L2	27	15.4	0.071	6.0	LOS A	0.2	1.5	0.12	0.24	0.12	54.3
5	T1	66	15.9	0.071	0.1	LOS A	0.2	1.5	0.12	0.24	0.12	57.2
6	R2	24	4.3	0.071	6.0	LOS A	0.2	1.5	0.12	0.24	0.12	55.0
Approach		118	13.4	0.071	2.7	NA	0.2	1.5	0.12	0.24	0.12	56.0
North: Avon Terrace												
7	L2	15	14.3	0.012	9.1	LOS A	0.0	0.4	0.16	0.93	0.16	50.7
8	T1	82	11.5	0.170	9.9	LOS A	0.6	5.4	0.38	0.98	0.38	50.2
9	R2	53	14.0	0.170	10.4	LOS B	0.6	5.4	0.38	0.98	0.38	49.8
Approach		149	12.7	0.170	10.0	LOS A	0.6	5.4	0.36	0.97	0.36	50.1
West: Great Southern Highway												
10	L2	56	5.7	0.073	5.7	LOS A	0.1	0.5	0.04	0.29	0.04	55.1
11	T1	61	17.2	0.073	0.0	LOS A	0.1	0.5	0.04	0.29	0.04	57.0
12	R2	7	0.0	0.073	5.8	LOS A	0.1	0.5	0.04	0.29	0.04	55.3
Approach		124	11.0	0.073	2.9	NA	0.1	0.5	0.04	0.29	0.04	56.0
All Vehicles		468	10.8	0.170	6.1	NA	0.6	5.4	0.21	0.60	0.21	53.2

2041 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102v [2041 Do-Nothing PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	25	12.0	0.020	9.1	LOS A	0.1	0.7	0.21	0.91	0.21	50.8
2	T1	42	4.8	0.140	10.4	LOS B	0.5	5.5	0.50	1.00	0.50	49.1
3	R2	28	39.3	0.140	17.6	LOS C	0.5	5.5	0.50	1.00	0.50	46.3
Approach		95	16.8	0.140	12.2	LOS B	0.5	5.5	0.43	0.98	0.43	48.7
East: Balladong Street												
4	L2	38	26.3	0.114	6.2	LOS A	0.3	2.9	0.17	0.25	0.17	53.2
5	T1	93	18.3	0.114	0.2	LOS A	0.3	2.9	0.17	0.25	0.17	56.9
6	R2	41	4.9	0.114	6.1	LOS A	0.3	2.9	0.17	0.25	0.17	54.8
Approach		172	16.9	0.114	3.0	NA	0.3	2.9	0.17	0.25	0.17	55.5
North: Avon Terrace												
7	L2	31	16.1	0.026	9.4	LOS A	0.1	0.9	0.21	0.92	0.21	50.5
8	T1	71	11.3	0.188	10.9	LOS B	0.7	6.0	0.47	1.00	0.47	49.7
9	R2	56	14.3	0.188	11.5	LOS B	0.7	6.0	0.47	1.00	0.47	49.1
Approach		158	13.3	0.188	10.8	LOS B	0.7	6.0	0.42	0.98	0.42	49.6
West: Great Southern Highway												
10	L2	59	5.1	0.105	5.8	LOS A	0.2	1.5	0.09	0.25	0.09	55.2
11	T1	89	18.0	0.105	0.1	LOS A	0.2	1.5	0.09	0.25	0.09	57.1
12	R2	17	17.6	0.105	6.4	LOS A	0.2	1.5	0.09	0.25	0.09	53.8
Approach		165	13.3	0.105	2.8	NA	0.2	1.5	0.09	0.25	0.09	56.1
All Vehicles		590	14.9	0.188	6.5	NA	0.7	6.0	0.25	0.57	0.25	52.8

2041 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102v [2041 Proposed PM]

3. Great Southern Highway, Avon Terrace and Balladong Street
Site Category: (None)
Stop (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Avon Terrace												
1	L2	16	0.0	0.012	8.3	LOS A	0.0	0.3	0.17	0.89	0.17	51.8
2	T1	59	3.6	0.090	9.5	LOS A	0.3	2.7	0.38	0.96	0.38	50.8
3	R2	13	16.7	0.090	11.0	LOS B	0.3	2.7	0.38	0.96	0.38	49.5
Approach		87	4.8	0.090	9.5	LOS A	0.3	2.7	0.34	0.95	0.34	50.8
East: Balladong Street												
4	L2	31	17.2	0.081	6.0	LOS A	0.2	1.9	0.14	0.24	0.14	54.1
5	T1	74	15.7	0.081	0.2	LOS A	0.2	1.9	0.14	0.24	0.14	57.1
6	R2	28	7.4	0.081	6.1	LOS A	0.2	1.9	0.14	0.24	0.14	54.7
Approach		133	14.3	0.081	2.8	NA	0.2	1.9	0.14	0.24	0.14	55.9
North: Avon Terrace												
7	L2	17	18.8	0.014	9.4	LOS A	0.1	0.5	0.17	0.94	0.17	50.3
8	T1	91	11.6	0.197	10.2	LOS B	0.8	6.5	0.41	0.98	0.41	50.1
9	R2	59	14.3	0.197	10.8	LOS B	0.8	6.5	0.41	0.98	0.41	49.6
Approach		166	13.3	0.197	10.3	LOS B	0.8	6.5	0.39	0.98	0.39	49.9
West: Great Southern Highway												
10	L2	62	5.1	0.081	5.7	LOS A	0.1	0.6	0.04	0.29	0.04	55.1
11	T1	67	17.2	0.081	0.0	LOS A	0.1	0.6	0.04	0.29	0.04	57.0
12	R2	8	0.0	0.081	5.8	LOS A	0.1	0.6	0.04	0.29	0.04	55.3
Approach		138	10.7	0.081	2.9	NA	0.1	0.6	0.04	0.29	0.04	56.0
All Vehicles		524	11.4	0.197	6.3	NA	0.8	6.5	0.23	0.61	0.23	53.0

Balladong St/ Panmure Rd

2031 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2031 Do-Nothing AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	88	18.2	0.060	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
2	T1	11	9.1	0.007	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		99	17.2	0.060	5.2	NA	0.0	0.0	0.00	0.51	0.00	52.9
North: Panmure Road												
8	T1	13	23.1	0.008	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	39	15.4	0.034	6.2	LOS A	0.1	1.2	0.23	0.55	0.23	51.5
Approach		52	17.3	0.034	4.7	NA	0.1	1.2	0.17	0.41	0.17	53.4
West: Balladong Street												
10	L2	39	17.9	0.033	5.9	LOS A	0.1	1.1	0.06	0.55	0.06	52.0
12	R2	37	35.1	0.052	7.3	LOS A	0.2	2.4	0.29	0.58	0.29	49.7
Approach		76	26.3	0.052	6.6	LOS A	0.2	2.4	0.17	0.56	0.17	50.8
All Vehicles		227	20.3	0.060	5.5	NA	0.2	2.4	0.10	0.51	0.10	52.3

2031 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2031 Proposed AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	44	19.0	0.029	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
2	T1	20	15.8	0.014	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		64	18.0	0.029	4.0	NA	0.0	0.0	0.00	0.39	0.00	54.3
North: Panmure Road												
8	T1	22	14.3	0.013	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	32	16.7	0.026	6.0	LOS A	0.1	0.9	0.17	0.55	0.17	51.5
Approach		54	15.7	0.026	3.5	NA	0.1	0.9	0.10	0.32	0.10	54.7
West: Balladong Street												
10	L2	34	18.8	0.028	5.9	LOS A	0.1	0.9	0.08	0.55	0.08	51.9
12	R2	14	38.5	0.017	6.9	LOS A	0.1	0.7	0.25	0.55	0.25	49.6
Approach		47	24.4	0.028	6.2	LOS A	0.1	0.9	0.13	0.55	0.13	51.2
All Vehicles		165	19.1	0.029	4.5	NA	0.1	0.9	0.07	0.41	0.07	53.5

2036 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2036 Do-Nothing AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	97	17.5	0.065	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.2
2	T1	12	8.3	0.008	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		109	16.5	0.065	5.2	NA	0.0	0.0	0.00	0.51	0.00	53.0
North: Panmure Road												
8	T1	14	21.4	0.009	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	43	16.3	0.037	6.3	LOS A	0.1	1.3	0.24	0.56	0.24	51.4
Approach		57	17.5	0.037	4.7	NA	0.1	1.3	0.18	0.42	0.18	53.2
West: Balladong Street												
10	L2	43	18.6	0.036	5.9	LOS A	0.1	1.2	0.06	0.55	0.06	51.9
12	R2	41	34.1	0.058	7.4	LOS A	0.2	2.6	0.31	0.58	0.31	49.7
Approach		84	26.2	0.058	6.6	LOS A	0.2	2.6	0.18	0.57	0.18	50.8
All Vehicles		250	20.0	0.065	5.6	NA	0.2	2.6	0.10	0.51	0.10	52.3

2036 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2036 Proposed AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	48	17.4	0.031	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.2
2	T1	23	18.2	0.017	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		72	17.6	0.031	3.9	NA	0.0	0.0	0.00	0.39	0.00	54.5
North: Panmure Road												
8	T1	24	13.0	0.014	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	36	17.6	0.029	6.1	LOS A	0.1	1.0	0.18	0.55	0.18	51.4
Approach		60	15.8	0.029	3.6	NA	0.1	1.0	0.11	0.33	0.11	54.6
West: Balladong Street												
10	L2	37	20.0	0.031	5.9	LOS A	0.1	1.0	0.09	0.54	0.09	51.7
12	R2	16	33.3	0.020	6.9	LOS A	0.1	0.7	0.27	0.56	0.27	50.0
Approach		53	24.0	0.031	6.2	LOS A	0.1	1.0	0.15	0.55	0.15	51.2
All Vehicles		184	18.9	0.031	4.5	NA	0.1	1.0	0.08	0.41	0.08	53.5

2041 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2041 Do-Nothing AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	106	17.0	0.071	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.2
2	T1	14	14.3	0.010	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		120	16.7	0.071	5.1	NA	0.0	0.0	0.00	0.51	0.00	53.0
North: Panmure Road												
8	T1	15	20.0	0.009	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	48	16.7	0.043	6.4	LOS A	0.2	1.6	0.26	0.56	0.26	51.3
Approach		63	17.5	0.043	4.9	NA	0.2	1.6	0.20	0.43	0.20	53.1
West: Balladong Street												
10	L2	49	20.4	0.043	5.9	LOS A	0.2	1.5	0.07	0.55	0.07	51.8
12	R2	45	35.6	0.067	7.7	LOS A	0.3	3.1	0.33	0.59	0.33	49.4
Approach		94	27.7	0.067	6.8	LOS A	0.3	3.1	0.20	0.57	0.20	50.6
All Vehicles		277	20.6	0.071	5.6	NA	0.3	3.1	0.11	0.51	0.11	52.2

2041 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2041 Proposed AM]

4. Balladong Street and Panmure Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Panmure Road												
1	L2	56	18.9	0.036	5.8	LOS A	0.0	0.0	0.00	0.57	0.00	52.1
2	T1	27	23.1	0.022	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach		83	20.3	0.036	3.9	NA	0.0	0.0	0.00	0.38	0.00	54.5
North: Panmure Road												
8	T1	26	12.0	0.015	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
9	R2	40	18.4	0.034	6.2	LOS A	0.1	1.2	0.21	0.55	0.21	51.3
Approach		66	15.9	0.034	3.7	NA	0.1	1.2	0.13	0.33	0.13	54.4
West: Balladong Street												
10	L2	41	20.5	0.035	6.0	LOS A	0.1	1.1	0.11	0.54	0.11	51.7
12	R2	18	35.3	0.023	7.1	LOS A	0.1	0.9	0.29	0.57	0.29	49.8
Approach		59	25.0	0.035	6.3	LOS A	0.1	1.1	0.16	0.55	0.16	51.1
All Vehicles		208	20.2	0.036	4.5	NA	0.1	1.2	0.09	0.41	0.09	53.4

2031 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2031 Do-Nothing PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	3	0.0	0.002	8.4	LOS A	0.0	0.1	0.19	0.60	0.19	76.2
3	R2	2	50.0	0.003	11.0	LOS B	0.0	0.1	0.35	0.62	0.35	55.5
Approach		5	20.0	0.003	9.5	LOS A	0.0	0.1	0.26	0.61	0.26	66.4
East: Great Southern Highway												
4	L2	1	0.0	0.062	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.4
5	T1	94	19.1	0.062	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		95	18.9	0.062	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
West: Great Southern Highway												
11	T1	87	8.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.21	0.58	0.21	76.2
Approach		88	8.0	0.051	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
All Vehicles		188	13.8	0.062	0.3	NA	0.0	0.1	0.01	0.02	0.01	98.3

2031 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2031 Proposed PM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	27	25.9	0.022	8.4	LOS A	0.0	0.0	0.00	0.68	0.00	64.1
23	R2	2	50.0	0.002	9.9	LOS A	0.0	0.1	0.21	0.62	0.21	57.6
Approach		29	27.6	0.022	8.5	NA	0.0	0.1	0.01	0.68	0.01	63.6
NorthEast: Great Southern Highway												
24	L2	1	0.0	0.072	8.3	LOS A	0.3	2.2	0.24	0.63	0.24	71.1
26a	R1	64	12.5	0.072	8.4	LOS A	0.3	2.2	0.24	0.63	0.24	67.8
Approach		65	12.3	0.072	8.4	LOS A	0.3	2.2	0.24	0.63	0.24	67.8
West: Great Southern Highway												
10a	L1	59	0.0	0.031	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	28	25.0	0.022	8.2	LOS A	0.0	0.0	0.00	0.68	0.00	65.1
Approach		87	8.0	0.031	7.8	NA	0.0	0.0	0.00	0.67	0.00	74.6
All Vehicles		181	12.7	0.072	8.1	NA	0.3	2.2	0.09	0.66	0.09	70.1

2036 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2036 Do-Nothing PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	3	0.0	0.002	8.5	LOS A	0.0	0.1	0.20	0.60	0.20	76.1
3	R2	2	50.0	0.003	11.1	LOS B	0.0	0.1	0.37	0.63	0.37	55.4
Approach		5	20.0	0.003	9.5	LOS A	0.0	0.1	0.27	0.61	0.27	66.3
East: Great Southern Highway												
4	L2	1	0.0	0.067	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.4
5	T1	103	18.4	0.067	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		104	18.3	0.067	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
West: Great Southern Highway												
11	T1	95	7.4	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.22	0.58	0.22	76.1
Approach		96	7.3	0.055	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
All Vehicles		205	13.2	0.067	0.3	NA	0.0	0.1	0.01	0.02	0.01	98.4

2036 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2036 Proposed PM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	30	26.7	0.026	8.5	LOS A	0.0	0.0	0.00	0.68	0.00	63.8
23	R2	2	50.0	0.002	9.9	LOS A	0.0	0.1	0.22	0.62	0.22	57.5
Approach		32	28.1	0.026	8.6	NA	0.0	0.1	0.01	0.68	0.01	63.4
NorthEast: Great Southern Highway												
24	L2	1	0.0	0.079	8.3	LOS A	0.3	2.4	0.25	0.63	0.25	71.0
26a	R1	70	11.4	0.079	8.4	LOS A	0.3	2.4	0.25	0.63	0.25	68.0
Approach		71	11.3	0.079	8.4	LOS A	0.3	2.4	0.25	0.63	0.25	68.0
West: Great Southern Highway												
10a	L1	65	0.0	0.034	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	30	23.3	0.023	8.1	LOS A	0.0	0.0	0.00	0.68	0.00	65.5
Approach		95	7.4	0.034	7.8	NA	0.0	0.0	0.00	0.67	0.00	74.8
All Vehicles		198	12.1	0.079	8.1	NA	0.3	2.4	0.09	0.66	0.09	70.3

2041 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2041 Do-Nothing PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	3	0.0	0.002	8.5	LOS A	0.0	0.1	0.22	0.59	0.22	76.1
3	R2	4	50.0	0.006	11.4	LOS B	0.0	0.2	0.39	0.64	0.39	55.2
Approach		7	28.6	0.006	10.2	LOS B	0.0	0.2	0.32	0.62	0.32	62.5
East: Great Southern Highway												
4	L2	2	0.0	0.076	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.3
5	T1	115	19.1	0.076	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.5
Approach		117	18.8	0.076	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.3
West: Great Southern Highway												
11	T1	105	7.6	0.061	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	8.0	LOS A	0.0	0.0	0.23	0.57	0.23	76.0
Approach		106	7.5	0.061	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.7
All Vehicles		230	13.9	0.076	0.4	NA	0.0	0.2	0.01	0.03	0.01	97.7

2041 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2041 Proposed PM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	32	25.0	0.027	8.4	LOS A	0.0	0.0	0.00	0.68	0.00	64.3
23	R2	4	50.0	0.004	10.0	LOS A	0.0	0.2	0.24	0.62	0.24	57.5
Approach		36	27.8	0.027	8.6	NA	0.0	0.2	0.03	0.67	0.03	63.5
NorthEast: Great Southern Highway												
24	L2	2	0.0	0.090	8.3	LOS A	0.4	2.8	0.26	0.63	0.26	70.9
26a	R1	78	11.5	0.090	8.5	LOS A	0.4	2.8	0.26	0.63	0.26	67.9
Approach		80	11.3	0.090	8.5	LOS A	0.4	2.8	0.26	0.63	0.26	68.0
West: Great Southern Highway												
10a	L1	72	0.0	0.038	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	33	24.2	0.025	8.2	LOS A	0.0	0.0	0.00	0.68	0.00	65.3
Approach		105	7.6	0.038	7.8	NA	0.0	0.0	0.00	0.67	0.00	74.8
All Vehicles		221	12.2	0.090	8.2	NA	0.4	2.8	0.10	0.66	0.10	70.2

Proposed Bypass/ Knotts Rd
2031 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102vv [2031 Do-Nothing AM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Knotts Road												
5	T1	5	20.0	0.005	0.0	LOS A	0.0	0.1	0.04	0.25	0.04	99.5
6	R2	3	0.0	0.005	7.7	LOS A	0.0	0.1	0.04	0.25	0.04	77.9
Approach		8	12.5	0.005	2.9	NA	0.0	0.1	0.04	0.25	0.04	90.1
North: Cut Hill Road												
7	L2	1	0.0	0.006	8.2	LOS A	0.0	0.2	0.06	0.65	0.06	71.3
9	R2	6	16.7	0.006	8.3	LOS A	0.0	0.2	0.06	0.65	0.06	66.1
Approach		7	14.3	0.006	8.3	LOS A	0.0	0.2	0.06	0.65	0.06	66.8
West: Talbot Road												
10	L2	5	20.0	0.008	8.8	LOS A	0.0	0.0	0.00	0.25	0.00	54.9
11	T1	9	11.1	0.008	0.0	LOS A	0.0	0.0	0.00	0.25	0.00	101.6
Approach		14	14.3	0.008	3.1	NA	0.0	0.0	0.00	0.25	0.00	78.0
All Vehicles		29	13.8	0.008	4.3	NA	0.0	0.2	0.03	0.35	0.03	77.7

2031 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102vv [2031 Proposed AM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Knotts Road												
1	L2	7	14.3	0.014	5.9	LOS A	0.1	0.4	0.13	0.54	0.13	55.1
3	R2	8	12.5	0.014	6.1	LOS A	0.1	0.4	0.13	0.54	0.13	55.3
Approach		15	13.3	0.014	6.0	LOS A	0.1	0.4	0.13	0.54	0.13	55.2
East: Bypass												
4	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	79.7
5	T1	32	18.8	0.021	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach		33	18.2	0.021	0.2	NA	0.0	0.0	0.00	0.02	0.00	108.7
West: Bypass												
11	T1	20	35.0	0.018	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
12	R2	4	0.0	0.003	7.8	LOS A	0.0	0.1	0.11	0.63	0.11	63.6
Approach		24	29.2	0.018	1.3	NA	0.0	0.1	0.02	0.11	0.02	98.1
All Vehicles		72	20.8	0.021	1.8	NA	0.1	0.4	0.03	0.16	0.03	87.8

2036 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102vv [2036 Do-Nothing AM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Knotts Road												
5	T1	5	20.0	0.005	0.0	LOS A	0.0	0.1	0.04	0.25	0.04	99.5
6	R2	3	0.0	0.005	7.7	LOS A	0.0	0.1	0.04	0.25	0.04	77.9
Approach		8	12.5	0.005	2.9	NA	0.0	0.1	0.04	0.25	0.04	90.1
North: Cut Hill Road												
7	L2	1	0.0	0.007	8.2	LOS A	0.0	0.2	0.06	0.65	0.06	71.3
9	R2	7	14.3	0.007	8.2	LOS A	0.0	0.2	0.06	0.65	0.06	66.8
Approach		8	12.5	0.007	8.2	LOS A	0.0	0.2	0.06	0.65	0.06	67.3
West: Talbot Road												
10	L2	5	20.0	0.008	8.8	LOS A	0.0	0.0	0.00	0.25	0.00	54.9
11	T1	9	11.1	0.008	0.0	LOS A	0.0	0.0	0.00	0.25	0.00	101.6
Approach		14	14.3	0.008	3.1	NA	0.0	0.0	0.00	0.25	0.00	78.0
All Vehicles		30	13.3	0.008	4.4	NA	0.0	0.2	0.03	0.36	0.03	77.5

2036 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102vv [2036 Proposed AM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Knotts Road												
1	L2	8	12.5	0.017	5.9	LOS A	0.1	0.5	0.14	0.55	0.14	55.4
3	R2	10	10.0	0.017	6.1	LOS A	0.1	0.5	0.14	0.55	0.14	55.7
Approach		18	11.1	0.017	6.0	LOS A	0.1	0.5	0.14	0.55	0.14	55.6
East: Bypass												
4	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	79.7
5	T1	35	20.0	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach		36	19.4	0.023	0.2	NA	0.0	0.0	0.00	0.02	0.00	108.8
West: Bypass												
11	T1	21	33.3	0.018	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
12	R2	4	0.0	0.003	7.8	LOS A	0.0	0.1	0.11	0.63	0.11	63.6
Approach		25	28.0	0.018	1.3	NA	0.0	0.1	0.02	0.10	0.02	98.5
All Vehicles		79	20.3	0.023	1.9	NA	0.1	0.5	0.04	0.16	0.04	86.9

2041 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102vv [2041 Do-Nothing AM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Knotts Road												
5	T1	7	28.6	0.006	0.0	LOS A	0.0	0.1	0.04	0.20	0.04	100.6
6	R2	3	0.0	0.006	7.7	LOS A	0.0	0.1	0.04	0.20	0.04	78.6
Approach		10	20.0	0.006	2.3	NA	0.0	0.1	0.04	0.20	0.04	92.8
North: Cut Hill Road												
7	L2	1	0.0	0.008	8.2	LOS A	0.0	0.2	0.07	0.65	0.07	71.3
9	R2	8	25.0	0.008	8.6	LOS A	0.0	0.2	0.07	0.65	0.07	63.9
Approach		9	22.2	0.008	8.6	LOS A	0.0	0.2	0.07	0.65	0.07	64.6
West: Talbot Road												
10	L2	7	28.6	0.012	9.1	LOS A	0.0	0.0	0.00	0.27	0.00	53.3
11	T1	11	18.2	0.012	0.0	LOS A	0.0	0.0	0.00	0.27	0.00	101.1
Approach		18	22.2	0.012	3.5	NA	0.0	0.0	0.00	0.27	0.00	75.0
All Vehicles		37	21.6	0.012	4.4	NA	0.0	0.2	0.03	0.34	0.03	75.9

2041 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102vv [2041 Proposed PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Knotts Road												
1	L2	2	0.0	0.007	5.7	LOS A	0.0	0.2	0.17	0.54	0.17	63.1
3	R2	5	0.0	0.007	6.0	LOS A	0.0	0.2	0.17	0.54	0.17	63.0
Approach		7	0.0	0.007	5.9	LOS A	0.0	0.2	0.17	0.54	0.17	63.0
East: Bypass												
4	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	79.7
5	T1	35	31.4	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach		36	30.6	0.030	0.2	NA	0.0	0.0	0.00	0.02	0.00	108.8
West: Bypass												
11	T1	33	24.2	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
12	R2	2	0.0	0.001	7.8	LOS A	0.0	0.0	0.13	0.62	0.13	63.6
Approach		35	22.9	0.024	0.5	NA	0.0	0.0	0.01	0.04	0.01	105.6
All Vehicles		78	24.4	0.030	0.8	NA	0.0	0.2	0.02	0.07	0.02	100.8

2031 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102vv [2031 Do-Nothing PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Knotts Road												
5	T1	11	45.5	0.009	0.0	LOS A	0.0	0.1	0.01	0.06	0.01	106.3
6	R2	1	0.0	0.009	7.7	LOS A	0.0	0.1	0.01	0.06	0.01	82.1
Approach		12	41.7	0.009	0.6	NA	0.0	0.1	0.01	0.06	0.01	103.8
North: Cut Hill Road												
7	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.04	0.65	0.04	79.8
9	R2	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.04	0.65	0.04	79.3
Approach		2	0.0	0.001	8.0	LOS A	0.0	0.0	0.04	0.65	0.04	79.6
West: Talbot Road												
10	L2	1	0.0	0.005	8.2	LOS A	0.0	0.0	0.00	0.12	0.00	59.6
11	T1	5	20.0	0.005	0.0	LOS A	0.0	0.0	0.00	0.12	0.00	104.8
Approach		6	16.7	0.005	1.4	NA	0.0	0.0	0.00	0.12	0.00	93.1
All Vehicles		20	30.0	0.009	1.6	NA	0.0	0.1	0.01	0.13	0.01	97.4

2031 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102vv [2031 Proposed PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Knotts Road												
1	L2	1	0.0	0.005	5.7	LOS A	0.0	0.1	0.15	0.54	0.15	63.2
3	R2	4	0.0	0.005	5.9	LOS A	0.0	0.1	0.15	0.54	0.15	63.0
Approach		5	0.0	0.005	5.8	LOS A	0.0	0.1	0.15	0.54	0.15	63.1
East: Bypass												
4	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	79.7
5	T1	28	28.6	0.023	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach		29	27.6	0.023	0.3	NA	0.0	0.0	0.00	0.02	0.00	108.6
West: Bypass												
11	T1	28	25.0	0.021	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
12	R2	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.11	0.63	0.11	63.6
Approach		29	24.1	0.021	0.3	NA	0.0	0.0	0.00	0.02	0.00	107.3
All Vehicles		63	23.8	0.023	0.7	NA	0.0	0.1	0.01	0.06	0.01	102.1

2036 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102vv [2036 Do-Nothing PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Knotts Road												
5	T1	13	46.2	0.010	0.0	LOS A	0.0	0.1	0.01	0.05	0.01	106.8
6	R2	1	0.0	0.010	7.7	LOS A	0.0	0.1	0.01	0.05	0.01	82.3
Approach		14	42.9	0.010	0.6	NA	0.0	0.1	0.01	0.05	0.01	104.6
North: Cut Hill Road												
7	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.04	0.65	0.04	79.8
9	R2	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.04	0.65	0.04	79.3
Approach		2	0.0	0.001	8.0	LOS A	0.0	0.0	0.04	0.65	0.04	79.6
West: Talbot Road												
10	L2	1	0.0	0.005	8.2	LOS A	0.0	0.0	0.00	0.12	0.00	59.6
11	T1	5	20.0	0.005	0.0	LOS A	0.0	0.0	0.00	0.12	0.00	104.8
Approach		6	16.7	0.005	1.4	NA	0.0	0.0	0.00	0.12	0.00	93.1
All Vehicles		22	31.8	0.010	1.4	NA	0.0	0.1	0.01	0.12	0.01	98.4

2036 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102vv [2036 Proposed PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Knotts Road												
1	L2	1	0.0	0.005	5.7	LOS A	0.0	0.1	0.16	0.54	0.16	63.1
3	R2	4	0.0	0.005	5.9	LOS A	0.0	0.1	0.16	0.54	0.16	63.0
Approach		5	0.0	0.005	5.9	LOS A	0.0	0.1	0.16	0.54	0.16	63.0
East: Bypass												
4	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	79.7
5	T1	31	29.0	0.026	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach		32	28.1	0.026	0.3	NA	0.0	0.0	0.00	0.02	0.00	108.7
West: Bypass												
11	T1	30	23.3	0.022	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
12	R2	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.12	0.62	0.12	63.6
Approach		31	22.6	0.022	0.3	NA	0.0	0.0	0.00	0.02	0.00	107.5
All Vehicles		68	23.5	0.026	0.7	NA	0.0	0.1	0.01	0.06	0.01	102.7

2041 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102vv [2041 Do-Nothing PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
East: Knotts Road												
5	T1	14	42.9	0.011	0.0	LOS A	0.0	0.1	0.01	0.05	0.01	107.1
6	R2	1	0.0	0.011	7.7	LOS A	0.0	0.1	0.01	0.05	0.01	82.5
Approach		15	40.0	0.011	0.5	NA	0.0	0.1	0.01	0.05	0.01	105.0
North: Cut Hill Road												
7	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.05	0.65	0.05	79.7
9	R2	1	0.0	0.001	7.8	LOS A	0.0	0.0	0.05	0.65	0.05	79.2
Approach		2	0.0	0.001	8.0	LOS A	0.0	0.0	0.05	0.65	0.05	79.5
West: Talbot Road												
10	L2	2	0.0	0.008	8.2	LOS A	0.0	0.0	0.00	0.15	0.00	59.0
11	T1	7	28.6	0.008	0.0	LOS A	0.0	0.0	0.00	0.15	0.00	102.7
Approach		9	22.2	0.008	1.8	NA	0.0	0.0	0.00	0.15	0.00	88.2
All Vehicles		26	30.8	0.011	1.5	NA	0.0	0.1	0.01	0.13	0.01	96.3

2041 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102vv [2041 Proposed PM]

7. Knotts Road and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Knotts Road												
1	L2	2	0.0	0.007	5.7	LOS A	0.0	0.2	0.17	0.54	0.17	63.1
3	R2	5	0.0	0.007	6.0	LOS A	0.0	0.2	0.17	0.54	0.17	63.0
Approach		7	0.0	0.007	5.9	LOS A	0.0	0.2	0.17	0.54	0.17	63.0
East: Bypass												
4	L2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.00	0.67	0.00	79.7
5	T1	35	31.4	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
Approach		36	30.6	0.030	0.2	NA	0.0	0.0	0.00	0.02	0.00	108.8
West: Bypass												
11	T1	33	24.2	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	110.0
12	R2	2	0.0	0.001	7.8	LOS A	0.0	0.0	0.13	0.62	0.13	63.6
Approach		35	22.9	0.024	0.5	NA	0.0	0.0	0.01	0.04	0.01	105.6
All Vehicles		78	24.4	0.030	0.8	NA	0.0	0.2	0.02	0.07	0.02	100.8

Proposed Bypass/ Great Southern Hwy (M010)

2031 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2031 Do-Nothing AM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	8	0.0	0.005	8.4	LOS A	0.0	0.1	0.16	0.61	0.16	76.4
3	R2	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.25	0.60	0.25	76.1
Approach		9	0.0	0.005	8.4	LOS A	0.0	0.1	0.17	0.61	0.17	76.4
East: Great Southern Highway												
4	L2	4	0.0	0.046	7.8	LOS A	0.0	0.0	0.00	0.04	0.00	87.7
5	T1	73	9.6	0.046	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	98.8
Approach		77	9.1	0.046	0.4	NA	0.0	0.0	0.00	0.04	0.00	98.1
West: Great Southern Highway												
11	T1	41	17.1	0.029	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	3	0.0	0.002	7.9	LOS A	0.0	0.1	0.18	0.59	0.18	76.4
Approach		44	15.9	0.029	0.5	NA	0.0	0.1	0.01	0.04	0.01	97.9
All Vehicles		130	10.8	0.046	1.0	NA	0.0	0.1	0.02	0.08	0.02	96.2

2031 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2031 Proposed AM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	39	17.9	0.025	8.0	LOS A	0.0	0.0	0.00	0.67	0.00	66.8
23	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.13	0.62	0.13	79.1
Approach		40	17.5	0.025	8.0	NA	0.0	0.0	0.00	0.67	0.00	67.0
NorthEast: Great Southern Highway												
24	L2	4	0.0	0.049	8.3	LOS A	0.2	1.4	0.18	0.62	0.18	71.3
26a	R1	45	2.2	0.049	7.9	LOS A	0.2	1.4	0.18	0.62	0.18	70.7
Approach		49	2.0	0.049	7.9	LOS A	0.2	1.4	0.18	0.62	0.18	70.7
West: Great Southern Highway												
10a	L1	24	0.0	0.013	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	20	35.0	0.019	8.6	LOS A	0.0	0.0	0.00	0.68	0.00	62.4
Approach		44	15.9	0.019	8.1	NA	0.0	0.0	0.00	0.68	0.00	70.9
All Vehicles		133	11.3	0.049	8.0	NA	0.2	1.4	0.07	0.65	0.07	69.6

2036 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2036 Do-Nothing AM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	8	0.0	0.005	8.4	LOS A	0.0	0.2	0.17	0.61	0.17	76.4
3	R2	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.26	0.59	0.26	76.1
Approach		9	0.0	0.005	8.4	LOS A	0.0	0.2	0.18	0.60	0.18	76.3
East: Great Southern Highway												
4	L2	4	0.0	0.050	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	87.8
5	T1	80	8.8	0.050	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	98.9
Approach		84	8.3	0.050	0.4	NA	0.0	0.0	0.00	0.03	0.00	98.3
West: Great Southern Highway												
11	T1	45	15.6	0.031	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	3	0.0	0.002	7.9	LOS A	0.0	0.1	0.19	0.59	0.19	76.3
Approach		48	14.6	0.031	0.5	NA	0.0	0.1	0.01	0.04	0.01	98.1
All Vehicles		141	9.9	0.050	0.9	NA	0.0	0.2	0.02	0.07	0.02	96.4

2036 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2036 Proposed AM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	43	18.6	0.028	8.0	LOS A	0.0	0.0	0.00	0.67	0.00	66.6
23	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.14	0.62	0.14	79.1
Approach		44	18.2	0.028	8.0	NA	0.0	0.0	0.00	0.67	0.00	66.9
NorthEast: Great Southern Highway												
24	L2	4	0.0	0.054	8.3	LOS A	0.2	1.5	0.19	0.62	0.19	71.2
26a	R1	49	2.0	0.054	7.9	LOS A	0.2	1.5	0.19	0.62	0.19	70.7
Approach		53	1.9	0.054	7.9	LOS A	0.2	1.5	0.19	0.62	0.19	70.7
West: Great Southern Highway												
10a	L1	27	0.0	0.014	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	21	33.3	0.019	8.6	LOS A	0.0	0.0	0.00	0.68	0.00	62.8
Approach		48	14.6	0.019	8.0	NA	0.0	0.0	0.00	0.68	0.00	71.5
All Vehicles		145	11.0	0.054	8.0	NA	0.2	1.5	0.07	0.66	0.07	69.7

2041 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2041 Do-Nothing AM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	9	0.0	0.006	8.4	LOS A	0.0	0.2	0.18	0.60	0.18	76.3
3	R2	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.27	0.59	0.27	76.0
Approach		10	0.0	0.006	8.4	LOS A	0.0	0.2	0.19	0.60	0.19	76.3
East: Great Southern Highway												
4	L2	5	0.0	0.055	7.8	LOS A	0.0	0.0	0.00	0.04	0.00	87.7
5	T1	88	9.1	0.055	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	98.7
Approach		93	8.6	0.055	0.4	NA	0.0	0.0	0.00	0.04	0.00	98.1
West: Great Southern Highway												
11	T1	50	16.0	0.035	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	3	0.0	0.002	7.9	LOS A	0.0	0.1	0.20	0.59	0.20	76.2
Approach		53	15.1	0.035	0.5	NA	0.0	0.1	0.01	0.03	0.01	98.2
All Vehicles		156	10.3	0.055	0.9	NA	0.0	0.2	0.02	0.07	0.02	96.4

2041 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2041 Proposed AM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	47	17.0	0.030	8.0	LOS A	0.0	0.0	0.00	0.67	0.00	67.0
23	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.15	0.61	0.15	79.0
Approach		48	16.7	0.030	8.0	NA	0.0	0.0	0.00	0.67	0.00	67.3
NorthEast: Great Southern Highway												
24	L2	5	0.0	0.060	8.3	LOS A	0.2	1.7	0.20	0.62	0.20	71.2
26a	R1	54	1.9	0.060	8.0	LOS A	0.2	1.7	0.20	0.62	0.20	70.7
Approach		59	1.7	0.060	8.0	LOS A	0.2	1.7	0.20	0.62	0.20	70.7
West: Great Southern Highway												
10a	L1	29	0.0	0.015	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	23	34.8	0.022	8.6	LOS A	0.0	0.0	0.00	0.68	0.00	62.4
Approach		52	15.4	0.022	8.0	NA	0.0	0.0	0.00	0.68	0.00	71.2
All Vehicles		159	10.7	0.060	8.0	NA	0.2	1.7	0.08	0.66	0.08	69.8

2031 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2031 Do-Nothing PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	3	0.0	0.002	8.4	LOS A	0.0	0.1	0.19	0.60	0.19	76.2
3	R2	2	50.0	0.003	11.0	LOS B	0.0	0.1	0.35	0.62	0.35	55.5
Approach		5	20.0	0.003	9.5	LOS A	0.0	0.1	0.26	0.61	0.26	66.4
East: Great Southern Highway												
4	L2	1	0.0	0.062	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.4
5	T1	94	19.1	0.062	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		95	18.9	0.062	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
West: Great Southern Highway												
11	T1	87	8.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.21	0.58	0.21	76.2
Approach		88	8.0	0.051	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
All Vehicles		188	13.8	0.062	0.3	NA	0.0	0.1	0.01	0.02	0.01	98.3

2031 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2031 Proposed PM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	27	25.9	0.022	8.4	LOS A	0.0	0.0	0.00	0.68	0.00	64.1
23	R2	2	50.0	0.002	9.9	LOS A	0.0	0.1	0.21	0.62	0.21	57.6
Approach		29	27.6	0.022	8.5	NA	0.0	0.1	0.01	0.68	0.01	63.6
NorthEast: Great Southern Highway												
24	L2	1	0.0	0.072	8.3	LOS A	0.3	2.2	0.24	0.63	0.24	71.1
26a	R1	64	12.5	0.072	8.4	LOS A	0.3	2.2	0.24	0.63	0.24	67.8
Approach		65	12.3	0.072	8.4	LOS A	0.3	2.2	0.24	0.63	0.24	67.8
West: Great Southern Highway												
10a	L1	59	0.0	0.031	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	28	25.0	0.022	8.2	LOS A	0.0	0.0	0.00	0.68	0.00	65.1
Approach		87	8.0	0.031	7.8	NA	0.0	0.0	0.00	0.67	0.00	74.6
All Vehicles		181	12.7	0.072	8.1	NA	0.3	2.2	0.09	0.66	0.09	70.1

2036 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2036 Do-Nothing PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	3	0.0	0.002	8.5	LOS A	0.0	0.1	0.20	0.60	0.20	76.1
3	R2	2	50.0	0.003	11.1	LOS B	0.0	0.1	0.37	0.63	0.37	55.4
Approach		5	20.0	0.003	9.5	LOS A	0.0	0.1	0.27	0.61	0.27	66.3
East: Great Southern Highway												
4	L2	1	0.0	0.067	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.4
5	T1	103	18.4	0.067	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
Approach		104	18.3	0.067	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
West: Great Southern Highway												
11	T1	95	7.4	0.055	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	7.9	LOS A	0.0	0.0	0.22	0.58	0.22	76.1
Approach		96	7.3	0.055	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.6
All Vehicles		205	13.2	0.067	0.3	NA	0.0	0.1	0.01	0.02	0.01	98.4

2036 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2036 Proposed PM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	30	26.7	0.026	8.5	LOS A	0.0	0.0	0.00	0.68	0.00	63.8
23	R2	2	50.0	0.002	9.9	LOS A	0.0	0.1	0.22	0.62	0.22	57.5
Approach		32	28.1	0.026	8.6	NA	0.0	0.1	0.01	0.68	0.01	63.4
NorthEast: Great Southern Highway												
24	L2	1	0.0	0.079	8.3	LOS A	0.3	2.4	0.25	0.63	0.25	71.0
26a	R1	70	11.4	0.079	8.4	LOS A	0.3	2.4	0.25	0.63	0.25	68.0
Approach		71	11.3	0.079	8.4	LOS A	0.3	2.4	0.25	0.63	0.25	68.0
West: Great Southern Highway												
10a	L1	65	0.0	0.034	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	30	23.3	0.023	8.1	LOS A	0.0	0.0	0.00	0.68	0.00	65.5
Approach		95	7.4	0.034	7.8	NA	0.0	0.0	0.00	0.67	0.00	74.8
All Vehicles		198	12.1	0.079	8.1	NA	0.3	2.4	0.09	0.66	0.09	70.3

2041 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2041 Do-Nothing PM]

1. Great Southern Highway and Cut Hill Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Cut Hill Road												
1	L2	3	0.0	0.002	8.5	LOS A	0.0	0.1	0.22	0.59	0.22	76.1
3	R2	4	50.0	0.006	11.4	LOS B	0.0	0.2	0.39	0.64	0.39	55.2
Approach		7	28.6	0.006	10.2	LOS B	0.0	0.2	0.32	0.62	0.32	62.5
East: Great Southern Highway												
4	L2	2	0.0	0.076	7.8	LOS A	0.0	0.0	0.00	0.01	0.00	88.3
5	T1	115	19.1	0.076	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.5
Approach		117	18.8	0.076	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.3
West: Great Southern Highway												
11	T1	105	7.6	0.061	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
12	R2	1	0.0	0.001	8.0	LOS A	0.0	0.0	0.23	0.57	0.23	76.0
Approach		106	7.5	0.061	0.1	NA	0.0	0.0	0.00	0.01	0.00	99.7
All Vehicles		230	13.9	0.076	0.4	NA	0.0	0.2	0.01	0.03	0.01	97.7

2041 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 102 [2041 Proposed PM]

1. Great Southern Highway and Bypass
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Bypass												
21a	L1	32	25.0	0.027	8.4	LOS A	0.0	0.0	0.00	0.68	0.00	64.3
23	R2	4	50.0	0.004	10.0	LOS A	0.0	0.2	0.24	0.62	0.24	57.5
Approach		36	27.8	0.027	8.6	NA	0.0	0.2	0.03	0.67	0.03	63.5
NorthEast: Great Southern Highway												
24	L2	2	0.0	0.090	8.3	LOS A	0.4	2.8	0.26	0.63	0.26	70.9
26a	R1	78	11.5	0.090	8.5	LOS A	0.4	2.8	0.26	0.63	0.26	67.9
Approach		80	11.3	0.090	8.5	LOS A	0.4	2.8	0.26	0.63	0.26	68.0
West: Great Southern Highway												
10a	L1	72	0.0	0.038	7.6	LOS A	0.0	0.0	0.00	0.67	0.00	80.1
12a	R1	33	24.2	0.025	8.2	LOS A	0.0	0.0	0.00	0.68	0.00	65.3
Approach		105	7.6	0.038	7.8	NA	0.0	0.0	0.00	0.67	0.00	74.8
All Vehicles		221	12.2	0.090	8.2	NA	0.4	2.8	0.10	0.66	0.10	70.2

Proposed Bypass/ Great Southern Hwy (M031)

2031 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2031 Proposed AM]

8. Great Southern Highway and Bypass
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Great Southern Highway												
1	L2	1	0.0	0.024	4.1	LOS A	0.1	0.8	0.18	0.43	0.18	54.3
2	T1	26	3.8	0.024	4.4	LOS A	0.1	0.8	0.18	0.43	0.18	55.4
3	R2	4	0.0	0.024	9.0	LOS A	0.1	0.8	0.18	0.43	0.18	55.6
Approach		31	3.2	0.024	5.0	LOS A	0.1	0.8	0.18	0.43	0.18	55.4
East: Bypass												
4	L2	10	0.0	0.048	4.0	LOS A	0.2	2.2	0.12	0.48	0.12	54.0
5	T1	32	18.8	0.048	4.5	LOS A	0.2	2.2	0.12	0.48	0.12	54.5
6	R2	18	16.7	0.048	9.2	LOS A	0.2	2.2	0.12	0.48	0.12	50.9
Approach		60	15.0	0.048	5.8	LOS A	0.2	2.2	0.12	0.48	0.12	53.3
North: Great Southern Highway												
7	L2	11	36.4	0.031	4.6	LOS A	0.1	1.4	0.15	0.42	0.15	52.7
8	T1	23	26.1	0.031	4.6	LOS A	0.1	1.4	0.15	0.42	0.15	54.9
9	R2	1	0.0	0.031	8.9	LOS A	0.1	1.4	0.15	0.42	0.15	56.1
Approach		35	28.6	0.031	4.7	LOS A	0.1	1.4	0.15	0.42	0.15	54.2
West: Bypass												
10	L2	1	0.0	0.028	4.1	LOS A	0.1	1.5	0.19	0.41	0.19	54.5
11	T1	27	29.6	0.028	4.8	LOS A	0.1	1.5	0.19	0.41	0.19	54.5
12	R2	1	0.0	0.028	8.9	LOS A	0.1	1.5	0.19	0.41	0.19	55.8
Approach		29	27.6	0.028	4.9	LOS A	0.1	1.5	0.19	0.41	0.19	54.6
All Vehicles		155	18.1	0.048	5.2	LOS A	0.2	2.2	0.15	0.44	0.15	54.2

2036 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2036 Proposed AM]

8. Great Southern Highway and Bypass
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Great Southern Highway												
1	L2	2	0.0	0.028	4.1	LOS A	0.1	1.0	0.19	0.44	0.19	54.2
2	T1	29	3.4	0.028	4.4	LOS A	0.1	1.0	0.19	0.44	0.19	55.4
3	R2	5	0.0	0.028	9.0	LOS A	0.1	1.0	0.19	0.44	0.19	55.5
Approach		36	2.8	0.028	5.0	LOS A	0.1	1.0	0.19	0.44	0.19	55.3
East: Bypass												
4	L2	11	0.0	0.054	4.0	LOS A	0.3	2.5	0.13	0.48	0.13	54.0
5	T1	35	20.0	0.054	4.5	LOS A	0.3	2.5	0.13	0.48	0.13	54.4
6	R2	20	20.0	0.054	9.3	LOS A	0.3	2.5	0.13	0.48	0.13	50.1
Approach		66	16.7	0.054	5.9	LOS A	0.3	2.5	0.13	0.48	0.13	53.0
North: Great Southern Highway												
7	L2	12	41.7	0.035	4.7	LOS A	0.2	1.7	0.16	0.42	0.16	52.3
8	T1	26	26.9	0.035	4.6	LOS A	0.2	1.7	0.16	0.42	0.16	54.8
9	R2	1	0.0	0.035	8.9	LOS A	0.2	1.7	0.16	0.42	0.16	56.0
Approach		39	30.8	0.035	4.7	LOS A	0.2	1.7	0.16	0.42	0.16	54.1
West: Bypass												
10	L2	1	0.0	0.030	4.1	LOS A	0.1	1.5	0.20	0.41	0.20	54.5
11	T1	29	27.6	0.030	4.8	LOS A	0.1	1.5	0.20	0.41	0.20	54.6
12	R2	1	0.0	0.030	9.0	LOS A	0.1	1.5	0.20	0.41	0.20	55.8
Approach		31	25.8	0.030	4.9	LOS A	0.1	1.5	0.20	0.41	0.20	54.6
All Vehicles		172	18.6	0.054	5.3	LOS A	0.3	2.5	0.16	0.44	0.16	54.0

2041 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2041 Proposed AM]

8. Great Southern Highway and Bypass
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Great Southern Highway												
1	L2	2	0.0	0.032	4.2	LOS A	0.2	1.2	0.20	0.44	0.20	54.2
2	T1	34	5.9	0.032	4.5	LOS A	0.2	1.2	0.20	0.44	0.20	55.3
3	R2	5	0.0	0.032	9.0	LOS A	0.2	1.2	0.20	0.44	0.20	55.5
Approach		41	4.9	0.032	5.0	LOS A	0.2	1.2	0.20	0.44	0.20	55.2
East: Bypass												
4	L2	12	0.0	0.059	4.0	LOS A	0.3	2.8	0.15	0.48	0.15	54.0
5	T1	37	18.9	0.059	4.5	LOS A	0.3	2.8	0.15	0.48	0.15	54.4
6	R2	22	22.7	0.059	9.4	LOS A	0.3	2.8	0.15	0.48	0.15	49.5
Approach		71	16.9	0.059	5.9	LOS A	0.3	2.8	0.15	0.48	0.15	52.7
North: Great Southern Highway												
7	L2	13	38.5	0.039	4.7	LOS A	0.2	1.9	0.17	0.42	0.17	52.5
8	T1	29	27.6	0.039	4.6	LOS A	0.2	1.9	0.17	0.42	0.17	54.8
9	R2	1	0.0	0.039	8.9	LOS A	0.2	1.9	0.17	0.42	0.17	56.0
Approach		43	30.2	0.039	4.7	LOS A	0.2	1.9	0.17	0.42	0.17	54.1
West: Bypass												
10	L2	1	0.0	0.034	4.2	LOS A	0.2	1.7	0.22	0.42	0.22	54.3
11	T1	32	28.1	0.034	4.9	LOS A	0.2	1.7	0.22	0.42	0.22	54.4
12	R2	2	0.0	0.034	9.0	LOS A	0.2	1.7	0.22	0.42	0.22	55.6
Approach		35	25.7	0.034	5.1	LOS A	0.2	1.7	0.22	0.42	0.22	54.4
All Vehicles		190	18.9	0.059	5.3	LOS A	0.3	2.8	0.18	0.45	0.18	53.9

2031 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2031 Proposed PM]

8. Great Southern Highway and Bypass
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Great Southern Highway												
1	L2	7	14.3	0.034	4.4	LOS A	0.2	1.6	0.19	0.44	0.19	53.5
2	T1	26	11.5	0.034	4.6	LOS A	0.2	1.6	0.19	0.44	0.19	55.1
3	R2	5	20.0	0.034	9.5	LOS A	0.2	1.6	0.19	0.44	0.19	50.4
Approach		38	13.2	0.034	5.2	LOS A	0.2	1.6	0.19	0.44	0.19	54.1
East: Bypass												
4	L2	17	64.7	0.061	5.2	LOS A	0.3	4.0	0.19	0.49	0.19	50.2
5	T1	23	34.8	0.061	4.9	LOS A	0.3	4.0	0.19	0.49	0.19	53.4
6	R2	18	33.3	0.061	9.7	LOS A	0.3	4.0	0.19	0.49	0.19	46.9
Approach		58	43.1	0.061	6.5	LOS A	0.3	4.0	0.19	0.49	0.19	50.3
North: Great Southern Highway												
7	L2	19	42.1	0.048	4.9	LOS A	0.2	2.6	0.17	0.42	0.17	52.4
8	T1	32	12.5	0.048	4.5	LOS A	0.2	2.6	0.17	0.42	0.17	55.5
9	R2	1	0.0	0.048	8.9	LOS A	0.2	2.6	0.17	0.42	0.17	56.0
Approach		52	23.1	0.048	4.7	LOS A	0.2	2.6	0.17	0.42	0.17	54.3
West: Bypass												
10	L2	1	0.0	0.030	4.1	LOS A	0.1	1.4	0.20	0.46	0.20	54.0
11	T1	23	13.0	0.030	4.6	LOS A	0.1	1.4	0.20	0.46	0.20	54.7
12	R2	9	44.4	0.030	9.8	LOS A	0.1	1.4	0.20	0.46	0.20	45.0
Approach		33	21.2	0.030	6.0	LOS A	0.1	1.4	0.20	0.46	0.20	51.7
All Vehicles		181	27.1	0.061	5.6	LOS A	0.3	4.0	0.19	0.45	0.19	52.4

2036 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2036 Proposed PM]

8. Great Southern Highway and Bypass
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Great Southern Highway												
1	L2	7	14.3	0.036	4.4	LOS A	0.2	1.7	0.21	0.45	0.21	53.4
2	T1	28	10.7	0.036	4.6	LOS A	0.2	1.7	0.21	0.45	0.21	55.0
3	R2	6	16.7	0.036	9.5	LOS A	0.2	1.7	0.21	0.45	0.21	51.1
Approach		41	12.2	0.036	5.3	LOS A	0.2	1.7	0.21	0.45	0.21	54.1
East: Bypass												
4	L2	18	66.7	0.068	5.2	LOS A	0.3	4.5	0.20	0.49	0.20	50.0
5	T1	25	36.0	0.068	4.9	LOS A	0.3	4.5	0.20	0.49	0.20	53.3
6	R2	20	35.0	0.068	9.8	LOS A	0.3	4.5	0.20	0.49	0.20	46.5
Approach		63	44.4	0.068	6.5	LOS A	0.3	4.5	0.20	0.49	0.20	50.0
North: Great Southern Highway												
7	L2	21	42.9	0.053	5.0	LOS A	0.3	2.8	0.18	0.43	0.18	52.3
8	T1	34	11.8	0.053	4.5	LOS A	0.3	2.8	0.18	0.43	0.18	55.5
9	R2	1	0.0	0.053	8.9	LOS A	0.3	2.8	0.18	0.43	0.18	56.0
Approach		56	23.2	0.053	4.7	LOS A	0.3	2.8	0.18	0.43	0.18	54.3
West: Bypass												
10	L2	1	0.0	0.032	4.2	LOS A	0.1	1.5	0.21	0.46	0.21	54.0
11	T1	25	12.0	0.032	4.6	LOS A	0.1	1.5	0.21	0.46	0.21	54.8
12	R2	9	44.4	0.032	9.9	LOS A	0.1	1.5	0.21	0.46	0.21	45.0
Approach		35	20.0	0.032	6.0	LOS A	0.1	1.5	0.21	0.46	0.21	51.9
All Vehicles		195	27.2	0.068	5.7	LOS A	0.3	4.5	0.20	0.46	0.20	52.4

2041 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2041 Proposed PM]

8. Great Southern Highway and Bypass
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Great Southern Highway												
1	L2	9	22.2	0.043	4.6	LOS A	0.2	2.1	0.22	0.45	0.22	52.9
2	T1	31	9.7	0.043	4.6	LOS A	0.2	2.1	0.22	0.45	0.22	55.1
3	R2	7	28.6	0.043	9.9	LOS A	0.2	2.1	0.22	0.45	0.22	48.3
Approach		47	14.9	0.043	5.4	LOS A	0.2	2.1	0.22	0.45	0.22	53.5
East: Bypass												
4	L2	20	65.0	0.075	5.2	LOS A	0.4	5.0	0.21	0.49	0.21	50.1
5	T1	29	37.9	0.075	5.0	LOS A	0.4	5.0	0.21	0.49	0.21	53.2
6	R2	21	33.3	0.075	9.8	LOS A	0.4	5.0	0.21	0.49	0.21	46.8
Approach		70	44.3	0.075	6.5	LOS A	0.4	5.0	0.21	0.49	0.21	50.2
North: Great Southern Highway												
7	L2	23	43.5	0.059	5.1	LOS A	0.3	3.2	0.20	0.43	0.20	52.2
8	T1	38	10.5	0.059	4.5	LOS A	0.3	3.2	0.20	0.43	0.20	55.5
9	R2	1	0.0	0.059	9.0	LOS A	0.3	3.2	0.20	0.43	0.20	55.9
Approach		62	22.6	0.059	4.8	LOS A	0.3	3.2	0.20	0.43	0.20	54.2
West: Bypass												
10	L2	1	0.0	0.036	4.2	LOS A	0.2	1.7	0.22	0.46	0.22	53.9
11	T1	27	11.1	0.036	4.7	LOS A	0.2	1.7	0.22	0.46	0.22	54.7
12	R2	11	45.5	0.036	9.9	LOS A	0.2	1.7	0.22	0.46	0.22	44.8
Approach		39	20.5	0.036	6.1	LOS A	0.2	1.7	0.22	0.46	0.22	51.5
All Vehicles		218	27.5	0.075	5.7	LOS A	0.4	5.0	0.21	0.46	0.21	52.3

Proposed Bypass/ Top-Beverley York Rd/ Quairading-York Rd

2031 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2031 Do-Nothing AM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	30	3.3	0.017	8.3	LOS A	0.0	0.0	0.00	0.62	0.00	69.7
3	R2	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.26	0.57	0.26	69.2
Approach		31	3.2	0.017	8.3	LOS A	0.0	0.0	0.01	0.62	0.01	69.7
East: Quairading-York Road												
4	L2	3	100.0	0.007	9.2	LOS A	0.0	0.0	0.00	0.65	0.00	52.1
5	T1	60	23.3	0.041	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		63	27.0	0.041	0.4	NA	0.0	0.0	0.00	0.03	0.00	87.0
West: Quairading-York Road												
11	T1	26	38.5	0.024	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	20	25.0	0.017	8.4	LOS A	0.1	0.6	0.18	0.59	0.18	60.0
Approach		46	32.6	0.024	3.6	NA	0.1	0.6	0.08	0.26	0.08	73.9
All Vehicles		140	23.6	0.041	3.2	NA	0.1	0.6	0.03	0.24	0.03	78.1

2031 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2031 Proposed AM]

5. Bypass and Top Beverley-York Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	12	8.3	0.027	4.3	LOS A	0.1	1.0	0.22	0.43	0.22	54.0
2	T1	21	4.8	0.027	4.5	LOS A	0.1	1.0	0.22	0.43	0.22	55.7
3	R2	1	0.0	0.027	9.1	LOS A	0.1	1.0	0.22	0.43	0.22	55.9
Approach		34	5.9	0.027	4.6	LOS A	0.1	1.0	0.22	0.43	0.22	55.1
East: Bypass												
4	L2	3	100.0	0.058	4.9	LOS A	0.3	2.9	0.14	0.48	0.14	51.1
5	T1	40	20.0	0.058	4.5	LOS A	0.3	2.9	0.14	0.48	0.14	54.2
6	R2	24	29.2	0.058	9.3	LOS A	0.3	2.9	0.14	0.48	0.14	47.9
Approach		67	26.9	0.058	6.2	LOS A	0.3	2.9	0.14	0.48	0.14	51.7
North: Top Beverley-York Road												
7	L2	11	54.5	0.032	4.9	LOS A	0.1	1.7	0.14	0.48	0.14	50.9
8	T1	14	21.4	0.032	4.5	LOS A	0.1	1.7	0.14	0.48	0.14	54.2
9	R2	9	11.1	0.032	9.1	LOS A	0.1	1.7	0.14	0.48	0.14	52.1
Approach		34	29.4	0.032	5.8	LOS A	0.1	1.7	0.14	0.48	0.14	52.6
West: Bypass												
10	L2	8	25.0	0.031	4.5	LOS A	0.1	1.6	0.18	0.49	0.18	52.2
11	T1	15	46.7	0.031	5.1	LOS A	0.1	1.6	0.18	0.49	0.18	52.9
12	R2	9	0.0	0.031	8.9	LOS A	0.1	1.6	0.18	0.49	0.18	54.8
Approach		32	28.1	0.031	6.0	LOS A	0.1	1.6	0.18	0.49	0.18	53.2
All Vehicles		167	23.4	0.058	5.8	LOS A	0.3	2.9	0.16	0.47	0.16	52.8

2036 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2036 Do-Nothing AM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	33	3.0	0.018	8.3	LOS A	0.0	0.0	0.00	0.62	0.00	69.8
3	R2	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.28	0.57	0.28	69.1
Approach		34	2.9	0.018	8.3	LOS A	0.0	0.0	0.01	0.62	0.01	69.8
East: Quairading-York Road												
4	L2	3	100.0	0.007	9.2	LOS A	0.0	0.0	0.00	0.65	0.00	52.1
5	T1	66	24.2	0.045	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		69	27.5	0.045	0.4	NA	0.0	0.0	0.00	0.03	0.00	87.2
West: Quairading-York Road												
11	T1	30	40.0	0.028	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	23	26.1	0.020	8.4	LOS A	0.1	0.7	0.19	0.60	0.19	59.6
Approach		53	34.0	0.028	3.7	NA	0.1	0.7	0.08	0.26	0.08	73.6
All Vehicles		156	24.4	0.045	3.2	NA	0.1	0.7	0.03	0.24	0.03	78.0

2036 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2036 Proposed AM]

5. Bypass and Top Beverley-York Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	13	7.7	0.029	4.4	LOS A	0.1	1.1	0.23	0.43	0.23	54.0
2	T1	23	4.3	0.029	4.5	LOS A	0.1	1.1	0.23	0.43	0.23	55.6
3	R2	1	0.0	0.029	9.1	LOS A	0.1	1.1	0.23	0.43	0.23	55.8
Approach		37	5.4	0.029	4.6	LOS A	0.1	1.1	0.23	0.43	0.23	55.1
East: Bypass												
4	L2	3	100.0	0.064	5.0	LOS A	0.3	3.3	0.15	0.48	0.15	51.1
5	T1	44	20.5	0.064	4.6	LOS A	0.3	3.3	0.15	0.48	0.15	54.2
6	R2	27	29.6	0.064	9.4	LOS A	0.3	3.3	0.15	0.48	0.15	47.8
Approach		74	27.0	0.064	6.3	LOS A	0.3	3.3	0.15	0.48	0.15	51.5
North: Top Beverley-York Road												
7	L2	11	54.5	0.034	4.9	LOS A	0.2	1.8	0.15	0.47	0.15	51.0
8	T1	17	23.5	0.034	4.5	LOS A	0.2	1.8	0.15	0.47	0.15	54.2
9	R2	9	11.1	0.034	9.1	LOS A	0.2	1.8	0.15	0.47	0.15	52.2
Approach		37	29.7	0.034	5.8	LOS A	0.2	1.8	0.15	0.47	0.15	52.7
West: Bypass												
10	L2	10	30.0	0.035	4.7	LOS A	0.2	1.9	0.19	0.49	0.19	51.9
11	T1	16	43.8	0.035	5.1	LOS A	0.2	1.9	0.19	0.49	0.19	53.0
12	R2	10	0.0	0.035	9.0	LOS A	0.2	1.9	0.19	0.49	0.19	54.8
Approach		36	27.8	0.035	6.0	LOS A	0.2	1.9	0.19	0.49	0.19	53.1
All Vehicles		184	23.4	0.064	5.8	LOS A	0.3	3.3	0.18	0.47	0.18	52.8

2041 AM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2041 Do-Nothing AM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	38	5.3	0.022	8.3	LOS A	0.0	0.0	0.00	0.62	0.00	68.9
3	R2	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.29	0.57	0.29	69.0
Approach		39	5.1	0.022	8.3	LOS A	0.0	0.0	0.01	0.62	0.01	68.9
East: Quairading-York Road												
4	L2	3	100.0	0.007	9.2	LOS A	0.0	0.0	0.00	0.65	0.00	52.1
5	T1	73	23.3	0.049	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		76	26.3	0.049	0.4	NA	0.0	0.0	0.00	0.03	0.00	87.5
West: Quairading-York Road												
11	T1	32	37.5	0.029	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	25	24.0	0.021	8.4	LOS A	0.1	0.8	0.20	0.60	0.20	60.2
Approach		57	31.6	0.029	3.7	NA	0.1	0.8	0.09	0.26	0.09	73.9
All Vehicles		172	23.3	0.049	3.3	NA	0.1	0.8	0.03	0.24	0.03	77.9

2041 AM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2041 Proposed AM]

5. Bypass and Top Beverley-York Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	14	7.1	0.033	4.4	LOS A	0.2	1.2	0.24	0.43	0.24	54.0
2	T1	26	3.8	0.033	4.6	LOS A	0.2	1.2	0.24	0.43	0.24	55.6
3	R2	1	0.0	0.033	9.2	LOS A	0.2	1.2	0.24	0.43	0.24	55.7
Approach		41	4.9	0.033	4.6	LOS A	0.2	1.2	0.24	0.43	0.24	55.1
East: Bypass												
4	L2	3	100.0	0.070	5.0	LOS A	0.3	3.6	0.16	0.48	0.16	51.0
5	T1	47	21.3	0.070	4.6	LOS A	0.3	3.6	0.16	0.48	0.16	54.0
6	R2	30	30.0	0.070	9.4	LOS A	0.3	3.6	0.16	0.48	0.16	47.7
Approach		80	27.5	0.070	6.4	LOS A	0.3	3.6	0.16	0.48	0.16	51.3
North: Top Beverley-York Road												
7	L2	12	58.3	0.038	5.0	LOS A	0.2	2.0	0.15	0.48	0.15	50.7
8	T1	19	21.1	0.038	4.5	LOS A	0.2	2.0	0.15	0.48	0.15	54.2
9	R2	10	10.0	0.038	9.1	LOS A	0.2	2.0	0.15	0.48	0.15	52.4
Approach		41	29.3	0.038	5.8	LOS A	0.2	2.0	0.15	0.48	0.15	52.7
West: Bypass												
10	L2	11	36.4	0.039	4.8	LOS A	0.2	2.1	0.21	0.49	0.21	51.5
11	T1	18	44.4	0.039	5.1	LOS A	0.2	2.1	0.21	0.49	0.21	52.9
12	R2	11	0.0	0.039	9.0	LOS A	0.2	2.1	0.21	0.49	0.21	54.7
Approach		40	30.0	0.039	6.1	LOS A	0.2	2.1	0.21	0.49	0.21	53.0
All Vehicles		202	23.8	0.070	5.9	LOS A	0.3	3.6	0.19	0.47	0.19	52.7

2031 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2031 Do-Nothing PM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	15	0.0	0.008	8.2	LOS A	0.0	0.0	0.00	0.62	0.00	71.0
3	R2	1	0.0	0.001	8.3	LOS A	0.0	0.0	0.29	0.57	0.29	69.0
Approach		16	0.0	0.008	8.2	LOS A	0.0	0.0	0.02	0.62	0.02	70.9
East: Quairading-York Road												
4	L2	2	50.0	0.002	8.6	LOS A	0.0	0.0	0.00	0.65	0.00	53.3
5	T1	52	21.2	0.038	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		54	22.2	0.038	0.3	NA	0.0	0.0	0.00	0.02	0.00	87.7
West: Quairading-York Road												
11	T1	46	26.1	0.039	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	28	21.4	0.027	8.5	LOS A	0.1	1.2	0.18	0.60	0.18	60.5
Approach		74	24.3	0.039	3.2	NA	0.1	1.2	0.07	0.23	0.07	76.0
All Vehicles		144	20.8	0.039	2.7	NA	0.1	1.2	0.04	0.19	0.04	79.3

2031 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2031 Proposed PM]

5. Bypass and Top Beverley-York Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	5	0.0	0.013	4.3	LOS A	0.1	0.5	0.23	0.43	0.23	54.4
2	T1	11	0.0	0.013	4.5	LOS A	0.1	0.5	0.23	0.43	0.23	55.7
3	R2	1	0.0	0.013	9.1	LOS A	0.1	0.5	0.23	0.43	0.23	55.7
Approach		17	0.0	0.013	4.7	LOS A	0.1	0.5	0.23	0.43	0.23	55.3
East: Bypass												
4	L2	2	50.0	0.057	5.0	LOS A	0.3	3.2	0.22	0.48	0.22	50.8
5	T1	39	33.3	0.057	5.1	LOS A	0.3	3.2	0.22	0.48	0.22	53.3
6	R2	17	5.9	0.057	9.1	LOS A	0.3	3.2	0.22	0.48	0.22	53.1
Approach		58	25.9	0.057	6.2	LOS A	0.3	3.2	0.22	0.48	0.22	53.1
North: Top Beverley-York Road												
7	L2	20	40.0	0.063	4.9	LOS A	0.3	4.3	0.21	0.46	0.21	52.2
8	T1	22	27.3	0.063	4.8	LOS A	0.3	4.3	0.21	0.46	0.21	54.6
9	R2	14	85.7	0.063	10.7	LOS B	0.3	4.3	0.21	0.46	0.21	38.5
Approach		56	46.4	0.063	6.3	LOS A	0.3	4.3	0.21	0.46	0.21	48.7
West: Bypass												
10	L2	5	20.0	0.042	4.4	LOS A	0.2	2.4	0.14	0.47	0.14	52.7
11	T1	27	33.3	0.042	4.8	LOS A	0.2	2.4	0.14	0.47	0.14	53.7
12	R2	12	8.3	0.042	9.0	LOS A	0.2	2.4	0.14	0.47	0.14	52.8
Approach		44	25.0	0.042	5.9	LOS A	0.2	2.4	0.14	0.47	0.14	53.4
All Vehicles		175	29.7	0.063	6.0	LOS A	0.3	4.3	0.20	0.47	0.20	51.9

2036 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2036 Do-Nothing PM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	17	0.0	0.009	8.2	LOS A	0.0	0.0	0.00	0.62	0.00	71.0
3	R2	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.31	0.57	0.31	68.9
Approach		18	0.0	0.009	8.2	LOS A	0.0	0.0	0.02	0.62	0.02	70.9
East: Quairading-York Road												
4	L2	2	50.0	0.002	8.6	LOS A	0.0	0.0	0.00	0.65	0.00	53.3
5	T1	58	22.4	0.044	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		60	23.3	0.044	0.3	NA	0.0	0.0	0.00	0.02	0.00	88.0
West: Quairading-York Road												
11	T1	51	25.5	0.043	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	31	22.6	0.031	8.6	LOS A	0.1	1.5	0.20	0.60	0.20	60.0
Approach		82	24.4	0.043	3.3	NA	0.1	1.5	0.07	0.23	0.07	75.7
All Vehicles		160	21.3	0.044	2.7	NA	0.1	1.5	0.04	0.19	0.04	79.2

2036 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2036 Proposed PM]

5. Bypass and Top Beverley-York Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	5	0.0	0.014	4.3	LOS A	0.1	0.5	0.24	0.43	0.24	54.3
2	T1	12	0.0	0.014	4.5	LOS A	0.1	0.5	0.24	0.43	0.24	55.7
3	R2	1	0.0	0.014	9.1	LOS A	0.1	0.5	0.24	0.43	0.24	55.6
Approach		18	0.0	0.014	4.7	LOS A	0.1	0.5	0.24	0.43	0.24	55.3
East: Bypass												
4	L2	2	50.0	0.063	5.1	LOS A	0.3	3.5	0.24	0.49	0.24	50.7
5	T1	42	33.3	0.063	5.1	LOS A	0.3	3.5	0.24	0.49	0.24	53.2
6	R2	19	5.3	0.063	9.1	LOS A	0.3	3.5	0.24	0.49	0.24	53.1
Approach		63	25.4	0.063	6.3	LOS A	0.3	3.5	0.24	0.49	0.24	53.1
North: Top Beverley-York Road												
7	L2	22	40.9	0.071	5.0	LOS A	0.3	5.0	0.22	0.47	0.22	52.1
8	T1	25	28.0	0.071	4.9	LOS A	0.3	5.0	0.22	0.47	0.22	54.5
9	R2	16	81.3	0.071	10.7	LOS B	0.3	5.0	0.22	0.47	0.22	39.1
Approach		63	46.0	0.071	6.4	LOS A	0.3	5.0	0.22	0.47	0.22	48.8
West: Bypass												
10	L2	6	16.7	0.046	4.3	LOS A	0.2	2.7	0.15	0.47	0.15	52.9
11	T1	29	34.5	0.046	4.8	LOS A	0.2	2.7	0.15	0.47	0.15	53.6
12	R2	13	7.7	0.046	9.0	LOS A	0.2	2.7	0.15	0.47	0.15	53.0
Approach		48	25.0	0.046	5.9	LOS A	0.2	2.7	0.15	0.47	0.15	53.4
All Vehicles		192	29.7	0.071	6.1	LOS A	0.3	5.0	0.21	0.47	0.21	51.9

2041 PM Peak – Do-nothing

MOVEMENT SUMMARY

Site: 102 [2041 Do-Nothing PM]

5. Quairading-York Road and Top Beverley-York Road
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	19	0.0	0.010	8.2	LOS A	0.0	0.0	0.00	0.62	0.00	71.0
3	R2	2	0.0	0.002	8.6	LOS A	0.0	0.1	0.32	0.58	0.32	68.8
Approach		21	0.0	0.010	8.2	LOS A	0.0	0.1	0.03	0.62	0.03	70.8
East: Quairading-York Road												
4	L2	4	50.0	0.003	8.6	LOS A	0.0	0.0	0.00	0.65	0.00	53.3
5	T1	63	22.2	0.048	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
Approach		67	23.9	0.048	0.5	NA	0.0	0.0	0.00	0.04	0.00	86.4
West: Quairading-York Road												
11	T1	56	25.0	0.047	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	90.0
12	R2	34	23.5	0.034	8.7	LOS A	0.1	1.6	0.21	0.60	0.21	59.7
Approach		90	24.4	0.047	3.3	NA	0.1	1.6	0.08	0.23	0.08	75.5
All Vehicles		178	21.3	0.048	2.8	NA	0.1	1.6	0.04	0.20	0.04	78.6

2041 PM Peak – Proposed Bypass

MOVEMENT SUMMARY

Site: 101 [2041 Proposed PM]

5. Bypass and Top Beverley-York Road
Site Category: (None)
Roundabout

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Top Beverley-York Road												
1	L2	6	0.0	0.017	4.3	LOS A	0.1	0.6	0.26	0.45	0.26	54.2
2	T1	13	0.0	0.017	4.6	LOS A	0.1	0.6	0.26	0.45	0.26	55.5
3	R2	2	0.0	0.017	9.2	LOS A	0.1	0.6	0.26	0.45	0.26	55.5
Approach		21	0.0	0.017	4.9	LOS A	0.1	0.6	0.26	0.45	0.26	55.1
East: Bypass												
4	L2	4	50.0	0.073	5.1	LOS A	0.4	4.1	0.25	0.49	0.25	50.6
5	T1	46	34.8	0.073	5.2	LOS A	0.4	4.1	0.25	0.49	0.25	53.1
6	R2	22	9.1	0.073	9.3	LOS A	0.4	4.1	0.25	0.49	0.25	52.1
Approach		72	27.8	0.073	6.4	LOS A	0.4	4.1	0.25	0.49	0.25	52.6
North: Top Beverley-York Road												
7	L2	24	41.7	0.078	5.1	LOS A	0.4	5.5	0.24	0.47	0.24	52.0
8	T1	27	29.6	0.078	5.0	LOS A	0.4	5.5	0.24	0.47	0.24	54.3
9	R2	17	82.4	0.078	10.8	LOS B	0.4	5.5	0.24	0.47	0.24	38.9
Approach		68	47.1	0.078	6.5	LOS A	0.4	5.5	0.24	0.47	0.24	48.7
West: Bypass												
10	L2	7	28.6	0.054	4.6	LOS A	0.3	3.2	0.16	0.47	0.16	52.2
11	T1	32	34.4	0.054	4.9	LOS A	0.3	3.2	0.16	0.47	0.16	53.6
12	R2	15	13.3	0.054	9.1	LOS A	0.3	3.2	0.16	0.47	0.16	51.5
Approach		54	27.8	0.054	6.0	LOS A	0.3	3.2	0.16	0.47	0.16	52.8
All Vehicles		215	31.2	0.078	6.2	LOS A	0.4	5.5	0.22	0.48	0.22	51.6

Appendix G – Road Design

Appendix H – Bridge Structure

Appendix I – Construction Estimates

Appendix J – Land Requirement Plan

Appendix L– Alignment Selection Report, MCA

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Appendix M– Alignment Selection Report

York_HV_Bypass_Alignment_Study-Plan D18#885764