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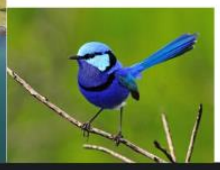

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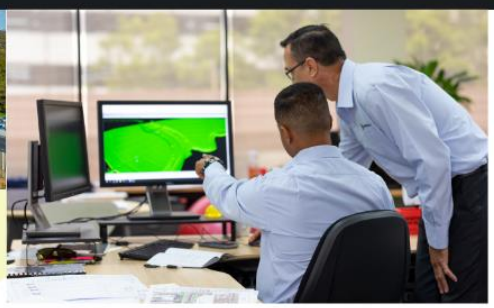

Tweed Sand Plant, Altona Road, Cudgen

Traffic Impact Assessment

Client: Hanson Construction Materials Pty Ltd
Project No: BE190043
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October 2021

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Prepared by:	Aga Szewczak / Dale Kleimeyer
Position:	Senior Traffic Engineer
Signed:	
Date:	27 October 2021

Approved by:	Dale Kleimeyer
Position:	Principal Traffic Engineer RPEQ 6876
Signed:	
Date:	27 October 2021

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Coote Burchills Engineering Pty Ltd ACN: 166 942 365

Level 2, 26 Marine Parade SOUTHPORT QLD 4215
PO Box 3766, Australia Fair SOUTHPORT QLD 4215
Telephone: +61 7 5509 6400
Level 14, 167 Eagle Street BRISBANE QLD 4000
PO Box 83, BRISBANE QLD 4000
Telephone: +61 7 3606 0201
Email: admin@burchills.com.au

Executive Summary

Burchills Engineering Solutions has been commissioned by Hanson Construction Materials Pty Ltd (Hanson) to prepare a Traffic Impact Assessment (TIA) report to support a Development Application (DA) for the expansion of the existing Tweed Sand Plant (TSP) located at Altona Road, Cudgen. The development is located within Tweed Shire Council Local Authority. The current approved sand extraction sites include Lot Plans: 22 on DP1082435, 23 on DP1077509 and 494 on DP720450. The proposed expansion site includes the current site plus Lot Plans; 1 on DP1250570, 2 on DP1192506, 3 on DP1243752, 50 on DP1056966 and 51 on DP1166990.

The total area for the future Tweed Sand Plant site would be approximately 236ha and result in an increase in the sand production rate from the current limit of 500,000 tonnes per annum (tpa) to 950,000 tpa. The applicant proposes to gain access from Tweed Valley Way via a new roundabout, contrary to the current arrangements utilising the local street network involving Altona Road, Crescent Street and Tweed Coast Road.

Tweed Coast Road is a local council-controlled road that provides access to Cudgen, Kingscliff, Casuarina and Cabarita Beach from the M1 Pacific Motorway. The above areas are forecasted to have substantial population growth due to the land development on both sides of the road. Removing heavy vehicles from Tweed Coast Road has significant road safety benefits. The need for private access to the interchange and the relative merits of supporting a direct versus the comparative outcome of previously approved access arrangement via Tweed Coast Road is relevant to the Consent Authority's consideration of Clause 101 of the SEPP Infrastructure.

To quantify the potential benefits of removing heavy vehicle demand from Tweed Coast Road (TCR), a comparative economic analysis of impacts introduced to the Tweed Valley Way interchange in terms of delay and/or safety has been prepared. The Economic Evaluation assessment as contained in Appendix F demonstrated that the proposed Tweed Sand Plant haulage route via Tweed Valley Way including upgrade of the Tweed Valley Way / ABLP intersection does provide economic benefits to the local community which outweighs its cost to residents, Local and State Governments. The Cost-benefit analysis prepared determined that the project will generate a Present Value (PV) total of $2.59M in benefits at a Present Value cost of $1.05M above the Base Case, providing a NPV of $1.54M and a Benefit-Cost Ratio (BCR) of 2.46. The majority of benefits relate to travel time savings along Tweed Coast Road via a reduction in travel time, maintenance costs reduction, environmental and safety benefits. The analysis includes maintenance costs associated with the proposed new Tweed Valley Way roundabout over the life of the project but excludes the capital costs covered by Hanson.

Pacific Motorway (M1) is a declared Freeway and Transport for New South Wales (TfNSW) is the Roads Authority for Freeways in accordance with Section 7 of the Roads Act 1993. Tweed Valley Way (679) is a classified (Regional) Road and a declared Controlled Access Road (CAR) in the subject area. Tweed Shire Council is the Roads Authority for all public roads in the local government area, including Tweed Valley Way. However, TfNSW can exercise Roads Authority powers in relation to classified roads and provides consent to any new connection with a Freeway or CAR in accordance with the Roads Act. Developer works are subject to the terms of a Works Authorisation Deed (WAD).

Several options for connection to Tweed Valley Way were investigated with the TfNSW with the proposed roundabout being a preferred option. The design vehicle for the TSP is 26m B-Double truck. The preferred site access strategy is contained in Appendix A.

Available traffic surveys were used for traffic analysis adopting the Tweed Shire Council Transport traffic volume forecasts in the analysis. Traffic growth at the rate of 0.6% per annum was calculated from traffic surveys and forecast traffic volumes extracted from the TSC *Tweed Road Development Strategy* and adopted for the capacity analysis of the intersection at the ABLP property. The growth rate is consistent with the medium growth scenario adopted for Tweed Shire Transport Planning.

2020 traffic surveys were completed in early March 2020 (pre COVID -19) and represent the normal situation. The speed surveys identified that the advisory speed of 75km/hr is exceeded by speeds of 87km/hr recorded as the 85th percentile speed. A review of the 2019 AADT volumes along the M1 Pacific Motorway identified that there are seasonal variations in traffic with the highest volumes recorded in January. Based on the above, traffic survey data from March 2020 has been increased to account for the seasonal variations in traffic volumes. The above represents the worst-case scenario under 100th Highest Hour Volumes as adopted for all SIDRA capacity calculations.

Safety and efficiency on the surrounding road network identified that no accidents have been recorded between 2013 and 2019 at the existing ABLP intersection with Tweed Valley Way.

TSP destinations involve 95% delivery trips travelling north and 5% south. Sensitivity testing was undertaken for the 50% north and 50% south distribution.

The SIDRA software capacity analysis identified that the proposed roundabout would operate well within its theoretical capacity in the 2042 assessment year with the proposed development traffic superimposed with minimal delays and satisfactory Degree of Saturation.

The proposed site access arrangements are adequate to service the site. Auxiliary lanes at the roundabout approaches provide additional safety measures by allowing segregation of the heavy vehicles at the approaches.

The Tweed Valley Way / Caltex Service Station roundabout is designed to cater for 26m B-Double heavy vehicles. However, swept path analysis of the U-turn movement at this roundabout identified that modifications to the roundabout island are required. To ensure road safety, it is proposed to provide additional signage with advisory safe turning speed for trucks manoeuvring the roundabout as part of an upgrade that marginally widens the pavement to the circulating lane on the southeast side. Note that the drawing is based on aerial photography and the final extent of widening is subject to swept paths based on the detail survey of the existing roundabout.

Hanson will retain ownership of the site following completion of sand extraction and any proposed subsequent use of the site will be decided via the appropriate consultative, application and regulation processes in place at that time.

Assessment of the impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling, recommended access from the existing Tweed Coast Road as part of the Tweed Shire Council bus services and active transport infrastructure.

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1. Introduction

1.1 Background

Burchills Engineering Solutions has been commissioned by Hanson Construction Materials Pty Ltd (Hanson) to prepare a Traffic Impact Assessment (TIA) report to support a Development Application (DA) for the expansion of the existing Tweed Sand Plant located at Altona Road, Cudgen. The development is located within Tweed Shire Council Local Authority.

The current approved sand extraction sites include Lot Plans: 22DP1082435, 23DP1077509 and 494DP720450. The proposed expansion site includes the current site plus Lot Plans; 1 on DP1250570, 2 on DP1192506, 3 on DP1243752, 50 on DP1056966 and 51 on DP1166990. The total area for the future Tweed Sand Plant (TSP) site would be approximately 236ha and results in an increase in the sand production rate from the current approved limit of 500,000 tonnes per annum (tpa) to 950,000 tpa. The applicant proposes to gain access from Tweed Valley Way to the west of the site at the Pacific Motorway Interchange, for the total annual sand production rate, contrary to the current arrangements utilising the local street network involving Altona Road, Crescent Street and Tweed Coast Road.

Pacific Motorway (M1) is a declared Freeway and TfNSW is the Roads Authority for freeways in accordance with Section 7 of the Roads Act 1993. Tweed Valley Way (679) is a classified (Regional) Road and a declared Controlled Access Road (CAR) in the subject area. Tweed Shire Council is the Roads Authority for all public roads in the local government area, including the Tweed Valley Way. However, TfNSW can exercise Roads Authority powers in relation to classified roads and provides consent to any new connection with a Freeway or CAR in accordance with the Roads Act. Developer works are subject to the terms of a Works Authorisation Deed (WAD).

Email correspondence of 22 August 2019 forwarded to Transport for New South Wales (TfNSW) requested comments in relation to the proposed expansion of the abovementioned development and the outcomes of a subsequent pre-lodgment meeting held between the applicant and TfNSW on 23 September 2019 included the following:

- TfNSW requested a Traffic Impact Assessment (TIA) be prepared by suitably qualified person/s in accordance with the Austroads *Guide to Traffic Management* Part 12, the complementary Roads and Maritime Supplement and RTA *Guide to Traffic Generating Developments*.

The primary objective of the Traffic Impact Assessment report (TIA) is to consider the safety, efficiency and ongoing operation of the classified road and demonstrate compliance with all relevant standards, guidelines and codes. It concludes that the proposed site access arrangements are adequate to service the site.

1.2 Scope

This Traffic Impact Assessment report has been prepared to the following scope:

Section 2 Describes the site location and the existing road network in the vicinity of the site.

Section 3 Describes the existing and forecast traffic data in the vicinity of the site.

Section 4 Outlines Committed Developments in the vicinity of the site.

Section 5 Outlines the relevant characteristics of the proposed development including site access strategy, including a description of the types of vehicles likely to be used for transportation of sand products by the proposed development, and an explanation of assumptions and justification of adopted parameters informing the TIA. Assessment of existing road safety and consideration for any increased risk arising from trips generated by the proposed development, particularly at affected intersection including available sight distances.

Economic appraisal of the proposed haulage route via Tweed Valley Way (Project Case) including the construction of a new roundabout, evaluated over a 30-year evaluation period against Base Case which includes haulage route via Tweed Coast Road. Project Case includes removal of all Hanson Trucks from Tweed Coast Road.

Assessment and Impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling.

Section 6 Estimates the increase in traffic generated by the proposed development including; existing traffic volumes and background traffic growth expected on the surrounding road network and along proposed haulage route/s using actual traffic counts, daily and peak hourly volume distribution of traffic generated by the proposed development, identification of existing and proposed turn treatments warrants at affected intersections.

Section 7 Assess the operation of key intersections in the vicinity of the site by demonstrating the total impact of existing and proposed development on the road network with consideration for 10 year horizons over the life of the proposed operation by modeling of intersection capacity using SIDRA analysis to identify Level of Service (LOS) at affected intersections along the proposed haulage route/s.

Section 8 Assess any proposed mitigation requirements on safety and efficiency on the surrounding road network, swept path analysis; demonstrate accessibility for relevant design vehicles. Functional layout plans of the proposed intersection improvements and internal haulage roads.

Section 9 Tweed Shire Council Draft Comments

Following submission of a draft Traffic Impact Report to Tweed Shire Council, the relevant engineering minutes with respect to Traffic Impact assessment are extracted from Minutes of Assessment Panel held 2 December 2020 with response:

Section 10 Public Access Strategy End Use Development

Hanson will retain ownership of the site following completion of sand extraction and any proposed subsequent use of the site will be decided via the appropriate consultative, application and regulation processes in place at that time.

2. Existing Conditions

Section 2 of this report details the baseline conditions in the vicinity of the site, including the existing development site, the local road infrastructure and existing traffic volumes.

2.1 Existing Tweed Sand Plant

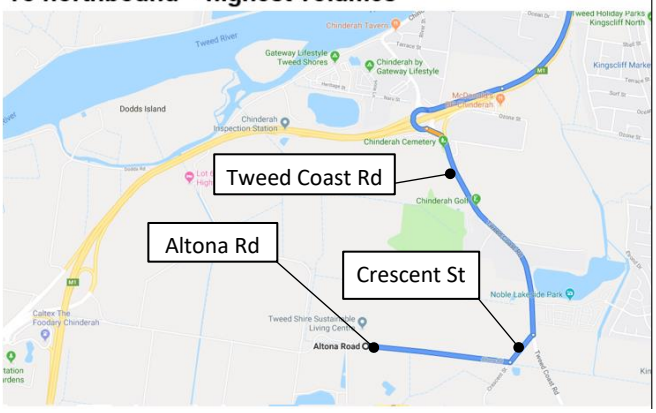
The current Tweed Sand Plant site shown in Figure 2.1 consists of three lots (Lot 22 on DP1082435, Lot 23 on DP1077509, Lot 494 on DP720450) on Altona Road, Cudgen.

Figure 2.1 Current Approval Sites

The current approval relates to Phases 3 and 4 only, across Lot Plans 22DP1082435, 23DP1077509 and 494DP720450) with approval to produce and transport a maximum of 500,000 tonnes of sand products from the site in any financial year.

Access to and egress from the existing site is obtained via Altona Road, Crescent Street, and Tweed Coast Road as shown in Figure 2.2 below.

To northbound – highest volumes



From northbound – highest volumes

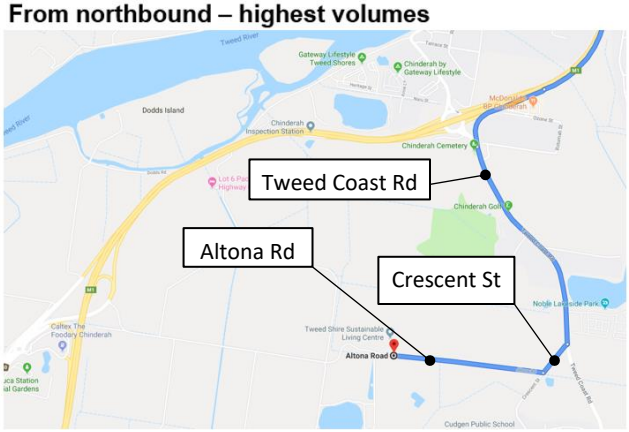


Figure 2.2 Existing Tweed Sand Plant Truck Routes

2.1.1 Existing Tweed Sand Plant Traffic Generation (2017-2018)

Sand Production (up to 150,000m³) Prior to modification (The Development Consent DA152-6-2005)

The annual and daily heavy vehicle movements for the existing site were extracted from the following reports:

- *"Traffic Impact Assessment for Tweed Sand Plant Lot 22 (DP1082435), Lot 23 (DP1077509) and Lot 494 (DP7240450) Crescent Street Cudgen"* report prepared by Bitzios; and
- *"Annual Environmental Management Report Tweed Sand Plant Cudgen, NSW July 2017 to June 2018"* report prepared by +Gilbert Southerland.

Between July 2017 and June 2018, the total annual extraction of sand was approximately 214,000 tonnes. Heavy vehicle movements recorded for the same period are summarised in Table 2.1 below.

Table 2.1 2017-2018 Recorded Heavy Vehicle Movement Volumes

Extraction	2-way Vehicle Movement volumes	Period
214,000 tonnes	126	Maximum daily recorded
	20	Max peak volumes recorded (typically occurring between 12:00-14:00)
	13,958	Annual recorded vehicle movements

Further to the above, Schedule 2, Condition 9 of the TSP Development Consent restricted heavy vehicle movements as follows:

- 200 per day (max 2-way);
- 80 per day (rolling quarterly average 2-way); and
- 20 per hour (max peak 2-way).

It is worth noting that the peak period for heavy vehicle movements occurs typically between 12:00 and 14:00, which is outside of typical road network AM Peak hour (08:00-09:00) and PM Peak hour (15:30-16:30).

Truck volumes at Tweed Sand Plant road network during peak hours were recorded in a traffic survey on 15th December 2016. Survey data extracted from Bitzios Traffic Impact Assessment report is summarised in Table 2.2 below.

Table 2.2 Surveyed AM and PM Peak Tweed Sand Plant Traffic Volumes (214,000 tonnes June 2018)

Extraction	AM Peak (08:00-09:00)			PM Peak (15:00-16:00)		
	In	Out	Two-way	In	Out	Two-way
214,000 tonnes	2	7	9	5	4	9
In/Out % Split	22%	87%	100%	56%	44%	100%

As shown in Figure 2.2 above, during a typical morning and evening peak hours, TSP generated significantly lower truck volumes (9) than the maximum two-way volumes (20) conditioned via Schedule 2, Condition 9 of the TSP Development Consent.

Approved Sand Extraction up to a maximum 500,000 tonnes per annum

In 2018, a Notice of Modification to the Development Consent (DA152-6-2005) for the Tweed Sand Plant was granted by the Minister for Planning. The modification to the approval increased the sand extraction limit to 500,000 tonnes per annum. In addition, the following has been conditioned:

- *The Applicant must not dispatch more than 10 laden trucks from the site in any hour until the agreement required by condition 23 of Schedule 3 for the upgrade and maintenance of Altona Road has been entered into and the upgrade of Altona Road under that agreement has been completed.*

  Following the upgrade of Altona Road, the Applicant must not dispatch more than 18 laden trucks from the site in any hour (Schedule 2, Condition 9).

Based on the above development condition, the Tweed Sand Plant is limited to generate the following heavy vehicles movements based on the sand extraction limit of 500,000 tonnes per annum:

Table 2.3 AM and PM Peak Tweed Sand Plant Traffic Volumes 500,000 tonnes extraction limit)

Extraction	AM Peak (08:00-09:00)			PM Peak (15:00-16:00)		
	In	Out	Two-way	In	Out	Two-way
500,000 tonnes	18	18	36	18	18	36

The above Table 2.3 represents worst-case scenario as the maximum 36 two-way volumes are unlikely to occur during AM and PM road network peak hours as discussed previously due to the misalignment between the TSP peak hour delivery times and the typical road network peak hour times.

2.1.2 Current Operating Hours

Current operating hours of the TSP are shown in Figure 2.3 below.

Activity	*Permissible Hours*
Quarrying operations (excluding loading and dispatch of trucks)	• 7 am to 5 pm Monday to Friday • 7 am to 4 pm Saturday • At no time on Sundays or public holidays
Loading and dispatch of trucks	• 7 am to 5 pm Monday to Friday • 7 am to 12 pm Saturday • At no time on Sundays or public holidays
Maintenance	• May be conducted at any time, provided that these activities are not audible at any privately-owned residence

Figure 2.3 TSP Operating Hours

Currently the Plant operates within normal business hours.

2.2 Surrounding Road Network

The surrounding road network in the vicinity of the proposed redevelopment site includes the Pacific Motorway M1, Tweed Valley Way, Altona Road, Crescent Street and Tweed Coast Road (Refer Figure 2.4).

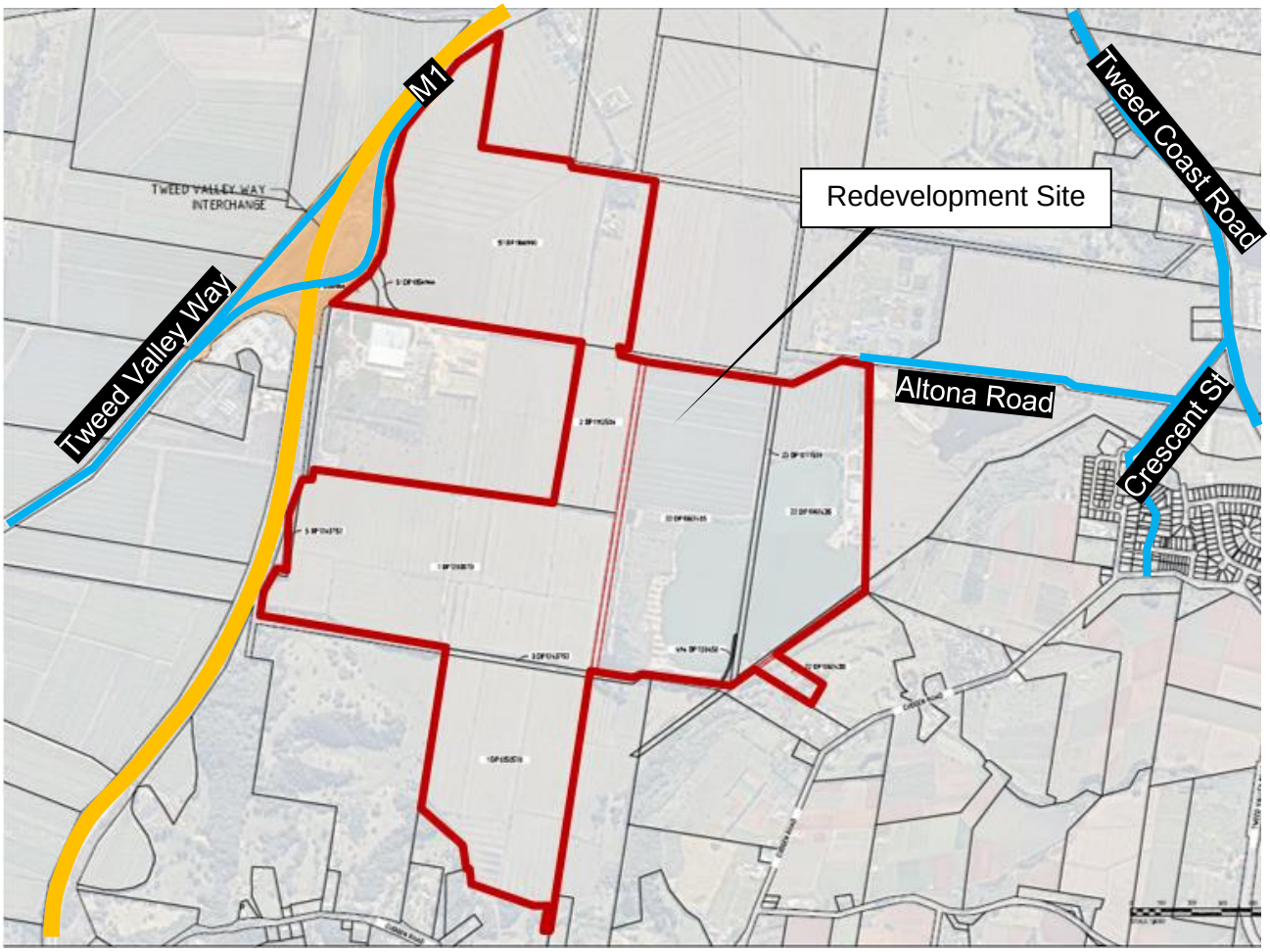


Figure 2.4 Proposed Redevelopment Site. Location Surrounding Roads

2.2.1 Tweed Valley Way

A photograph of Tweed Valley Way off ramp approaching the Australian Bay Lobster Producers Limited (ABLP) property access from the north is presented in Figure 2.5 below.

Figure 2.5 Tweed Valley Way Northern Approach to ABLP Property Access

The following Figure 2.6 shows the general speed environment.

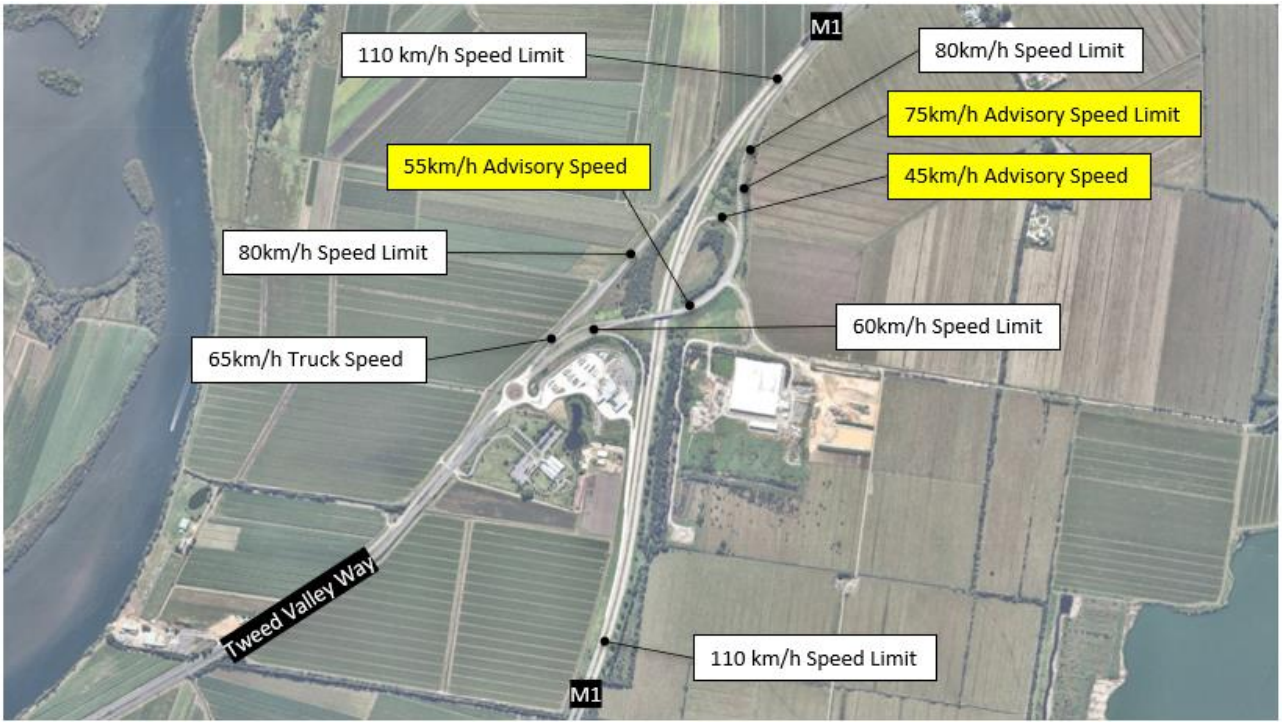


Figure 2.6 Speed Limit along Tweed Valley Way

The speed limit along Tweed Valley Way off-ramp decreases from 110km/hr to 80km/hr before the ABLP Property access. As shown in Figure 2.6, there is a 75km/h advisory speed limit at the northern approach to the ABLP property intersection and 55km/h at the southern approach.

2.2.2 Altona Road

A photograph of Altona Road approaching Crescent Street is presented in Figure 2.7.

Source: Nearmap.com

Figure 2.7 Altona Road Approach to Intersection with Crescent Street

Altona Road is a low order standard road with narrow pavement and formation width (One lane past the TSP access). Passing bays are also provided.

2.2.3 Crescent Street

A photograph of recently upgraded Crescent Street / Tweed Coast Road priority T-intersection is presented in Figure 2.8. The priority intersection benefits from a left turn slip lane from Crescent Street into Tweed Coast Road including a dedicated 200m long acceleration lane and right turn lane.

Figure 2.8 Crescent Street / Tweed Coast Road Intersection

Crescent Street connects Altona Road to Tweed Coast Road.

2.2.4 Tweed Coast Road

A photograph of Tweed Coast Road approaching the Tweed Coast Road / Crescent Street priority T-intersection is presented in Figure 2.9.

Figure 2.9 Tweed Coast Road Cross-section

Tweed Coast Road (679) is a classified (Regional) Road and a declared Controlled Access Road (CAR) in the subject area. Tweed Shire Council is the Roads Authority for the Tweed Coast Road. The road connects Crescent Street to the Tweed Coast Road interchange at the M1 and represents the current haulage route onto the Pacific Motorway.

2.2.5 Pacific Motorway

Pacific Motorway (M1) is a declared Freeway and TfNSW is the Roads Authority for Freeways in accordance with Section 7 of the Roads Act 1993. The Pacific Motorway provides a significant contribution to the east coast of Australia road transport by facilitating the north-south coastal route between Queensland including the Brisbane CBD and Sydney NSW. Locally, the last section in Northern NSW through the Tweed Shire, provides local access for the surrounding towns and suburbs and provides accessibility for Queensland residents travelling to Northern NSW, including tourist destinations such as Byron Bay as well as access for residents in northern NSW commuters to work and shopping in southern Gold Coast. The following Figure 2.10 shows the road classifications and declarations at the Tweed Valley Way / Pacific Motorway Interchange.

Figure 2.10 Road Classifications and Declarations Tweed Valley Way / Pacific Motorway Interchange

2.3 Existing Road Safety Assessment

Assessment of existing road safety and consideration for any increased risk arising from trips generated by the proposed development, particularly at affected intersections includes:

- Available sight distances identified and addressed by the assessment; and
- Identification of existing and proposed turn treatments at affected intersections along the proposed haulage route/s, having reference to warrants provided in Austroads *Guide to Traffic Management* Part 6 and treatments identified in Austroads *Guide to Road Design* Part 4A.

2.3.1 Crash data

Crash data at the Tweed Valley Way / Pacific Motorway M1 interchange has been obtained from the NSW database between 2013 and 2019 and reproduced in the following Figure 2.11.

ID	Year	Crash Severity	Crash Description
1	2013	Non-casualty	Off road left, hit object
2	2013	Fatal	Head on
3	2013	Non-casualty	Off road left, hit object
4	2013	Non-casualty	Off road left/right bend, hit object
5	2013	Non-casualty	Off right/right bend
6	2014	Non-casualty	Off road to right
7	2014	Non-casualty	Off road left, hit object
8	2014	Non-casualty	Off road left, left bend, hit object
9	2015	Non-casualty	Off road right, hit object
10	2015	Minor injury	Off road right, hit object
11	2016	Non-casualty	Off road to left
12	2016	Fatal	Head on
13	2016	Non-casualty	Off road left, hit object
14	2017	Serious injury	Off road left, hit object
15	2017	Serious injury	Off road left/right bend
16	2017	Non-casualty	Rear end
17	2017	Serious injury	Head on
18	2017	Serious injury	Off road right, hit object

Figure 2.11 Existing Crash Records Tweed Valley Way Interchange

Two fatal accidents were recorded along the M1 as shown by the red colour. Accidents recorded on the Tweed Valley Way that impact on the safety of the existing and proposed operations occurred at the east of the M1 overpass bridge and the two recorded at the Service Centre roundabout. No accidents were recorded at the ABLP property intersection with the Tweed Valley Way off-ramp.

2.3.2 Intersection Sight Distance

The existing ABLP property intersection sight visibility is shown in the following Figure 2.12. Due to the overpass bridge balustrade, there is restricted visibility for vehicles travelling north along Tweed Valley Way to gain access onto the southbound on-ramp onto the Pacific Motorway.

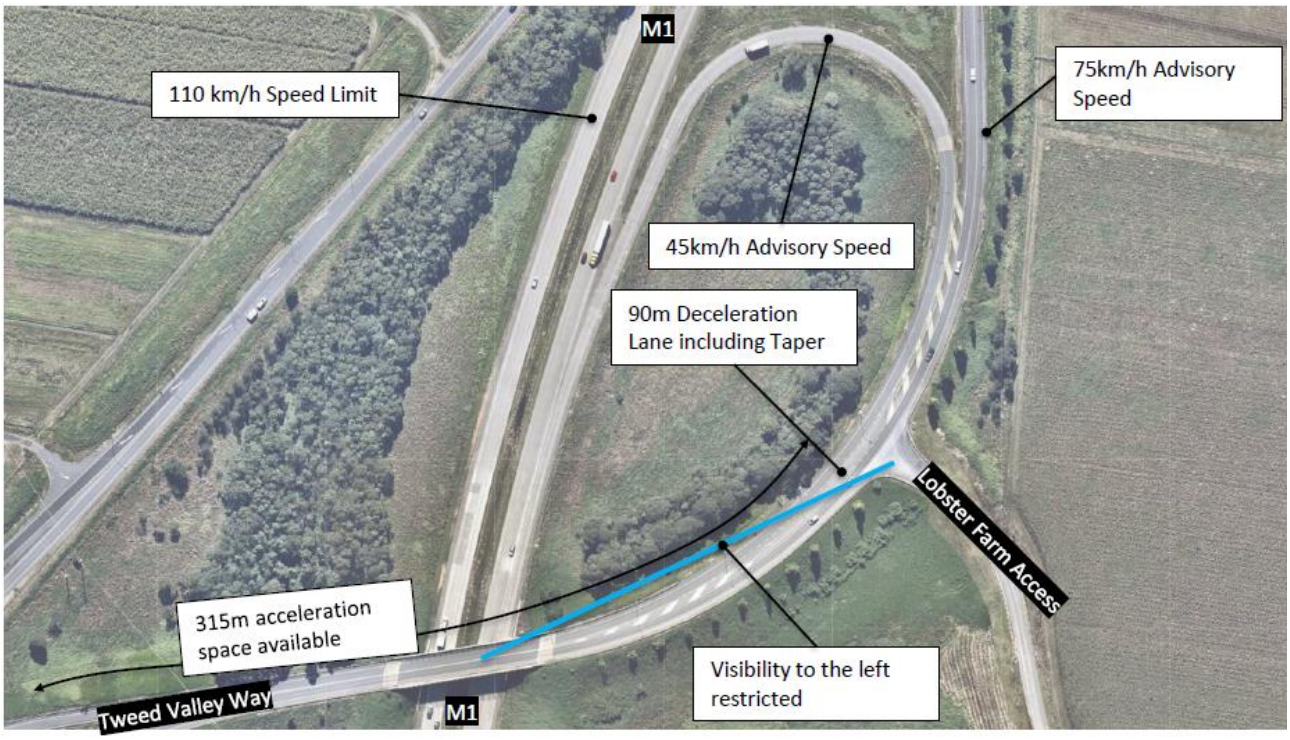


Figure 2.12 Existing ABLP Property Intersection Sight Visibility

2.3.3 Recorded Speeds

At the location of the 75 km /hr advisory speed sign in Tweed Valley Way off-ramp, the recorded 85th percentile speed is as follows:

- 7-day 85th percentile speed in southbound direction of travel was 86.4km/h;
- 7-day 85th percentile speed in northbound direction of travel was 64.9km/h; and
- Bidirectional 85th percentile speed is 84.4km/h.

2.4 Drivers Code of Conduct

In consideration for Clause 16(1) of the Mining SEPP including consideration of impacts on school zones and residential areas, a Drivers Code of Conduct for haulage operators, and assessment of road safety along the proposed haulage route/s is currently in place. Generally, a Driver Code of Conduct includes, but not be limited to:

- A map of the primary haulage route/s highlighting critical locations;
- Safety initiatives for haulage through residential areas and/or school zones;
- An induction process for vehicle operators and regular toolbox meetings;
- A complaint resolution and disciplinary procedure; and
- Any community consultation measures proposed for peak haulage periods.

A copy of the current Operational Traffic Management Plan for Tweed Sand Plant is included in Appendix D as an example document. The updated version of the CoC with respect to the current Application will form part of the standard operating procedures and induction process for all ongoing

operations at the Tweed Sand Plant incorporating all relevant approval conditions from TfNSW and TSC.

Where road safety concerns are identified at a specific location along the identified haulage route/s, TfNSW recommend that the TIA be supported by a targeted Road Safety Audit undertaken by suitably qualified persons. No road safety concerns have been identified outside the Tweed Valley Way interchange as the destinations are similar with existing deliveries. However, should operations identify concerns, then it is recommended the safety issues be documented and the CoC modified accordingly.

A new Operational Traffic Management Plan (OTMP), inclusive of a Driver Code of Conduct (CoC) and consistent with the Consent Authorities typical format for SSD, is proposed for the project approval. The document should be prepared in consultation with the relevant Road Authorities and approved by the Consent Authority prior to the commencement of vehicle movements associated with the major project.

3. Traffic Data

3.1 Reference Documentation

The traffic volume, speed and vehicle classification survey locations were adopted for the TIA to describe and justify the approach taken for data collection. The most recent update to the Tweed Road Development Strategy (TRDS 2017) as prepared by TSC in consultation with RMS and is considered to be the relevant source reference for forecasting future traffic conditions.

3.1.1 Previous Traffic Reports

Previous relevant traffic reports include the following:

1. Traffic Impact Study Proposed Aquaculture (ABLP Property) Development September 2004;
2. Proposed modification to existing Aquaculture (ABLP Property) Rytenskild February 2019;
3. TTM Chinderah Service Centre Development 1st December 2014;
4. Bitzios Report response to RMS comments 2nd November 2017;
5. Tweed Sand Plant Response to DPE and Gailes Submission Correspondence 15th February 2018; and
6. Tweed Shire Council – Tweed Road Development Strategy, (TRDS) Bitzios Consulting, November 2018.
7. Proposed Modification of Existing Aquaculture (ABLP Property) prepared by the Rytenskild Traffic Engineering (Doc Reference 18394, Feb 2021).

3.1.2 Traffic Volume Survey Data Available

Existing traffic volumes and background traffic growth is available on the surrounding road network and along the proposed haulage routes. The following sources of traffic data and new actual traffic counts obtained to inform the base case were obtained from the following sources;

a) Existing sources of traffic volume data:
   - NSW Government Traffic Census Data;
   - Tweed Shire Council Traffic Count Database;
   - Tweed Shire Council traffic studies and forecast traffic volumes; and
   - Previous traffic studies at the Tweed Valley Way / Pacific Motorway interchange as listed in 3.1.1 previous traffic reports above.

Pacific Motorway M1 traffic volumes are recorded in the annual traffic census data. The following Figure 3.1 shows the M1 traffic volumes.

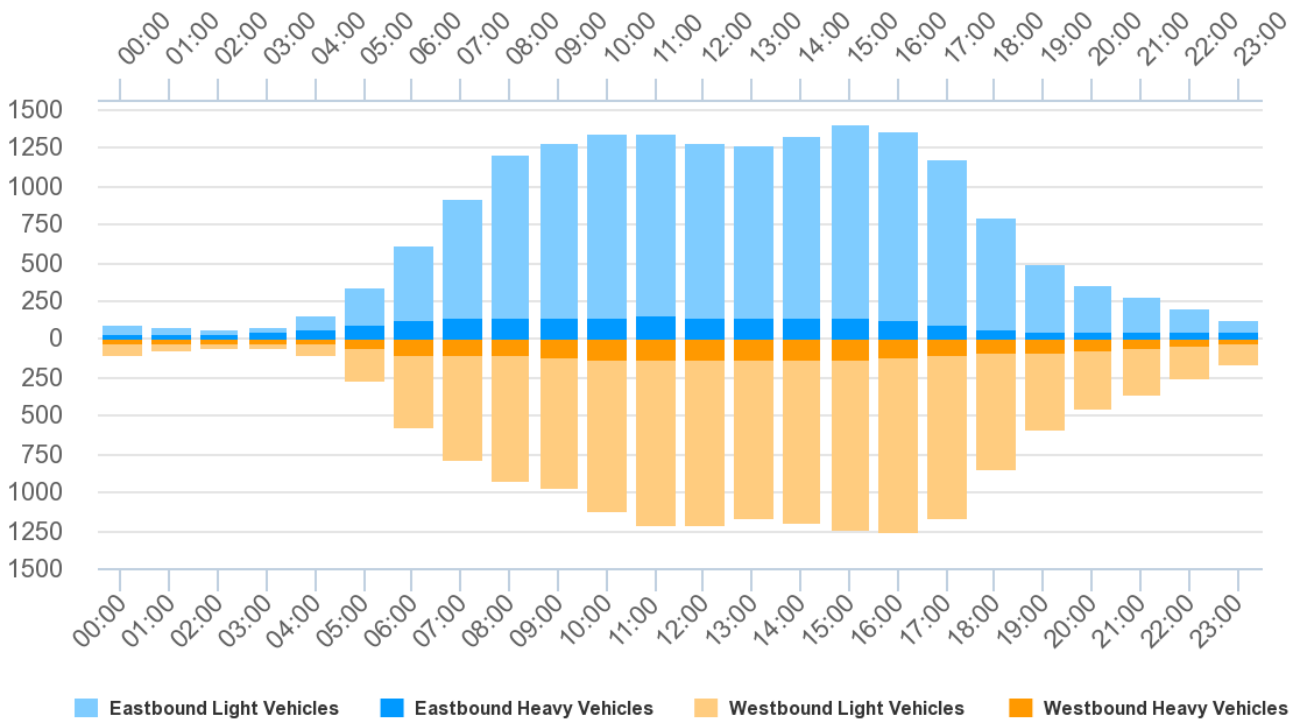


Figure 3.1 Pacific Motorway M1 Traffic Volumes

The graph shows the daily profile for all census data recorded from 21/11/2008 – 28/06/2019 for all days from 0.00 to 24.00 for all vehicles separately in each direction.

3.2 New Traffic Count Surveys

For the purposes of the assessment of development traffic impact onto the local road network, surveys were undertaken of the roads in the vicinity of the proposed new western access with Tweed Valley Way. New Traffic volume surveys were undertaken at the Tweed Valley Way / Pacific Motorway Interchange and Tweed Valley Way west of the interchange from 4th to 10th March 2020 at the following locations:

1. Tweed Valley Way southbound off-ramp. 7 x 24 hr day tube counters located between the start of the Tweed Valley Way southbound off-ramp and the existing ABLP property access 'T' intersection;
2. The start of the merge with the northbound off-ramp on the western side and Tweed Valley Way; and
3. Tweed Valley Way (M.R.679) - at No 232 IGA west of the interchange.

Data collected includes vehicle by type, volumes and travel speed. All traffic counts surveys are provided in Appendix B.

Fully classified turning count surveys were undertaken for the 07.00 to 19.00 periods on a Thursday and for the 10.00 to 15.00 period on a Saturday, including peak hour turning volumes at the following intersections:

- The Service Station / Tweed Valley Way roundabout; and

- The existing ABLP property access / Tweed Valley Way off-ramp priority 'T' intersection.

All surveys avoided school and public holiday periods. Figure 3.2 shows the survey locations.

Figure 3.2 Location of Traffic Surveys

Reference Figure 3.2, details of the traffic surveys at each location are as follows:

- 7 day x 24 hr day Tube counters located as follows:
  - Location 1 Tweed Valley Way southbound off-ramp. 7 x 24 hr day tube counters located between the start of the Tweed Valley Way southbound off-ramp and the existing ABLP property access 'T' intersection (two way);
  - Location 2 Existing ABLP property access (two way);
  - Location 3 Tweed Valley Way southbound off-ramp. 7 x 24 hr day tube counters located west of the Pacific Highway overpass bridge (two way);
  - Location 4 The start of the merge with the northbound on-ramp on the western side and Tweed Valley Way (one way); and
  - Tweed Valley Way (M.R.679) - at No 232 IGA west of the interchange, located at start of merge. (Two way). Not shown on diagram below.

Data collected includes vehicle by type, volumes and travel speed.

Locations nominated by red circle in Figure 3.2 data collected included:

- AM and PM Peak hour turning volumes at the following intersections:
  - The Service Station / Tweed Valley Way roundabout; and
  - The existing 'T' intersection at the ABLP property access / Tweed Valley Way southbound off-ramp.

Weekday intersection surveys recorded from 6.00 am until 9.00 am and 3.00 pm until 6.00 pm.

3.2.1 Survey Results Tweed Valley Way

Location 1 near proposed merge. Bio directional Peak Hours summary as follows:

- Weekday peak hour. AM 529vph from 8.00am to 9.00am; PM 596vph from 16.00pm to 17.00pm;
- Saturday peak hour. AM 571vph from 11.00am to 12.00pm; PM 610vph from 13.00pm to 14.00pm; and
- Sunday peak hour. AM 747vph from 8.00am to 9.00am; PM 533vph from 12.00pm to 13.00pm.

The following Figure 3.3 shows the weekly volume traffic flows.

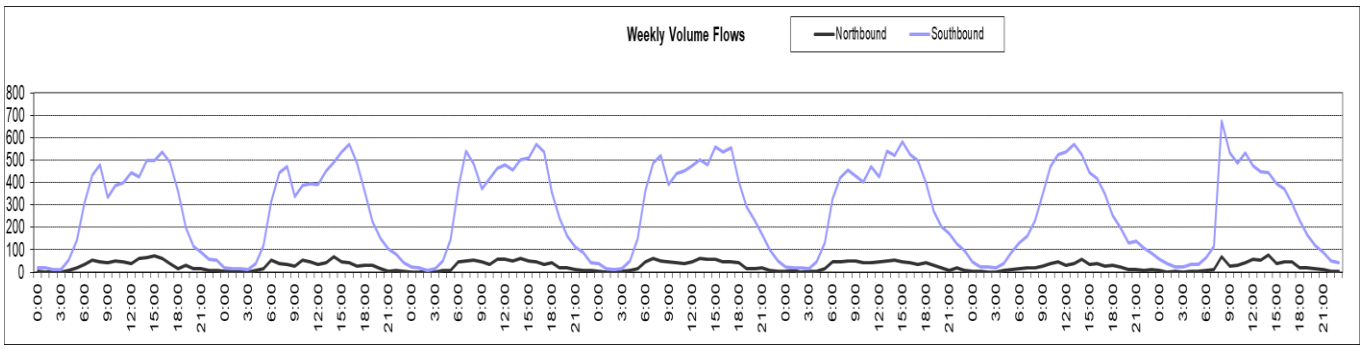


Figure 3.3 Location 1 Bio Directional Weekly Volume Flows Tweed Valley Way Site 1.

The highest weekly peak traffic volume occurred on the Sunday, followed by the Saturday, then the average weekday. During the week the highest AM peak hour 591vph occurred on the Wednesday. The highest PM peak hour 630vph occurred on the Friday. This higher result is consistent with the evening commuter traffic combining with the start of weekend holiday traffic.

Location 1 Tweed Valley Way speed distribution Northbound (towards Tweed Heads then southbound on-ramp) summary as follows

- Weekday average speed 54.2km/hr, 85th percentile speed 65.1km/hr;
- Saturday mean speed 57.0km/hr, 85th percentile 65km/hr; and
- Sunday mean speed 55.8km/hr, 85th percentile 64km/hr.

The following Figure 3.4 shows the Speed Distribution Northbound towards the southbound on-ramp.

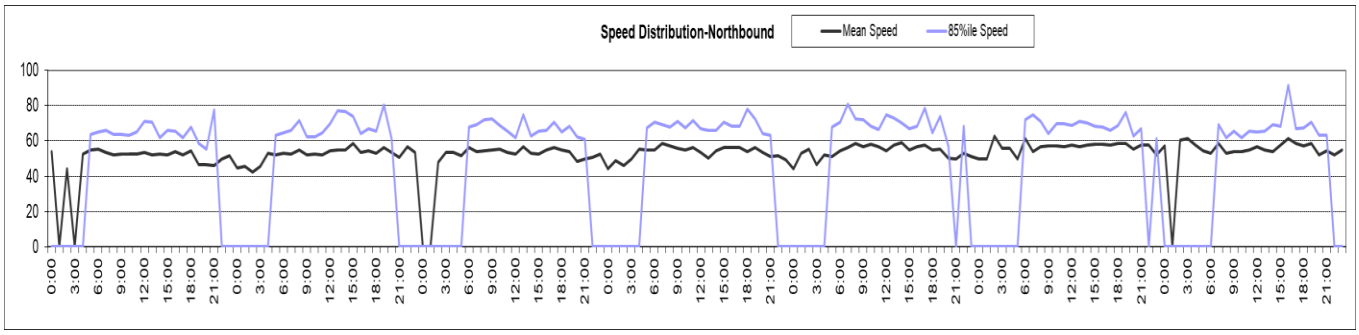


Figure 3.4 Location 1 Speed Distribution Northbound (towards M1 Southbound On-Ramp)

- Tweed Valley Way speed distribution Southbound away from Tweed Heads.
- Weekday Southbound 75.1km/hr; 85th percentile 86.3km/hr.
- Saturday Southbound 74.0km/hr; 85th percentile 87km/hr.
- Sunday Southbound 74.0km/hr; 85th percentile 86km/hr.

The following Figure 3.5 shows the Speed Distribution Southbound away from Tweed Heads.

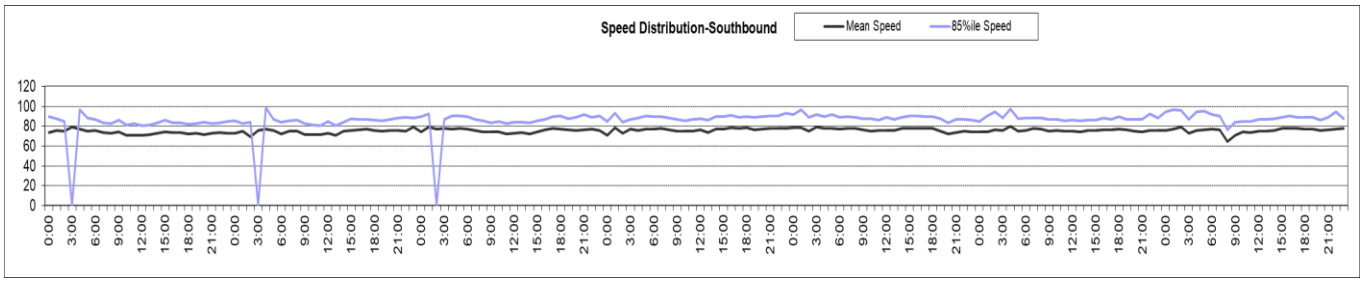


Figure 3.5 Location 1 Speed Distribution Southbound Tweed Valley Way

The higher speeds recorded on the southbound off-ramp compared with the lower speeds northbound towards the M1 southbound on-ramp are consistent with the speed environment expected in each case. Vehicles travelling towards the bend in the southbound on-ramp are slowing due to the 45km/hr advisory speed sign ahead compared to the 75km/hr advisory speed sign on the off-ramp.

87km/hr has been adopted for the 85th percentile speed for the merge from the TSP haul road onto the southbound off-ramp. Weekday traffic volumes have been adopted for the intersection capacity analysis as the distribution loads from the TSP are higher for the weekdays compared to the weekends.

Heavy Vehicles Proportions to M1 Southbound on-ramp are shown in Figure 3.6.

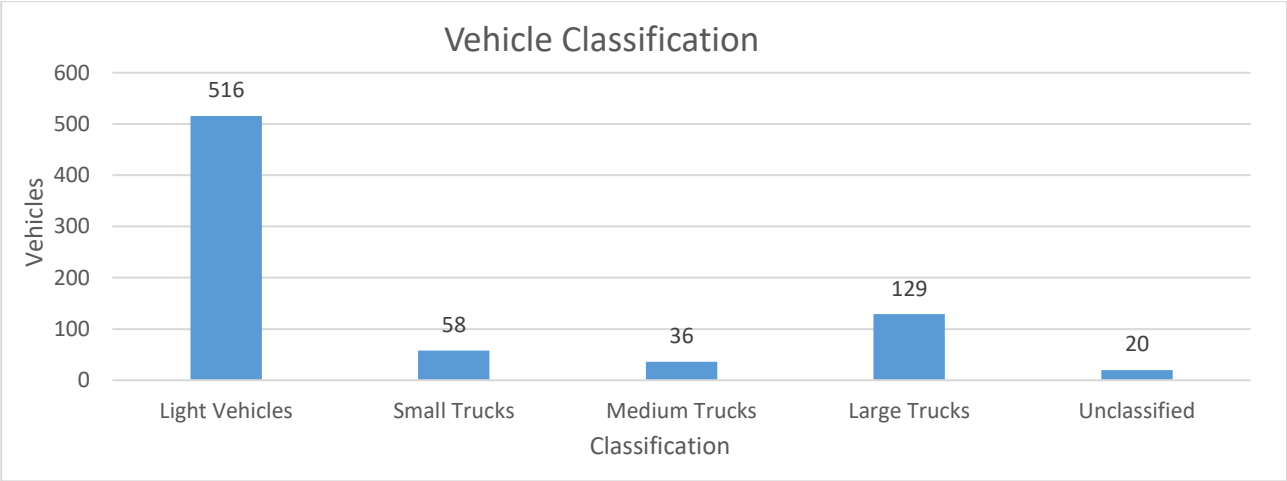


Figure 3.6 Location 1 Heavy Vehicle Proportions Travelling Northbound

The following Table 3.1 shows the volumes for each vehicle class.

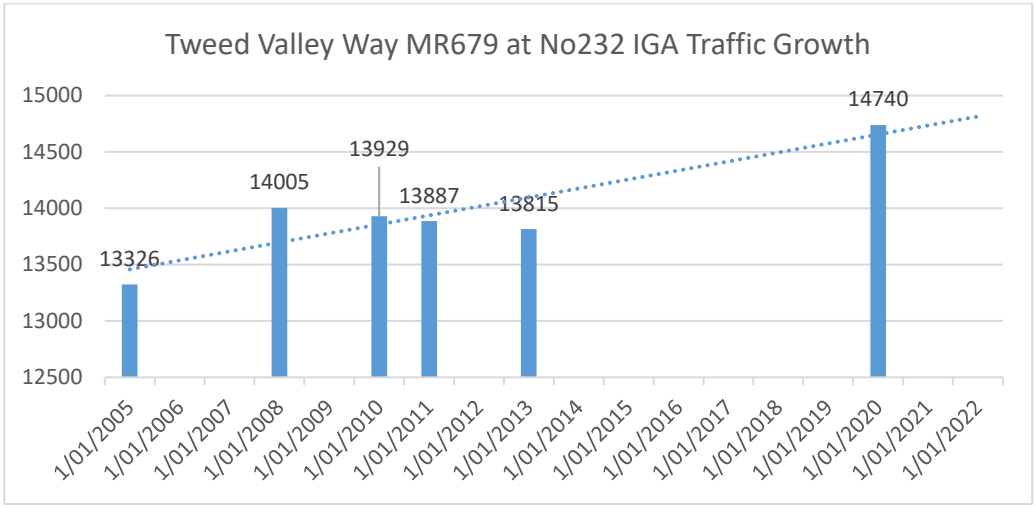
Table 3.1 Location 1 - 5-day Average Volumes

Vehicle Class	Northbound		Southbound	
	Volume Data	Percentage	Volume Data	Percentage
Light Vehicles – Classes 1 to 2	508	70.36%	6,198	90.56%
Small Trucks – Class 3	50	6.93%	305	4.46%
Medium Trucks – Classes 4 to 5	44	6.09%	120	1.75%
Large Trucks – Classes 6 to 12	107	14.82%	220	3.21%
Unclassified – Class 13	13	1.80%	1	0.01%
Total Class 3-13	214	29.64%	646	9.4%
Total	722	100%	6,844	100%

Overall, there is a 29.6% proportion of heavy vehicles currently using the Tweed Valley Way on-ramp northbound and 9.4% southbound. Note that the high value is a result of heavy vehicles from the M1 accessing the heavy vehicle Service Centre. A further 4 heavy vehicle trips in a peak hour will occur in the future from the Tweed Sand Plant vehicles travelling south. Based on future Tweed Valley Way 2041 volumes and growth in current heavy vehicle and light vehicle trips, the heavy vehicle trips with the development trips superimposed is expected to increase to 30%. Large trucks are 34% of the heavy vehicle percentage southbound off ramp. At the southbound on ramp, large trucks are 50% of the heavy vehicle percentage.

3.2.2 Historical Traffic Growth

Several sources were investigated regarding the growth factor for traffic specifically along Tweed Valley Way. The following Figure 3.7 shows the calculation for the historical traffic growth along Tweed Valley Way.



29/07/2010	13929
4/03/2020	14740
	811
Growth	5.82%
Growth p.a.	**0.58%**

Figure 3.7 Traffic Survey Site Tweed Valley Way (TVW) Mr679 at No 232 LGA Historic Growth Calculation

Based on the above the historical growth along Tweed Valley Way is 0.58% per annum linear growth.

3.2.3 Traffic Growth Projection

An assessment of the growth future forecast was determined by comparing the 2020 pre COVID 19 survey in Tweed Valley Way with the Tweed Shire Council – Tweed Road Development Strategy TRDS, November 2018 output results for the medium yield 2041 base year. The following Figure 3.8 shows the reference material and calculation.

Tweed Road Development Strategy TRDS Report 2041 Scenario 6 (Medium Yield) Tweed Valley Way (TVW) 8090vpd northbound + 8620vpd southbound. ADT 16,710 vehs per day.
2020 Traffic Survey Tweed Valley Way ADT two way 14,740 vehs per day.
Growth 2020 to 2041; 1,970 vehs. per day.
Growth 13.36% or 0.006 (0.6)% per annum. ADOPT 0.60% pa compound growth.

Figure 3.8 Traffic Survey Site Tweed Valley Way (TVW) Mr679 at No 232 IGA Future Growth Calculation

The Tweed Valley Way annual growth rate of 0.60% compound was obtained adopting TRDS Scenario 6 as advised by Tweed Shire Council.

4. Committed Development

Before considering the implications of the proposed development it is considered appropriate to summarise the changes in traffic flows likely to be associated with ABLP committed development, as part of the construction requirement for their site as detailed in their recent 2019 application to Tweed Shire Council.

The ABLP committed development site is identified as Lot 1 on DP1192506 and has an area of approximately 45 hectares as shown on Figure 4.1 below.

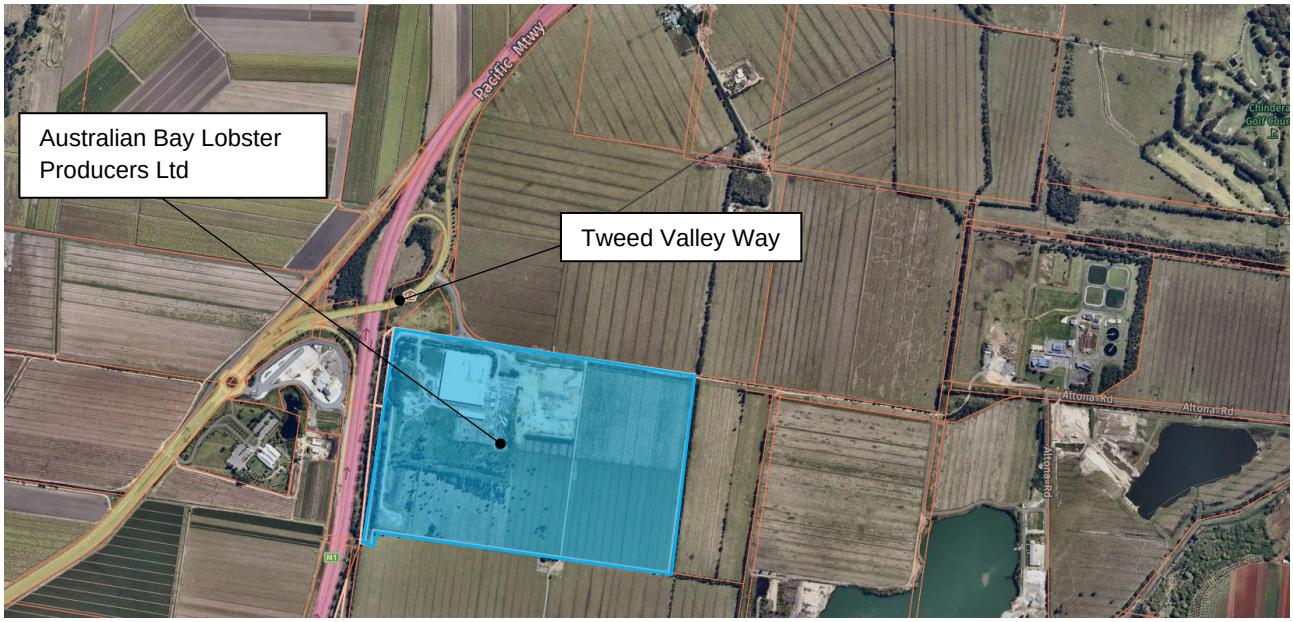


Figure 4.1 Committed Developments

The existing access to the ABLP site is gained via a T-priority intersection with the M1 southbound on and off-ramps at the M1 / Tweed Valley Way Interchange. The speed limit in the vicinity of the intersection is 80km/h. Due to the road geometry, a 75km/h advisory speed is present at the northern approach to the intersection and 55km/h at the southern approach to the intersection.

As part of the construction requirement for their site, ABLP are required to modify the ground level to ensure that the site would be immune to a 1 in 100-year flood event.

It is anticipated that 2,000,000m³ of material will be hauled to the site over five years up to 2025. Details of the forecast haulage volumes are presented below:

- Maximum haulage per day - 1,922m^3, or 2,500 tonnes.
- Average pay load per vehicles - 45 tonnes
- Max number of loaded vehicles per day - 56 loaded vehicles
- Max number of heavy vehicle trips per day - 112 trips (56 to and 56 from the site)

The proposed committed development layout plan shown in Figure 4.2 below was sourced from the Traffic Impact Assessment for the Proposed Modification of Existing Aquaculture (ABLP Property) prepared by the Rytenskild Traffic Engineering (Doc Reference 18394, Feb 2021).

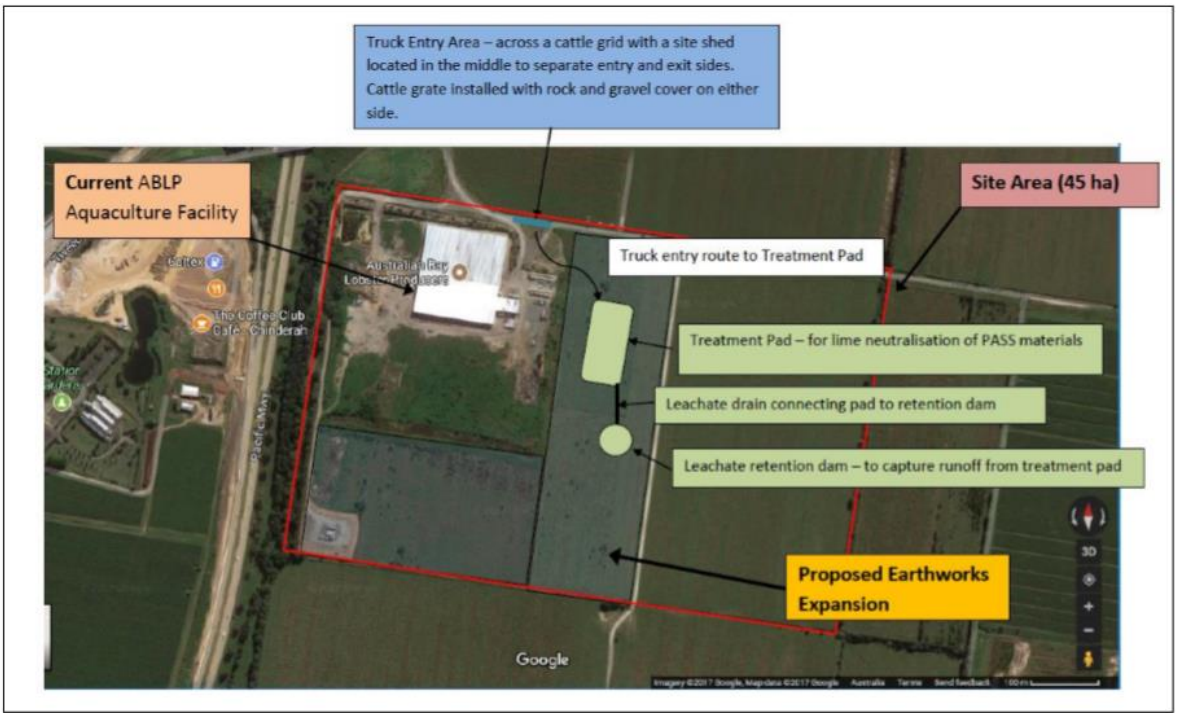


Figure 4.2 The Proposed Modification of Existing Aquaculture

It has been estimated that the proposed works will generate 14 heavy vehicles movements (7 to and 7 from the site) per hour. The committed development traffic flows shown in Figure 4.3 have been extracted from the Traffic Impact Assessment report prepared for the site by Rytenskild Traffic Engineering.

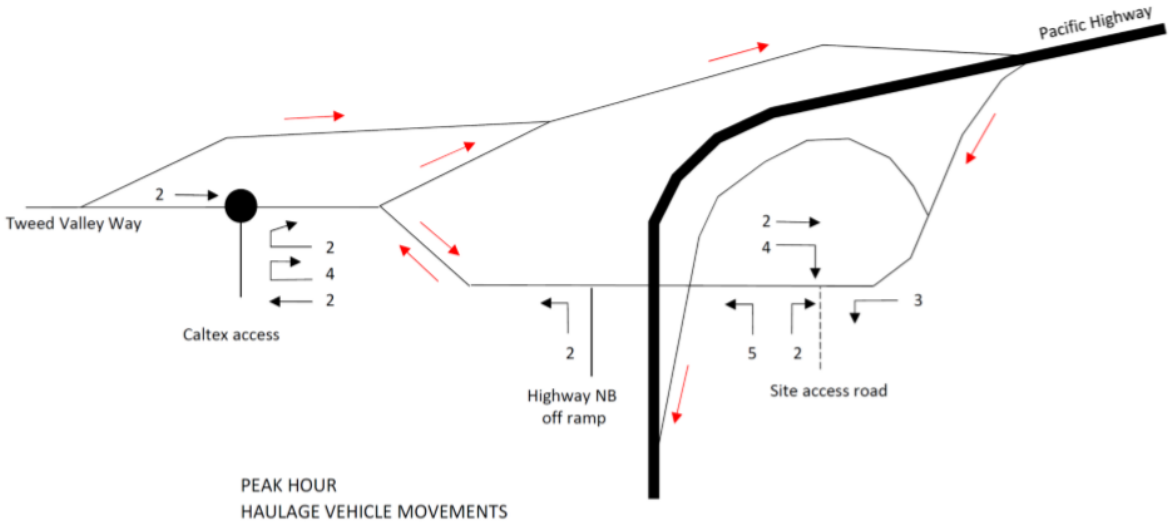


Figure 4.3 Australian Bay Lobster Producers Limited Committed Development

5. Proposed Development

5.1 Development Details

The proposed development with Street address as Altona Road, Cudgen comprises the following land parcels:

- Lot 22, DP 1082435; Lot 23 DP1077509; Lot 494 DP720450; Lot 1 DP1250570; Lot 2 DP1192506; Lot 3 DP1243752; Lot 51 DP1166990; and Lot 50 DP1056966.

The Tweed Sand Plant proposed development seeks to:

- Increase the sand production rate from the current limit of 500,000 tonnes per annum (tpa) of sand products from site up to 950,000 tpa. The annual extraction and sales rate would be market driven, up to the proposed maximum 950,000 tpa;
- Increase the extraction area yielding a total Tweed Sand Plant re-development site area of 236ha compared to the current 77ha site, of which 46ha is currently approved for extraction;
- All extraction would be via a dredge unit (i.e. wet excavation), piped to an onshore wash plant. The dredge and wash plant would have a larger capacity and footprint compared to the current operation, albeit noise output, air emissions etc would likely be lower due to improvements in technology;
- Consistent with existing operations, loading of the product would be via a front-end loader(s) into standard highway trucks (i.e. truck and dog, and articulated heavy vehicles including B-Doubles);
- Operating hours would be as follows:
    - Sand dredging & processing, 24 hours/day, 7 days/week;
    - Haulage, 24 hours/day, 7 days/week; and
    - Maintenance, 24 hours/day, 7 days/week.
- Site personnel would remain at a similar number to present (currently three full-time employees), however the increase in extraction and sales rate requires an increase in truck drivers to transport the material;
- A ‘ramp-up’ phase may be adopted during the initial phase (first five years) of the expansion, depending upon market conditions, plus ongoing availability of suitable fine sand from alternate sources;
- Transporting material off-site by public roads. The intention is to access TSP via a new roundabout with Tweed Valley Way that also services the ABLP property access;
- Progressive rehabilitation of the site.

Hanson will retain ownership of the site following completion of sand extraction and any proposed subsequent use of the site will be decided via the appropriate consultative, application and regulation processes in place at that time.

The proposed redevelopment site is shown in Figure 5.1 below.

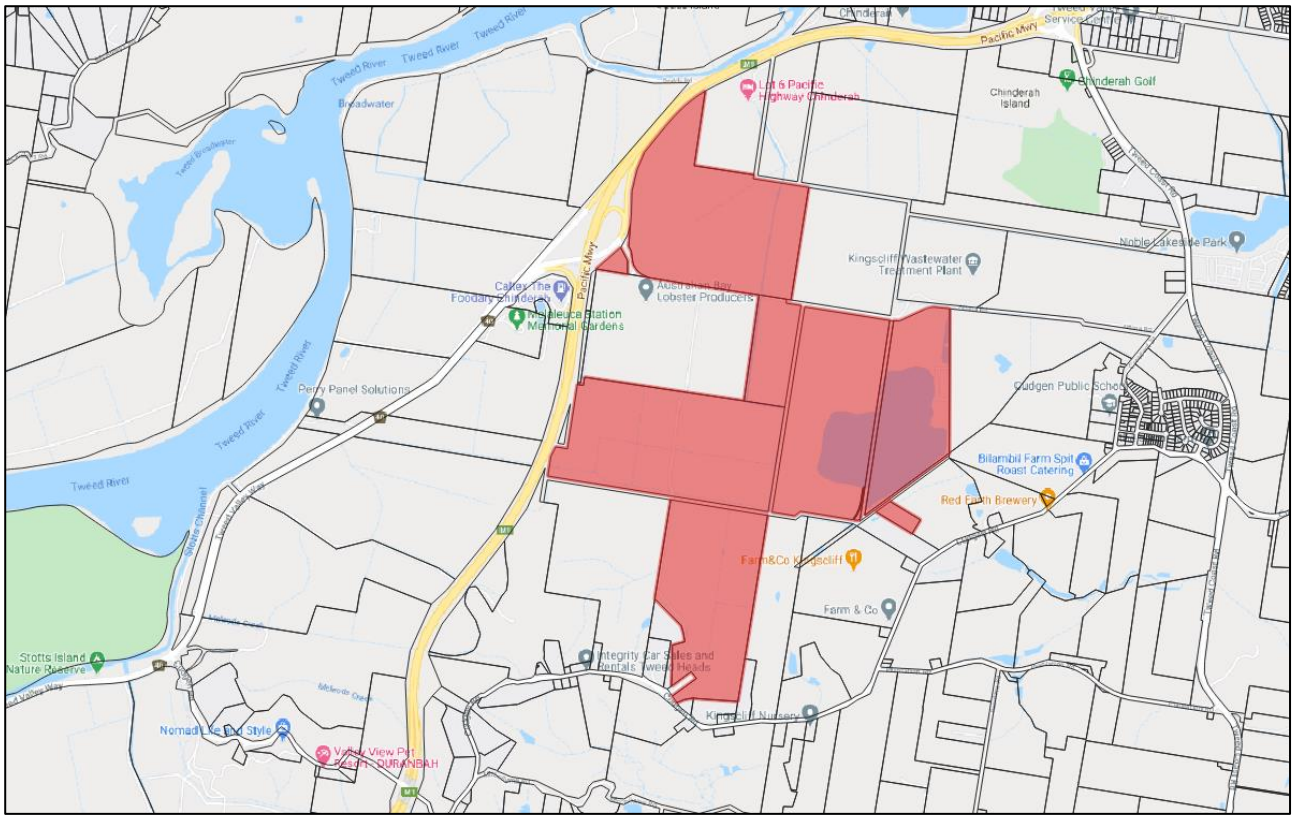


Figure 5.1 Locality Plan of the Proposed Redevelopment Site (Base from Google maps)

5.2 Site Access Strategy

Tweed Coast Road is a local council-controlled road that provides access to Cudgen, Kingscliff, Casuarina and Cabarita Beach from the M1 Pacific Motorway. The above areas are forecasted to have substantial population growth due to the land development on both sides of the road. Removing heavy vehicles from Tweed Coast Road has significant road safety benefits.

As part of initial investigations for the alternate access onto the southbound Tweed Valley Way off-ramp at the M1 interchange, 4 options were investigated and forwarded to the TfNSW for initial discussion and comment. Based on initial consensus the acceleration lane merge Option 4 was further developed and submitted as the preferred solution.

Upon further review TfNSW advised that *It is considered likely that heavy vehicles merging into the off-ramp will find it difficult to regulate speed and will be reliant on through traffic making adjustments to accommodate entering trucks. This presents a safety risk and is contrary to the function of the off-ramp. TfNSW requests that further consideration be given to alternative options for access to the proposed development in consultation with TfNSW.*

Section 17.1.1 of the *Austroads Guide to Road Design Part 4C: Interchanges* (2015), provides relevant guidance for considering the access to a Freeway or interchange which states that;

No private access should be allowed to the main carriageways or ramps of a Freeway. The only exception is privately owned generators such as service centres. Access control on freeways provides the greatest single benefit to road safety on these high-speed facilities.

This is further reinforced in Section 7.6.4 of the Austroads *Guide to Traffic Management* Part 6 (2020), which states that;

A special case may exist where a road network or major service centre requires access and there is no alternative but to intersect the ramp alignment. In such cases, access should only be permitted through a roundabout or signalised intersection that effectively becomes the ramp terminal.

The preferred option and supported by the TfNSW is a roundabout intersection with Tweed Valley Way. The original submission investigated Option 3 that only considered the benefits of a roundabout located on the existing alignment and further investigation was undertaken to consider the benefits of offsetting a roundabout further to the south-east to increase separation from the Motorway ramps and overpass.

The applicant proposes that all site and ancillary vehicles will gain access from a new roundabout with Tweed Valley Way to the west of the site. No vehicular access will occur via Altona Road, Crescent Street and Tweed Coast Road to the east. The site access approach road via the new proposed roundabout superimposed on the existing ABLP priority intersection is shown in the following Figure 5.2.

Figure 5.2 Proposed Site Access Strategy

ABLP also gains access via the roundabout. The alignment of the roundabout allows potential benefits gained where the new intersection works can be built off-line to minimise impacts on traffic passing through the interchange. All construction occurs on the eastern side with tie-ins to the existing Tweed Valley Way alignment limited to the extremities at either end. The shift east increases

the horizontal curve radius at the southbound on-ramp to the M1 allowing a higher exit speed out of the curve requiring a shorter acceleration distance to the M1 merge. No change to the existing ramps at the M1 termination points is proposed.

Approach to the roundabout will necessitate a change in speed zoning. The proposed treatment is more appropriate for heavy vehicle access in the subject location from a design perspective. The speed zoning of 60km/hr would be extended to incorporate the new roundabout. For the southbound on ramp to the M1 the existing speed advisory speed is 45km/hr on the curve in any case, hence not impacting the on-ramp acceleration and merge operation by maintaining current speed when approaching the Motorway. On the northern approach side to the roundabout, deceleration distances are achieved for the existing 80km/hr to the 60km/hr at the roundabout approach. Safety benefits are achieved when compared to the previously proposed high-speed merge alternative.

In further support of the roundabout access arrangement the following has been considered:

- Detailed Sidra analysis to quantify the capacity of the proposed roundabout including the existing roundabout at the Service Centre on the western side to include the haulage trucks;
- A sensitivity test also considered a 50 % increase in a southerly destinations that utilises the Service Centre roundabout on Tweed Valley Way for return trips;
- Swept path diagrams including 26m B-Double Articulated vehicle;
- Sight distance criterion as per Austroads. Refer Appendix A Drawing BE190043-SK141 Rev A;
- Economic Appraisal Report examines the cost / benefits of using Tweed Valley Way compared to Tweed Coast Road;
- A functional and safe design for the proposed roundabout is achieved by the position of the approaches resulting in the arc of the curve passing through the middle of the roundabout. The proposed horizontal alignment providing balanced deflection for traffic movement from the overpass bridge to roundabout continuing to M1 southbound on-ramp. Similar deflection provided for the southbound direction from the southbound off-ramp through roundabout to the overpass bridge;
- A further key feature of the roundabout design is the provision of two lanes at each approach. This allows separation of through and turning traffic volumes resulting in minimum delays to through traffic movements; and
- The site access and ABLP approach road via the new proposed roundabout will not exceed 3% grade creating a standing area at the approach which ensures that appropriate start up speeds can be achieved.

Drawings detailing the horizontal and vertical geometry are contained in Appendix A. Refer drawing Numbers BE190043:SK123 – SK125 and SK129 to SK 139.

The roundabout would achieve an appropriate interchange form as identified in Section 7.5.3 of the Austroads *Guide to Traffic Management* Part 6. Batter slopes are proposed at 1 vertical to 4 horizontal for stability, safety and maintenance purposes. It is acknowledged the roundabout requires the dedication of land by the Applicant. Reference the previous Figure 2.10 road classifications and declarations at the Tweed Valley Way / Pacific Motorway Interchange, the following Figure 5.3 shows the extent of private (Hanson) land dedication proposed.

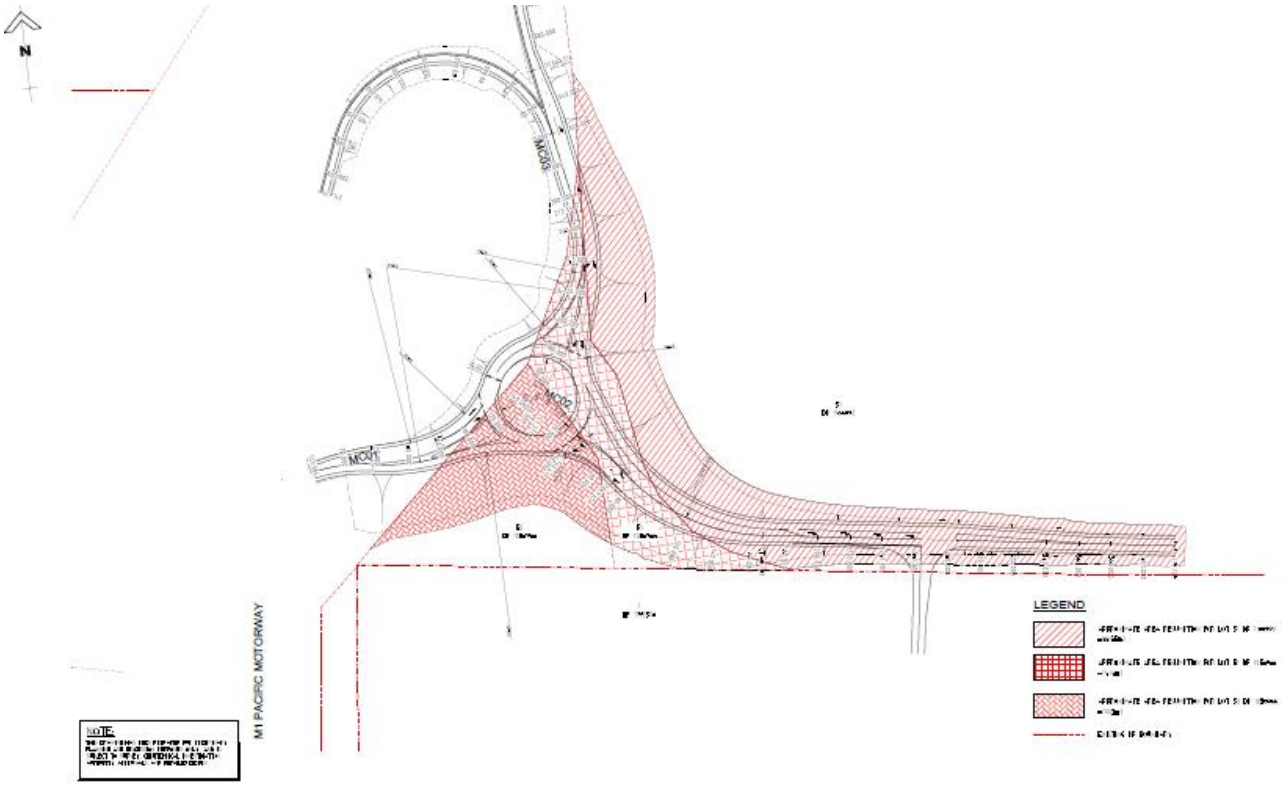


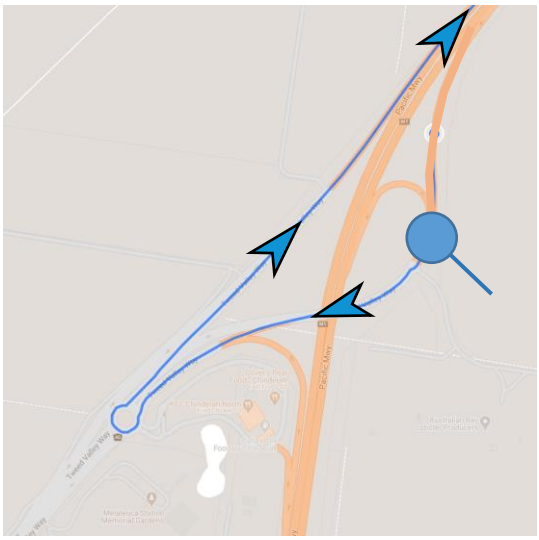
Figure 5.3 Extent of Land Dedication Proposed

Refer Appendix A Drawing BE190043:SK140 Rev B. Overall a roundabout lowers the speed of all vehicles to accommodate the entry speed of trucks. The benefits of a suitably designed and located roundabout, assists TfNSW to support access to the proposed development.

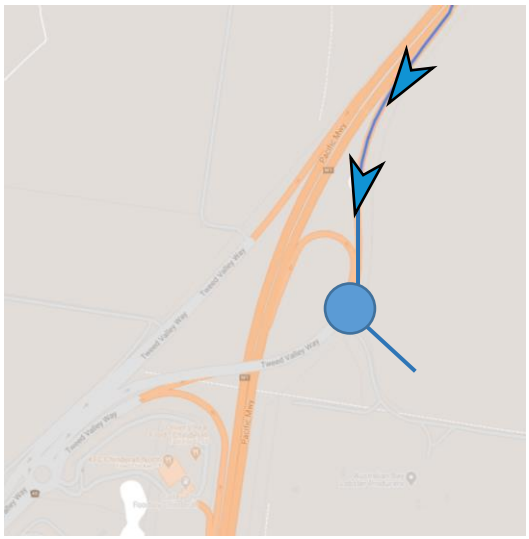
The existing intersection on Tweed Valley Way is licensed to Australian Bay Lobster Producers (ABLP) and DPIE is currently considering DA282-11-2004-I-MOD-4. The most recent TfNSW response to the RTS for this modification was provided on 19 March 2021 and requested further clarification of forecast heavy vehicle movements related to the proposed increase in construction-related fill over the 5 year construction period. Since Construction Traffic Management Plans are typically required by the Department for approved SSD, coordination between the Proponents is recommended to address any potential for overlaps in construction and/or operational activities that have potential to impact on the safety and efficiency of the M1 interchange.

5.2.1 Traffic Distribution

The analysis of published annual operations from the existing Tweed Sand Plant site shows the destinations of the deliveries. The following Figure 5.4 shows the proposed haulage route to / from northbound and southbound destinations.



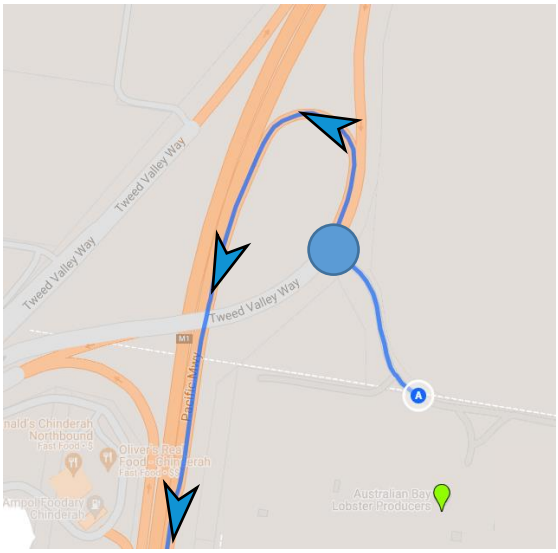
To North



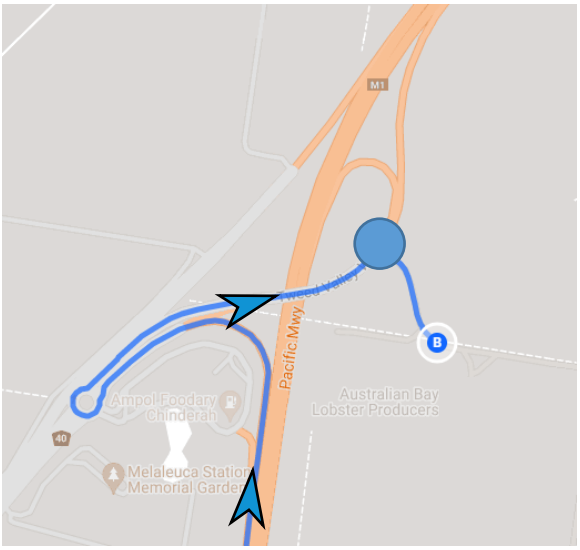
From North

Figure 5.4 Tweed Sand Plant Haulage Route Northbound

The following Figure 5.5 shows the haulage route to / from southbound destinations.



To South



From South

Figure 5.5 Tweed Sand Plant Haulage Route Southbound Destinations

5.3 Economic Appraisal

The need for private access to the interchange and the relative merits of supporting a direct versus the comparative outcome of previously approved access arrangement via Tweed Coast Road is relevant to the Consent Authority's consideration of Clause 101 of the SEPP Infrastructure. To quantify the potential benefits of removing heavy vehicle demand from Tweed Coast Road (TCR), a comparative economic analysis of impacts introduced to the Tweed Valley Way interchange in terms of delay and/or safety has been prepared.

It is noted that the proposed roundabout has potential to provide a safer access arrangement for existing approved uses but will generate a delay to through traffic movements. These costs may be

offset by savings in heavy vehicle demand on Tweed Coast Road and at the Chinderah interchange over the life of the project. The supporting assessment addressing Economic and Transport Impacts is contained in Appendix F.

5.3.1 Economic Appraisal Methodology

The economic appraisal of the proposed haulage route via Tweed Valley Way (Project Case) including the construction of a new roundabout, has been evaluated over a 30-year evaluation period against Base Case which includes haulage route via Tweed Coast Road. Project Case includes removal of all Hanson Trucks from Tweed Coast Road.

The evaluation was conducted using cost-benefit analysis (CBA) framework that applies a discounted cash flow technique to assess the future net benefits of a Project Case against Base Case. CBA includes only benefits to the Tweed Shire Council residents and public, Tweed Shire Council and NSW State Government. Any benefits acquired by Hanson with respect to shorter travel distances have not been included. The analysis includes maintenance costs associated with the proposed new Tweed Valley Way roundabout over the life of the project but excludes the capital costs covered by Hanson.

As part of the CBA, SIDRA traffic modelling was undertaken to determine average intersection delays for the Base Case and Project Case. The evaluation was undertaken in accordance with National and NSW economic frameworks. Figure 5.6 below shows Base Case and Project Case TSP haulage routes via Tweed Coast Road and Tweed Valley Way respectively.

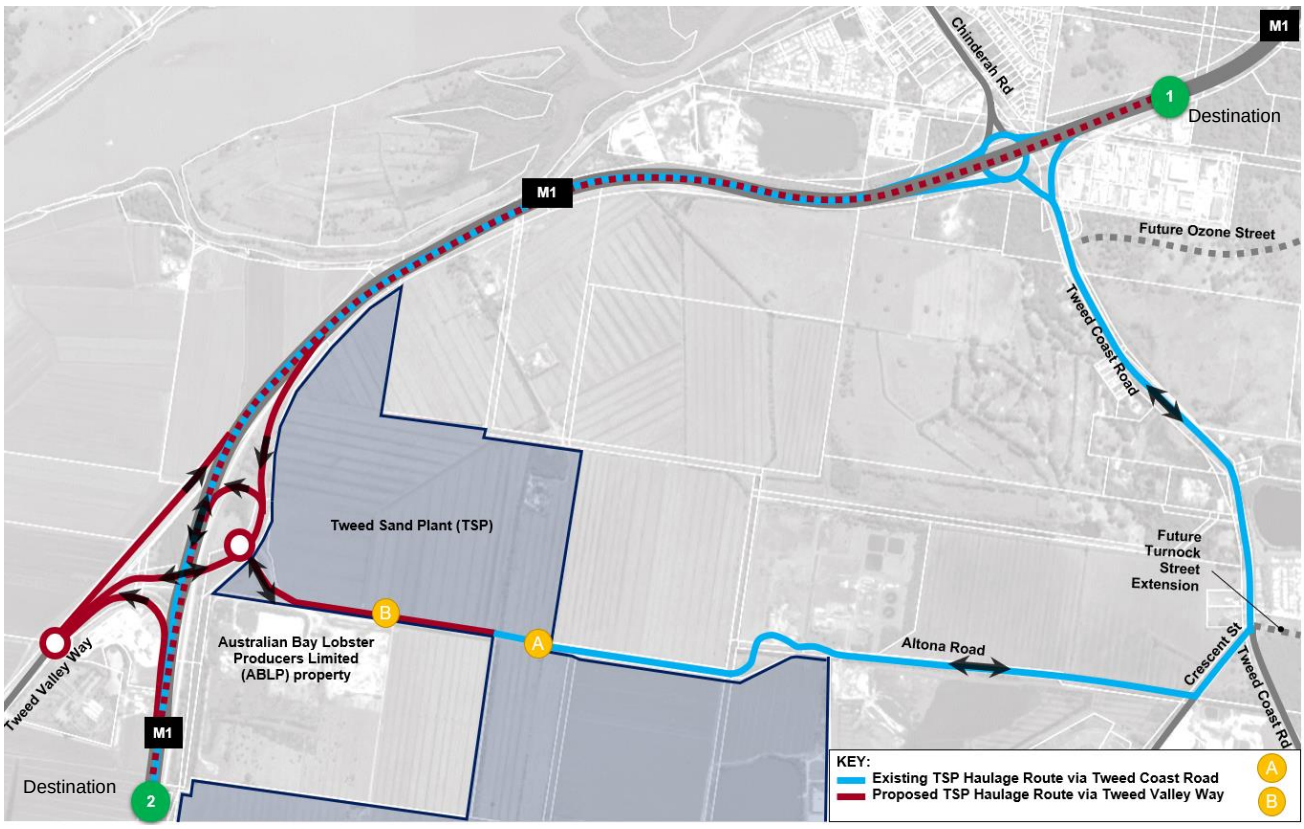


Figure 5.6 Base Case and Project Case Haulage Route to the M1 Pacific Motorway

5.3.2 Traffic Forecast

To inform SIDRA modelling, traffic count data was sourced for the following intersections:

Intersection	Survey Year	AM Peak Volumes	PM Peak Volumes
Existing Haulage Route via Tweed Coast Road			
Pacific Motorway / Tweed Coast Road interchange	2018	2,336	2,365
Tweed Coast Road / Morton Street priority intersection	2018	1,930	1,961
Tweed Coast Road / Morton Street priority intersection	2018	1,931	1,965
Tweed Coast Road / Crescent Street priority intersection	2016	1,546	1,480
Altona Road / Crescent Street priority intersection	2016	122	69
Proposed Haulage Route via Tweed Valley Way			
Tweed Valley Way / Australian Bay Lobster Producers	2020	660	625
Tweed Valley Way / Service Station Roundabout	2020	828	931

Background traffic growth in the area was calculated for each haulage route, based on the recorded AADT data and 2041 traffic volumes extracted from the Tweed Strategic Transport Model (2041 medium yield Scenario 6).

The recorded AADT volumes and 2041 Tweed Strategic Transport Model volumes used for the calculation of the growth rates for Tweed Coast Road and Tweed Valley Way are shown below.

Road	Survey Year	Recorded AADT	2041 Strategic Model AADT*	Compound growth p.a.
Tweed Coast Road	2018	17,757	34,280	2.90%
Tweed Valley Way	2020	14,740	16,710	0.60%

** Medium Yield Scenario 6*

5.3.3 Base Case and Project Case

The proposed haulage route via Tweed Valley Way including the Tweed Valley Way / Australian Bay Lobster Producers intersection upgrade to a roundabout (Project Case), was tested against the haulage route via Tweed Coast Road (Base Case) using SIDRA traffic modelling software and considering the broader network operations as follows:

- Base Case – Tweed Sand Plant haulage route via Tweed Coast Road and no access to Tweed Valley Way; and
- Project Case – Tweed Sand Plant haulage route via Tweed Valley Way including the Tweed Valley Way / Australian Bay Lobster Producers intersection upgrades. Project Case includes removal of all Hanson trucks from Tweed Coast Road.

Both Base Case and Project Case include traffic volumes associated with the expansion of the existing Tweed Sand Plant (950,000 tpa sand production rate per annum).

5.3.4 Traffic Modelling

Comprehensive traffic modelling studies were undertaken to inform the Cost-Benefit Analysis of the preferred haulage route (Project Case) in comparison with the existing haulage route (Base Case).

Given the project's proximity to the existing and planned major state-controlled roads, the forensic traffic modelling analysis in 2032 and 2042 includes Tweed Coast Road upgrade works from 2-lanes to 4-lanes including individual intersection upgrade works.

SIDRA modelling was undertaken for the morning peak and afternoon peak based on the available intersections traffic count data for the following intersection:

- Altona Road / Crescent Street priority intersection;
- Tweed Coast Road / Crescent Street intersection;
- Tweed Coast Road / Ozone Street extension intersection;
- Tweed Coast Road / M1 Pacific Motorway Interchange intersection;
- Tweed Valley Way / Australian Bay Lobster Producers intersection; and
- Tweed Valley Way / Service Station Roundabout.

The key performance criteria considered as part of the network assessment is intersection average delay (s). A comparison of the travel time benefits along Tweed Coast Road and Tweed Valley Way for the Base Case and Project Case shows the combined AM and PM peak travel time benefit achieved along Tweed Coast Road and additional delay cost along Tweed Valley Way post-development.

5.3.5 Project Costs

The preliminary cost estimates for the proposed roundabout were used for the Economic Appraisal. The above costs were used to establish likely maintenance costs associated with the new roundabout over the 30-years asset design life.

It is important to note that the Benefit Cost Ratio analysis doesn't use the construction cost for the roundabout as Hanson will carry the upgrade works.

The preliminary estimated construction cost for the proposed roundabout is shown in table below.

Cost	Total Construction Cost (Undiscounted, 2021 prices)
Project Case - Roundabout Upgrade	$4,800,000

For appraisal purposes, it has been assumed that design and construction will occur between 2021 and 2022. The roundabout would be constructed with a durable 30-year design life concrete pavement and maintainable one in four batters. However, for robust assessment a 1% maintenance cost has been adopted. A summary of the ongoing maintenance costs for the proposed roundabout are shown in table below.

Cost	Total Maintenance Cost (Undiscounted, 2021 prices)
Project Case – Roundabout Maintenance Costs	$1,440,000

Tweed Valley Way in the vicinity of the ABLP access intersection is currently subject to 80km/h speeds. The proposed roundabout includes the introduction of a 60km/h speed limit at the approach to the roundabout which will result in additional delays for through traffic along Tweed Valley Way. The above has been included in the assessment in addition to SIDRA intersection delay assessment. A summary of the Tweed Valley Way Travel Time Cost is presented in table below.

Cost	Total Tweed Valley Way Travel Time Cost (Undiscounted, 2021 prices)
Travel Time Cost along Tweed Valley Way	$1,107,887

5.3.6 Project Benefits

CBA includes only benefits to the Tweed Shire Council residents and public, Tweed Shire Council and NSW State Government. Any benefits acquired by Hanson with respect to shorter travel distances have not been included.

The Tweed Shire Council strategic modelling shows that traffic along TCR increases significantly as a result of residential and business growth in the area. Local congestion and delays can be expected into the future as the volume of traffic increases. Removing TSP trucks from Tweed Coast Road will generate substantial benefits to road users, particularly through savings in travel time, reduction in crash costs and environmental benefits. Benefits to local authority include reduction in Tweed Coast Road Maintenance Costs. As part of this economic analysis, potential benefits were quantitatively evaluated against the Base Case. Benefits quantified include:

- Travel Time Saving along Tweed Coast Road;
- Safety Benefits;
- Environmental Benefits; and
- Tweed Coast Road Maintenance Cost Reduction.

The summary of project benefits and costs are presented in table below.

Economic Results	Total (Undiscounted, 2021 prices)	Present Value (7% discount)
Costs		
Travel Time Cost along Tweed Valley Way	$1,107,887	$453,685
Proposed Roundabout Maintenance Cost	$1,440,000	$595,634
Total Cost	**$2,547,887**	**$1,049,319**
Benefits		
Travel Time Saving along Tweed Coast Road	$4,289,900	$1,269,772
Tweed Coast Road Maintenance Cost Reduction	$1,001,193	$474,300
Safety Benefits	$269,120	$94,197
Environmental Benefits	$1,806,952	$747,418
Total Benefit	**$7,367,165**	**$2,585,686**
NPV @7%		**$1,536,367**

The present value of benefits associated with Project Case were calculated over a 30-year evaluation period based on a seven per cent real discount rate.

5.3.7 Economic Appraisal Results

Cost-benefit analysis has determined that the project will generate a Present Value (PV) total of $2.59M in benefits at a Present Value cost of $1.05M above the Base Case, providing a NPV of $1.54M and a Benefit-Cost Ratio (BCR) of 2.46. The majority of benefits relate to travel time savings along Tweed Coast Road via a reduction in travel time, maintenance costs reduction, environmental and safety benefits.

Sensitivity testing of the BCR inputs identified a BCR range of 1.64 to 3.70 for the following tests:

- The NPV discount rate was tested at 3%, 7% (original assessment) and 10%;
- The benefit was reduced by 20% and cost increased by 20%; and
- The benefit was increased by 20% and cost reduced by 20%.

5.3.8 Conclusions

This Economic Evaluation assessment has demonstrated that the proposed Tweed Sand Plant haulage route via Tweed Valley Way including upgrade of the Tweed Valley Way / ABLP intersection does provide economic benefits to the local community which outweighs its cost to residents, local and state governments.

5.4 Description of the Types of Haulage Vehicles

A description of the types of vehicles to be used for transportation of sand products from the proposed development are shown in the following Table 5.1.

Table 5.1 Description of the Types of Vehicles to be used for Transportation of Sand Products

Vehicle Description	PBS Vehicle configuration	Maximum length	GCM	Engine Horsepower	Transmission Model/Rear Axle Ratio
	Three Axle prime mover and three axle semi- trailer	20.0m	44 Tonnes	435	mDrive / 3.42
	Three Axle truck and Three Axle dog trailer	20.0m	49.5 Tonnes	500	mDrive / 3.42
	Three Axle Truck and Four Axle dog trailer	20.0m	57.5 Tonnes	535	mDrive / 3.42
	Nine Axle B-Double	26.0m	62.5 Tonnes		

Fully laden at maximum GCM 57.5 tonnes (PBS truck & quad trailer) represents the worst case scenario with respect to acceleration. To provide for larger vehicles if required for future use along dedicated freight haulage routes, provision for haulage by 26 metre B-Doubles has been allowed and swept paths within the Tweed Valley Way / Pacific Motorway Interchange have been checked

with the design vehicles plus the 26 metre B-Double vehicles. Refer Appendix A Drawings: BE190043: SK126 – SK128

5.5 Public and Active Transport

This section investigates the impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling as part of the DA application within the life of the project.

All site, ancillary and haulage vehicles will access the Tweed Sand Plant site via from Tweed Valley Way to the west. No vehicular access is proposed via Altona Road, Crescent Street and Tweed Coast Road to the east. The operations associated with the dredging, stockpiling and loading of the product on site do not require extensive personnel and there is minimal parking of haulage vehicles on site over night at the end of shifts. There are no public and active transport opportunities associated with the proposed access arrangements at the western side of the development and Tweed Valley Way. If fact, pedestrian or cyclist activities in proximity to the interchange are not contemplated or currently exist.

6. Traffic Demands

In order to assess the relative impact of the proposal on the surrounding road network, it is necessary to define the existing traffic demands on the road network and estimate future traffic demands on key intersections.

This section of the report details the existing traffic demands as defined in traffic surveys and forecasts these to the future assessment years. These volumes represent the “Pre-Development” scenario.

The traffic generated by the proposed development is estimated, along with its distribution across the surrounding road network. These volumes are added to the “Pre-Development” scenario to provide the “Post Development” traffic scenario.

6.1 Pre-Development Traffic

A traffic survey data and background growth rates have been used to establish background traffic demands. As mentioned in Section 4 of this report, traffic surveys have been undertaken at the following intersections:

- Tweed Valley Way / ABLP Property Site Access priority T-intersection; and
- Tweed Valley Way / Service Station Access Roundabout.

Traffic counts used for analysis have been provided in Appendix B. Figure 6.1 below shows a summary of surveyed AM and PM weekday Peak Hour traffic volumes (March 2020).

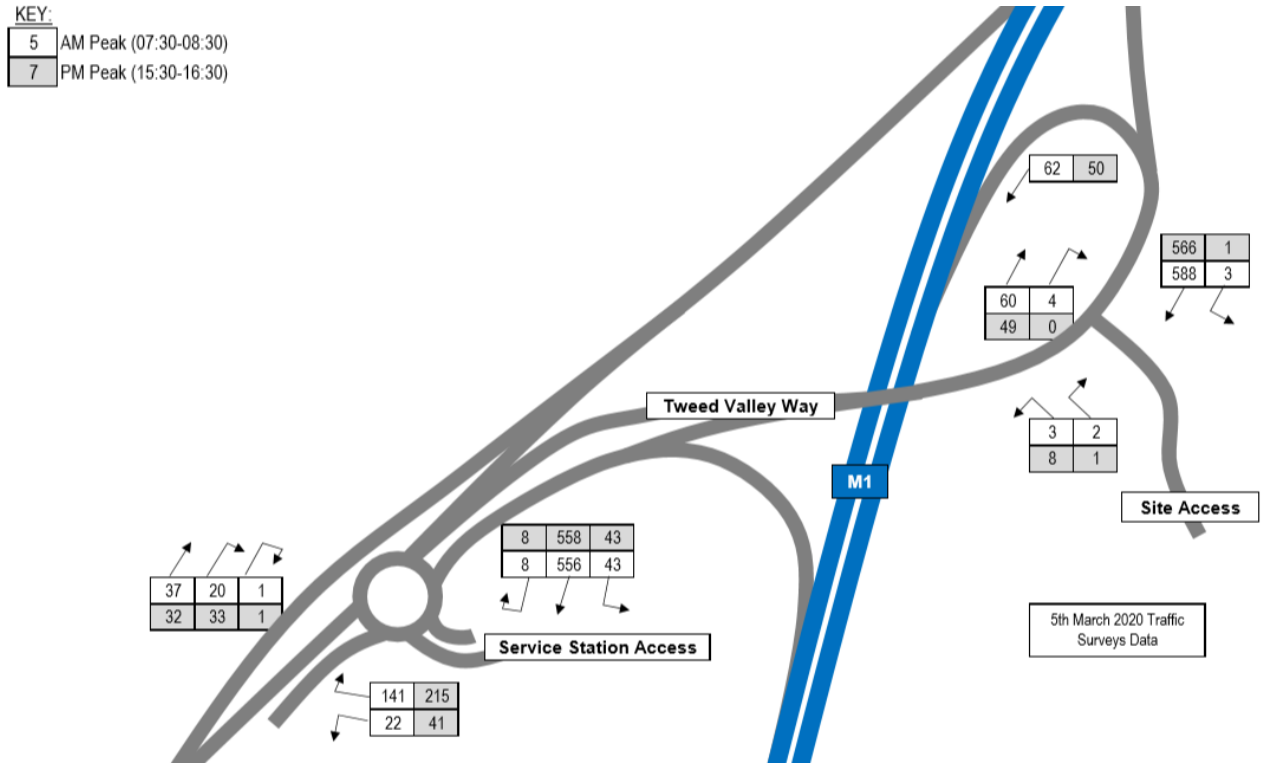


Figure 6.1 Surveyed 2020 Traffic Flows AM and PM Peak

6.1.1 Seasonal Variations in Traffic

The historical traffic volumes along the M1 Pacific Motorway north from the interchange with Tweed Valley Way were investigated to identify the seasonal variation in traffic.

Table 6.1 2019 Annual Average Traffic Volumes M1 (Eastbound)

Months	2019 Daily Total	AM Peak	PM Peak
January	**22,981**	**1,770**	**1,850**
February	21,703	1,528	1,767
March	**20,615**	**1,512**	**1,657**
April	19,970	1,429	1,592
May	20,876	1,457	1,665
June	20,013	1,433	1,605
July	21,603	1,573	1,762
August	21,024	1,456	1,726
September	21,252	1,528	1,716
October	21,521	1,597	1,721
November	21,496	1,571	1,736
December	21,539	1,680	1,677

As shown in Table 6.1 above, the highest daily volumes were recorded in January 2019 with 22,981 vehicles traveling eastbound along the M1 Pacific Motorway.

As the traffic surveys were undertaken in March, the percentage variations in traffic volumes relative to March volumes were calculated as shown in Figure 6.2 below for each month in 2019.

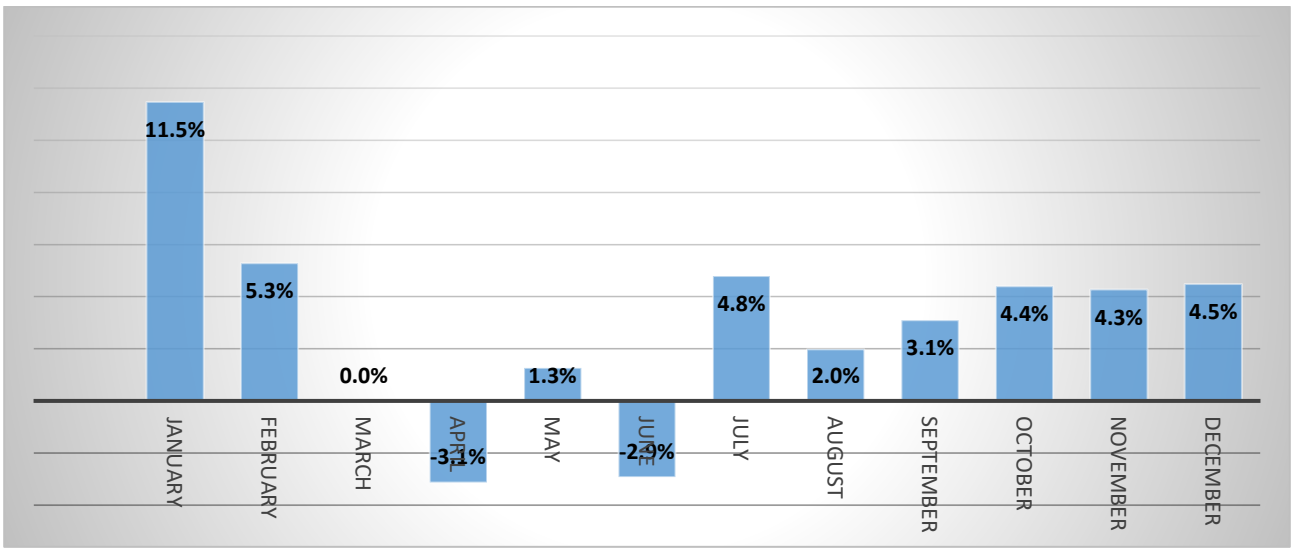


Figure 6.2 2019 Monthly Variation in Traffic along the M1 relative Traffic Recorded in March

As can be seen in Figure 6.2 above, traffic volumes recorded in March 2019 are 11.5% lower than highest traffic volumes recorded in January 2019 traffic surveys.

Table 6.2 below shows the January 2019 Peak hour traffic comparison relative to 2019 March data.

Table 6.2 January 2019 Peak hour traffic comparison relative to 2019 March data

	Highest Recorded Volumes (Jan 2019)	Mar-19	Difference	% Difference
AM Peak	1,770	1,512	258	**17.1%**
PM Peak	1,850	1,657	193	**11.6%**
Daily	22,981	20,615	2366	**11.5%**

6.1.2 100th Highest Hour Volumes.

The above percentages have been applied to the 2019 surveyed AM and PM Peak traffic volumes (Refer Figure 6.1) to ensure that the traffic impact assessment is robust and accounts for seasonal variations in traffic volumes. Including the 30% added to the trips for the ABLP construction, the above represents the worst-case scenario analysis of development impacts under 100th Highest Hour Volumes.

The following Figure 6.3 shows the adjusted 2020 traffic volumes which formed the basis for the traffic impact assessment.

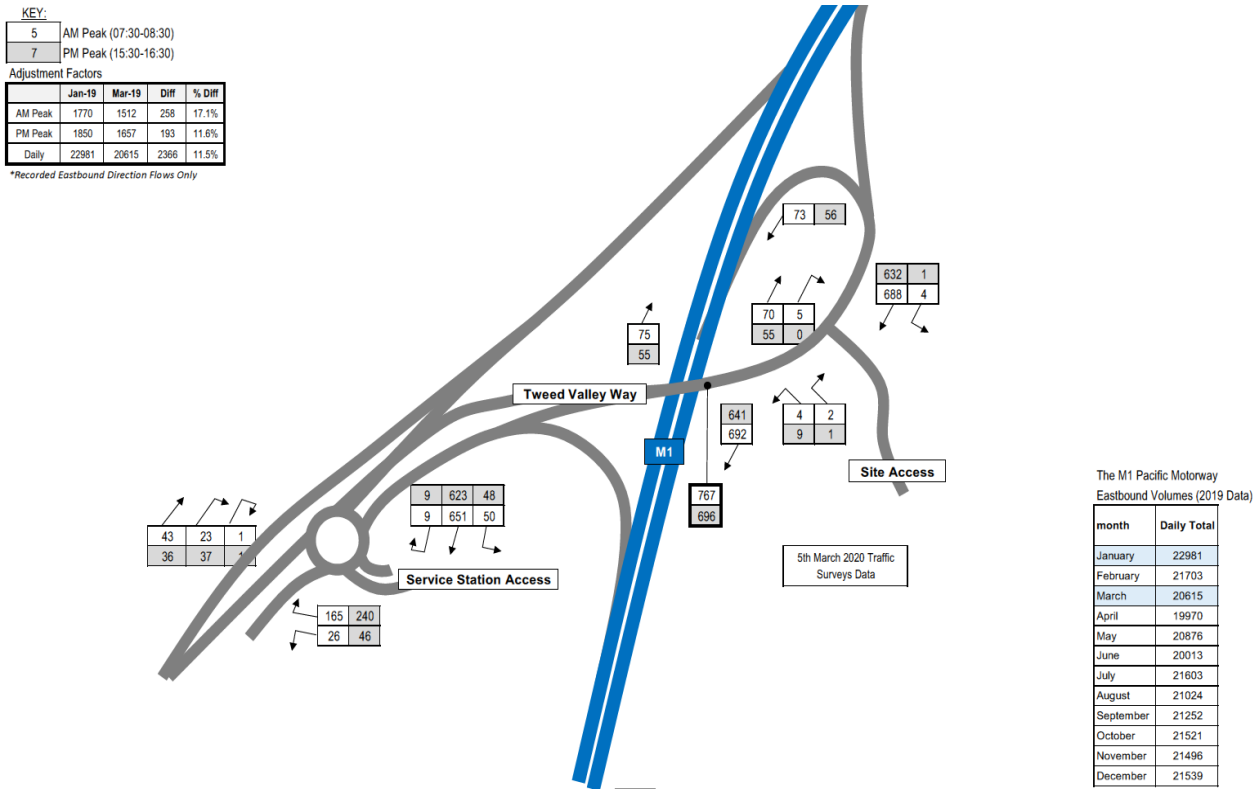


Figure 6.3 Adjusted 2020 Traffic Flows for 100th Highest Hour Volumes.

6.1.3 Background Traffic Growth Rates

The 0.60% p.a. compound traffic growth rate for Tweed Valley Way has been used in the assessment in line with the Tweed Shire Council recommendations. The development is expected to be operational by 2022 and the 10-year design horizon in accordance with TfNSW recommendations, is therefore 2032. For a robust assessment, a 20-year horizon out to 2042 has also been adopted.

The project life would be up to approximately 30 years, accessing an available resource of approximately 30-35 million tonnes. The traffic forecast above 30 years is not recommended due to uncertainty of the traffic forecast over the extended time period.

Table 6.3 below summarises the compound growth rates used in the traffic impact assessment.

Table 6.3 Traffic Growth Factors

Growth Period	2020 to 2022	2020 to 2032	2020 to 2042
Traffic Growth Factor	1.012	1.074	1.140

6.1.4 Future Year Traffic Volumes

Growth factors summarised in Table 6.3 have been applied to the 2020 adjusted surveyed traffic flows (Refer Figure 6.1) to identify future traffic flows in 2022, 2032 and 2042. The resultant future traffic for the year of 2022, 2032 and 2042 AM and PM peak hours is shown in the Figure 6.4, Figure 6.5 and Figure 6.6 respectively.

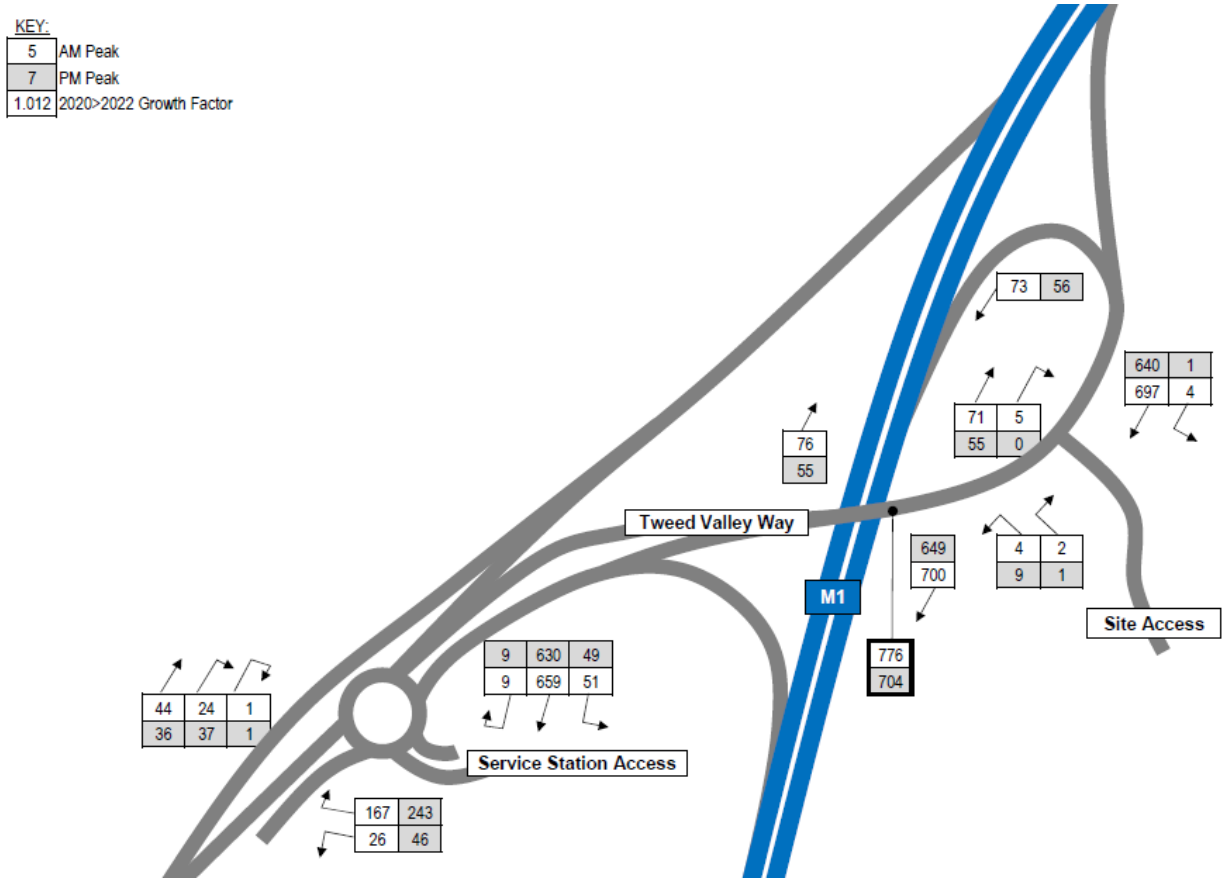


Figure 6.4 2022 Background Traffic Flows Peak Hours

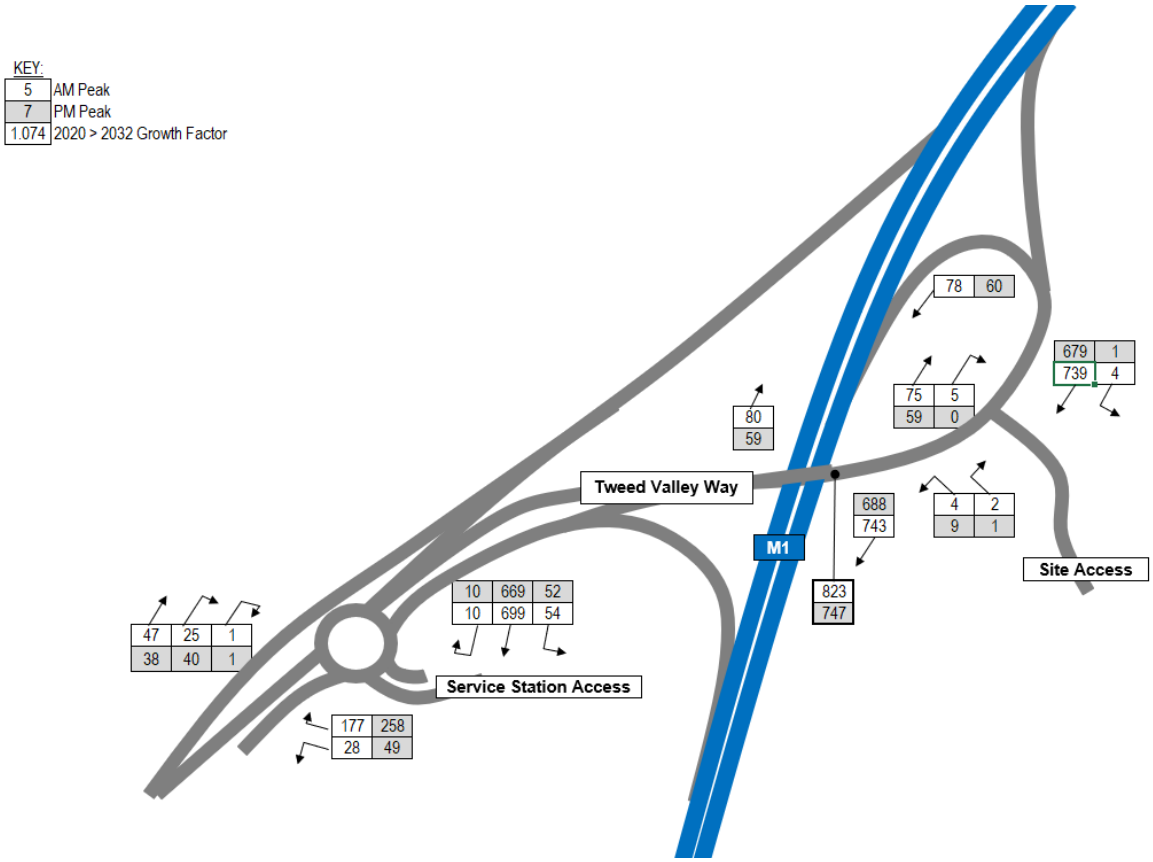


Figure 6.5 2032 'Pre-development' Traffic Flows Peak Hours

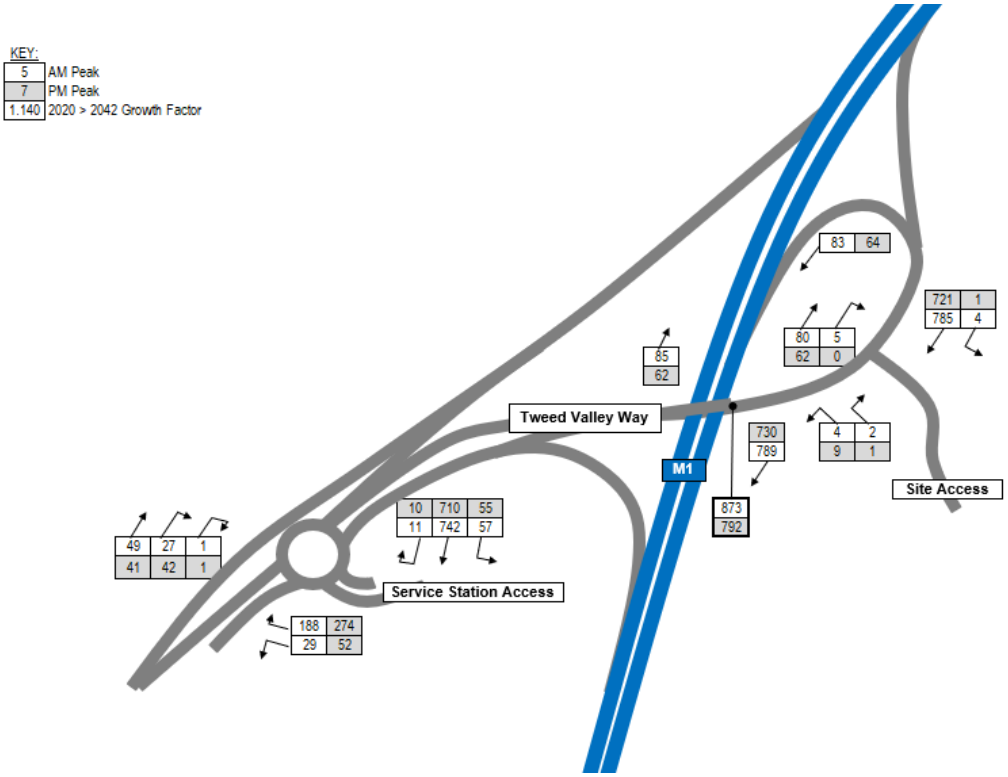


Figure 6.6 2042 'Pre-development' Traffic Flows Peak Hours

6.1.5 Future Year Traffic Volumes with Committed Development

As mentioned earlier, it is anticipated that 2,000,000 cu.m of material will be hauled by ABLP committed development site over four years up to 2025. Consequently, the committed development traffic volumes have been combined with the 2022 assessment year (previous Figure 6.4). Figure 6.7 shows 'Pre-development' Traffic Flows for the 2022 assessment year with the flows representing the reference case against which the implications of the proposed development can be assessed.

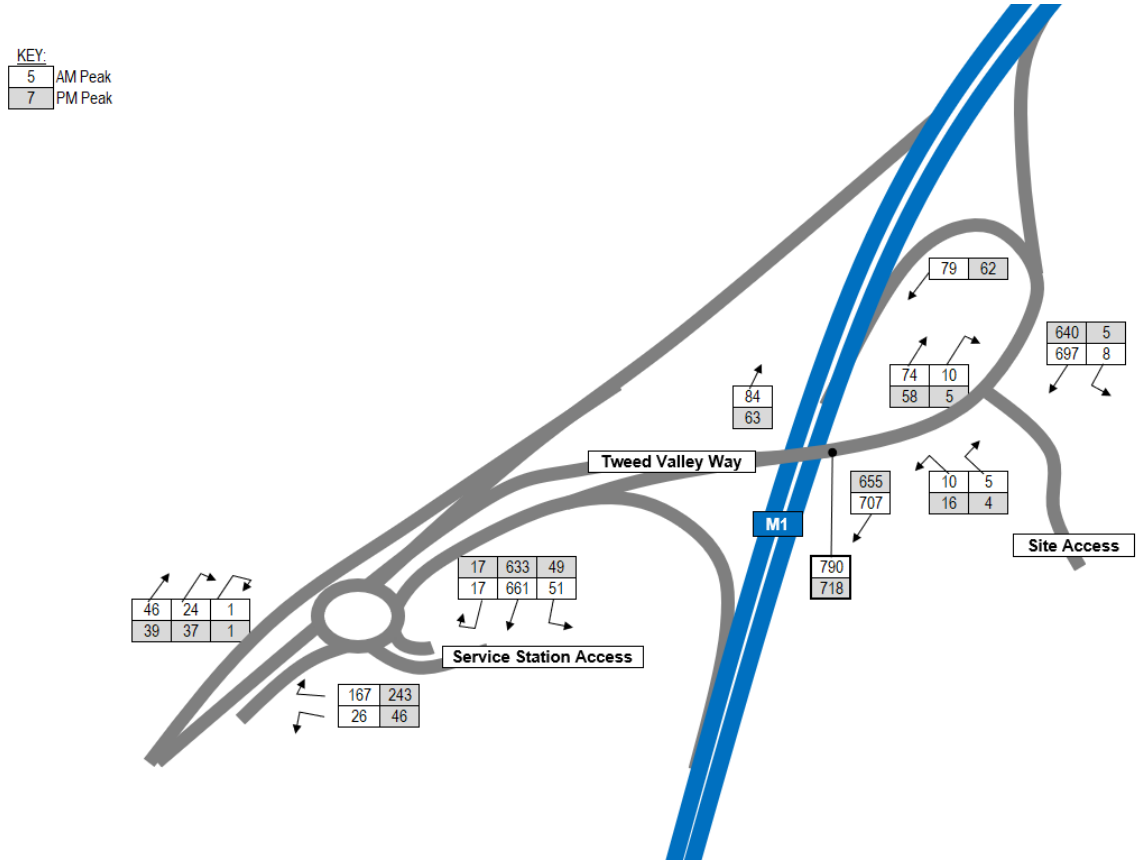


Figure 6.7 2022 Base with ABLP Property Committed Development

For robust assessment ABLP traffic volume flows have been increased by 30% to account for the fluctuations in traffic.

6.2 Development Traffic

6.2.1 Trip Generation

The existing TSP trip generation for the site based on the current maximum 500,000 tpa was previously shown in Table 2.3. In summary, TSP must not dispatch more than 18 laden trucks from the site in any hour following the upgrade of Altona Road and the Crescent Street/Tweed Coast Road intersection.

It is important to note that the existing site truck movements to and from the development are restricted between 7:00am to 5:00pm Monday to Friday and 7:00am to 12.00pm on Saturday with no operation on Sundays and public holidays.

The additional traffic generated by the proposed redevelopment is calculated pro-rata on the basis of the anticipated increase in haulage trucks compared to the existing traffic volumes generated by the site and volumes generated by a similar site with 24 hours operation.

As TSP is proposing to increase to 24 hours operation, it is considered appropriate to use Hanson's Lytton Sand Plant heavy vehicle movement data which benefits from 24hr operation and similar sand extraction per annum (up to 450,000 tpa).

It is proposed to increase the truck movement period to 24 hours as part of the redevelopment proposal. This reduces the peak hour truck movements as truck volumes are spread over the longer period. For comparison purposes and to forecast future demand, 2018/2019 data for Hanson's Lytton Sand Plant, which extracts up to 450,000 tpa of sand has been used. Figure 6.8 below shows the typical daily trip generation for the Lytton Sand Plant.

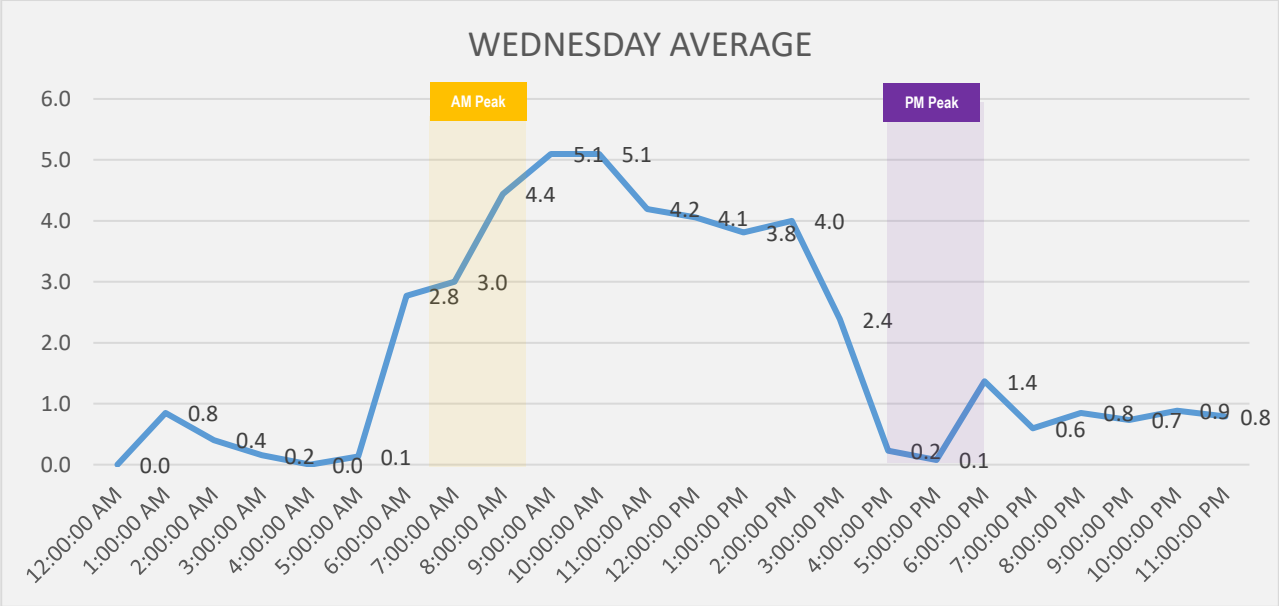


Figure 6.8 Recorded Lytton Sand Plant Wednesday Average Traffic Volumes (Arrivals Only)

As can be seen in the above figure, the highest trip generation occurs between 09:00 and 11:00AM, which is outside the typical network morning peak period (07:00-09:00). However, for robust assessment, the highest recorded trip generation from the site in a year (13 laden trucks dispatched from the site) has been used for the assessment. Table 6.4 below shows the highest recorded trip generation at Lytton Sand Plant.

Table 6.4 Recorded Lytton Sand Plant Truck Movements

Extraction (tonnes)	Plant	In	Out	Two-way
424,025	Highest recorded Lytton Sand Plant Truck Movements (2018 data)	13	13	26
450,000	Pro-rata to 450,000 tonnes	14	14	28

It is worth to note that the highest recorded trips for the 424,025 tonnes have been adopted to pro rata the equivalent number of trips applicable to 450,000 tonnes.

The proposed Tweed Sand Plant redevelopment trip generation was calculated by adding the existing TSP trips (approved 500,000 tonnes) (Refer Table 2.3) and Lytton Sand Plant traffic volumes (450,000 tonnes) (Refer Table 6.3) as summarised in Table 6.5 below.

Table 6.5 Forecast Tweed Sand Plant Redevelopment Truck Movements

Extraction	Plant	In	Out	Two-way
500,000	TSP Approved truck movements	18	18	36
450,000	Lytton Sand Plant truck movements	14	14	28
950,000	**Forecast Tweed Sand Plant Redevelopment**	**32**	**32**	**64**

As show in Table 6.5 above, the proposed TSP redevelopment is forecast to generate 64 two-way truck movements per hour. In reality this is likely to be a worst-case value as the highest trip generation occurs outside the traditional road network peak hours as presented in the previous Figure 6.8.

Annual trip generation is based on the Tweed Sand Plant trip generation pro-rata to account for the increased extraction from the TSP. Table 6.6 shows the pro-rata calculations of the existing annual trip generation year 2020-2021.

Table 6.6 Forecast Tweed Sand Plant Redevelopment Annual Truck Movements

Year	Two-way Volumes	Yearly tonnage	Minimum Load per truck (Tonnes)	Maximum Load per truck (Tonnes)	Average Load per truck (Tonnes)	Future Extraction (Tonnes)	Forecast Two Way Volumes based on 950,000 extraction tonnes (pro-rata)
2020-2021	11,780	214,932	11.02	40.94	36.49	950,000	**52,068**

In summary, the proposed TPS expansion site is forecast to generate approximately 52,068 two-way vehicles per year.

6.2.2 Trip Distribution

Trip distribution for the proposed TSP redevelopment is based on the combined Lytton Sand Plant and the existing Tweed Sand Plant key destinations.

It is considered that the geographical spread of the key destinations for delivery are unlikely to be significantly different from those of the existing two plants. For simplicity this existing distribution information was used to determine the distribution of the new truck trips associated with the site redevelopment.

The distribution of trips to the local road network has been undertaken using Google Maps, assigning the trip to the most logical / shortest route available as shown in Table 6.7.

Table 6.7 Combined Lytton Sand Plant and Tweed Sand Plant Key Destinations

Plant	Trucks	Destination based on 2018 data	Northbound	Southbound
Lytton Sand Plant	1	*CLOSED NOOSA HEADS CONCRETE	1	
	1	{CREEK RD}		1
	192	CABOOLTURE CONCRETE {ROSEBY ROAD}	192	
	267	CALOUNDRA CONCRETE	267	
	871	COOPERS PLAINS CONCRETE {NORBURY ST	871	
	13	FERNY GROVE QUARRY	13	
	3	GLASSHOUSE MOUNTAINS QUARRY	3	
	23	HANSON LABRADOR CONCRETE	23	
	574	HYMIX SPRINGWOOD	574	
	557	HYMIX WACOL	557	
	20	HYMIX BURLEIGH HEADS {WILLIAM BANKS	20	
	393	HYMIX CLEVELAND	393	
	735	HYMIX NARANGBA	735	
	827	HYMIX PARK RIDGE {MT LINDESAY HWY}	827	
	21	HYMIX SOUTHPORT	21	
	710	HYMIX WINDSOR	710	
	427	IPSWICH CONCRETE {BRIGGS RD}	427	
	954	JINDALEE CONCRETE {SINNAMON RD}	954	
	736	LYTTON CONCRETE {ANTON RD}	736	
	588	MAROOCHYDORE CONCRETE	588	
	513	NORTHGATE CONCRETE {NUDGEE RD}	513	
	203	EXTERNAL VARIOUS*	203	
	567	SPRINGWOOD CONCRETE {HANSON}	567	
	36	STAPYLTON CONCRETE {ELLIOT DR}	36	
	690	STRATHPINE CONCRETE {DUNTROON ST}	690	
	2,539	WEST END CONCRETE {NOTT ST}	2,539	
	1	ZONE 1 GATE 56 EASTBOUND {LOGAN MWY	1	
Tweed Sand Plant	360	BALLINA CONCRETE		360
	669	BURLEIGH CONCRETE (HANSON)	669	
	135	BYRON BAY CONCRETE		135
	20	COOPERS PLAINS CONCRETE {NORBURY ST	20	
	285	EXBIN TWEED - BENOWA {BORAL BENOWA}	285	
	165	EXBIN TWEED - CHINDERAH {BORAL CHIN	165	
	558	EXBIN TWEED SANDS - Q CRETE BURLEIGH	558	
	542	HANSON LABRADOR CONCRETE	542	
	522	HYMIX BURLEIGH HEADS {WILLIAM BANKS	522	
	809	HYMIX CHINDERAH	809	
	577	HYMIX SOUTHPORT	577	
	9	JINDALEE CONCRETE {SINNAMON RD}	9	
	168	LISMORE CONCRETE		168
	18	LYTTON CONCRETE {ANTON RD}	18	
	506	NERANG QUARRY	506	
	127	Q EXBIN TWEED - WEST BURLEIGH QUARRY	127	
	1	Q WESTFIELD {FOXWELL RD}	1	
	679	STAPYLTON CONCRETE {ELLIOT DR}	679	
%			96.4%	3.6%

The adopted trip distribution is summarised as follows:

- Northbound 95%
- Southbound 5%

The above trip generation and trip distribution data has then been combined to represent the likely distribution and volume of highway peak hour trips associated with the proposed TSP redevelopment. The assignment of the development trips onto the local road network is shown in Figure 6.9 below.

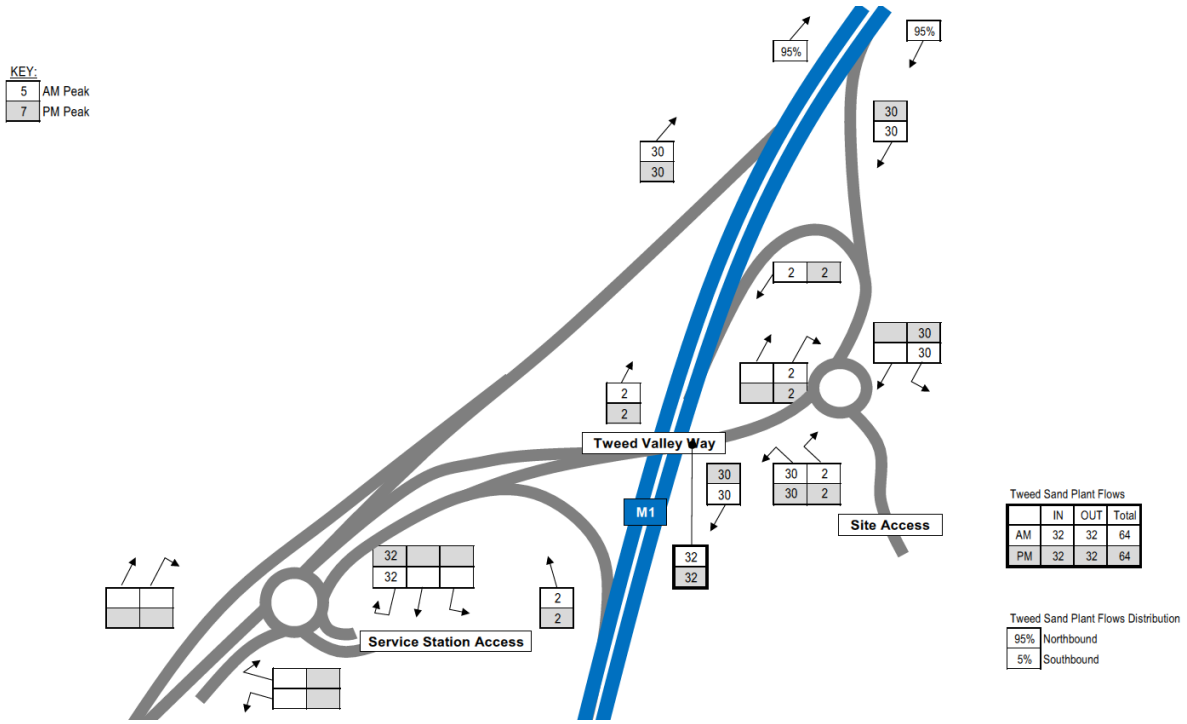


Figure 6.9 Development Trips Assignment

As per TfNSW request, sensitivity testing was undertaken to ensure a robust assessment.

The adopted development trip distribution for sensitivity testing is summarised as follows:

- Northbound (Sensitivity Testing) 50%
- Southbound (Sensitivity Testing) 50%

Figure 6.10 shows the results.

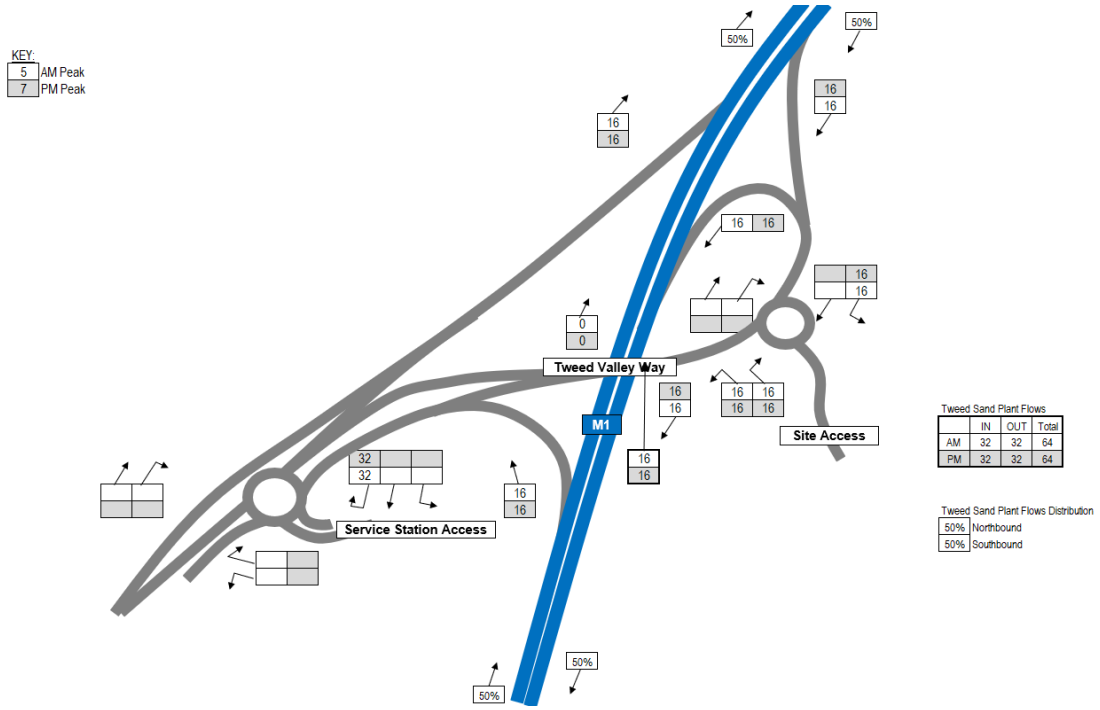


Figure 6.10 Development Trips Assignment (Sensitivity Testing)

6.3 Post Development Traffic

The development traffic (Figure 6.9) has been added to the Pre-Development traffic demands Figure 6.6 and Figure 6.7 to provide the Post Development traffic scenarios. The Post Development traffic demands for the 2022, 2032 and 2042 design years are shown in Figure 6.11, Figure 6.12 and Figure 6.13 respectively with all traffic flow diagrams provided in Appendix C.

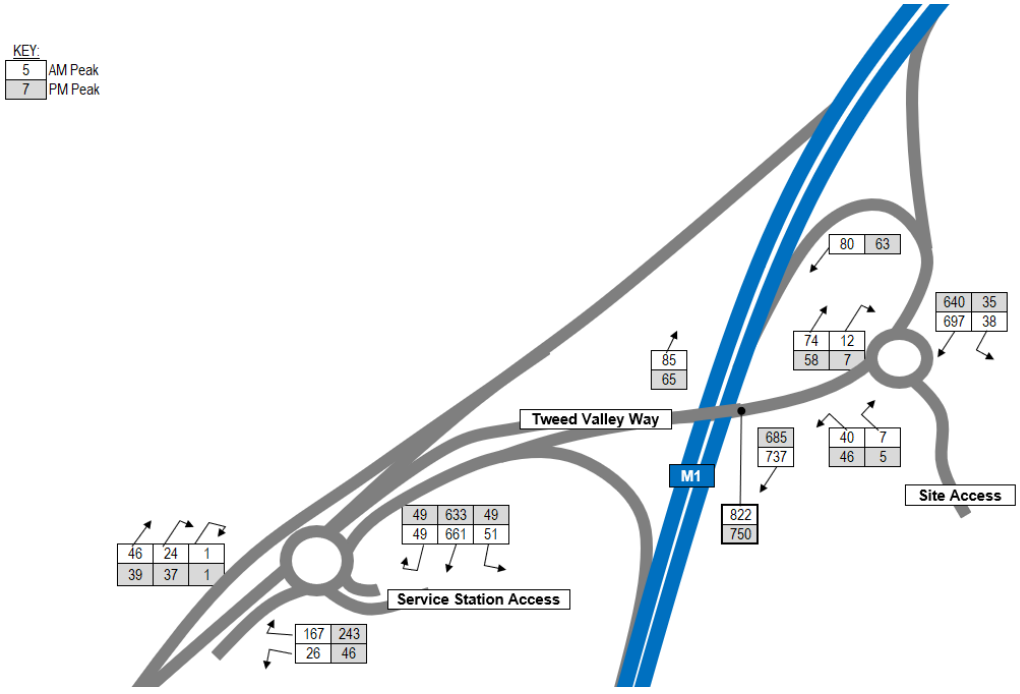


Figure 6.11 2022 'Post-development' Traffic Flows Peak Hours

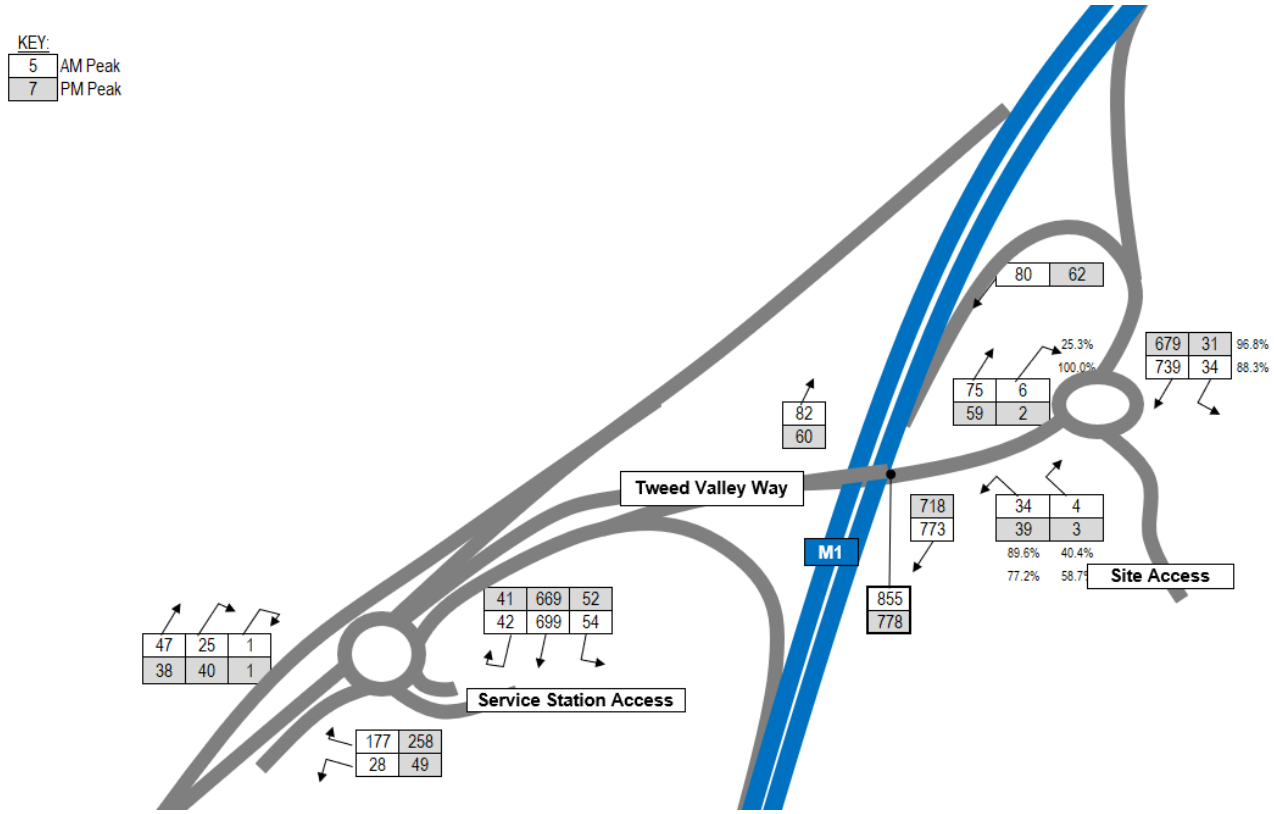


Figure 6.12 2032 'Post-development' Traffic Flows Peak Hours

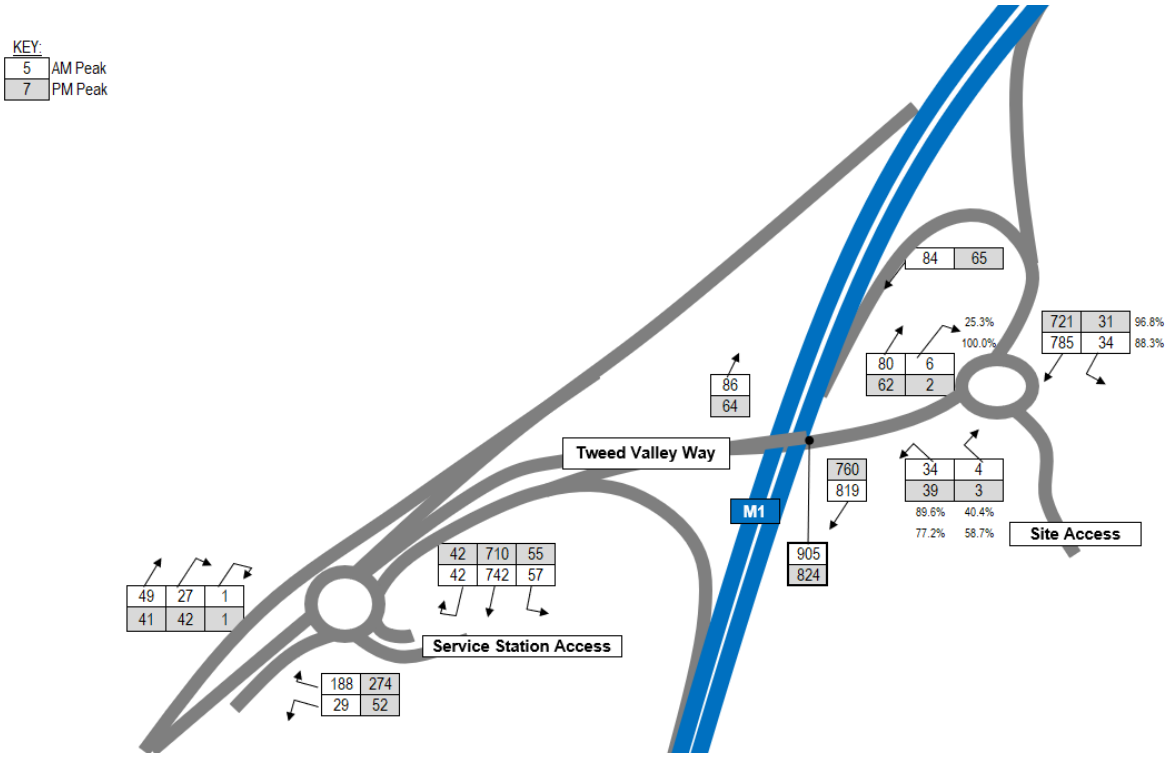


Figure 6.13 2042 'Post-development' Traffic Flows Peak Hours

The development traffic with higher southbound truck trip distribution (Figure 6.10) has been added to the Pre-Development traffic demands in 2042 assessment year (Figure 6.6) to provide the Post Development traffic scenarios for sensitivity testing. The Sensitivity Testing Post Development traffic demands for the 2042 design years are shown in Figure 6.14.

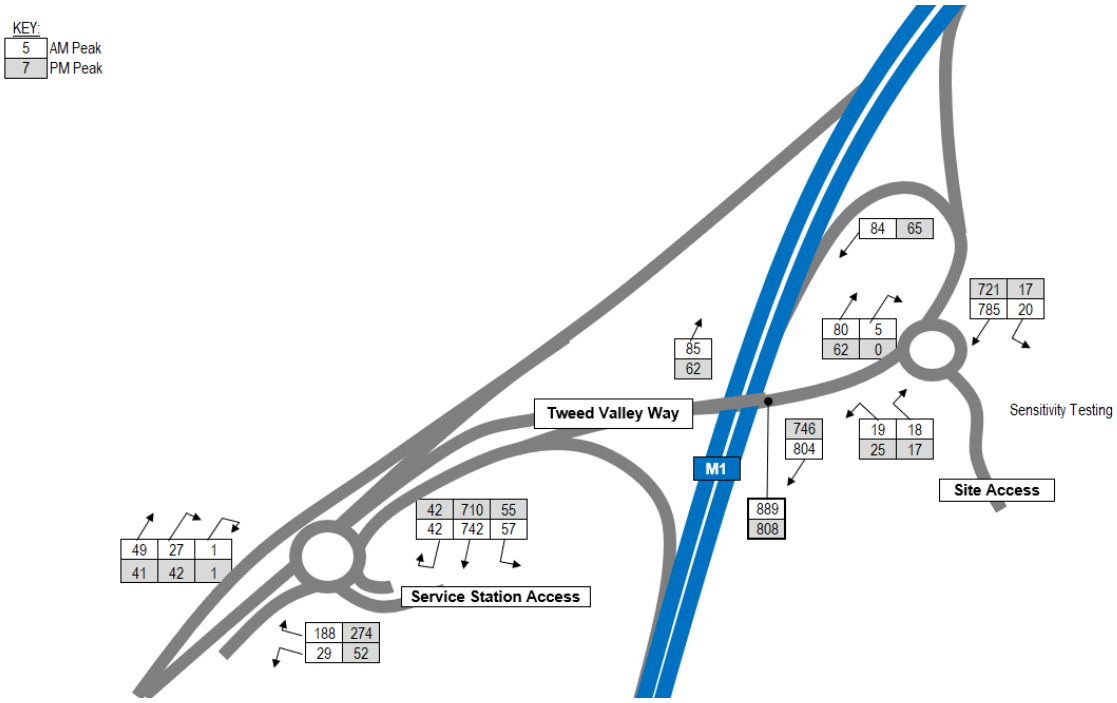


Figure 6.14 2042 'Post-development' Traffic Flows (Sensitivity Testing) Peak Hours.

The following Figure 6.15 shows the 2022 base Heavy vehicle percentages

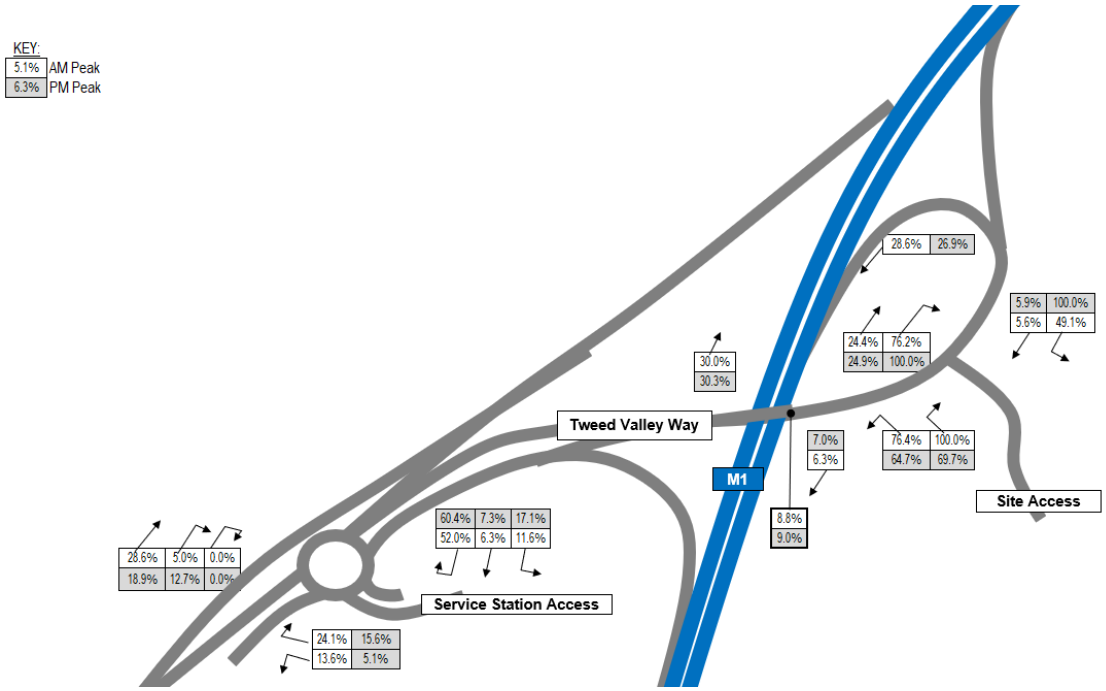


Figure 6.15 2022 Heavy Vehicle Percentages Base 2020 Peak Hours.

7. Operational Assessment

The following assessment scenarios have been undertaken at the Tweed Valley Way / ABLP Property Site Access priority T-intersection and the Tweed Valley Way / Service Station Access roundabout:

- 2020 – existing situation – Figure 6.1;
- 2022 – pre-development scenario (year of opening) – Figure 6.7;
- 2022 – post -development scenario (year of opening) – Figure 6.11;
- 2032 – pre-development scenario (10-year design horizon) –Figure 6.5;
- 2032 – post-development scenario (10-year design horizon) – Figure 6.12;
- 2042 – pre-development scenario (20-year design horizon) – Figure 6.6;
- 2042 – post-development scenario (20-year design horizon) – Figure 6.13; and
- 2042 – post-development sensitivity scenario (20-year design horizon) – Figure 6.14.

7.1 Intersection Capacity Analysis

Capacity analysis of the surrounding intersections has been carried out utilising SIDRA INTERSECTION 9 traffic modelling software. This is an advanced micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive models and can assess intersections within a network.

The key performance criteria considered are Degree of Saturation (DOS), Delays and Queuing. For a priority-controlled intersection, a DOS in excess of 80% is considered over capacity, 85% for roundabouts and 90% for signalised intersections. A DOS of 90% is the recommended upper limit as above this value performance quickly deteriorates. For priority-controlled intersections, a delay up to 42 seconds is considered satisfactory and a delay greater than 56 seconds is considered over capacity (*Guide to Traffic Generating Developments*, Roads and Traffic Authority, 2002, Tab. 4.2). Acceptable queue lengths are determined on a site by site basis, considering available storage.

7.2 Tweed Valley Way / ABLP Property Site Access Priority T-intersection

The diagrammatic layout of the intersection as well as aerial photo of the existing intersection layout, are shown in the following Figure 7.1.

Figure 7.1 Tweed Valley Way / ABLP Property Site Access Intersection (Existing Layout)

Table 7.1 shows the intersection performance indicators for the Tweed Valley Way / ABLP Property Site intersection for the surveyed 2020 year.

Table 7.1 Tweed Valley Way / ABLP Property Site Access Intersection SIDRA Results – Year 2020

Approach / Movement	Year 2020 without development					
	AM Peak Hour			PM Peak Hour		
	DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
Site Access	0.026	19.3	0.9	0.024	12.7	0.8
Tweed Valley Way (North East)	0.393	0.2	0.0	0.359	0.1	0.0
Tweed Valley Way (South West)	0.047	0.9	0.4	0.037	0.2	0.0
Intersection overall	0.393	0.4	0.9	0.359	0.3	0.8

SIDRA intersection capacity analysis has demonstrated that the existing Tweed Valley Way / ABLP property intersection currently works within its theoretical operational capacity of 80%. The junction is operating within a satisfactory Level of Service. The Degree of Saturation during AM Peak hour reached a maximum Degree of Saturation (DOS) of 39.3%. 35.2 seconds average delay is achieved for the right turn movement from ABLP site access road into the Tweed Valley Way.

To check the performance on a hypothetical upgraded T junction as the ultimate layout with the TSP development traffic superimposed, for comparison it has been assumed that there will be requirement to provide an Auxiliary Left-turn Lane Treatment (AUL) at Tweed Valley Way northern approach to ensure no disruption to through traffic and that appropriate road safety outcomes are achieved. Consequently, SIDRA analysis for ‘’Post Development” scenario includes AUL lane as shown in Figure 7.2.

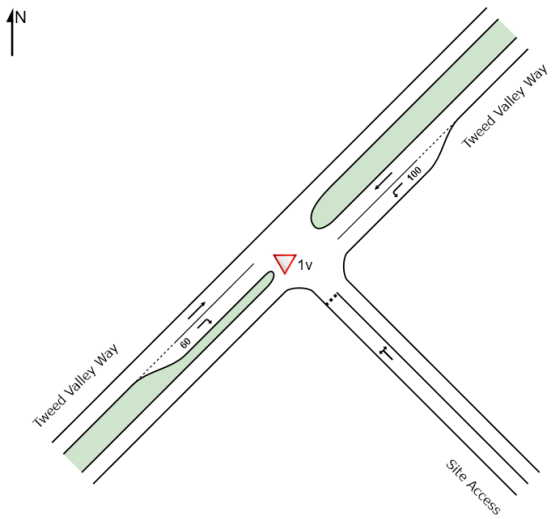


Figure 7.2 Tweed Valley Way / ABLP Property Site Access Intersection (Proposed Layout)

Table 7.2 below shows SIDRA results for the Tweed Valley Way / ABLP property intersection for the 2022 Pre and Post Development Scenarios. It is important to note that 2022 Pre and Post development scenarios includes committed development traffic associated with the ABLP property redevelopment.

Table 7.2 Tweed Valley Way / ABLP Property Site Access Intersection SIDRA Results – Year 2022

Peak Hour	Approach / Movement	Year 2022 without development			Year 2022 with development		
		DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
AM	Site Access	0.267	12.1	10.0	0.483	56.5	33.9
	Tweed Valley Way (NE)	0.264	3.2	15.9	0.396	0.5	0.0
	Tweed Valley Way (SW)	0.069	6.2	3.3	0.067	3.4	2.9
	Intersection overall	0.267	5.1	15.9	0.483	3.7	33.9
PM	Site Access	0.368	11.8	14.1	0.354	34.5	23.0
	Tweed Valley Way (NE)	0.262	3.3	16.1	0.365	0.5	0.0
	Tweed Valley Way (SW)	0.077	7.6	3.7	0.042	2.8	2.1
	Intersection overall	0.368	5.8	16.1	0.365	2.9	23.0

SIDRA analysis indicated that with the anticipated background traffic growth for 2022 and additional committed ABLP property development traffic, the intersection is expected to operate within its theoretical operational capacity with DOS reaching 36.8% in the PM Peak. Superimposing the development traffic results in increased DOS marginally to 48.3%. SIDRA analysis confirmed that the Tweed Valley Way / ABLP property intersection performs with high right turn delay 69.1 sec with development traffic superimposed. The delay at the minor road for right turn is above the recommended maximum delay for priority intersections.

Table 7.3 below shows a SIDRA results for Tweed Valley Way / ABLP property intersection for the 2032 Pre and Post Development Scenarios.

Table 7.3 Tweed Valley Way / ABLP property Site Access Intersection SIDRA Results – Year 2032

Peak Hour	Approach / Movement	Year 2032 without development			Year 2032 with development		
		DOS	Delay (s)	Queue (m)	DOS	Delay (s)	Queue (m)
AM	Site Access	0.031	22.3	1.3	0.490	66.72	34.4
	Tweed Valley Way (NE)	0.422	0.2	0.0	0.420	0.5	0.0
	Tweed Valley Way (SW)	0.050	0.9	0.6	0.052	2.6	2.6
	Intersection overall	0.422	0.4	0.7	0.490	3.5	34.4
PM	Site Access	0.023	12.1	0.7	0.372	41.4	24.3
	Tweed Valley Way (NE)	0.388	0.1	0.0	0.387	0.4	0.0
	Tweed Valley Way (SW)	0.039	0.2	0.0	0.047	1.6	1.6
	Intersection overall	0.388	0.3	0.7	0.387	2.7	24.3

In the 2032 without the development scenario, the Tweed Valley Way / ABLP property Site continues to operate within its theoretical operational capacity in all peak hours. The maximum DOS value becomes 46.8% during AM Peak hour. It is worth noting that right turn out from the site becomes challenging, the recorded delay is 41.8secs during AM Peak with LOS E. Under the 2032 with the proposed development scenario, the maximum DOS value increases to 49.0% with the maximum queue length also increasing in the weekday AM peak hour. Due to the through traffic volumes, getting out of the side road is very challenging. LOS F with significant delays at the site access

approach occurs during AM and PM Peak hours with the delays 78.1 secs exceeding the maximum allowable for safe operations.

Table 7.4 below shows SIDRA results for the Tweed Valley Way / ABLP Property intersection for the 2042 Pre and Post Development Scenarios.

Table 7.4 Tweed Valley Way / ABLP property Site Access Intersection SIDRA Results – Year 2042

Peak Hour	Approach / Movement	Year 2042 without development			Year 2042 with development		
		DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
AM	Site Access	0.037	26.0	1.2	0.668	107.7	51.0
	Tweed Valley Way (NE)	0.454	0.2	0.0	0.446	0.5	0.0
	Tweed Valley Way (SW)	0.053	0.9	0.5	0.054	1.8	1.5
	Intersection overall	0.454	0.4	1.2	0.668	4.9	51.0
PM	Site Access	0.024	12.8	0.8	0.431	51.5	28.8
	Tweed Valley Way (NE)	0.412	0.2	0.0	0.410	0.4	0.0
	Tweed Valley Way (SW)	0.041	0.2	0.0	0.042	1.7	1.9
	Intersection overall	0.412	0.3	0.8	1.431	3.0	28.8

In summary the analysis of the Tweed Valley Way / ABLP Property Site intersection showed that with proposed traffic superimpose, the priority intersection fails to operate satisfactorily. An increase in the delay 114.4 secs and queue length 51.0 metres at the Site Access approach was recorded with LOS F for the right turn movement during the AM and PM Peak hours.

To cater for the proposed and existing heavy vehicles movements, it is proposed to upgrade the existing Tweed Valley Way / ABLP property Site Access priority intersection a new roundabout.

7.3 Tweed Valley Way / ABLP Property Site Access Proposed Roundabout

The diagrammatic layout of the proposed roundabout and actual design plan is shown in the following Figure 7.3.

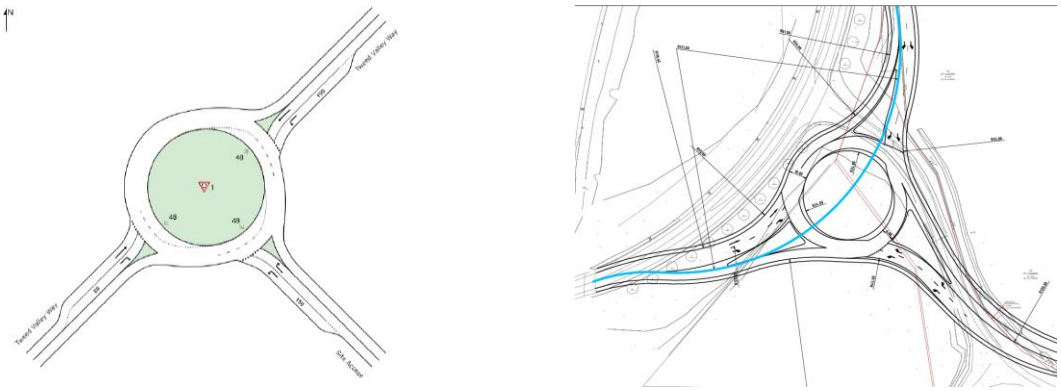


Figure 7.3 Tweed Valley Way / ABLP and TSP Access Proposed Roundabout

Table 7.5 below shows SIDRA results for the proposed Tweed Valley Way / ABLP and TSP access roundabout for the 2022 and 2032 Post Development Scenarios.

Table 7.5 Tweed Valley Way / ABLP and TSP Access Proposed Roundabout SIDRA – 2022 & 2032

Peak Hour	Approach / Movement	Year 2022 with development			Year 2032 with development		
		DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
AM	Site Access	0.118	15.8	11.6	0.106	14.3	10.0
	Tweed Valley Way (NE)	0.468	2.5	21.9	0.443	2.5	19.9
	Tweed Valley Way (SW)	0.058	3.0	2.8	0.055	3.1	2.7
	Intersection overall	0.468	3.0	21.9	0.443	3.0	19.9
PM	Site Access	0.109	10.9	9.0	0.104	12.1	9.1
	Tweed Valley Way (NE)	0.379	2.5	15.2	0.403	2.4	17.2
	Tweed Valley Way (SW)	0.044	3.4	2.2	0.051	2.8	2.9
	Intersection overall	0.379	3.1	15..2	0.403	3.0	17.2

SIDRA analysis indicated that with the proposed roundabout will operate well within its theoretical capacity with the proposed development traffic superimposed. DOS reaching 44.3% in the AM Peak and 40.3% in the PM Peak for the 2032 assessment year is achieved with overall intersection LOS A.

Table 7.6 below shows SIDRA results for Tweed Valley Way / ABLP and TSP access roundabout for the 2042 Post Development Scenarios including sensitivity testing.

Table 7.6 Tweed Valley Way / ABLP and TSP Access Proposed Roundabout SIDRA – 2042

Peak Hour	Approach / Movement	Year 2042 with development			Year 2042 with development (sensitivity testing)		
		DOS	Delay (s)	Queue (m)	DOS	Delay (s)	Queue (m)
AM	Site Access	0.118	15.8	11.6	0.108	12.8	9.6
	Tweed Valley Way (NE)	0.468	2.5	21.9	0.428	2.4	18.7
	Tweed Valley Way (SW)	0.058	3.0	2.8	0.045	2.7	2.2
	Intersection overall	0.468	3.0	21.9	0.428	3.0	18.7
PM	Site Access	0.108	12.8	9.6	0.072	15.8	6.6
	Tweed Valley Way (NE)	0.428	2.4	18.7	0.454	2.6	22.0
	Tweed Valley Way (SW)	0.045	2.7	2.2	0.048	4.4	2.5
	Intersection overall	0.428	3.0	18.7	0.454	3.4	22.0

In the 2042 without the development scenario, the proposed Tweed Valley Way / ABLP roundabout continues to operate within its theoretical operational capacity in all peak hours. The maximum DOS value becomes 46.8% during AM Peak hour.

7.4 Tweed Valley Way / Service Station Access roundabout

The schematic layout used for the 2022, 2032 and 2042 intersection analysis is shown in the following Figure 7.4 alongside the aerial photograph of existing roundabout.

Figure 7.4 Tweed Valley Way / Service Station Roundabout (Existing Layout)

A SIDRA summary of the operation of the existing roundabout is presented in Table 7.7 below.

Table 7.7 Tweed Valley Way / Service Station Roundabout SIDRA Results – Year 2020

Approach / Movement	Year 2020 without development					
	AM Peak Hour			PM Peak Hour		
	DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
Service Station	0.272	11.0	10.5	0.333	11.0	11.3
Tweed Valley Way (North East)	0.230	2.7	11.4	0.229	2.7	11.8
Tweed Valley Way (South West)	0.064	5.6	3.2	0.071	7.1	3.4
Intersection overall	0.272	4.5	11.4	0.333	5.3	11.8

The existing roundabout operates within its theoretical capacity during AM and PM peak hours. The maximum DOS value of 33.3% and an associated average queue length of approximately 11.3 vehicles is reached in 2020 assessment year during PM Peak hour. The intersection currently operates with LOS A during AM Peak and PM Peak hours. A SIDRA outputs for the 2022 assessment year scenario are summarised in Table 7.8 below.

Table 7.8 Tweed Valley Way / Service Station Roundabout SIDRA Results – Year 2022

Peak Hour	Approach / Movement	Year 2022 without development			Year 2022 with development		
		DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
AM	Service Station	0.333	11.0	11.3	0.267	12.1	10.0
	Tweed Valley Way (NE)	0.229	2.7	11.8	0.264	3.2	15.9
	Tweed Valley Way (SW)	0.071	10.9	3.4	0.069	6.2	3.3
	Intersection overall	0.333	11.0	11.8	0.267	5.1	15.9
PM	Service Station	0.370	11.7	14.4	0.368	11.8	14.1
	Tweed Valley Way (NE)	0.232	2.7	12.1	0.262	3.3	16.1

	Tweed Valley Way (SW)	0.073	11.0	3.6	0.077	7.6	3.7
	Intersection overall	0.370	11.7	14.1	0.368	5.8	16.1

As can be seen in Table 7.8, the intersection operation in the 2022 without the proposed development scenario is expected to operate well within its theoretical operational capacity. With proposed development traffic superimposed, the roundabout is still expected to operate well within its theoretical capacity both during AM and PM Peak hours.

As shown in Table 7.9 above, the Tweed Valley Way / Service Station Roundabout is forecast to operate within its theoretical capacity in 2032 assessment year.

Table 7.9 Tweed Valley Way / Service Station Roundabout SIDRA Results – Year 2032

Peak Hour	Approach / Movement	Year 2032 without development			Year 2032 with development		
		DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
AM	Service Station	0.297	12.2	11.6	0.288	12.2	10.9
	Tweed Valley Way (NE)	0.247	2.6	12.6	0.276	3.2	17.3
	Tweed Valley Way (SW)	0.069	5.9	3.4	0.070	6.3	3.4
	Intersection overall	0.297	4.8	12.6	0.288	5.1	17.3
PM	Service Station	0.410	12.3	17.0	0.398	12.1	16.0
	Tweed Valley Way (NE)	0.266	2.7	13.6	0.278	3.2	16.7
	Tweed Valley Way (SW)	0.076	7.5	3.7	0.079	7.8	3.8
	Intersection overall	0.410	5.5	17.0	0.398	5.8	16.7

As can be seen in Table 7.9, the Tweed Valley Way / Service Station roundabout is expected to operate well within its theoretical operational capacity with the proposed development traffic superimposed in the 2032 assessment year. Table 7.10 shows the Tweed Valley Way / Service Station Roundabout forecast operation in 2042 assessment year.

Table 7.10 Tweed Valley Way / Service Station Roundabout SIDRA Results – Year 2042

Peak Hour	Approach / Movement	Year 2042 without development			Year 2042 with development		
		DOS	Delay (seconds)	Queue (metres)	DOS	Delay (seconds)	Queue (metres)
AM	Service Station	0.398	12.1	16.0	0.308	12.4	11.9
	Tweed Valley Way (NE)	0.278	3.2	16.7	0.288	3.1	17.8
	Tweed Valley Way (SW)	0.079	7.8	3.8	0.077	6.5	3.8
	Intersection overall	0.398	5.8	16.7	0.308	5.1	17.8
PM	Service Station	0.429	12.4	18.1	0.425	12.4	17.7
	Tweed Valley Way (NE)	0.255	2.7	13.8	0.281	3.2	17.6
	Tweed Valley Way (SW)	0.068	6.7	3.3	0.084	7.9	4.0
	Intersection overall	0.429	5.6	18.1	0.425	6.0	17.7

As can be seen in Table 7.10, the Tweed Valley Way / Service Station roundabout is expected to operate well within its theoretical operational capacity with the proposed development traffic superimposed in the 2042 assessment year with the Hanson traffic superimposed. The results of the sensitivity test with 50 % increase in the southbound travel was analysed as well and the results are similar for the 2042 operating year. All Sidra Outputs are contained in Appendix E.

8. Proposed Mitigation Works

8.1 Tweed Valley Way / Service Station Roundabout

The Tweed Valley Way / Service Station Roundabout is required to be upgraded following development of the site to accommodate additional Heavy Vehicles utilising the roundabout and undertaking a U-turn. The proposed layout for the upgraded Tweed Valley Way / Service Station Roundabout is shown in Figure 8.1 below.

The hatched area shows the proposed modification to the roundabout centre island. Currently vehicles either turn into the Service Centre or continue onto Tweed Valley Way. The above effectively represents a U turn from the M1.

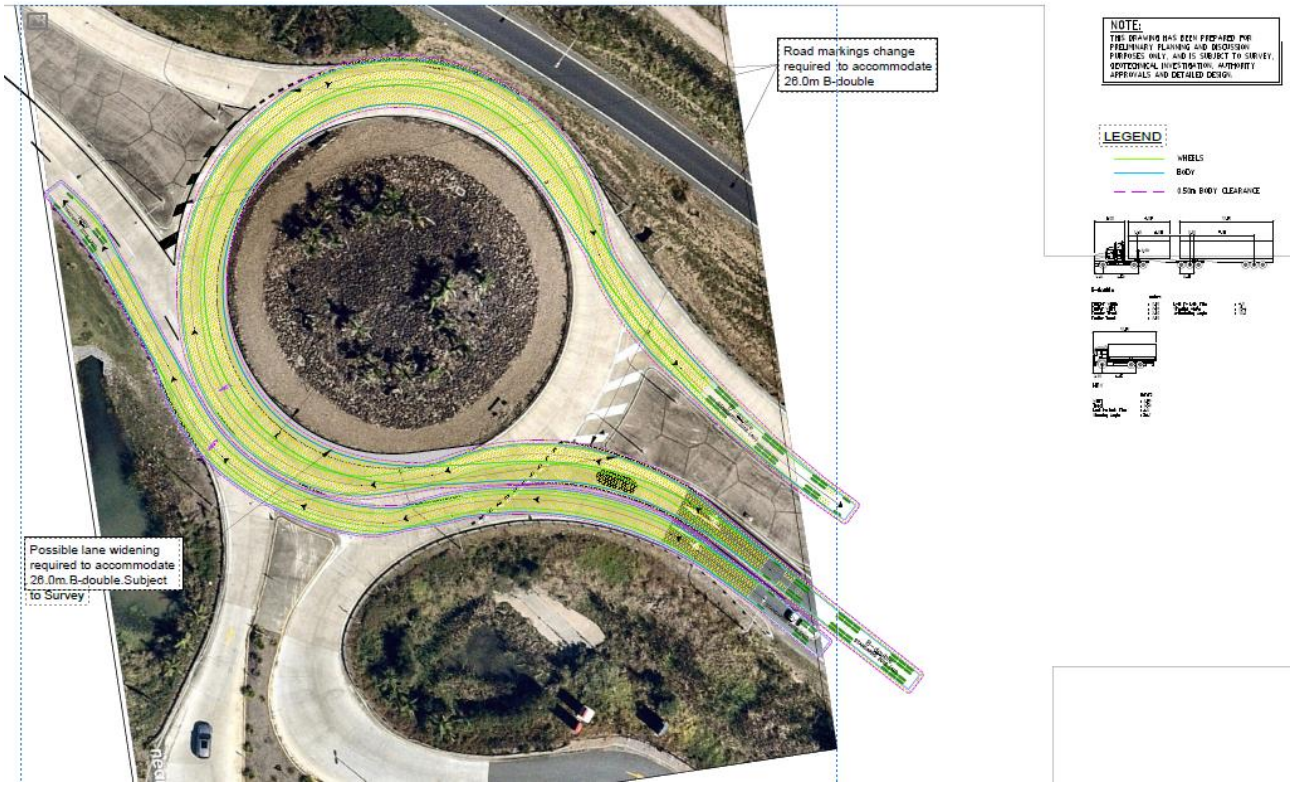


Figure 8.1 Proposed Upgrades to Tweed Valley Way / Service Station Roundabout

The swept paths for the B-Double vehicle and HRV shows the extent of the lane widening required to the southern side of the roundabout to accommodate the two heavy vehicles passing. Refer Appendix A Drawing BE190043-SK131 Rev B - Tweed Valley Way and ABLP Access _ Widening Works; Swept path Analysis – 26m B-Double. Note that the drawing is based on aerial photography and the final extent of widening is subject to swept paths based on the detail survey of the existing roundabout.

8.2 Swept Paths Analysis New Roundabout Eastern Side M1

Swept paths analysis has been undertaken for the intersection which demonstrate appropriate clearances are achieved with the pavement widths proposed. The following Drawings in Appendix A show the swept paths adopted.

- Drawing BE190043-SK126 Rev C - Tweed Valley Way and Australian Bay Lobster Producers Access _ Widening Works; Swept Path Analysis – B- Double.
- Drawing BE190043-SK127 Rev C - Tweed Valley Way and Australian Bay Lobster Producers Access _ Widening Works; Swept Path Analysis – B- Double.
- Drawing BE190043-SK128 Rev C - Tweed Valley Way and Australian Bay Lobster Producers Access _ Widening Works; Swept Path Analysis – B- Double.

8.3 Project Phasing Concept Plan

The concept phasing plan is shown in the following Figure 8.2 below.

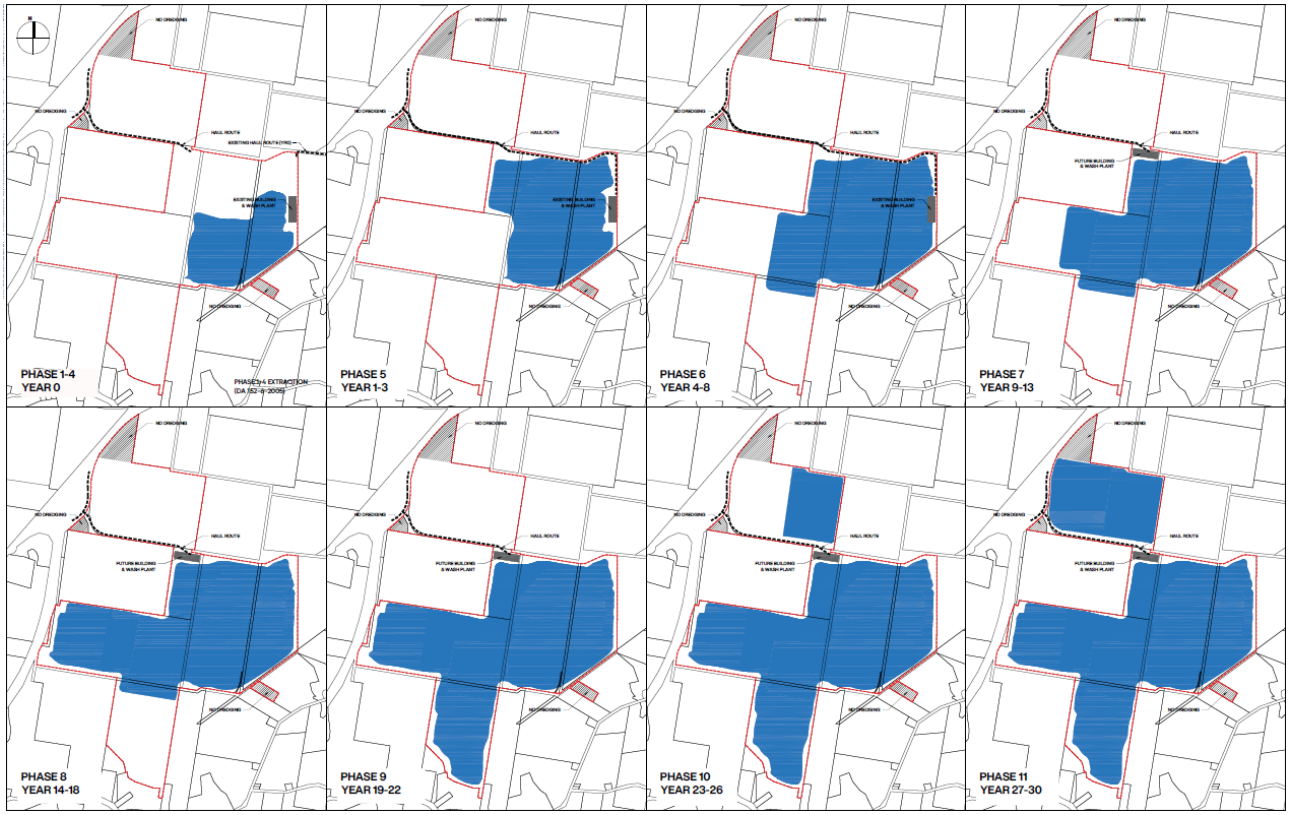


Figure 8.2 Project Phasing Concept Plan

The concept plan shows proposed 11 phases and western migration of the work area, consistent with the vehicle access objectives adopting and maintaining the Tweed Valley Way as the point of access to the external road network. The access onto Tweed Valley Way is proposed with Phase 1. The access arrangements proposed do not change throughout the life of the project.

Refer Appendix A for a copy of the Concept Development Phasing Drawing Z19163-104 Sheet 01 of 01. The following Figure 8.3 shows the final concept plan.

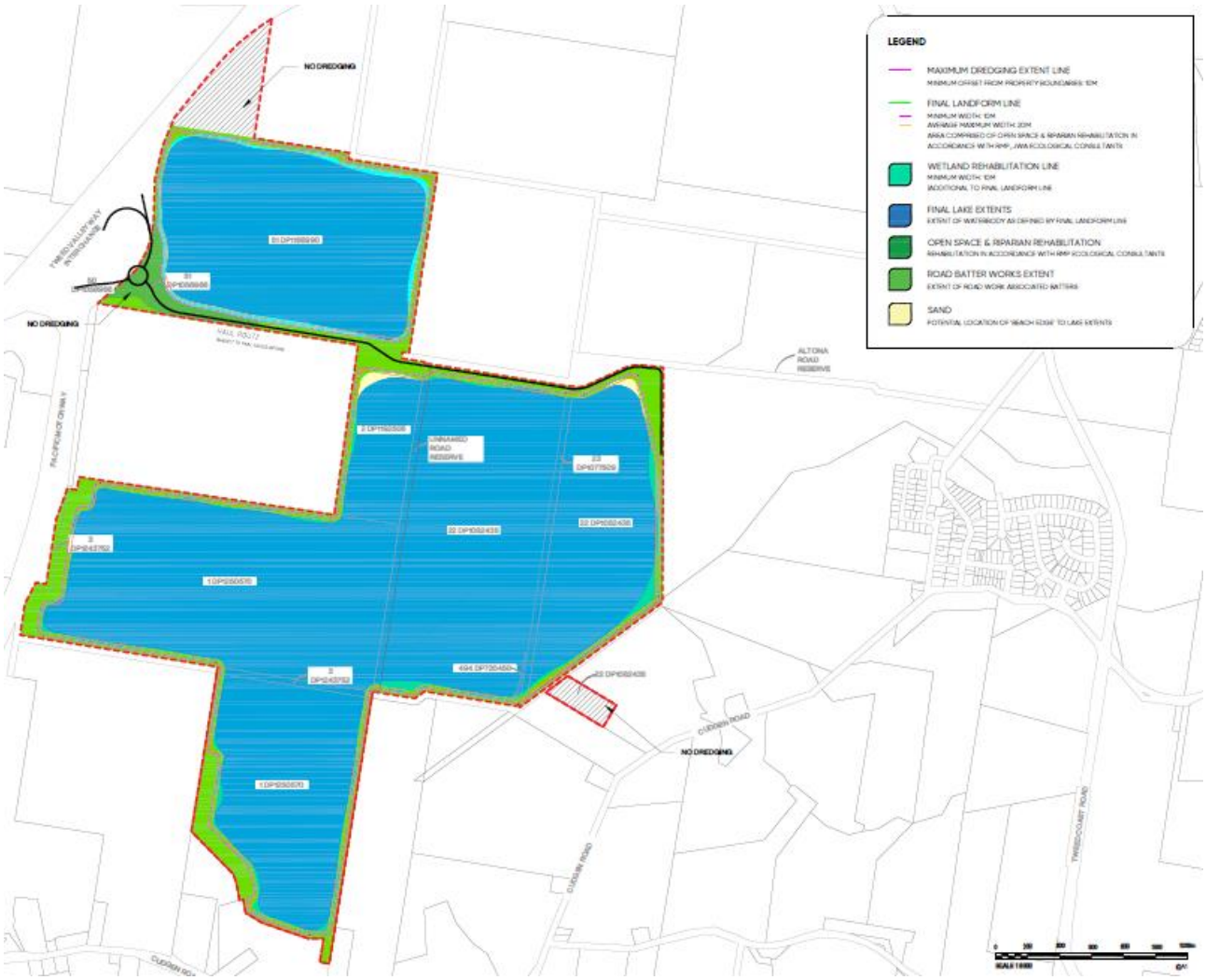


Figure 8.3 Final Concept Plan

9. Tweed Shire Council Draft Comments

Following submission of a draft Traffic Impact Report to Tweed Shire Council, the following relevant engineering minutes with respect to Traffic Impact assessment are extracted from Minutes of Assessment Panel held 2 December 2020 as follows (in italics) with response:

- *The development site has no existing right of access to the Pacific Highway – Tweed Valley Way interchange. The public road reserve (Altona Road) terminates part way across the frontage of Lot 2 DP 1192506. In order to achieve road access the proponents will need to negotiate the appropriate licenses (for the life of the sand quarry) or easements with the adjoining property owner(s) and Roads and Maritime Services. The access road would need to be sealed to address ongoing management of dust, erosion and sediment export onto the Highway.*

RESPONSE

The appropriate licences with the adjoining property owners have been obtained by Hanson, plus relevant applications to TfNSW for access approval form part of the development application. Within the state controlled road reserve, road pavement and widening are to be in accordance with TfNSW requirements and standards and subject to detailed design and approval. The internal haul roads are to be sealed.

- *The proposal will require a traffic impact analysis to ensure that the road access for the site (subject to negotiations above) is capable of catering for the forecast truck movements, up to b-double configuration. This assessment will need to include adequacy of the existing intersection with the highway off ramp, and the new roundabout intersection on Tweed Valley Way and merge which would be utilised for each north bound load.*

RESPONSE

The new roundabout onto the Tweed Valley Way is adopted for northbound and southbound trips. Southbound trips use the new roundabout for a right from the east approach (TSP and ABLP) sites to the Pacific Motorway southbound on-ramp. The swept path analysis as contained in the text include provisions for B-Double Trucks. Refer preceding sections. Items raised are included in this TIA.

- *A draft Traffic Impact Assessment was submitted for discussion at the meeting. This report proposes a graded acceleration lane to reduce risk at the merge point on the southbound highway off ramp, as the preferred option from previous consultation with RMS/TfNSW. As this presents a significant conflict point for vehicle safety, further review of the TIA is required in consultation with TfNSW.*

RESPONSE

Initially a number of access options were submitted to TfNSW. In response to subsequent feedback from both TfNSW and TSC, a new roundabout is proposed as preferred access control onto the Tweed Valley Way as detailed in this TIA.

- *The proposal places a high reliance on turning movements at the Tweed Valley Way / Service Centre roundabout, and will significantly increase heavy vehicle movements (up to b-doubles) impacting on the operation and pavement life of the roundabout, which is a Council asset. A review of the design of the roundabout is warranted and should be added to the TIA with any upgrades proposed. Changes to the roundabout centre island have been identified. It is questioned how this can be achieved under live traffic and to a suitably resilient design.*

RESPONSE

As shown in Figure 8.1, there are two circulating lanes on the southern side of the roundabout that follow the alignment of the Tweed Valley Way. Traffic Management proposed for the construction of the lane widening and changes to the roundabout centre island, involves the closure of the inside lane of the two lane section of the roundabout plus utilising the existing additional lane width available in the chevron marked area of the east and west sides of the roundabout. One circulating lane remains open at all times. At the eastern approach to the roundabout, lane designation signs close the inside (RHS) lane creating a single approach lane. Note that the drawing is based on aerial photography and the final extent of widening is subject to swept paths based on the detail survey of the existing roundabout.

The pavement construction is subject to detail investigation and design and further submission to TSC and TfNSW for construction approval. A key goal of the design to achieve a resilient outcome will involve designing uniform surface levels consistent with the existing crossfall, that can be maintained throughout the life of the roundabout similar to concrete pavement widening construction methods.

- *The road design does not appear to cater for potential traffic demands from other users along Altona Road to the east. Clarification is sought as to intended tenure and ability for this infrastructure to service a larger area.*

RESPONSE

Altona Road reserve is not currently continuous to the west and is not being extended or connected to the Tweed Valley Way off ramp. All heavy vehicle haulage and traffic will use the Tweed Valley Way without any connection to Altona Road. The existing connection between the site / Altona Road to Tweed Coast Road for haulage vehicles will not be retained. The use of the existing intersection by ABLP onto Tweed Valley Way is to be replaced with the roundabout and the capacity calculations submitted allow for the anticipated traffic volumes forecast. Altona Road traffic will not have access to the Pacific Motorway to the west.

- *The application should address geotechnical properties of the quarry site, including consideration of long term stability of the excavation batters, to ensure that they are designed and constructed to prevent slumping and instability on adjoining land in perpetuity.*

RESPONSE

A geotechnical investigation has been commissioned to investigate bank stability of the dredged submerged batters adjacent to the Tweed Valley Way off-ramp.

- *Section 94 Plan No. 4 (TRCP) Contributions would be applicable. Any variation to the standard rate would require the submission of a traffic analysis.*

RESPONSE

A traffic analysis will be separately submitted regarding any variation to the standard rate.

- *Analysis will be required to determine the required amount of car parking and to assist Council in determining the applicable parking provision under the relevant DCP.*

RESPONSE

Hanson will retain ownership of the site following completion of sand extraction and any proposed subsequent use of the site will be decided via the appropriate consultative, application and regulation processes in place at that time. The report gives a general outline of public and active infrastructure currently available.

10. Public Access Strategy End Use Development

Hanson will retain ownership of the site following completion of sand extraction and any proposed subsequent use of the site will be decided via the appropriate consultative, application and regulation processes in place at that time.

10.1.1 Vehicular Access

Vehicular access to the end use completed development of the TSP land by the public will be provided via Crescent Street / Tweed Coast Road priority intersection, Crescent Street and Tweed Coast Road as shown in Figure 10.1 below. Sight distance at the Crescent Street / Tweed Coast Road priority intersection accords with the minimum requirement of the Australian Standards for 90km/h Design Speed. The desirable visibility of 185m is achieved in both directions.

In summary, the means of ingress to or egress from the future end use site development are adequate and provide for safe and convenient movement to and from the site.

Figure 10.1 Existing Tweed Coast Road / Crescent Street Priority Intersection

It is recommended for a traffic impact assessment of the Crescent Street / Tweed Coast Road intersection to be undertaken at the appropriate time in the future when the Crescent Street access is required as part of the end use.

10.1.2 Walking and Cycling Distances

The accessibility of the site by active and sustainable modes of transport in the future is important as it is likely to impact upon the number of private car trips made to and from the site and their localised impacts onto the local road network. Facilitating competitive, attractive and sustainable

travel mode choices through the provision of quality transport infrastructure and incentives / disincentives has a potential to reduce dependency on car use and car parking demand.

The location of the site with respect to the wider built-up area and active transport facilities is shown in Figure 10.2 below.

Figure 10.2 Existing Walking and Cycling Paths in the Vicinity of the TSP Site (Source Tweed Shire Council)

Comfortable cycling distance of 5km is achieved and covers Kingscliff, Casuarina, Chinderah and Dodds Island.

10.1.3 Public Transport

The existing public transport infrastructure in the vicinity of the site is shown in Figure 10.3 and Figure 10.4 below.

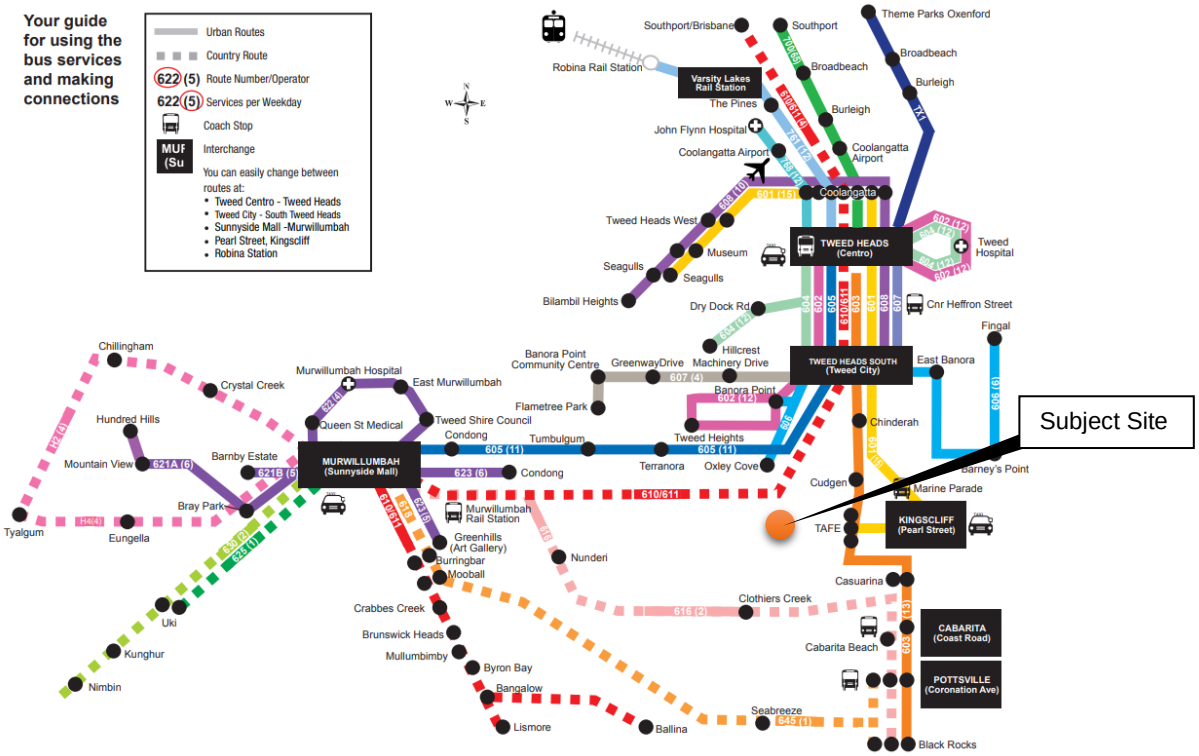


Figure 10.3 Public Transport Accessibility (Source Tweed Shire Council)

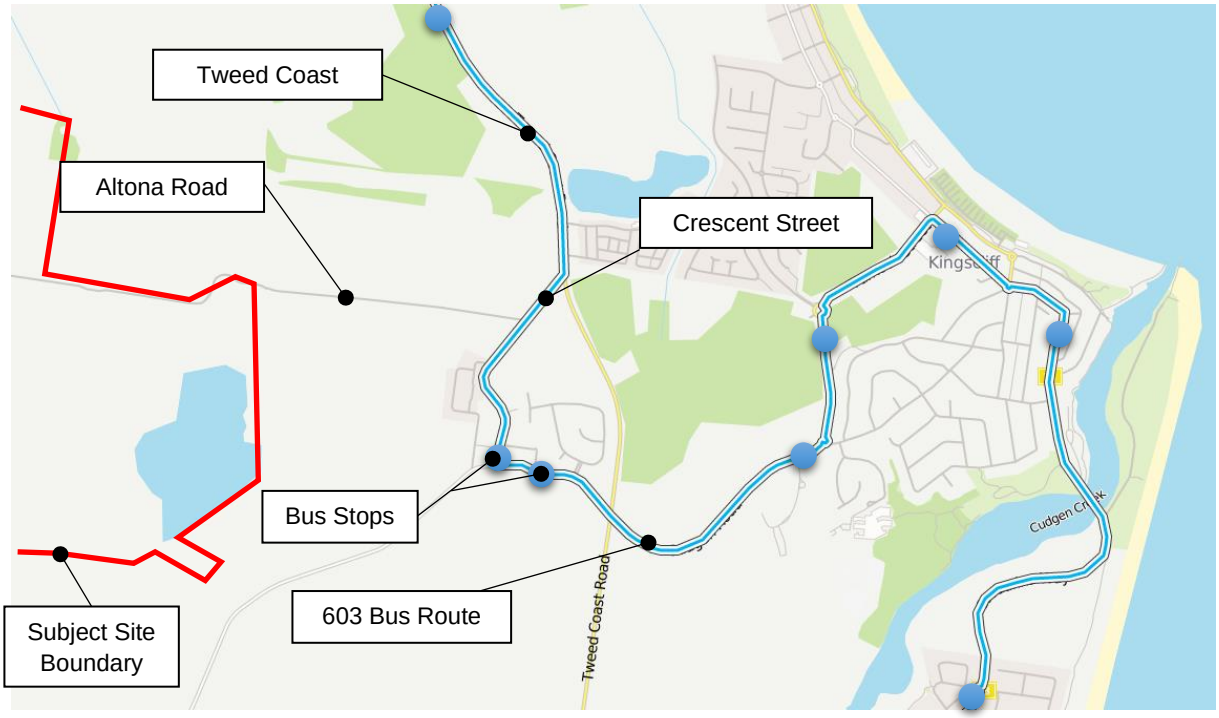


Figure 10.4 Bus 603 Route (Source Tweed Shire Council)

"Streets for People Compendium" document identifies recommended distances to bus stops within 400m from the site and tram stop or high-frequency bus stops within 800m from the site. The above distances could relate to walking journeys to and from the development.

There are bus stops along Crescent Street located outside comfortable walking distance from the site. Bus stops located along Crescent Street are accessible within 24-minute walk (1.9km).

The bus service operating at this stop is 603, which provides connection from Tweed Heads to Kingscliff and Pottsville with 60-minute frequency.

11. Conclusions and Recommendations

Burchills Engineering Solutions has been commissioned by Hanson Construction Materials Pty Ltd (Hanson) to prepare a Traffic Impact Assessment (TIA) report to support a Development Application (DA) for the expansion of the existing Tweed Sand Plant (TSP) located at Altona Road, Cudgen. The development is located within Tweed Shire Council Local Authority.

The current approved sand extraction sites include Lot Plans: 22 on DP1082435, 23 on DP1077509 and 494 on DP720450. The proposed expansion site includes the current site plus Lot Plans; 1 on DP1250570, 2 on DP1192506, 3 on DP1243752, 50 on DP1056966 and 51 on DP1166990. The total area for the future Tweed Sand Plant site would be approximately 236ha and result in an increase in the sand production rate from the current limit of 500,000 tonnes per annum (tpa) to 950,000 tpa. The applicant proposes to gain access from Tweed Valley Way via a new roundabout, contrary to the current arrangements utilising the local street network involving Altona Road, Crescent Street and Tweed Coast Road.

Tweed Coast Road is a local council-controlled road that provides access to Cudgen, Kingscliff, Casuarina and Cabarita Beach from the M1 Pacific Motorway. The above areas are forecasted to have substantial population growth due to the land development on both sides of the road. Removing heavy vehicles from Tweed Coast Road has significant road safety benefits. Other secondary benefits associated with reduced travel distances to the M1 via Tweed Valley Way interchange are associated with reduced fuel and vehicle operating costs and significant reductions in vehicle emissions.

The Economic Evaluation assessment as contained in Appendix F demonstrated that the proposed Tweed Sand Plant haulage route via Tweed Valley Way including upgrade of the Tweed Valley Way / ABLP intersection does provide economic benefits to the local community which outweighs its cost to residents, Local and State Governments. The Cost-benefit analysis prepared determined that the project will generate a Present Value (PV) total of $2.59M in benefits at a Present Value cost of $1.05M above the Base Case, providing a NPV of $1.54M and a Benefit-Cost Ratio (BCR) of 2.46. The majority of benefits relate to travel time savings along Tweed Coast Road via a reduction in travel time, maintenance costs reduction, environmental and safety benefits. The analysis includes maintenance costs associated with the proposed new Tweed Valley Way roundabout over the life of the project but excludes the capital costs covered by Hanson.

Pacific Motorway (M1) is a declared Freeway and Transport for New South Wales (TfNSW) is the Roads Authority for Freeways in accordance with Section 7 of the Roads Act 1993. Tweed Valley Way (679) is a classified (Regional) Road and a declared Controlled Access Road (CAR) in the subject area. Tweed Shire Council is the Roads Authority for all public roads in the local government area, including Tweed Valley Way. However, TfNSW can exercise Roads Authority powers in relation to classified roads and provides consent to any new connection with a Freeway or CAR in accordance with the Roads Act. Developer works are subject to the terms of a Works Authorisation Deed (WAD).

Several options for connection to Tweed Valley Way were investigated with the TfNSW with the proposed roundabout being a preferred option. The design vehicle for the TSP is 26m B-Double truck. The preferred site access strategy is contained in Appendix A.

Available traffic surveys were used for traffic analysis adopting the Tweed Shire Council Transport traffic volume forecasts in the analysis. Traffic growth at the rate of 0.6% per annum was calculated from traffic surveys and forecast traffic volumes extracted from the TSC *Tweed Road Development Strategy* and adopted for the capacity analysis of the intersection at the ABLP property. The growth rate is consistent with the medium growth scenario adopted for Tweed Shire Transport Planning.

2020 traffic surveys were completed in early March 2020 (pre COVID -19) and represent the normal situation. The speed surveys identified that the advisory speed of 75km/hr is exceeded by speeds of 87km/hr recorded as the 85th percentile speed. A review of the 2019 AADT volumes along the M1 Pacific Motorway identified that there are seasonal variations in traffic with the highest volumes recorded in January. Based on the above, traffic survey data from March 2020 has been increased to account for the seasonal variations in traffic volumes. The above represents the worst-case scenario under 100th Highest Hour Volumes as adopted for all SIDRA capacity calculations.

Safety and efficiency on the surrounding road network identified that no accidents have been recorded between 2013 and 2019 at the existing ABLP intersection with Tweed Valley Way.

TSP destinations involve 95% delivery trips travelling north and 5% south. Sensitivity testing was undertaken for the 50% north and 50% south distribution.

The SIDRA software capacity analysis identified that the proposed roundabout would operate well within its theoretical capacity in the 2042 assessment year with the proposed development traffic superimposed with minimal delays and satisfactory Degree of Saturation. The proposed site access arrangements are adequate to service the site.

The Tweed Valley Way / Caltex Service Station roundabout is designed to cater for 26m B-Double heavy vehicles. However, swept path analysis of the U-turn movement at this roundabout identified that modifications to the roundabout island are required. To ensure road safety, it is proposed to provide additional signage with advisory safe turning speed for trucks manoeuvring the roundabout as part of an upgrade that marginally widens the pavement to the circulating lane on the southeast side. Note that the drawing is based on aerial photography and the final extent of widening is subject to swept paths based on the detail survey of the existing roundabout.

Hanson will retain ownership of the site following completion of sand extraction and any proposed subsequent use of the site will be decided via the appropriate consultative, application and regulation processes in place at that time.

Assessment of the impact on public transport (public and school bus routes) and consideration for alternative transport modes such as walking and cycling, recommended access from the existing Tweed Coast Road as part of the Tweed Shire Council bus services and active transport infrastructure.

12. References

Australian / New Zealand Standard 2004, Parking Facilities Part 1: Off-Street Car Parking, Standards Australia, Sydney

Roads and Traffic Authority 2002, *Guide to Traffic Generating Developments*, Roads and Traffic Authority, Sydney

Austroads Guide to Traffic Management Part 6

Austroads Guide to Traffic Management Part 12

Austroads Guide to Road Design – Part 4C *Interchanges*

Austroads Guide to Road Design – Part 4B *Roundabouts*

Tweed Shire Council Guidelines

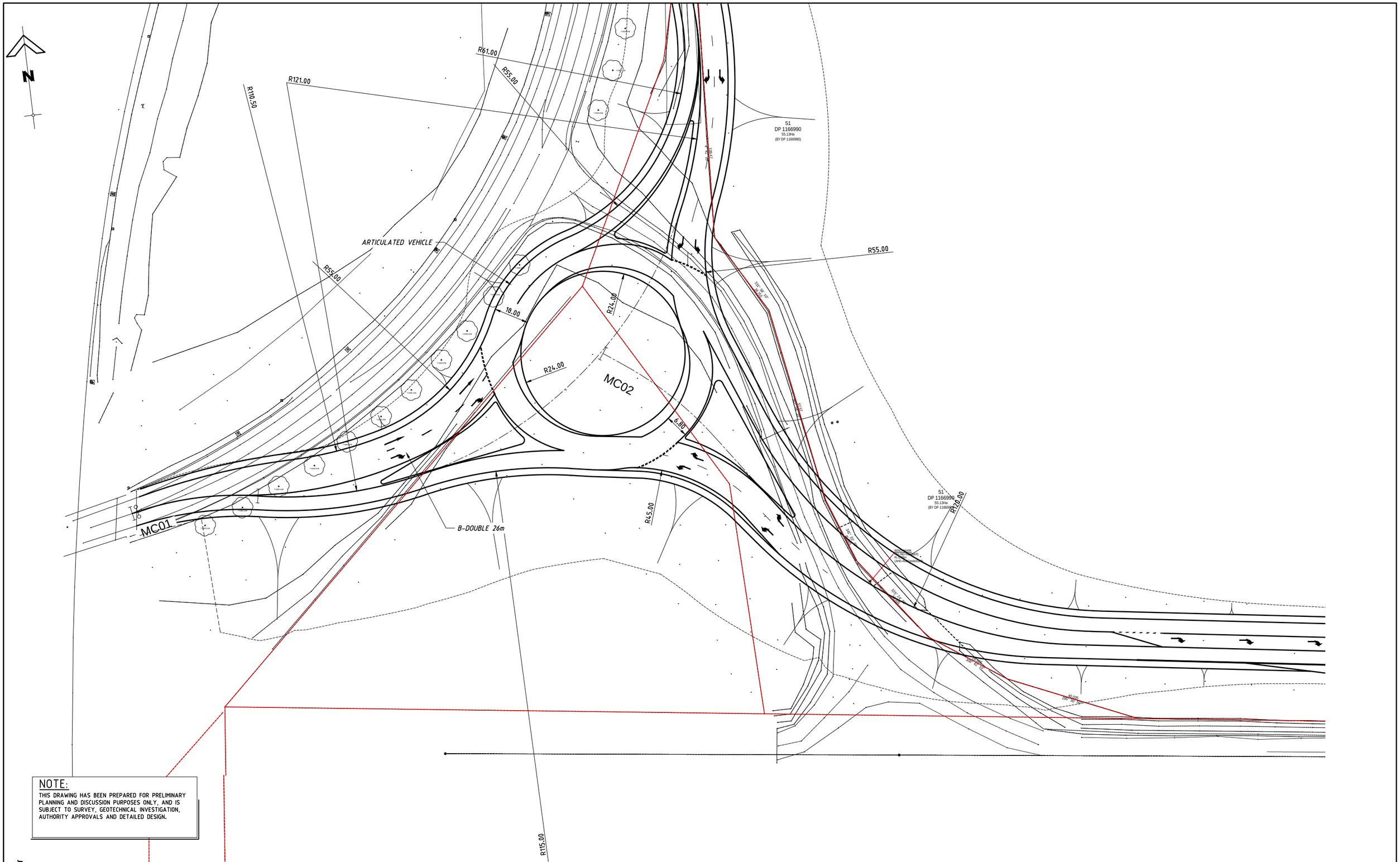
Road Design Guide (RMS)

Austroads *"Guide to Road Design - Part 4A Unsignalised and Signalised intersections "*

Austroads *"Guide to Road Design - Part 3"*

Tweed Shire Council *Tweed Road Development Strategy*

Appendix A – Site Layout and Swept Path Analysis



NOTE:
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Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 25/10/2021

SCALE 5 0 5 10 15 20 25 (metres)
1 : 500 (FULL SIZE)

BE190043-SK123 Rev C

Hanson HEIDELBERGCEMENT Group

BURCHILLS ENGINEERING SOLUTIONS
Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

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HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

SCALE 10 0 10 20 30 40 50 (metres)
1 : 1000 (FULL SIZE)

BE190043-SK124 Rev C

Designer : AGA SZEWCZAK

Date : 25/10/2021

Hanson HEIDELBERGCEMENT Group

BURCHILLS ENGINEERING SOLUTIONS
Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
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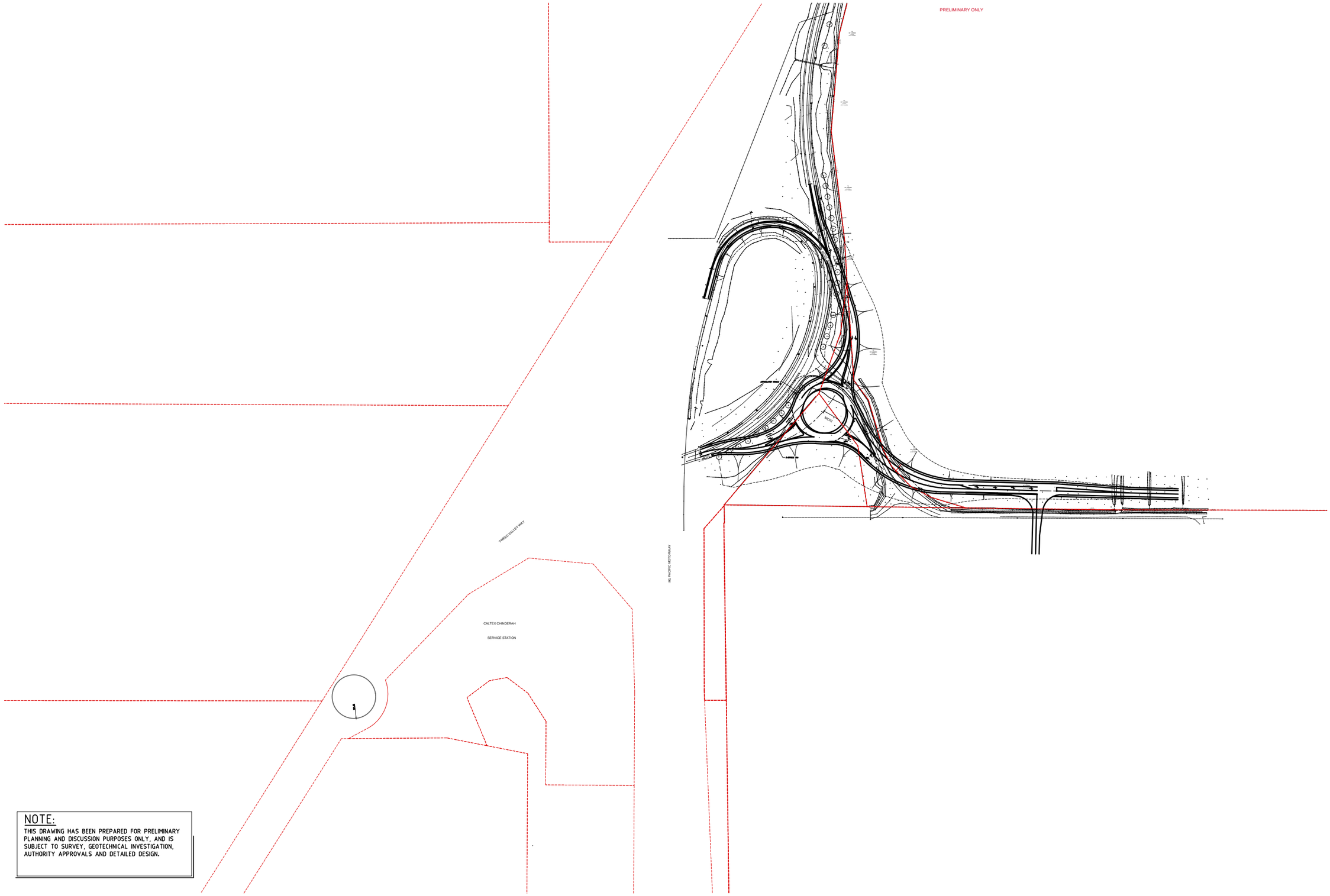
ABN 76 166 942 365

PRELIMINARY ONLY



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HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Scale 1:2000

BE190043-SK125 Rev C

Designer : AGA SZEWCZAK

Date : 25/10/2021

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BURCHILLS ENGINEERING SOLUTIONS

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
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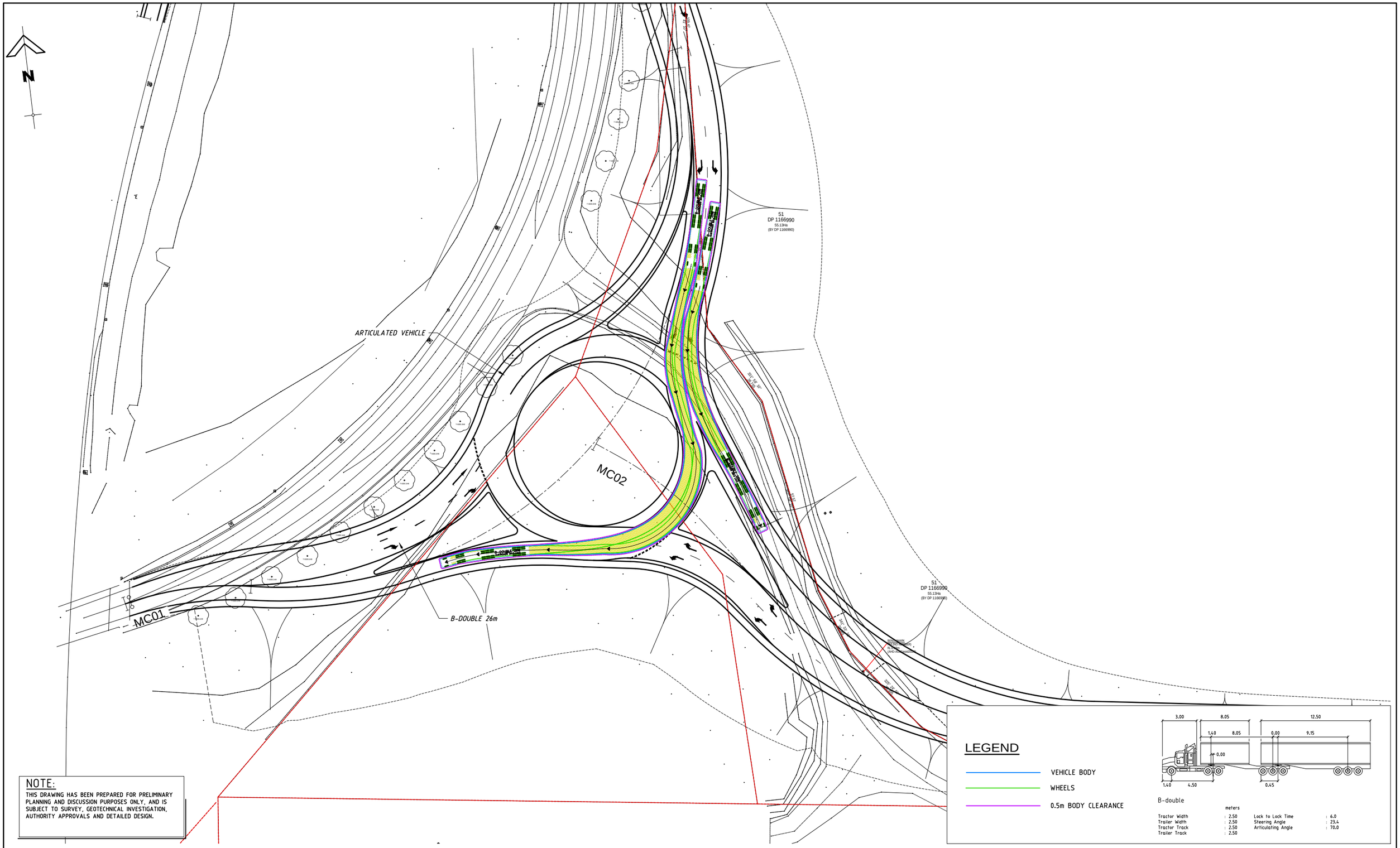

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HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY - SWEPT PATH ANALYSIS

SCALE 5 0 5 10 15 20 25 (metres)
1 : 500 (FULL SIZE)

BE190043-SK126 Rev C

Designer : AGA SZEWCZAK

Date : 25/10/2021

BURCHILLS ENGINEERING SOLUTIONS
Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
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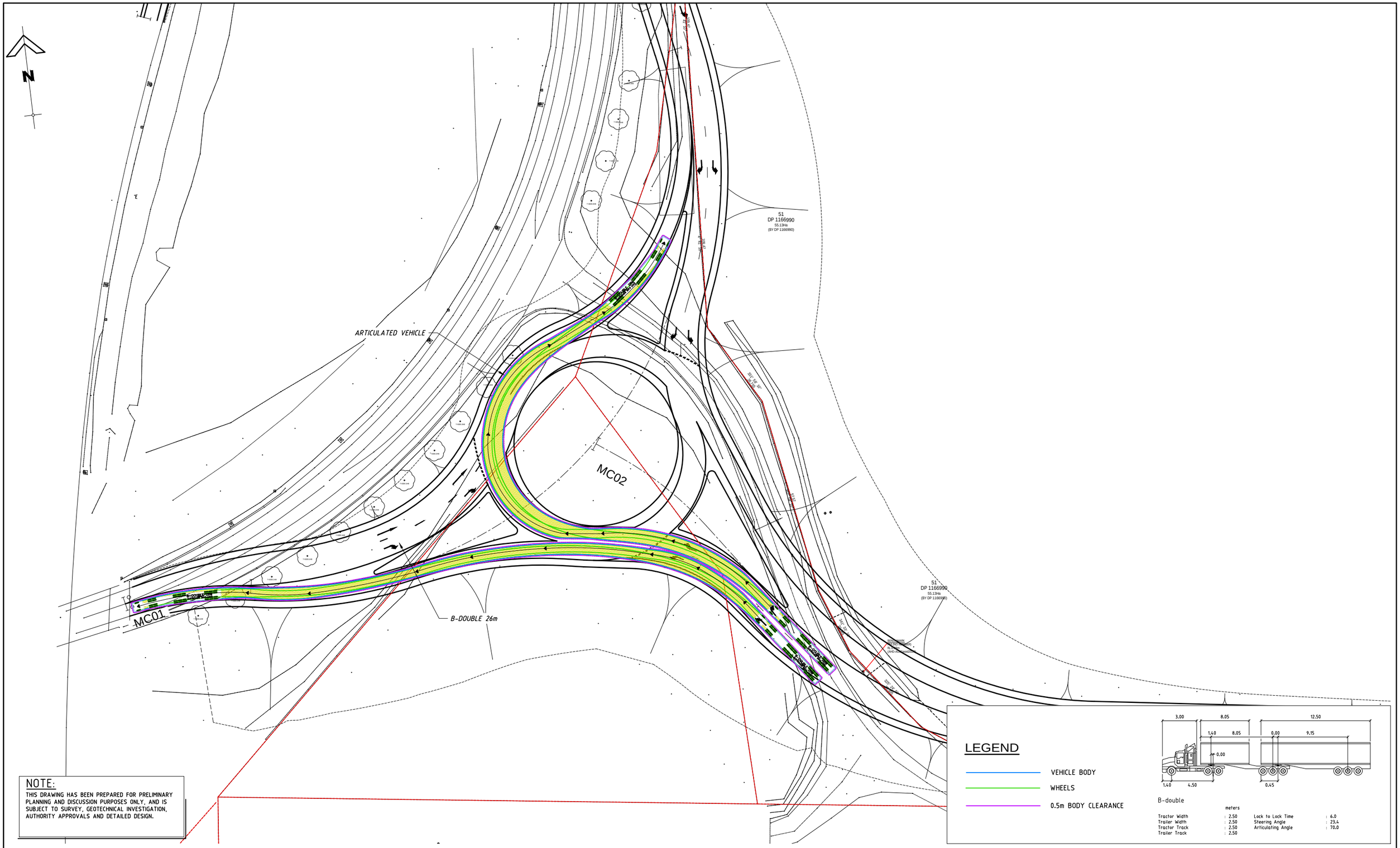

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Designer : AGA SZEWCZAK

Date : 25/10/2021

BE190043-SK127 Rev C

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BURCHILLS ENGINEERING SOLUTIONS
Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
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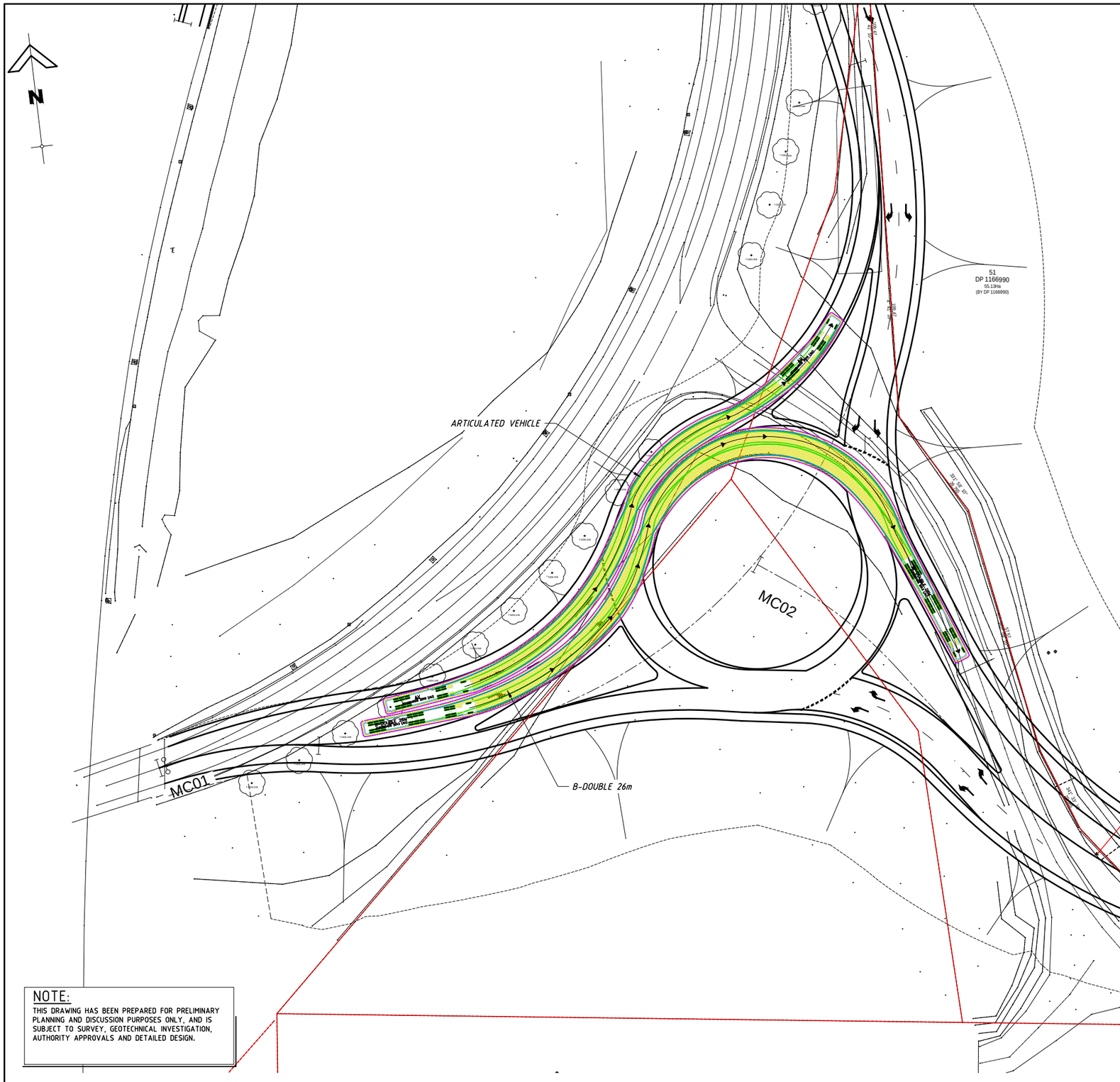

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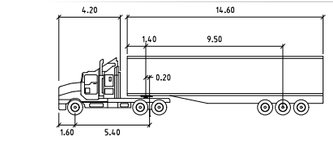
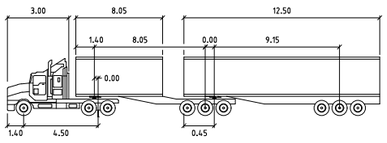
LEGEND

- VEHICLE BODY
- WHEELS
- 0.5m BODY CLEARANCE



AV

	meters		
Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 28.3
Tractor Track	: 2.50	Articulating Angle	: 72.0
Trailer Track	: 2.50		



B-double

	meters		
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Trailer Width	: 2.50	Steering Angle	: 23.4
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY - SWEPT PATH ANALYSIS

Designer : AGA SZEWCZAK

Date : 17/08/2021

SCALE 5 0 5 10 15 20 25 (metres)
1 : 500 (FULL SIZE)

BE190043-SK128 Rev C

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BURCHILLS ENGINEERING SOLUTIONS
Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
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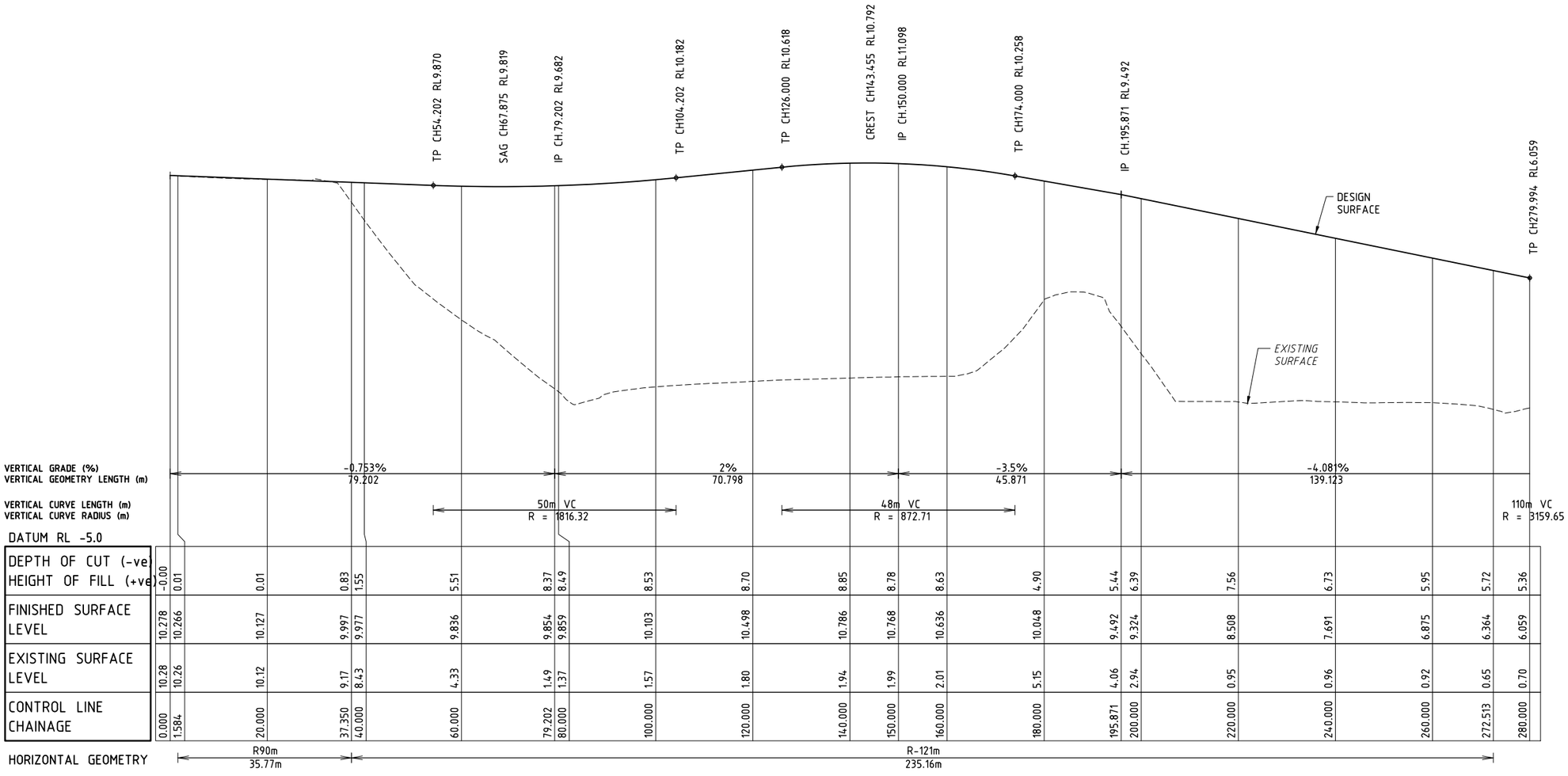

DEPTH OF CUT (-ve) / HEIGHT OF FILL (+ve)	-0.00	0.01	0.01	0.01	0.83	1.55	5.51	8.37	8.49	8.53	8.70	8.85	8.78	8.63	4.90	5.44	6.39	7.56	6.73	5.95	5.72	5.36
FINISHED SURFACE LEVEL	10.278	10.266	10.127	9.997	9.977	9.836	9.854	9.859	10.103	10.498	10.786	10.768	10.636	10.048	9.492	9.324	8.508	7.691	6.875	6.364	6.059	
EXISTING SURFACE LEVEL	10.28	10.26	10.12	9.17	8.43	4.33	1.49	1.37	1.57	1.80	1.94	1.99	2.01	5.15	4.06	2.94	0.95	0.96	0.92	0.65	0.70	
CONTROL LINE CHAINAGE	0.000	1.584	20.000	37.350	40.000	60.000	79.202	80.000	100.000	120.000	140.000	150.000	160.000	180.000	195.871	200.000	220.000	240.000	260.000	272.513	280.000	

LONGITUDINAL SECTION - MC01

VERTICAL SCALE 1 0 1 2 3 4 5 1:100 (meters)
HORIZONTAL SCALE 5 0 5 10 15 20 25 1:500 (meters)
(FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

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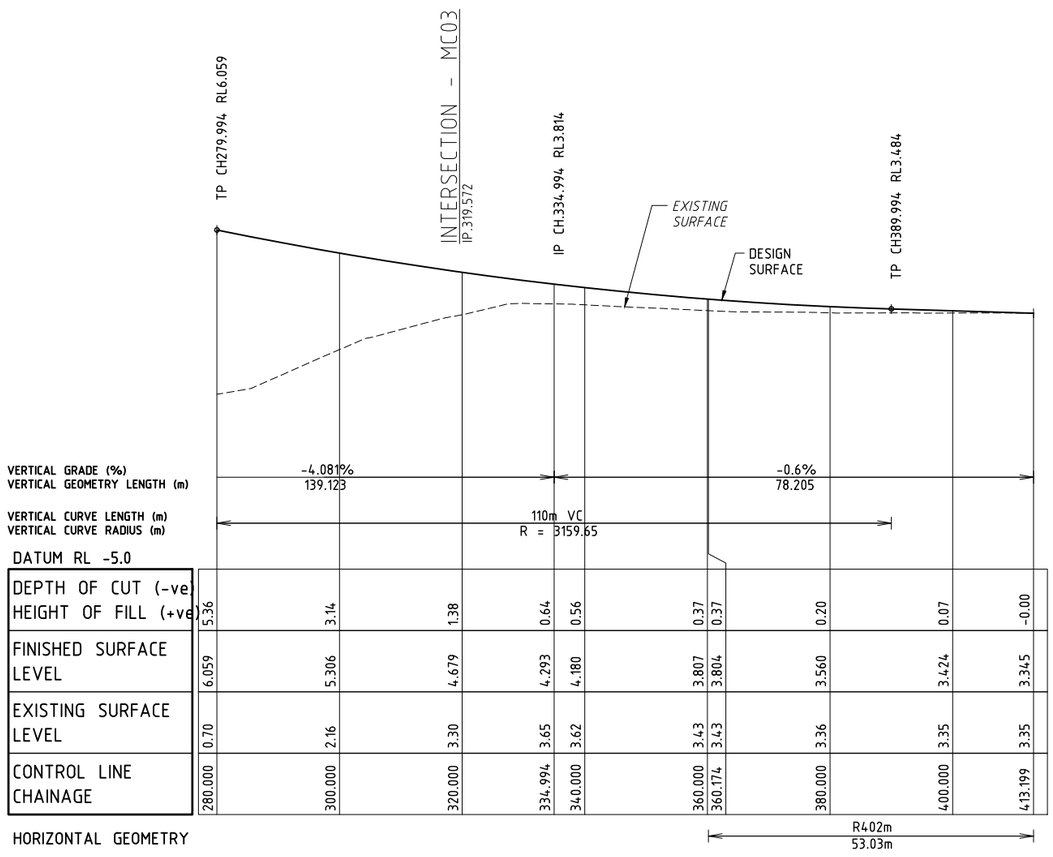
Designer : AGA SZEWCZAK

Date : 17/08/2021

BE190043-SK129 Rev B

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365



LONGITUDINAL SECTION - MC01

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HORIZONTAL SCALE 5 0 5 10 15 20 25 1:500 (meters)

(FULL SIZE)

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Designer : AGA SZEWCZAK

Date : 17/08/2021

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Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
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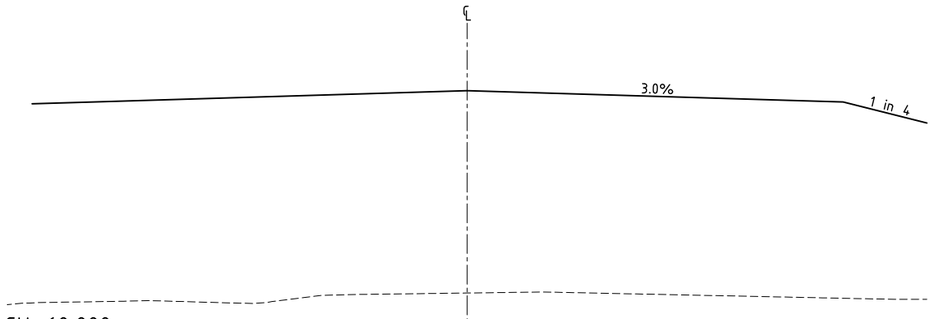

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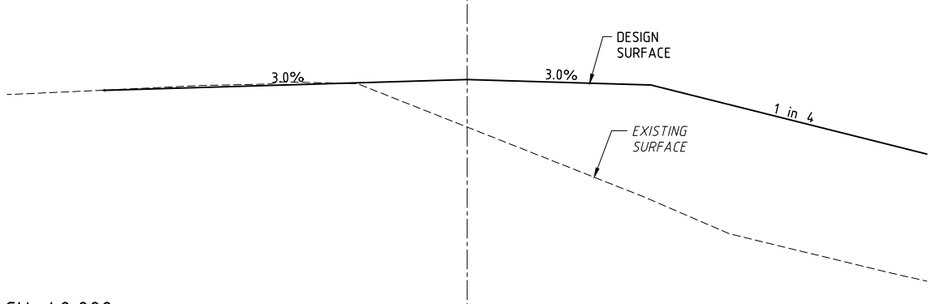

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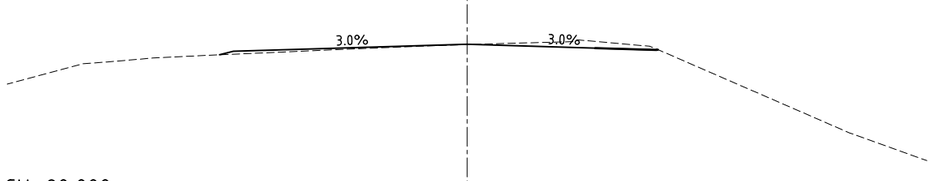

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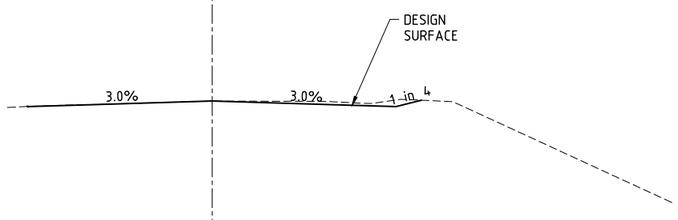

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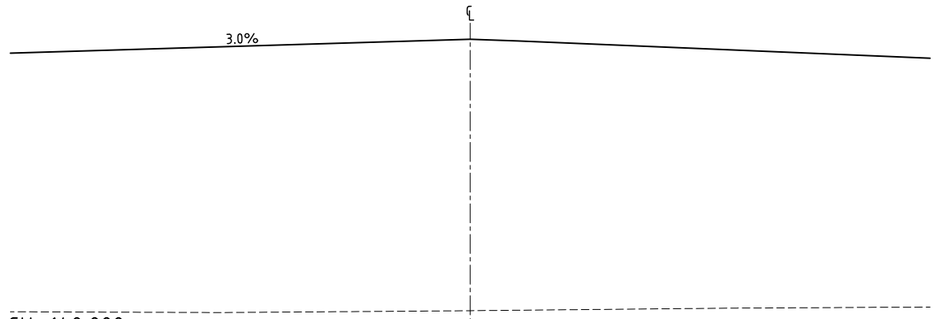

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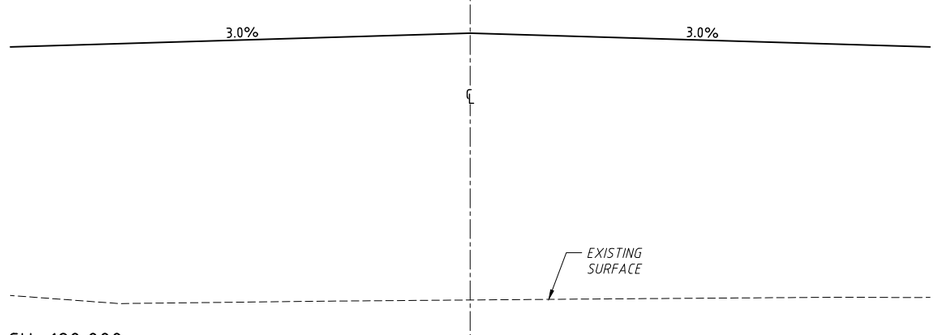

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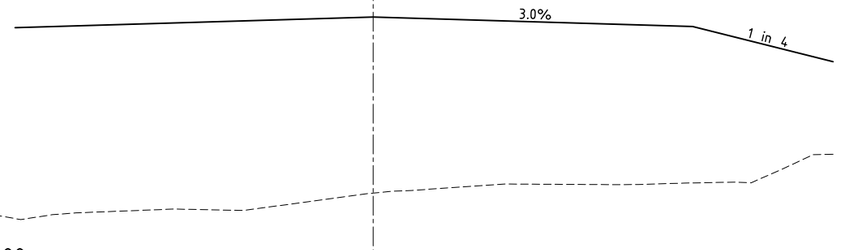

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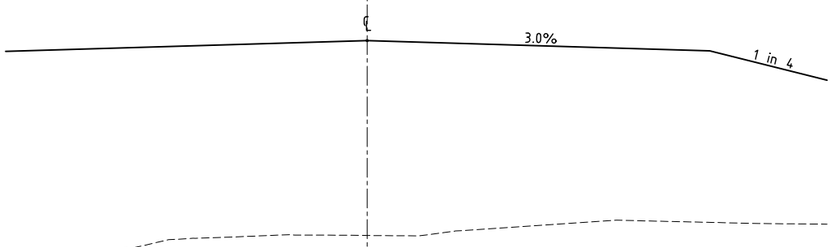

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DATUM RL 0.0

CROSS SECTIONS - MC01

SCALE 1 0 1 2 3 4 5 (metres)

1 : 100 (FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

BE190043-SK131 Rev B

BURCHILLS ENGINEERING SOLUTIONS

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
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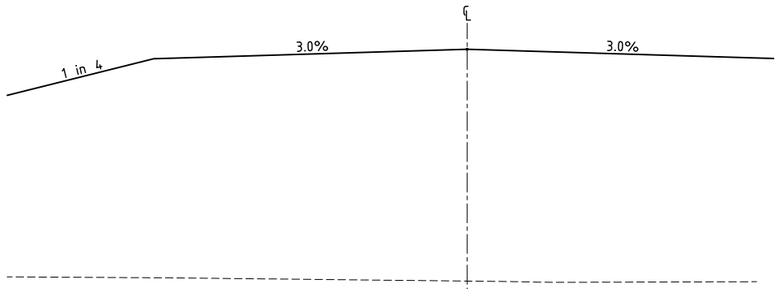

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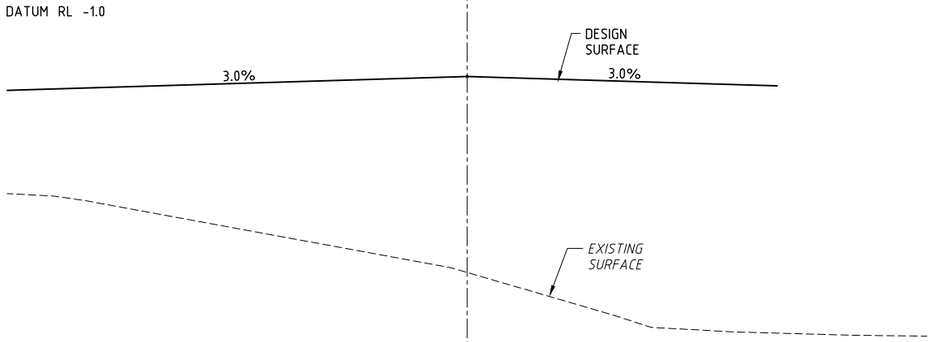

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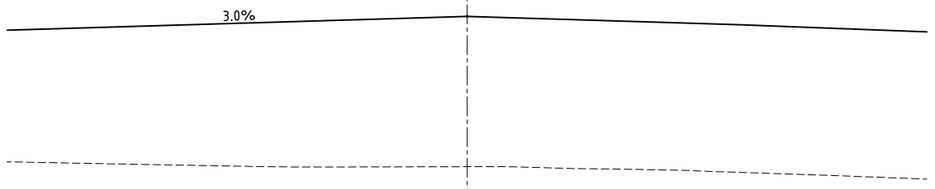

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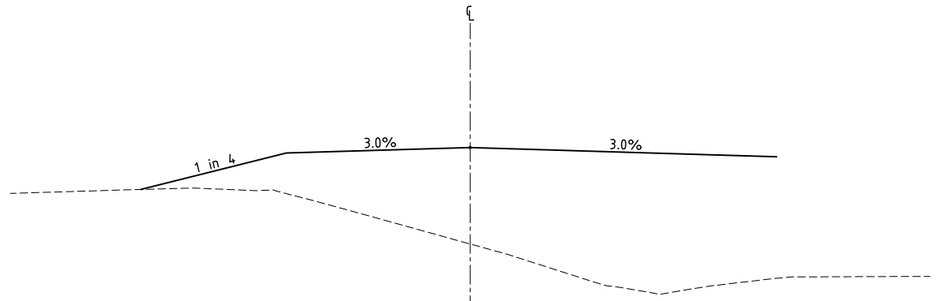

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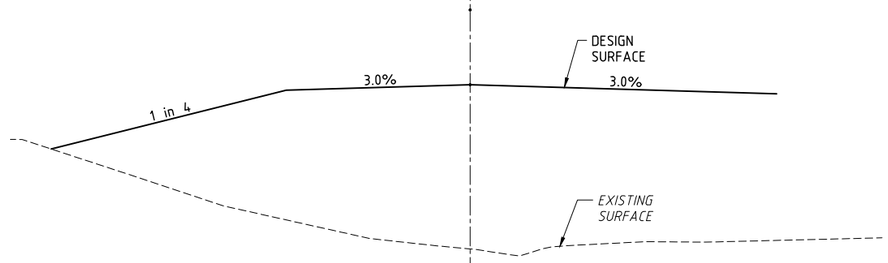

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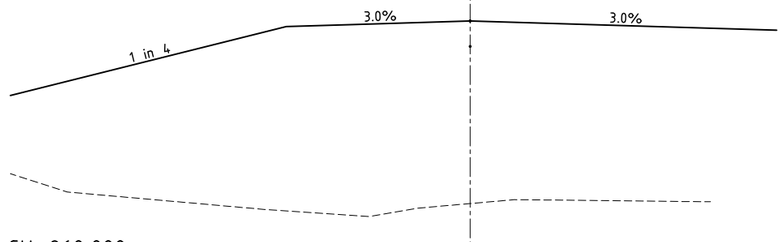

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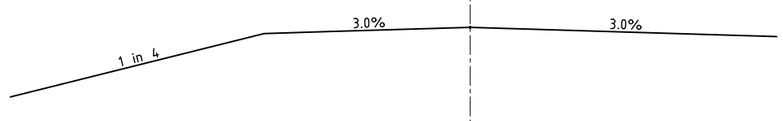


CH 240.000 CONTROL LINE R.L.7.691

DATUM RL -1.0

CROSS SECTIONS - MC01

SCALE 1 0 1 2 3 4 5 (metres)

1 : 100 (FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

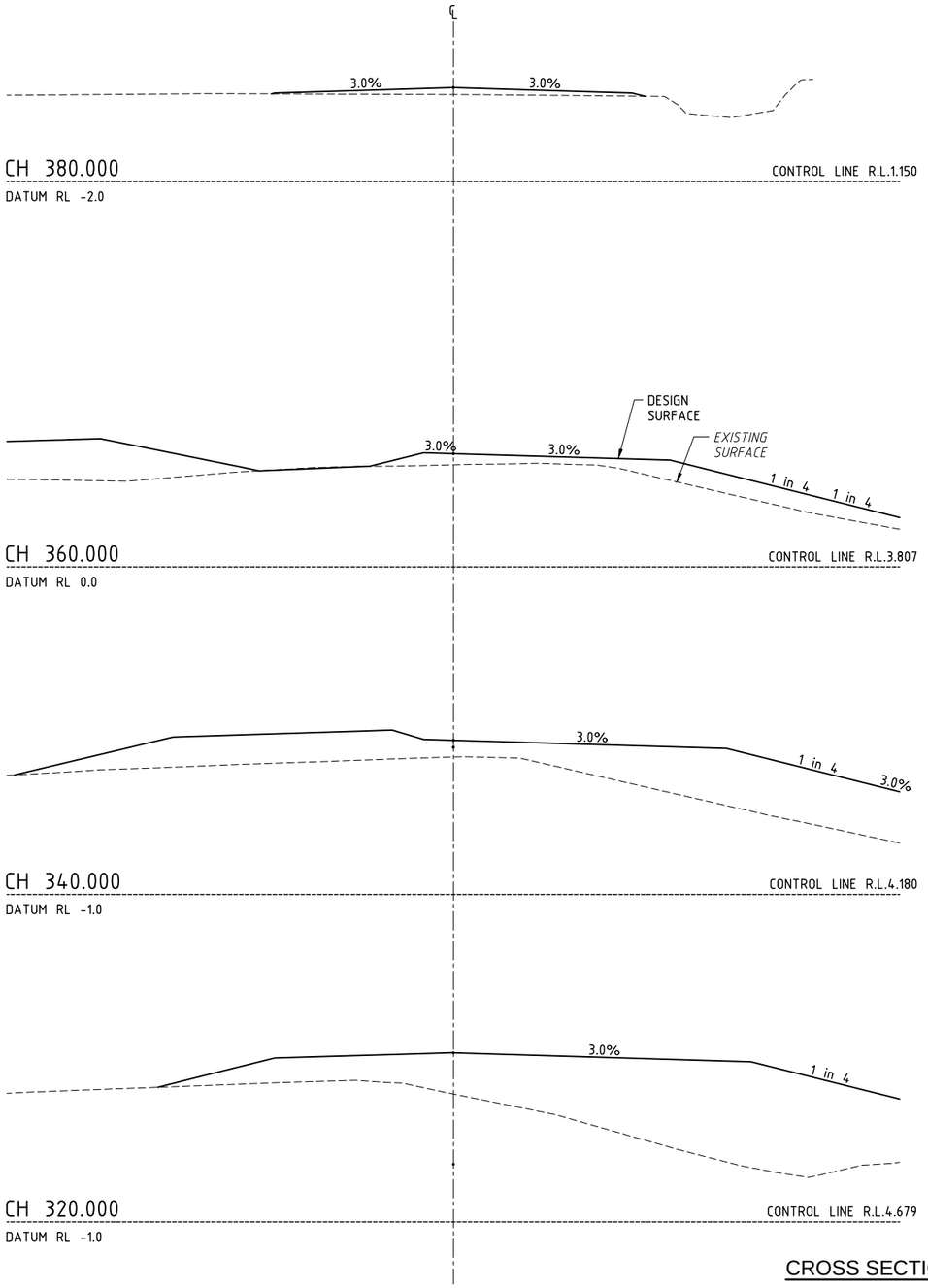
HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

BE190043-SK132 Rev B

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365



CROSS SECTIONS - MC01

SCALE 1 0 1 2 3 4 5 (metres)
1 : 100 (FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

BE190043-SK133 Rev B

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Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
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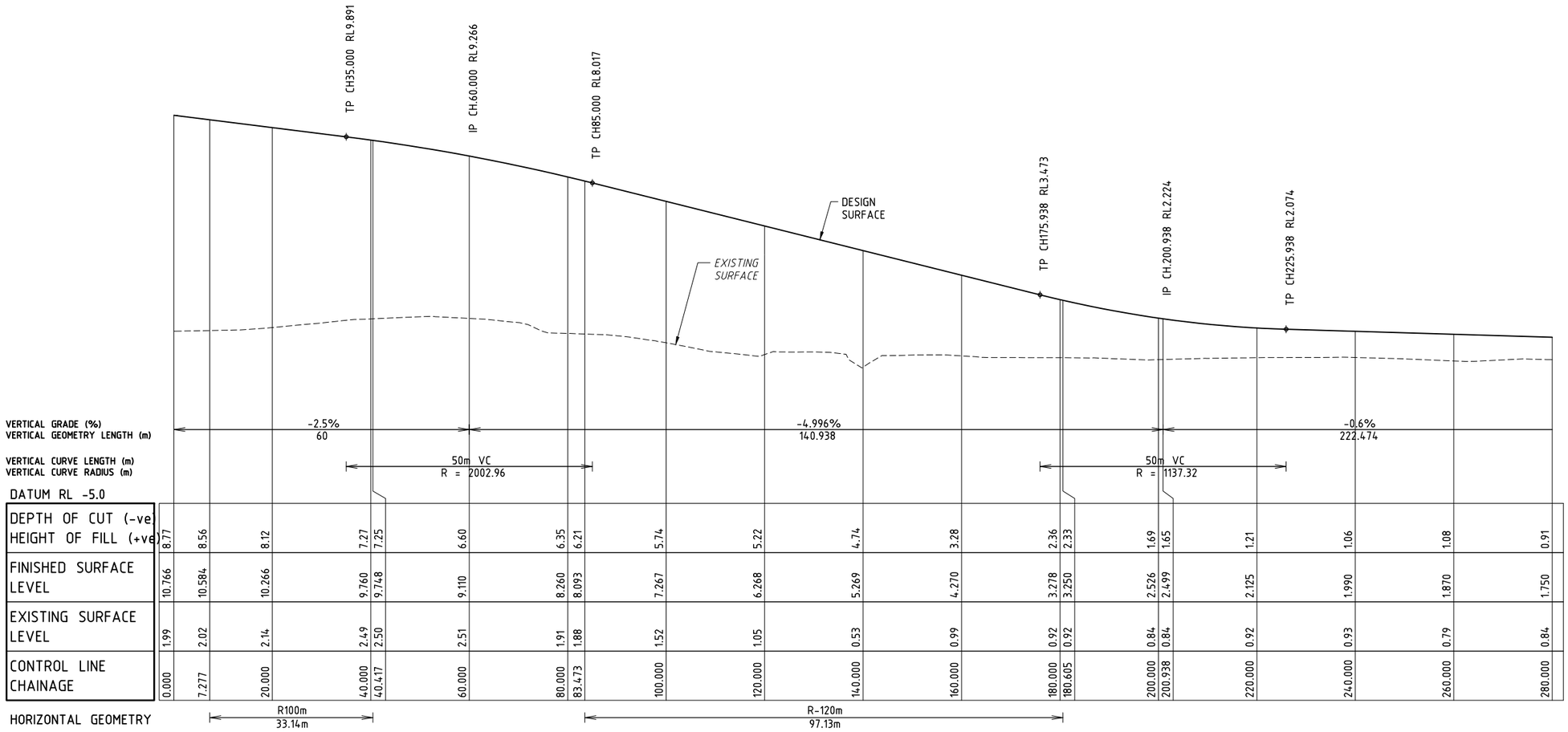

LONGITUDINAL SECTION - MC02

VERTICAL SCALE 1 0 1 2 3 4 5 1:100 (meters)
HORIZONTAL SCALE 5 0 5 10 15 20 25 1:500 (meters)
(FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

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26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
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Fax: +61 7 5509 6411
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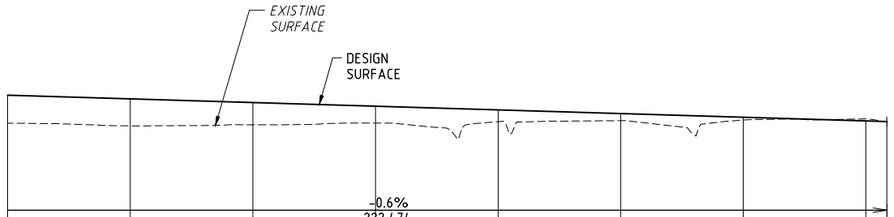

VERTICAL GRADE (%)				-0.6%						
VERTICAL GEOMETRY LENGTH (m)				222.474						
VERTICAL CURVE LENGTH (m)										
VERTICAL CURVE RADIUS (m)										
DATUM RL -5.0										
DEPTH OF CUT (-ve) HEIGHT OF FILL (+ve)	0.91	0.88	0.73	0.55	0.38	0.23	0.09	-0.07	0.02	
FINISHED SURFACE LEVEL	1.750	1.630	1.510	1.390	1.270	1.150	1.030	0.910	0.889	
EXISTING SURFACE LEVEL	0.84	0.75	0.78	0.84	0.89	0.92	0.94	0.98	0.87	
CONTROL LINE CHAINAGE	280.000	300.000	320.000	340.000	360.000	380.000	400.000	420.000	423.412	
HORIZONTAL GEOMETRY										

LONGITUDINAL SECTION - MC02

VERTICAL SCALE 1 0 1 2 3 4 5 1:100 (meters)
HORIZONTAL SCALE 5 0 5 10 15 20 25 1:500 (meters)
(FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK
Date : 17/08/2021

BE190043-SK135 Rev B

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
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Fax: +61 7 5509 6411
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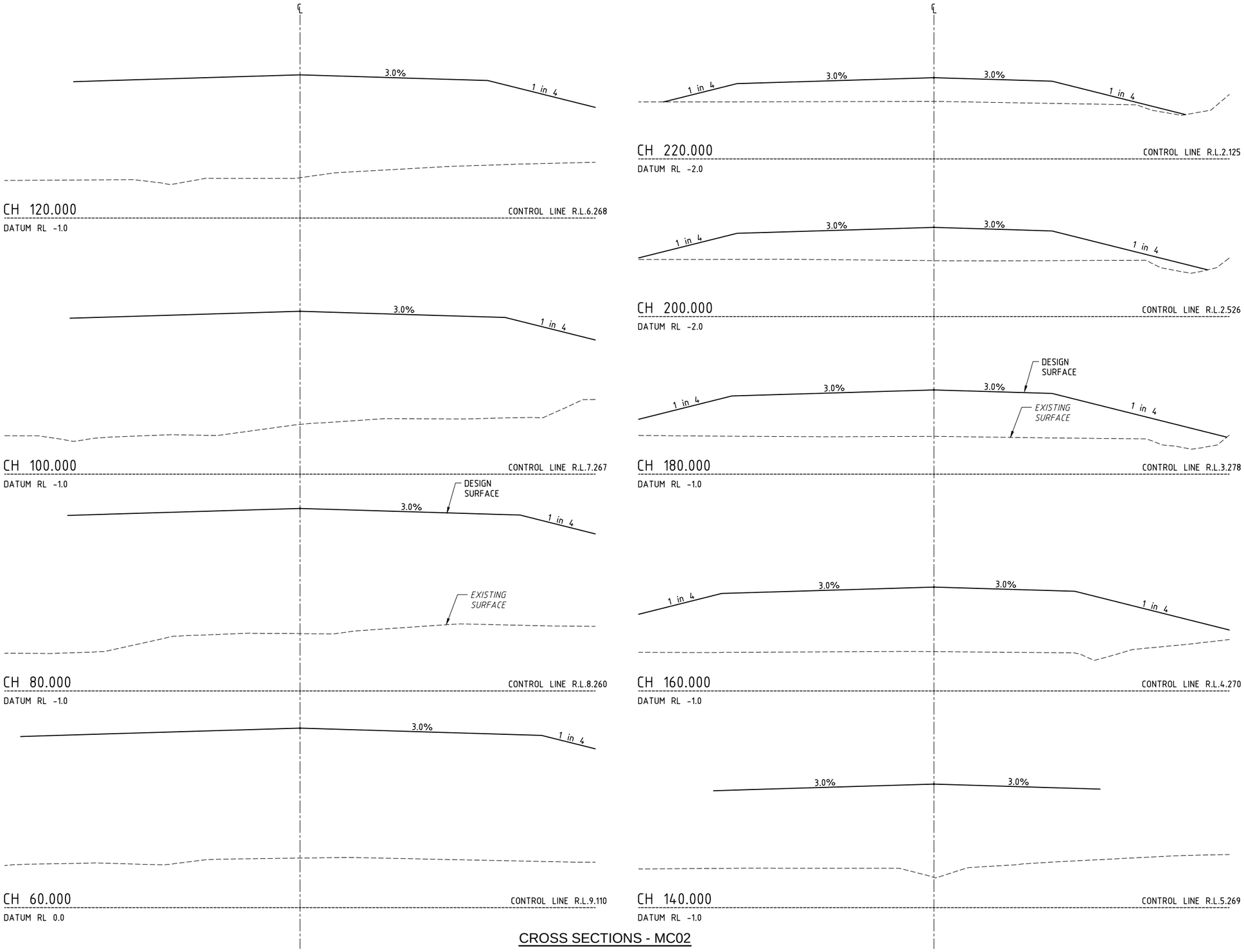

CROSS SECTIONS - MC02

SCALE 1 0 1 2 3 4 5 (metres)
1 : 100 (FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

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Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
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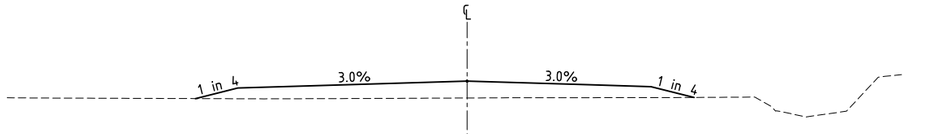
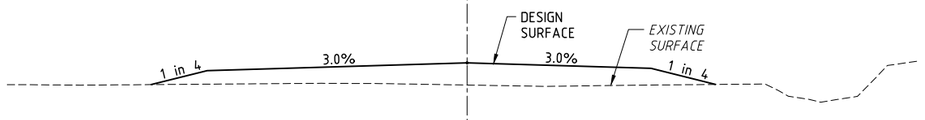


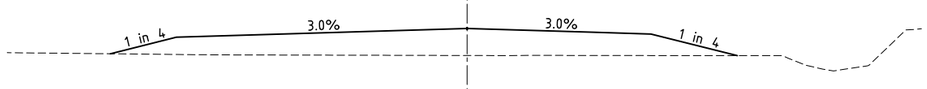
CH 340.000 — CONTROL LINE R.L.1.390

DATUM RL -2.0



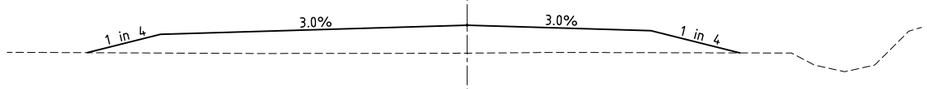
CH 320.000 — CONTROL LINE R.L.1.510

DATUM RL -2.0



CH 300.000 — CONTROL LINE R.L.1.630

DATUM RL -2.0

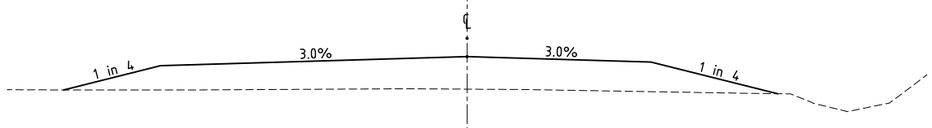


CH 280.000 — CONTROL LINE R.L.1.750

DATUM RL -2.0

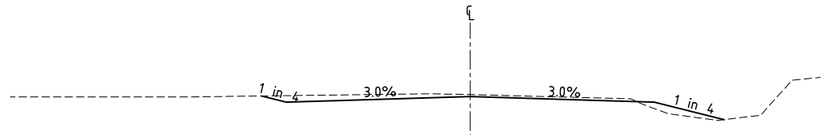
CH 260.000 — CONTROL LINE R.L.1.870

DATUM RL -1.0



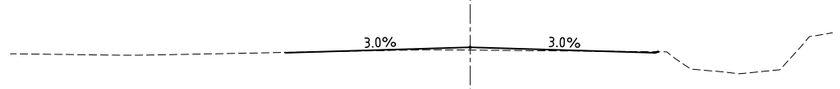
CH 240.000 — CONTROL LINE R.L.1.990

DATUM RL -2.0



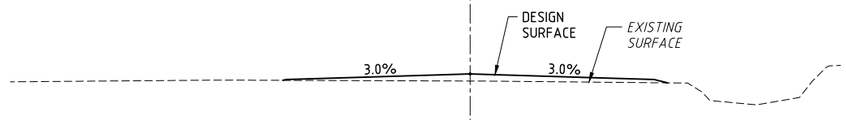
CH 420.000 — CONTROL LINE R.L.0.910

DATUM RL -2.0



CH 400.000 — CONTROL LINE R.L.1.030

DATUM RL -2.0



CH 380.000 — CONTROL LINE R.L.1.150

DATUM RL -2.0

CH 360.000 — CONTROL LINE R.L.1.270

DATUM RL -1.0

CROSS SECTIONS - MC02

SCALE 1 0 1 2 3 4 5 (metres)

1 : 100 (FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

BE190043-SK137 Rev B

BURCHILLS ENGINEERING SOLUTIONS

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
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Fax: +61 7 5509 6411
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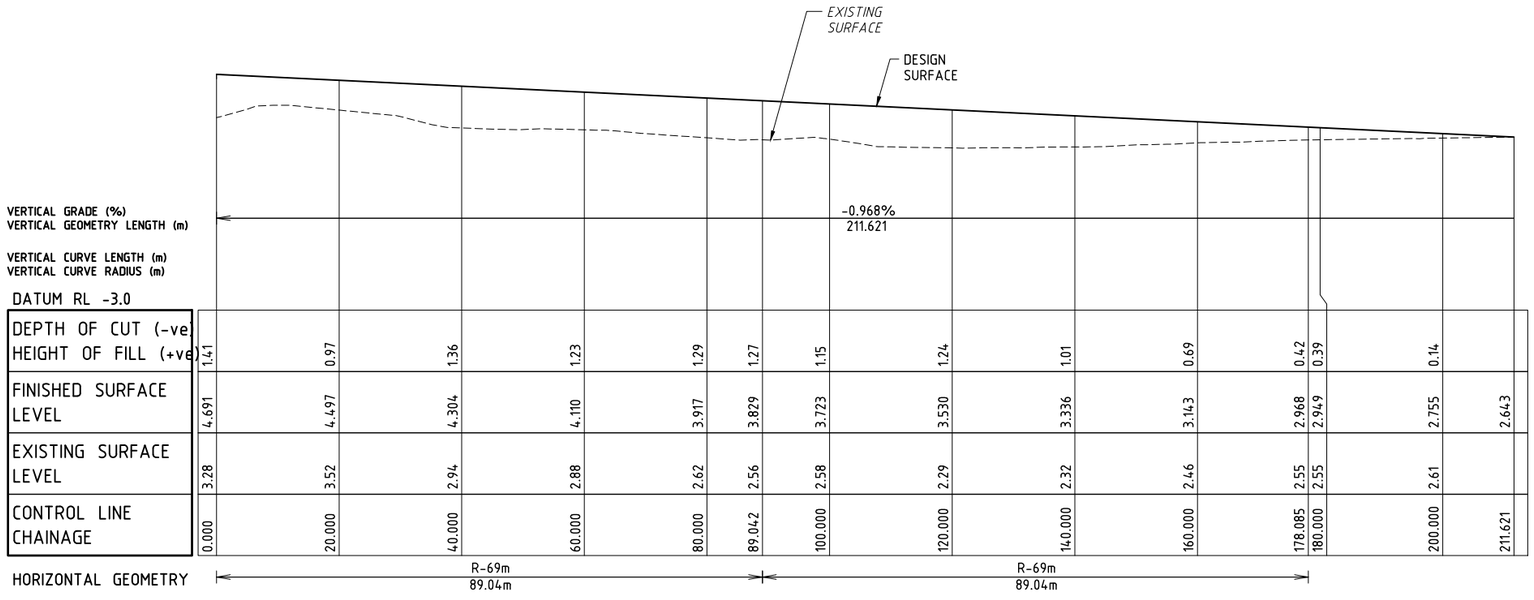
ABN 76 166 942 365



LONGITUDINAL SECTION - MC03

VERTICAL SCALE 1 0 1 2 3 4 5 1:100 (meters)

HORIZONTAL SCALE 5 0 5 10 15 20 25 1:500 (meters)

(FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

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Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
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Fax: +61 7 5509 6411
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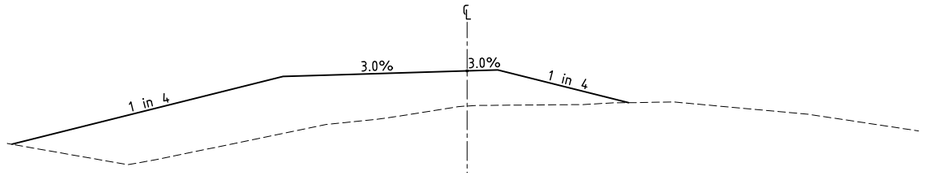
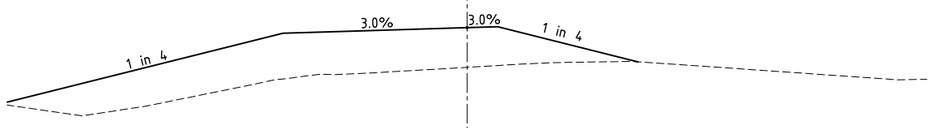


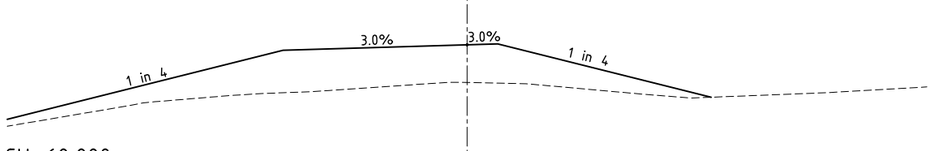
CH 100.000 — CONTROL LINE R.L.3.723

DATUM RL -1.0



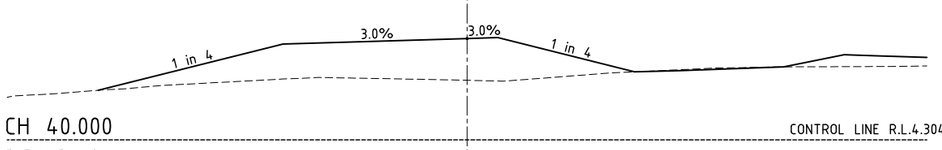
CH 80.000 — CONTROL LINE R.L.3.917

DATUM RL -1.0



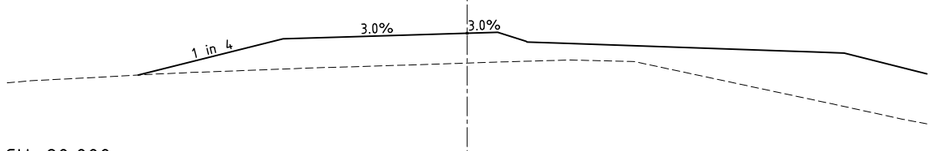
CH 60.000 — CONTROL LINE R.L.4.110

DATUM RL 0.0



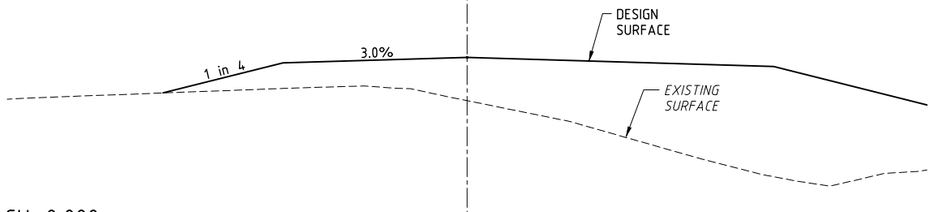
CH 40.000 — CONTROL LINE R.L.4.304

DATUM RL 1.0



CH 20.000 — CONTROL LINE R.L.4.497

DATUM RL 0.0



CH 0.000 — CONTROL LINE R.L.4.691

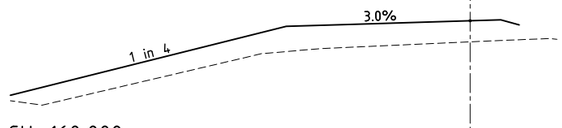
DATUM RL -1.0

CH 200.000 — CONTROL LINE R.L.2.755

DATUM RL -1.0

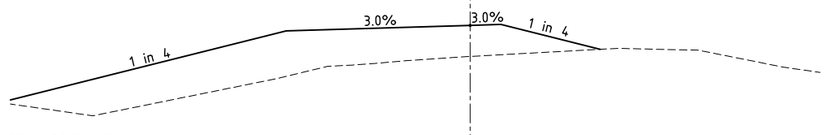
CH 180.000 — CONTROL LINE R.L.2.949

DATUM RL -1.0



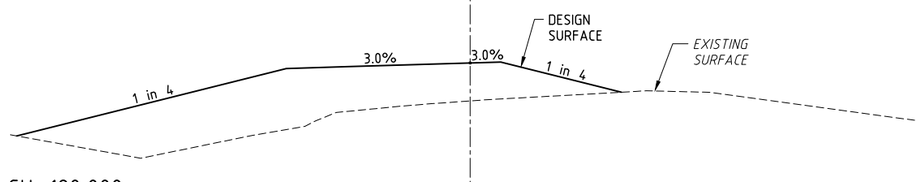
CH 160.000 — CONTROL LINE R.L.3.143

DATUM RL -1.0



CH 140.000 — CONTROL LINE R.L.3.336

DATUM RL -1.0



CH 120.000 — CONTROL LINE R.L.3.530

DATUM RL -1.0

CROSS SECTIONS - MC03

SCALE 1 0 1 2 3 4 5 (metres)

1 : 100 (FULL SIZE)

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY

Designer : AGA SZEWCZAK

Date : 17/08/2021

BE190043-SK139 Rev B

Hanson HEIDELBERGCEMENT Group

BURCHILLS ENGINEERING SOLUTIONS

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
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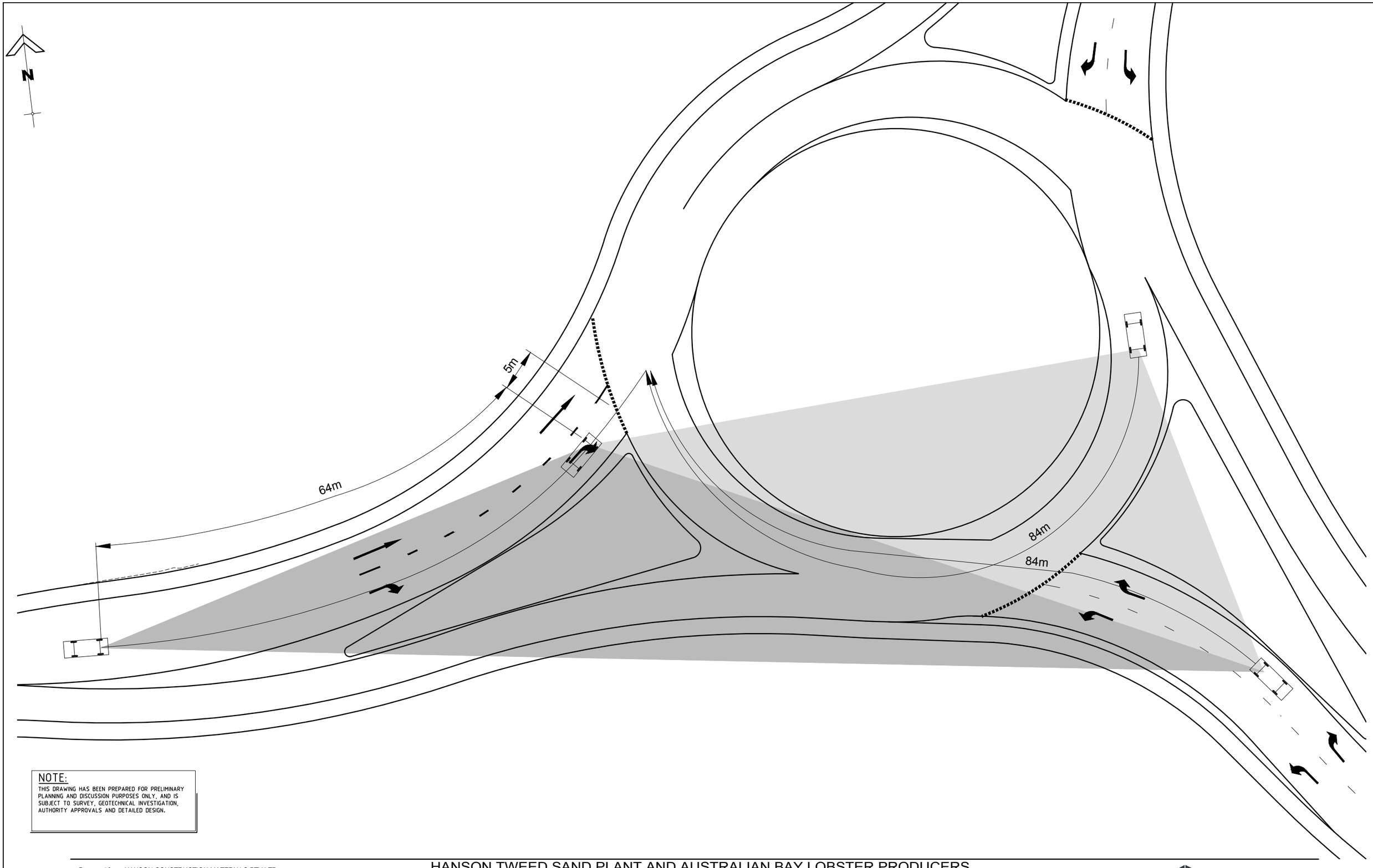

NOTE:
THIS DRAWING HAS BEEN PREPARED FOR PRELIMINARY PLANNING AND DISCUSSION PURPOSES ONLY, AND IS SUBJECT TO SURVEY, GEOTECHNICAL INVESTIGATION, AUTHORITY APPROVALS AND DETAILED DESIGN.

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

HANSON TWEED SAND PLANT AND AUSTRALIAN BAY LOBSTER PRODUCERS
PROPOSED SITE ACCESS STRATEGY VIA TWEED VALLEY WAY
SITE DISTANCE CHECK 1

SCALE 2 0 2 4 6 8 10 (metres)
1 : 200 (FULL SIZE)

BE190043-SK141 Rev A

Designer : G.CANNING
Date : 31-08-21

Hanson HEIDELBERGCEMENT Group

BURCHILLS ENGINEERING SOLUTIONS
Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

N

REFER TO BE190043-SK109 FOR CONTINUATION

Road markings change required to accommodate 26.0m B-double

Possible lane widening required to accommodate 26.0m B-double Subject to detail survey

NOTE:
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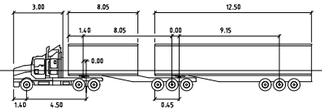
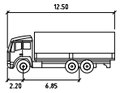
LEGEND

- WHEELS
- BODY
- 0.50m BODY CLEARANCE



B-double

	meters		
Tractor Width	: 2.50	Lock to Lock Time	: 6.0
Trailer Width	: 2.50	Steering Angle	: 29.4
Tractor Track	: 2.50	Articulating Angle	: 70.0
Trailer Track	: 2.50		



HRV

	meters
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 36.7

Prepared for : HANSON CONSTRUCTION MATERIALS PTY LTD

Designer : WELLINGTON JESUS

Date : 09/02/2021

TWEED VALLEY WAY AND AUSTRALIAN BAY LOBSTER PRODUCERS ACCESS_WIDENING WORKS

SWEPT PATH ANALYSIS - 26.0m B-Double

Scale: 1:500

BE190043-SK311 Rev B

BURCHILLS ENGINEERING SOLUTIONS

Level 2, Connaught Centre
26 Marine Parade, Southport QLD 4215
PO Box 3766, Australia Fair, Southport QLD 4215
Phone: +61 7 5509 6400
Fax: +61 7 5509 6411
Email: admin@burchills.com.au
Coote Burchills Engineering Pty Ltd
ABN 76 166 942 365

Appendix B – Traffic Surveys

Intersection Summary

Location	Tweed Valley Way / Lobster Farm (THU)				2
Time Interval	7:30	to	8:30	AM	
Time Interval	15:30	to	16:30	PM	

Survey Day, Date	Thursday, 5 March 2020
AM Peak Hour	7:30 to 8:30
PM Peak Hour	15:30 to 16:30
Weather	Fine

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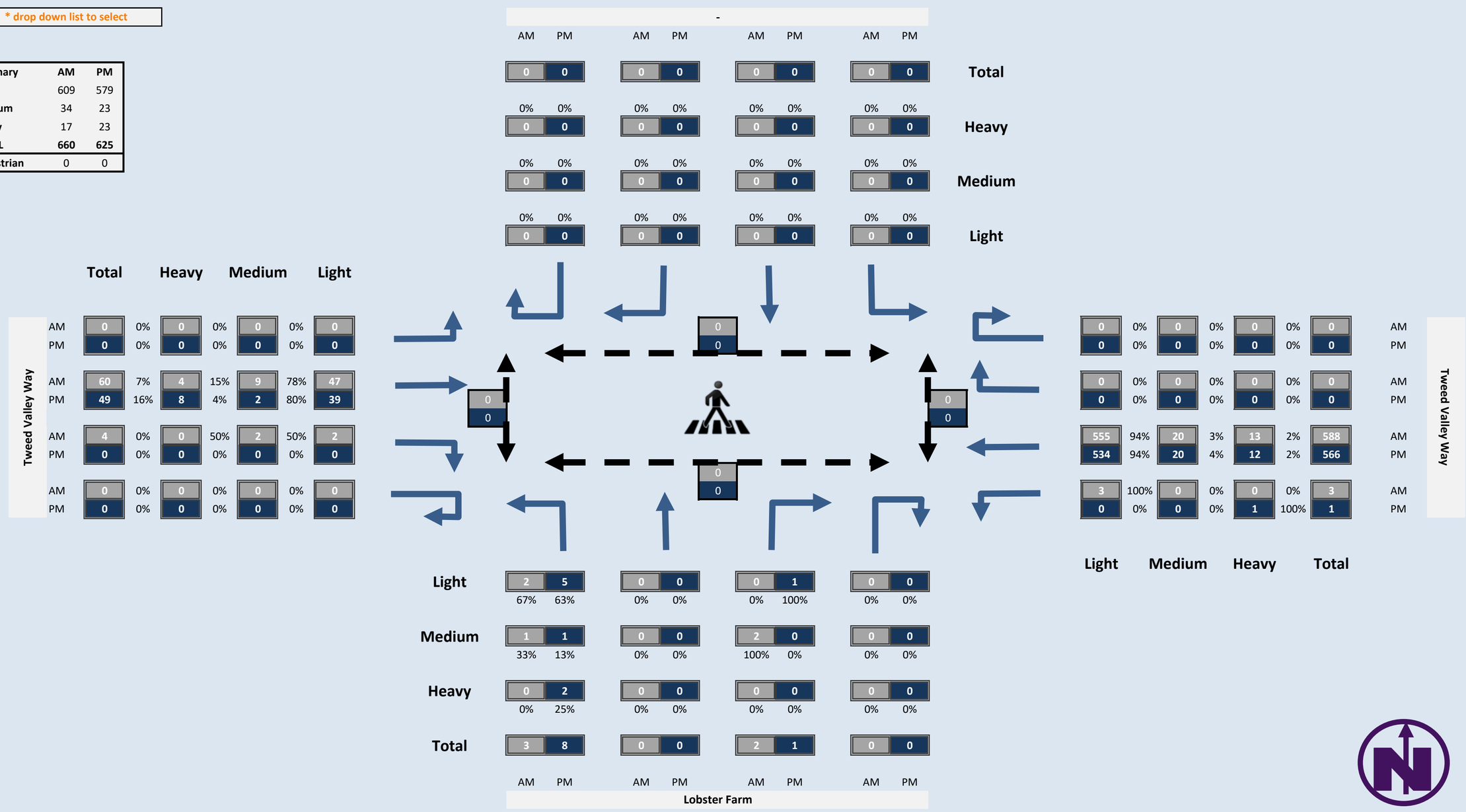
* drop down list to select

Summary	AM	PM
Light	609	579
Medium	34	23
Heavy	17	23
TOTAL	**660**	**625**
Pedestrian	0	0



Intersection Summary

Location	Tweed Valley Way / Service Station (THU)			1
Time Interval	7:30	to	8:30	AM
Time Interval	15:15	to	16:15	PM

Survey Day, Date	Thursday, 5 March 2020		
AM Peak Hour	7:30	to	8:30
PM Peak Hour	15:15	to	16:15
Weather	Fine		

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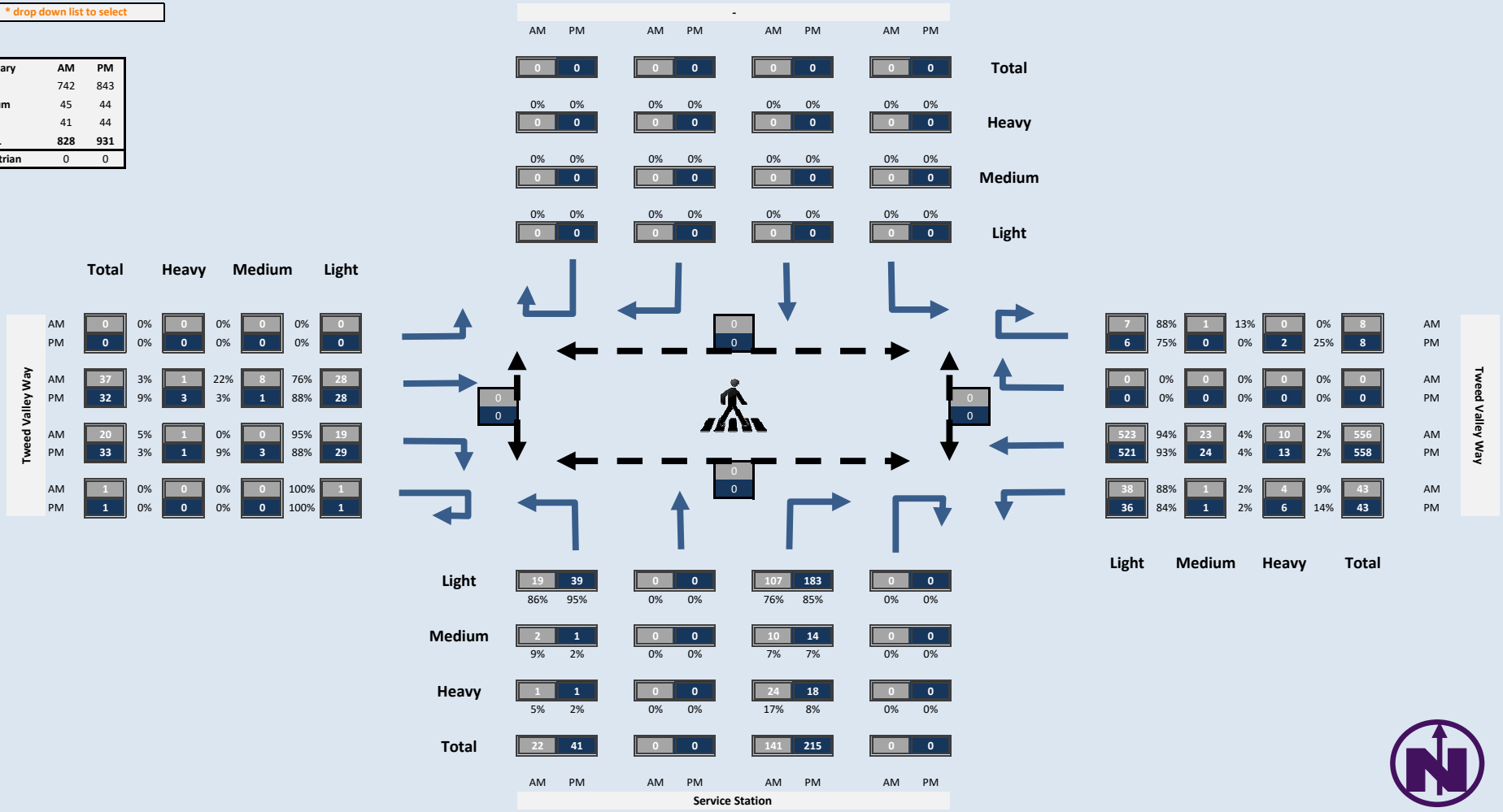
* drop down list to select

Summary	AM	PM
Light	742	843
Medium	45	44
Heavy	41	44
TOTAL	828	931
Pedestrian	0	0



One Page Summary

Back to Menu

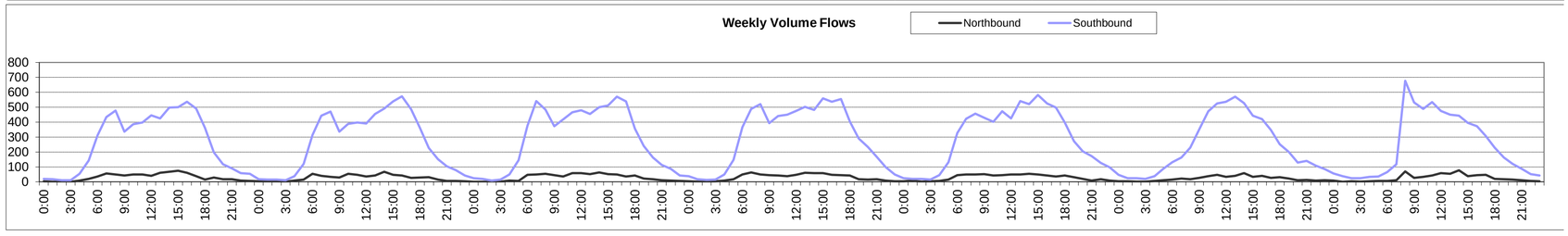
Street: Site 1, Tweed Valley Way
Suburb: Chinderah
Location: Site 1, Tweed Valley Way, to the electric light pole
Count No.: 1
Speed Limit: 80 km/h
Start Date: Wednesday, 4 March 2020

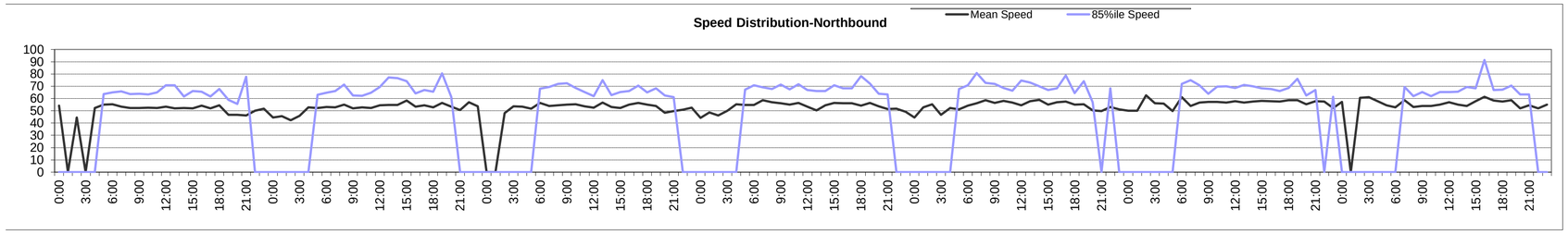
Research Analytics
Data Collection and Surveys
www.oneranda.com
contact@oneranda.com

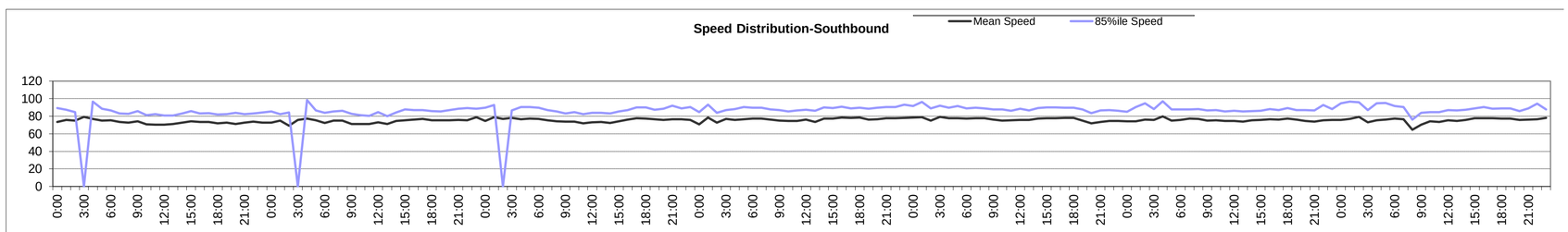
5-Day Speed & Volume Data				
		Travel Direction		
		Bidirectional	Northbound	Southbound
		7,566 vpd	722 vpd	6,844 vpd
Peak Hr AM	08:00	529 vpd	47 vpd	482 vpd
Peak Hr PM	16:00	596 vpd	48 vpd	548 vpd
Speeds	85th%	84.3 km/h	65.1 km/h	86.3 km/h
	Average	73.1 km/h	54.2 km/h	75.1 km/h
Commercial Vehicles %		11.2%	27.8%	9.4%

7-Day Speed & Volume Data				
		Travel Direction		
		Bidirectional	Northbound	Southbound
		7,226 vpd	676 vpd	6,549 vpd
Peak Hr AM	08:00	520 vpd	46 vpd	474 vpd
Peak Hr PM	14:00	560 vpd	65 vpd	505 vpd
Speeds	85th%	84.4 km/h	64.9 km/h	86.4 km/h
	Average	73.1 km/h	54.7 km/h	75.0 km/h
Commercial Vehicles %		9.5%	24.1%	8.0%

Data Record Inerval = 1-Hour	Monday, 09 Mar 20			Tuesday, 10 Mar 20			Wednesday, 04 Mar 20			Thursday, 05 Mar 20			Friday, 06 Mar 20			Saturday, 07 Mar 20			Sunday, 08 Mar 20		
	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional
Light Vehicle - Classes 1 to 2	516	5722	6238	465	5872	6337	510	6253	6763	510	6620	7130	537	6521	7058	458	5620	6078	518	5551	6069
Medium Vehicle - Classes 3 to 5	94	423	517	72	396	468	107	481	588	102	426	528	95	397	492	28	186	214	30	142	172
Long Vehicle - Classes 6 to 12	129	225	354	97	191	288	100	242	342	125	243	368	84	200	284	27	61	88	49	66	115
Volume 0700-1900	595	5287	5882	490	5331	5821	589	5696	6285	594	5805	6399	553	5669	6222	408	4836	5244	518	5021	5539
Volume 24-Hour	**739**	**6370**	**7109**	**634**	**6459**	**7093**	**717**	**6976**	**7693**	**737**	**7289**	**8026**	**716**	**7118**	**7834**	**513**	**5867**	**6380**	**597**	**5759**	**6356**
85%ile Speed	**63**	**83**	**81**	**65**	**85**	**83**	**64**	**86**	**84**	**66**	**89**	**86**	**67**	**89**	**87**	**65**	**87**	**85**	**64**	**86**	**84**
Mean Speed	**52.3**	**72.7**	**70.6**	**53.8**	**74.1**	**72.3**	**54.1**	**74.9**	**72.9**	**54.9**	**76.5**	**74.5**	**55.8**	**76.6**	**74.6**	**57.0**	**75.5**	**74.0**	**55.8**	**74.0**	**72.3**
AM Peak Hour Volume	55	478	526	53	471	504	57	542	591	62	521	571	51	473	517	46	525	571	70	677	747
AM Hour Factor	0.07	0.08	0.07	0.08	0.07	0.07	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.07	0.09	0.09	0.09	0.12	0.12	0.12
AM Peak 85%	66	97	88	71	98	85	72	93	93	72	93	88	81	96	89	75	97	91	69	97	97
AM Peak Time	7:00	8:00	8:00	9:00	8:00	8:00	11:00	7:00	7:00	7:00	8:00	8:00	9:00	11:00	11:00	11:00	11:00	11:00	10:00	9:00	8:00
PM Peak Hour Volume	74	536	596	68	572	614	63	571	619	61	559	618	54	582	630	57	570	610	77	474	533
PM Hour Factor	0.10	0.08	0.08	0.11	0.09	0.09	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.11	0.10	0.10	0.13	0.08	0.08
PM Peak 85%	78	86	83	81	89	87	75	92	89	78	93	89	79	90	89	76	93	87	91	94	91
PM Peak Time	15:00	16:00	13:00	14:00	16:00	16:00	14:00	14:00	16:00	13:00	15:00	15:00	14:00	15:00	15:00	14:00	13:00	13:00	14:00	14:00	12:00







Classification	Monday, 09 Mar 20			Tuesday, 10 Mar 20			Wednesday, 04 Mar 20			Thursday, 05 Mar 20			Friday, 06 Mar 20			Saturday, 07 Mar 20			Sunday, 08 Mar 20		
	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional	Northbound	Southbound	Bidirectional
Class 1 Car	495	5625	6120	447	5804	6251	477	6120	6597	487	6501	6988	510	6385	6895	430	5484	5914	492	5417	5909
Class 2 Car+Trailer	21	97	118	18	68	86	33	133	166	23	119	142	27	136	163	28	136	164	26	134	160
Class 3 2 axle Truck	58	297	355	37	296	333	45	332	377	47	297	344	64	301	365	23	165	188	23	124	147
Class 4 3 axle Truck	22	94	116	22	69	91	46	114	160	38	101	139	18	64	82	3	14	17	3	14	17
Class 5 4 axle Truck	14	32	46	13	31	44	16	35	51	17	28	45	13	32	45	2	7	9	4	4	8
Class 6 3 axle Semi	4	5	9	3	4	7	0	8	8	3	9	12	4	4	8	1	1	2	1	4	5
Class 7 4 axle Semi	5	8	13	6	14	20	5	9	14	4	9	13	8	11	19	1	3	4	1	2	3
Class 8 5 axle Semi	7	9	16	4	11	15	2	12	14	11	17	28	7	16	23	4	3	7	2	4	6
Class 9 6 axle Semi	55	105	160	40	98	138	55	134	189	62	123	185	35	110	145	11	32	43	24	26	50
Class 10 7/8 axle Truck	54	97	151	42	63	105	34	77	111	43	80	123	25	58	83	10	21	31	20	28	48
Class 11 B-Double	4	1	5	2	1	3	4	1	5	2	5	7	5	1	6	0	1	1	1	2	3
Class 12 Road Train	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Class 13 Unknown	20	3	23	11	1	12	13	0	13	13	0	13	10	2	12	5	0	5	10	1	11

Volume Summary

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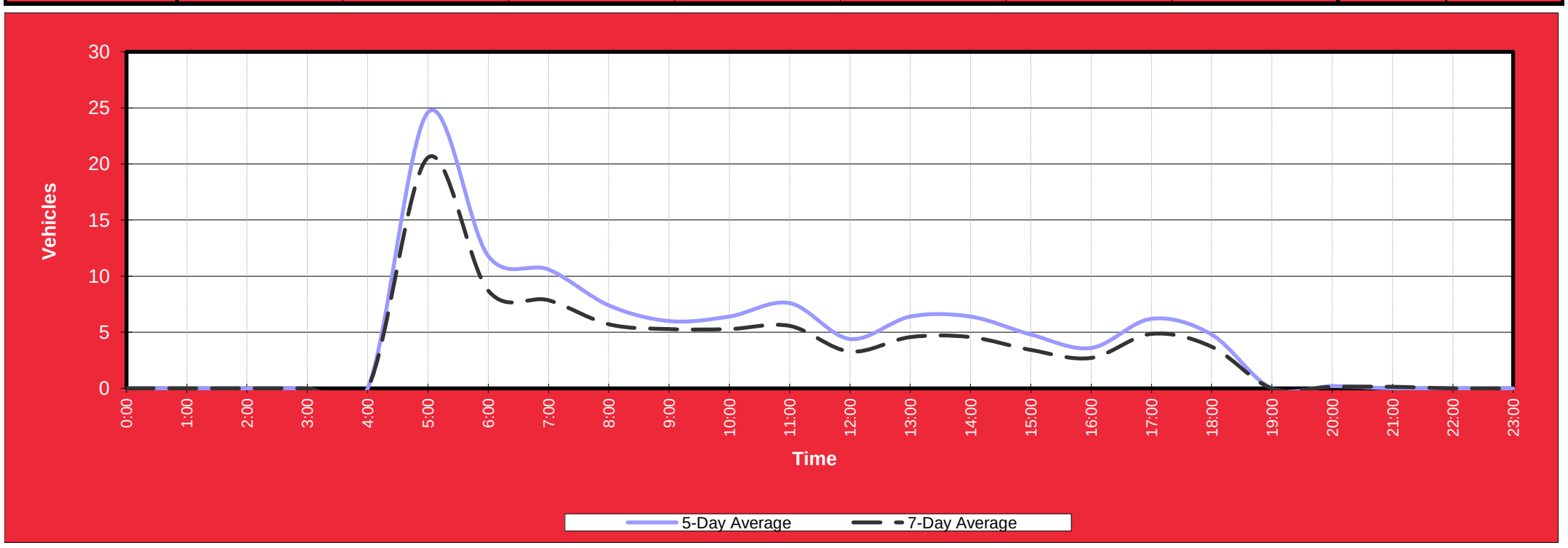
Street	Site 2, Tweed Valley Way				
Suburb	Chinderah				
Location	Site 2, Tweed Valley Way, to no through road sign board				
Count No.	2				
Start Date	Wednesday	04 Mar 2020	**Speed Limit**	20 km/h	
Direction	Eastbound				

5-Day Average	111
7-Day Average	86
5-Day Heavy (Classes 3 to 12)	7.2%
7-Day Heavy (Classes 3 to 12)	7.3%

Hour Starting	Day of Week - Classes 1 to 12							5-Day Average	7-Day Average
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	09/03/2020	10/03/2020	04/03/2020	05/03/2020	06/03/2020	07/03/2020	08/03/2020		
AM Peak	27	26	22	26	22	12	9		
PM Peak	10	7	9	6	8	2	2		
0:00	0	0	0	0	0	0	0	0	0
1:00	0	0	0	0	0	0	0	0	0
2:00	0	0	0	0	0	0	0	0	0
3:00	0	0	0	0	0	0	0	0	0
4:00	0	0	0	0	0	0	0	0	0
5:00	27	26	22	26	22	12	9	25	21
6:00	10	13	14	12	10	2	0	12	9
7:00	10	11	7	16	9	2	0	11	8
8:00	8	6	8	6	9	0	3	7	6
9:00	7	8	0	8	7	3	4	6	5
10:00	5	4	8	7	8	2	3	6	5
11:00	7	8	7	6	10	1	0	8	6
12:00	6	3	5	2	6	1	0	4	3
13:00	10	4	4	6	8	0	0	6	5
14:00	9	7	6	6	4	0	0	6	5
15:00	4	4	9	3	4	0	0	5	3
16:00	5	4	3	2	4	0	1	4	3
17:00	8	6	6	5	6	1	2	6	5
18:00	4	5	5	5	5	2	0	5	4
19:00	0	0	0	0	0	0	0	0	0
20:00	0	1	0	0	0	0	0	0	0
21:00	0	0	0	0	0	1	0	0	0
22:00	0	0	0	0	0	0	0	0	0
23:00	0	0	0	0	0	0	0	0	0
Total	**120**	**110**	**104**	**110**	**112**	**27**	**22**	**111**	**86**
Heavy %	4.2%	7.3%	7.7%	10.0%	7.1%	11.1%	4.5%	7.2%	7.3%



Hourly Classification Data

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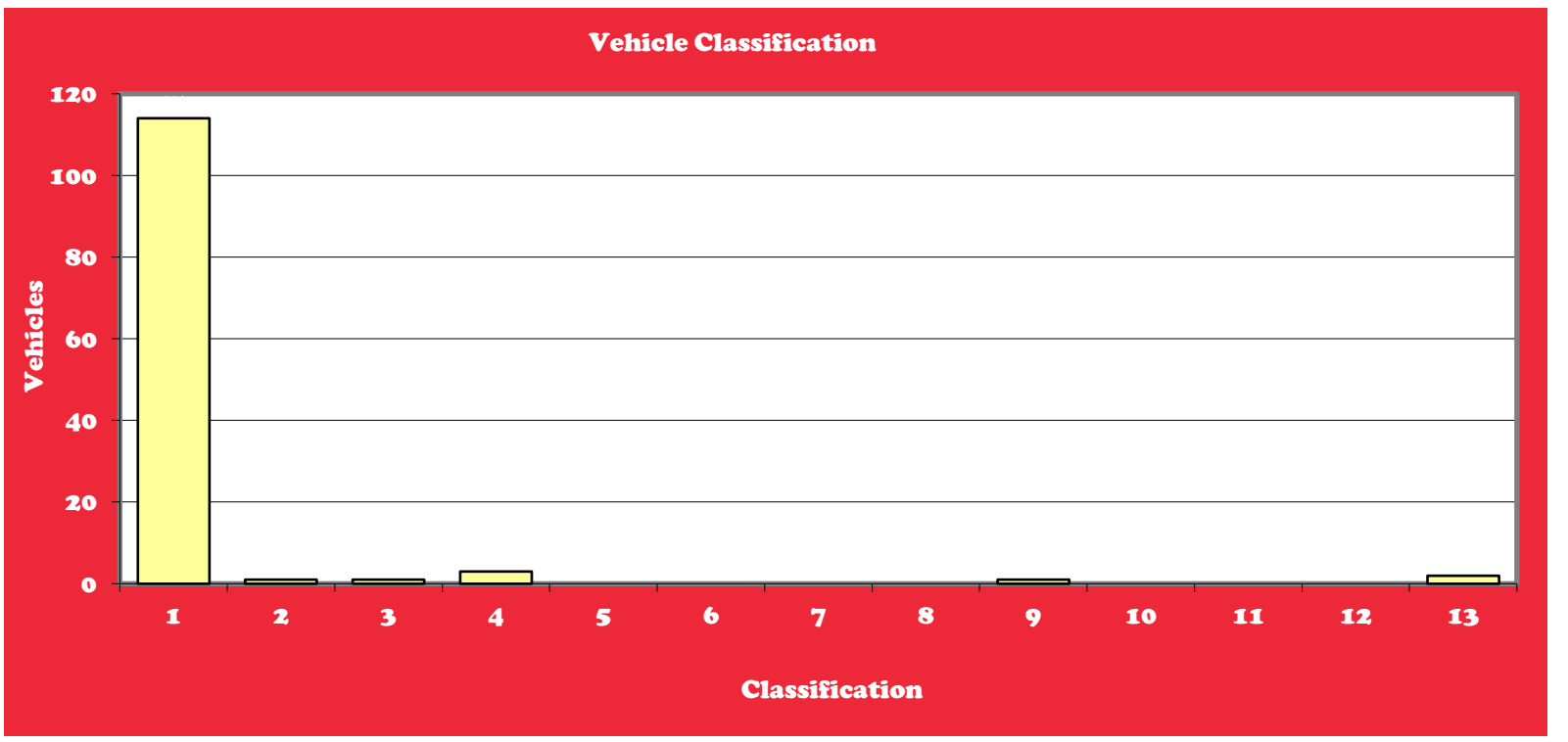
Street	Site 2, Tweed Valley Way			**AADT**	122
Suburb	Chinderah			**Average Speed**	32.5
Location	Site 2, Tweed Valley Way, to no through road sign board			**85th Percentile**	10
Direction	Eastbound			**Heavy Percentage**	4.1%
Day	Monday	**Count No.**	2	**AM Peak**	5:00 27 vph
Date	09 Mar 2020	**Speed Limit**	20 km/h	**PM Peak**	13:00 10 vph
Start Date	Wednesday 04 Mar 2020				

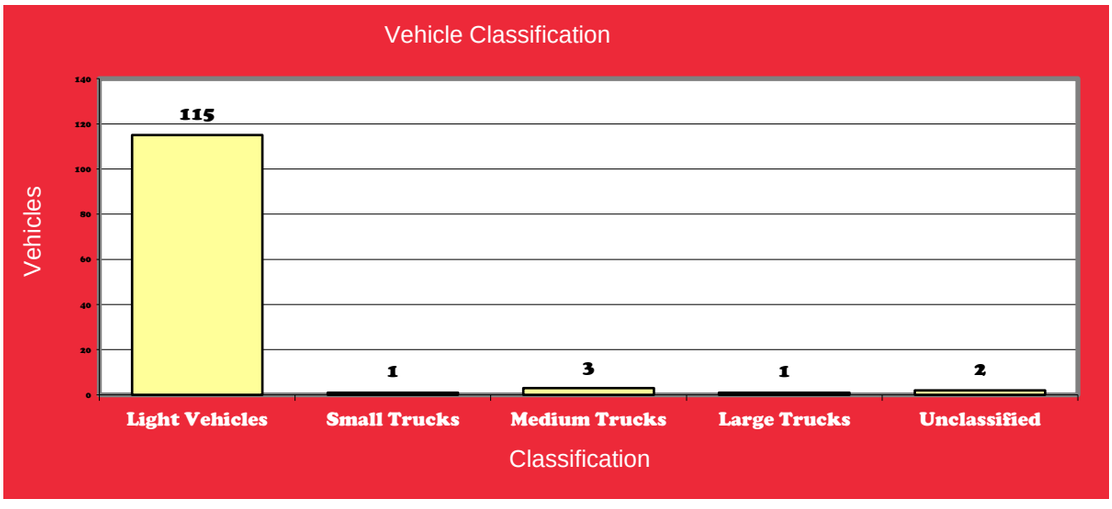
Hour Starting	Vehicle Classification														Speed	
	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	Average	85%ile
0:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
1:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
2:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
3:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
4:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
5:00	27	0	0	0	0	0	0	0	0	0	0	0	0	27	32.8	44
6:00	10	0	0	0	0	0	0	0	0	0	0	0	0	10	35.2	0
7:00	9	0	0	1	0	0	0	0	0	0	0	0	0	10	38.3	0
8:00	7	1	0	0	0	0	0	0	0	0	0	0	1	9	32.7	0
9:00	6	0	0	1	0	0	0	0	0	0	0	0	0	7	27.0	0
10:00	4	0	0	0	0	0	0	0	1	0	0	0	0	5	29.6	0
11:00	7	0	0	0	0	0	0	0	0	0	0	0	0	7	28.2	0
12:00	6	0	0	0	0	0	0	0	0	0	0	0	0	6	29.8	0
13:00	8	0	1	1	0	0	0	0	0	0	0	0	0	10	30.8	0
14:00	9	0	0	0	0	0	0	0	0	0	0	0	0	9	31.9	0
15:00	4	0	0	0	0	0	0	0	0	0	0	0	0	4	28.2	0
16:00	5	0	0	0	0	0	0	0	0	0	0	0	0	5	37.5	0
17:00	8	0	0	0	0	0	0	0	0	0	0	0	1	9	34.6	0
18:00	4	0	0	0	0	0	0	0	0	0	0	0	0	4	32.5	0
19:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
20:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
21:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
22:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
23:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
Total	114	1	1	3	0	0	0	0	1	0	0	0	2	122	32.5	10
Class %	93	1	1	2	0	0	0	0	1	0	0	0	2			



Class Data Summary

Street	Site 2, Tweed Valley Way		**Light Vehicles**	94.3%
Location	Chinderah		**Small Trucks**	0.8%
Count No.	Site 2, Tweed Valley Way, to no through road sign board		**Medium Trucks**	2.5%
Direction	Eastbound		**Large Trucks**	0.8%
Day	Monday		**Unclassified**	1.6%
Start Date	Wednesday	**AM Peak**	5:00	27 vph
Date	09 Mar 2020	**PM Peak**	13:00	10 vph

Hour Starting	Vehicle Classification					
	Light Vehicles	Small Trucks	Medium Trucks	Large Trucks	Unclassified	Total
0:00	0	0	0	0	0	0
1:00	0	0	0	0	0	0
2:00	0	0	0	0	0	0
3:00	0	0	0	0	0	0
4:00	0	0	0	0	0	0
5:00	27	0	0	0	0	27
6:00	10	0	0	0	0	10
7:00	9	0	1	0	0	10
8:00	8	0	0	0	1	9
9:00	6	0	1	0	0	7
10:00	4	0	0	1	0	5
11:00	7	0	0	0	0	7
12:00	6	0	0	0	0	6
13:00	8	1	1	0	0	10
14:00	9	0	0	0	0	9
15:00	4	0	0	0	0	4
16:00	5	0	0	0	0	5
17:00	8	0	0	0	1	9
18:00	4	0	0	0	0	4
19:00	0	0	0	0	0	0
20:00	0	0	0	0	0	0
21:00	0	0	0	0	0	0
22:00	0	0	0	0	0	0
23:00	0	0	0	0	0	0
Total	**115**	**1**	**3**	**1**	**2**	**122**



Light Vehicles – Classes 1 to 2

Small Trucks – Class 3

Medium Trucks – Classes 4 to 5

Large Trucks – Classes 6 to 12

Unclassified – Class 13

One Page Summary

Back to Menu

Street: Site 3, Tweed Valley Way
Suburb: Chinderah
Location: Site 1, Tweed Valley Way
Count No.: 3
Speed Limit: 80 km/h
Start Date: Thursday, 12 March 2020

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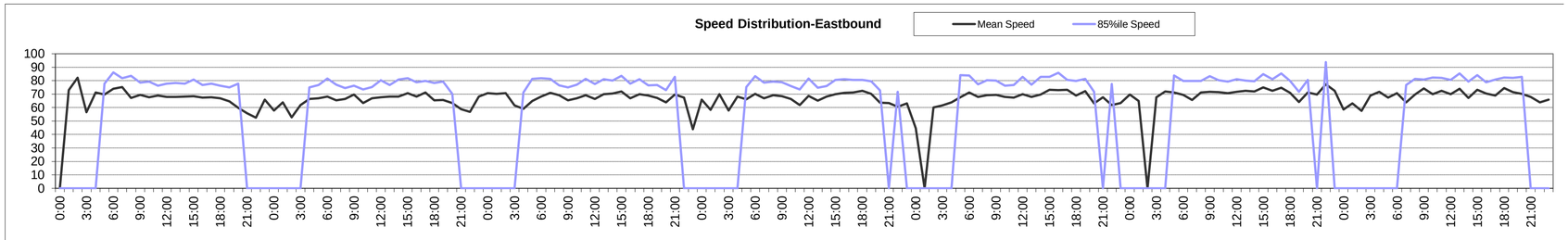
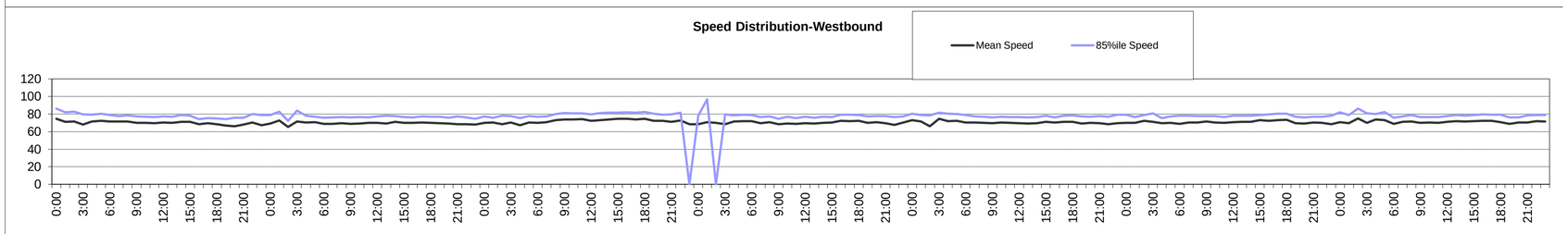
5-Day Speed & Volume Data				
		Travel Direction		
		Bidirectional	Eastbound	Westbound
		6,938 vpd	708 vpd	6,230 vpd
Peak Hr AM	07:00	497 vpd	52 vpd	445 vpd
Peak Hr PM	15:00	557 vpd	57 vpd	500 vpd
Speeds	85th%	77.5 km/h	75.9 km/h	77.7 km/h
	Average	70.4 km/h	68.2 km/h	70.6 km/h
Commercial Vehicles %		12.6%	32.4%	10.4%

7-Day Speed & Volume Data				
		Travel Direction		
		Bidirectional	Eastbound	Westbound
		6,380 vpd	631 vpd	5,749 vpd
Peak Hr AM	11:00	457 vpd	44 vpd	413 vpd
Peak Hr PM	15:00	507 vpd	52 vpd	455 vpd
Speeds	85th%	77.6 km/h	75.7 km/h	77.8 km/h
	Average	70.5 km/h	68.7 km/h	70.7 km/h
Commercial Vehicles %		11.0%	30.4%	8.9%

Data Record Inerval = 1-Hour	Monday, 16 Mar 20			Tuesday, 17 Mar 20			Wednesday, 18 Mar 20			Thursday, 12 Mar 20			Friday, 13 Mar 20			Saturday, 14 Mar 20			Sunday, 15 Mar 20		
	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional
Light Vehicle - Classes 1 to 2	485	5427	5912	505	5387	5892	418	5043	5461	493	5896	6389	478	6160	6638	354	4751	5105	327	3992	4319
Medium Vehicle - Classes 3 to 5	127	382	509	119	383	502	111	613	724	118	410	528	113	372	485	62	117	179	46	105	151
Long Vehicle - Classes 6 to 12	90	233	323	117	204	321	106	226	332	145	222	367	102	191	293	38	72	110	50	53	103
Volume 0700-1900	563	5119	5682	582	4981	5563	487	4884	5371	597	5352	5949	528	5566	6094	356	4110	4466	348	3517	3865
Volume 24-Hour	**702**	**6042**	**6744**	**741**	**5974**	**6715**	**635**	**5882**	**6517**	**756**	**6528**	**7284**	**693**	**6723**	**7416**	**454**	**4940**	**5394**	**423**	**4150**	**4573**
85%ile Speed	**76**	**77**	**77**	**74**	**77**	**77**	**77**	**80**	**80**	**75**	**77**	**77**	**77**	**77**	**77**	**76**	**78**	**78**	**74**	**78**	**78**
Mean Speed	**68.3**	**70.0**	**69.9**	**67.1**	**69.7**	**69.4**	**68.4**	**73.1**	**72.6**	**67.7**	**70.3**	**70.0**	**69.4**	**70.2**	**70.1**	**71.4**	**71.1**	**71.1**	**70.5**	**71.0**	**71.0**
AM Peak Hour Volume	56	421	452	59	444	503	51	466	517	68	445	513	62	451	513	41	446	487	36	412	448
AM Hour Factor	0.08	0.07	0.07	0.08	0.07	0.07	0.08	0.08	0.08	0.09	0.07	0.07	0.09	0.07	0.07	0.09	0.09	0.09	0.09	0.10	0.10
AM Peak 85%	86	86	86	82	84	77	82	81	81	83	97	90	84	82	81	84	81	79	82	86	79
AM Peak Time	6:00	7:00	7:00	9:00	7:00	7:00	7:00	7:00	7:00	11:00	11:00	11:00	7:00	7:00	7:00	11:00	11:00	11:00	10:00	9:00	11:00
PM Peak Hour Volume	68	546	613	61	491	537	46	508	552	64	500	551	57	564	614	51	492	528	47	403	437
PM Hour Factor	0.10	0.09	0.09	0.08	0.08	0.08	0.07	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.11	0.10	0.10	0.11	0.10	0.10
PM Peak 85%	81	80	79	82	78	78	84	82	82	82	79	79	86	79	79	94	80	81	85	80	79
PM Peak Time	15:00	16:00	13:00	13:00	17:00	9:00	12:00	14:00	15:00	14:00	16:00	15:00	15:00	14:00	15:00	14:00	13:00	13:00	15:00	14:00	12:00





Classification	Monday, 16 Mar 2020			Tuesday, 17 Mar 2020			Wednesday, 18 Mar 2020			Thursday, 12 Mar 2020			Friday, 13 Mar 2020			Saturday, 14 Mar 2020			Sunday, 15 Mar 2020		
	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional	Eastbound	Westbound	Bidirectional
Class 1 Car	458	5274	5732	488	5235	5723	406	4915	5321	473	5744	6217	457	5995	6452	337	4598	4935	307	3850	4157
Class 2 Car+Trailer	27	153	180	17	152	169	12	128	140	20	152	172	21	165	186	17	153	170	20	142	162
Class 3 2 axle Truck	108	264	372	92	269	361	81	499	580	79	291	370	78	269	347	56	102	158	45	89	134
Class 4 3 axle Truck	13	82	95	18	75	93	16	87	103	26	86	112	20	71	91	4	9	13	1	8	9
Class 5 4 axle Truck	6	36	42	9	39	48	14	27	41	13	33	46	15	32	47	2	6	8	0	8	8
Class 6 3 axle Semi	4	7	11	3	5	8	3	8	11	4	2	6	5	3	8	1	5	6	3	4	7
Class 7 4 axle Semi	8	10	18	5	9	14	6	20	26	9	12	21	8	8	16	5	4	9	5	2	7
Class 8 5 axle Semi	5	10	15	3	11	14	5	16	21	5	13	18	3	13	16	1	5	6	1	1	2
Class 9 6 axle Semi	20	110	130	38	102	140	39	103	142	49	108	157	34	95	129	23	42	65	21	29	50
Class 10 7/8 axle Truck	53	96	149	61	76	137	50	77	127	67	86	153	47	70	117	7	16	23	19	17	36
Class 11 B-Double	0	0	0	7	1	8	3	2	5	11	1	12	5	2	7	1	0	1	1	0	1
Class 12 Road Train	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Class 13 Unknown	3	0	3	1	0	1	6	1	7	1	0	1	2	0	2	0	0	0	2	0	2

Volume Summary

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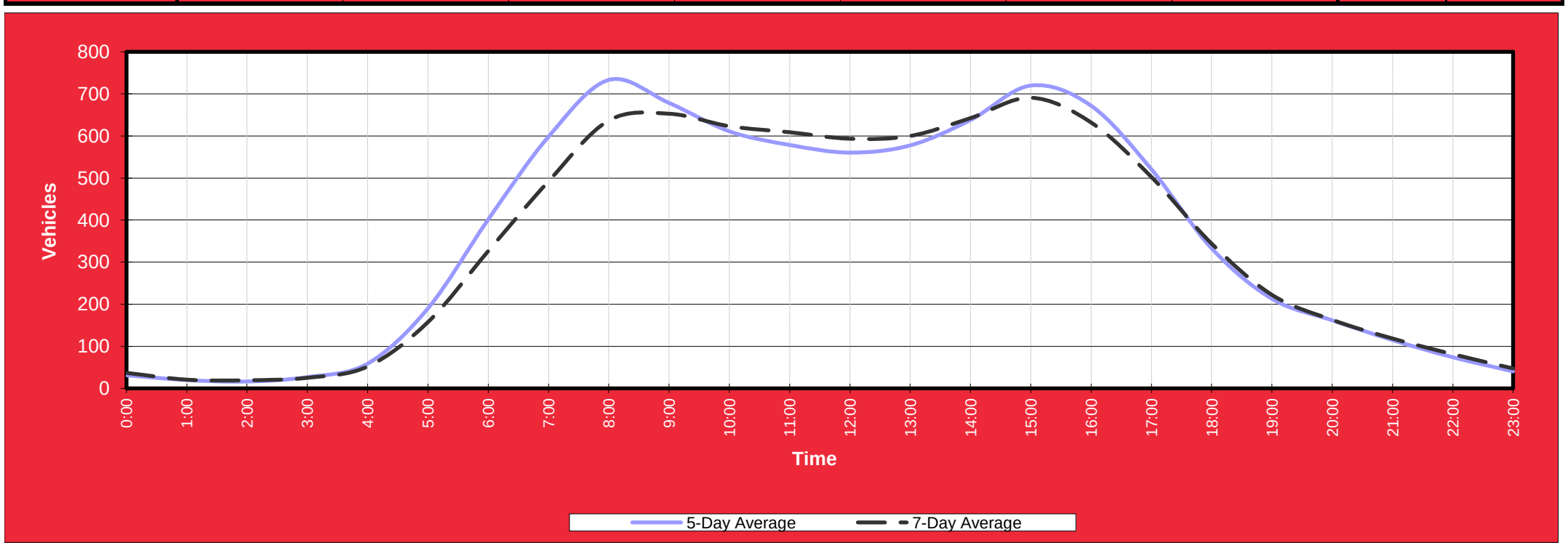
Street	Site 4, Tweed Valley Way				
Suburb	Chinderah			**5-Day Average**	8,569
Location	Site 4, Tweed Valley Way			**7-Day Average**	8,289
Count No.	4			**5-Day Heavy (Classes 3 to 12)**	20.9%
Start Date	Wednesday	04 Mar 2020	**Speed Limit** 60 km/h	**7-Day Heavy (Classes 3 to 12)**	19.1%
Direction	Northbound				

Hour Starting	Day of Week - Classes 1 to 12							5-Day Average	7-Day Average
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	09/03/2020	10/03/2020	04/03/2020	05/03/2020	06/03/2020	07/03/2020	08/03/2020		
AM Peak	769	731	721	792	709	707	662		
PM Peak	647	680	744	778	750	642	730		
0:00	27	37	31	33	28	43	59	31	37
1:00	24	16	20	21	18	25	21	20	21
2:00	19	19	14	16	14	31	22	16	19
3:00	18	23	35	35	23	28	14	27	25
4:00	52	46	72	65	59	38	32	59	52
5:00	186	202	201	174	187	88	64	190	157
6:00	396	373	431	431	376	156	121	401	326
7:00	578	591	644	604	574	280	174	598	492
8:00	769	731	674	792	700	440	351	733	637
9:00	635	635	721	692	709	658	520	678	653
10:00	635	548	627	604	641	693	614	611	623
11:00	559	528	602	595	609	707	662	579	609
12:00	499	577	524	578	624	631	721	560	593
13:00	559	510	599	595	625	642	670	578	600
14:00	617	536	664	654	718	578	730	638	642
15:00	647	680	744	778	750	584	653	720	691
16:00	584	676	672	745	682	503	562	672	632
17:00	435	469	488	614	599	453	460	521	503
18:00	255	303	308	352	446	388	356	333	344
19:00	171	169	198	245	282	217	274	213	222
20:00	130	164	155	165	195	148	183	162	163
21:00	101	93	127	108	145	142	114	115	119
22:00	73	67	54	86	90	125	74	74	81
23:00	40	28	33	46	55	83	47	40	47
Total	**8,009**	**8,021**	**8,638**	**9,028**	**9,149**	**7,681**	**7,498**	**8,569**	**8,289**
Heavy %	22.2%	22.3%	20.7%	20.5%	19.1%	14.2%	14.0%	20.9%	19.1%

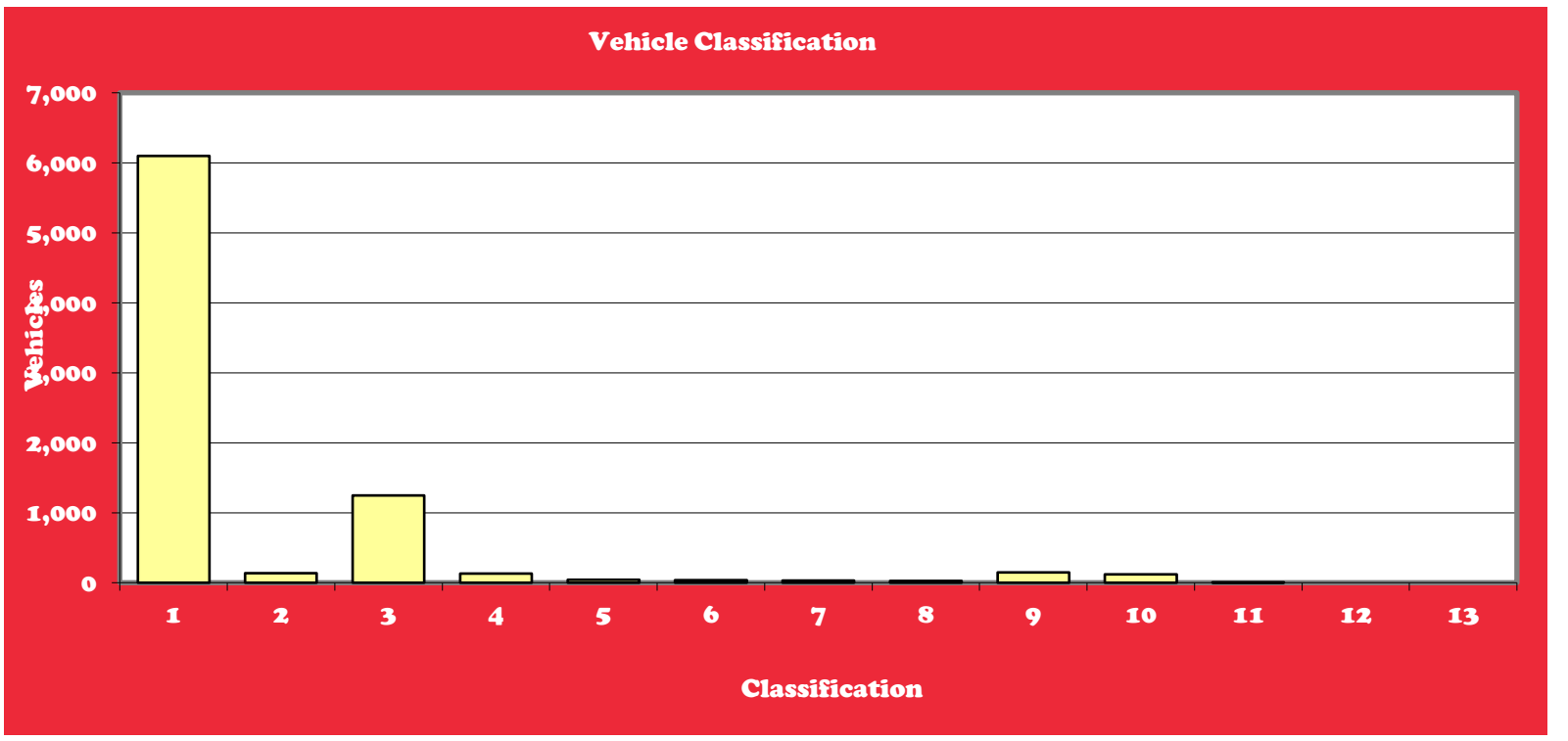


Hourly Classification Data

Research Analytics
Data Collection and Surveys

Street	Site 4, Tweed Valley Way		**AADT**	8,009	
Suburb	Chinderah		**Average Speed**	87.5	
Location	Site 4, Tweed Valley Way		**85th Percentile**	103	
Direction	Northbound		**Heavy Percentage**	22.2%	
Day	Monday	**Count No.** 4	**AM Peak**	8:00	769 vph
Date	09 Mar 2020	**Speed Limit** 60 km/h	**PM Peak**	15:00	647 vph
Start Date	Wednesday 04 Mar 2020				

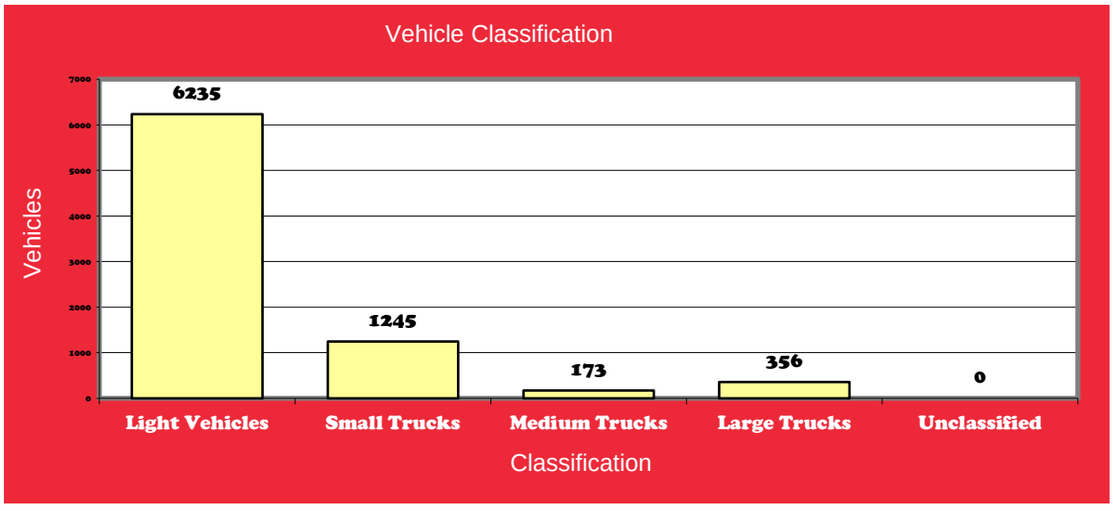
Hour Starting	Vehicle Classification														Speed	
	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	Average	85%ile
0:00	15	0	4	0	0	0	0	1	6	1	0	0	0	27	90.7	108
1:00	15	1	5	0	0	0	0	0	0	3	0	0	0	24	83.0	112
2:00	8	0	2	0	0	0	0	0	4	5	0	0	0	19	88.6	127
3:00	11	0	5	0	0	0	0	0	1	1	0	0	0	18	94.0	119
4:00	27	1	16	1	1	0	0	0	3	3	0	0	0	52	92.3	114
5:00	125	4	39	4	5	1	0	0	2	6	0	0	0	186	94.4	110
6:00	282	6	77	3	6	2	2	2	9	7	0	0	0	396	92.5	110
7:00	435	8	95	10	4	1	3	3	11	8	0	0	0	578	88.2	104
8:00	612	5	109	21	5	5	1	1	8	2	0	0	0	769	87.2	101
9:00	506	6	79	20	1	3	1	2	12	5	0	0	0	635	87.5	102
10:00	469	14	102	24	0	3	3	1	9	10	0	0	0	635	84.9	100
11:00	391	21	100	11	4	6	3	1	14	8	0	0	0	559	84.6	98
12:00	368	19	85	6	2	3	3	1	6	6	0	0	0	499	85.9	103
13:00	409	16	97	12	2	3	4	1	9	6	0	0	0	559	84.4	98
14:00	466	14	100	7	6	1	3	2	8	9	1	0	0	617	87.9	103
15:00	497	9	116	6	1	0	2	0	11	5	0	0	0	647	89.9	104
16:00	484	2	79	3	2	4	0	2	6	2	0	0	0	584	89.1	102
17:00	365	5	51	2	0	1	1	0	7	3	0	0	0	435	88.5	105
18:00	213	1	36	1	0	1	0	1	1	1	0	0	0	255	87.8	101
19:00	144	0	15	0	0	0	0	1	4	7	0	0	0	171	86.2	100
20:00	107	3	9	0	0	0	1	2	5	3	0	0	0	130	84.4	103
21:00	72	0	16	1	1	1	0	1	2	7	0	0	0	101	87.4	106
22:00	50	1	6	1	0	1	1	1	7	5	0	0	0	73	83.9	106
23:00	28	0	2	0	0	0	1	0	4	5	0	0	0	40	86.0	120
Total	6,099	136	1,245	133	40	36	29	23	149	118	1	0	0	8,009	87.5	103
Class %	76	2	16	2	0	0	0	0	2	1	0	0	0			



Class Data Summary

Street	Site 4, Tweed Valley Way		**Light Vehicles**	77.8%
Location	Chinderah		**Small Trucks**	15.5%
Count No.	Site 4, Tweed Valley Way		**Medium Trucks**	2.2%
Direction	Northbound		**Large Trucks**	4.4%
Day	Monday		**Unclassified**	0.0%
Start Date	Wednesday	**AM Peak**	8:00	769 vph
Date	09 Mar 2020	**PM Peak**	15:00	647 vph

Hour Starting	Vehicle Classification					
	Light Vehicles	Small Trucks	Medium Trucks	Large Trucks	Unclassified	Total
0:00	15	4	0	8	0	27
1:00	16	5	0	3	0	24
2:00	8	2	0	9	0	19
3:00	11	5	0	2	0	18
4:00	28	16	2	6	0	52
5:00	129	39	9	9	0	186
6:00	288	77	9	22	0	396
7:00	443	95	14	26	0	578
8:00	617	109	26	17	0	769
9:00	512	79	21	23	0	635
10:00	483	102	24	26	0	635
11:00	412	100	15	32	0	559
12:00	387	85	8	19	0	499
13:00	425	97	14	23	0	559
14:00	480	100	13	24	0	617
15:00	506	116	7	18	0	647
16:00	486	79	5	14	0	584
17:00	370	51	2	12	0	435
18:00	214	36	1	4	0	255
19:00	144	15	0	12	0	171
20:00	110	9	0	11	0	130
21:00	72	16	2	11	0	101
22:00	51	6	1	15	0	73
23:00	28	2	0	10	0	40
Total	**6235**	**1245**	**173**	**356**	**0**	**8009**



Light Vehicles – Classes 1 to 2

Small Trucks – Class 3

Medium Trucks – Classes 4 to 5

Large Trucks – Classes 6 to 12

Unclassified – Class 13

Volume Summary

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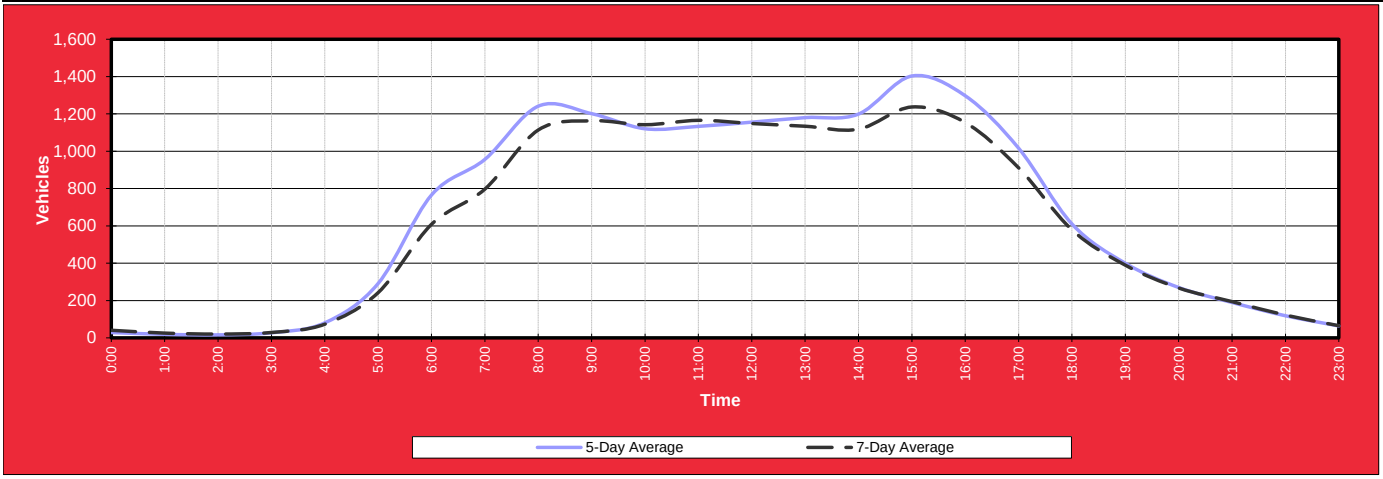
Street	Site 5, Tweed vallay Way				
Suburb	Murwillubah				
Location	Site 5, Murwillubah, Tweed vallay Way				
Count No.	5				
Start Date	Wednesday	04 Mar 2020	**Speed Limit** 60 km/h		
Direction	Bidirectional				

5-Day Average	15,783
7-Day Average	14,740
5-Day Heavy (Classes 3 to 12)	8.0%
7-Day Heavy (Classes 3 to 12)	7.1%

Hour Starting	Day of Week - Classes 1 to 12							5-Day Average	7-Day Average
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	09/03/2020	10/03/2020	04/03/2020	05/03/2020	06/03/2020	07/03/2020	08/03/2020		
AM Peak	1,244	1,229	1,258	1,313	1,176	1,292	1,201		
PM Peak	1,327	1,316	1,469	1,507	1,398	1,131	1,130		
0:00	23	20	32	38	29	69	74	28	41
1:00	14	16	23	18	23	45	39	19	25
2:00	14	15	17	14	20	31	32	16	20
3:00	28	19	32	30	27	39	27	27	29
4:00	80	70	81	95	76	51	59	80	73
5:00	273	295	306	297	286	153	86	291	242
6:00	690	730	848	862	697	284	148	765	608
7:00	946	922	1,008	1,002	904	486	312	956	797
8:00	1,244	1,229	1,248	1,313	1,173	742	847	1,241	1,114
9:00	1,170	1,172	1,258	1,231	1,176	1,084	1,051	1,201	1,163
10:00	1,074	1,038	1,110	1,204	1,176	1,221	1,171	1,120	1,142
11:00	1,041	1,159	1,184	1,107	1,175	1,292	1,201	1,133	1,166
12:00	1,148	1,092	1,175	1,143	1,221	1,131	1,130	1,156	1,149
13:00	1,093	1,092	1,212	1,207	1,296	1,003	1,034	1,180	1,134
14:00	1,042	1,143	1,257	1,203	1,350	882	949	1,199	1,118
15:00	1,327	1,314	1,469	1,507	1,398	807	838	1,403	1,237
16:00	1,226	1,316	1,311	1,422	1,211	816	774	1,297	1,154
17:00	939	985	1,017	1,095	1,046	705	591	1,016	911
18:00	494	579	598	714	667	541	458	610	579
19:00	308	385	403	465	437	371	357	400	389
20:00	201	244	257	326	321	288	233	270	267
21:00	102	183	208	206	249	255	156	190	194
22:00	91	89	103	120	189	174	87	118	122
23:00	58	57	61	37	106	104	34	64	65
Total	**14,626**	**15,164**	**16,218**	**16,656**	**16,253**	**12,574**	**11,688**	**15,783**	**14,740**
Heavy %	8.3%	8.0%	8.1%	8.4%	7.4%	4.4%	3.7%	8.0%	7.1%



Volume Summary

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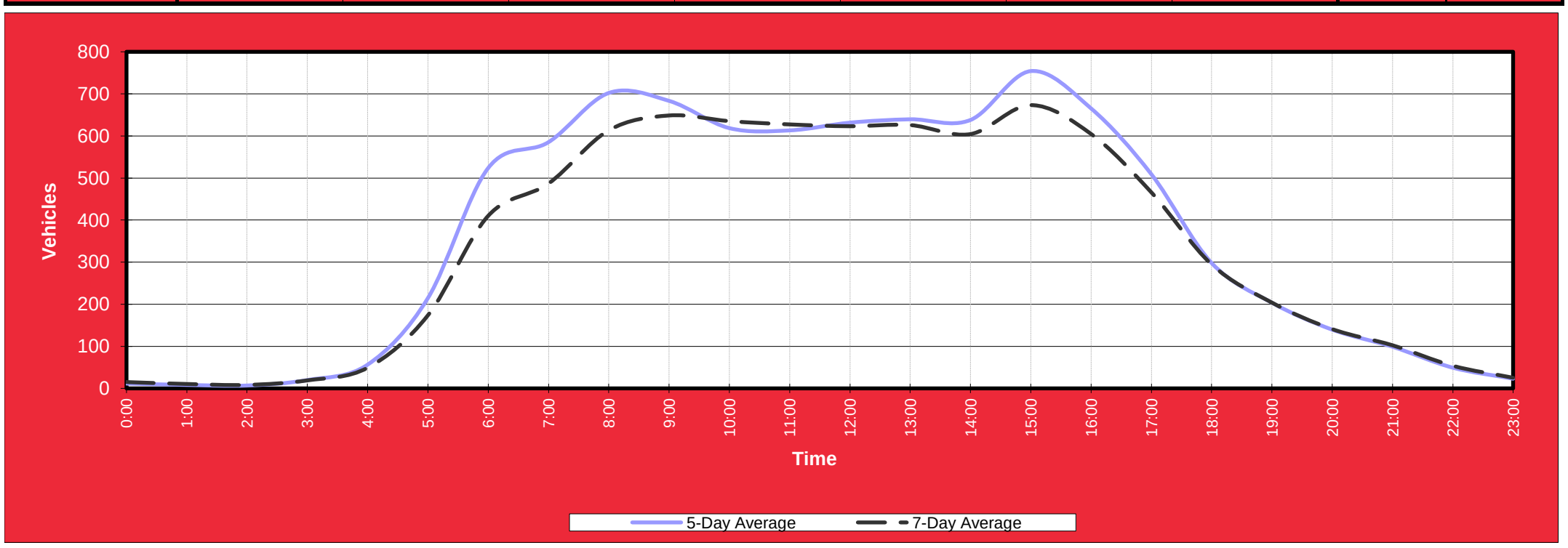
Street	Site 5, Tweed vallay Way				
Suburb	Murwillubah			**5-Day Average**	8,694
Location	Site 5, Murwillubah, Tweed vallay Way			**7-Day Average**	8,115
Count No.	5			**5-Day Heavy (Classes 3 to 12)**	6.1%
Start Date	Wednesday	04 Mar 2020	**Speed Limit** 60 km/h	**7-Day Heavy (Classes 3 to 12)**	5.2%
Direction	Northbound				

Hour Starting	Day of Week - Classes 1 to 12							5-Day Average	7-Day Average
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	09/03/2020	10/03/2020	04/03/2020	05/03/2020	06/03/2020	07/03/2020	08/03/2020		
AM Peak	707	703	719	754	676	707	666		
PM Peak	711	693	783	823	761	611	617		
0:00	10	7	15	13	12	22	26	11	15
1:00	6	9	9	6	11	18	14	8	10
2:00	6	4	6	8	10	15	9	7	8
3:00	19	13	24	21	22	24	10	20	19
4:00	56	47	56	68	55	27	35	56	49
5:00	205	220	223	222	203	94	49	215	174
6:00	486	499	576	587	471	157	95	524	410
7:00	573	576	607	611	559	284	198	585	487
8:00	707	703	692	754	655	426	357	702	613
9:00	647	680	719	695	676	625	499	683	649
10:00	630	572	620	632	639	688	666	619	635
11:00	557	617	658	597	637	707	619	613	627
12:00	641	611	652	618	636	611	593	632	623
13:00	578	601	669	663	687	566	617	640	626
14:00	549	595	696	660	690	487	554	638	604
15:00	711	693	783	823	761	445	497	754	673
16:00	600	642	661	753	671	441	465	665	605
17:00	454	502	493	566	530	386	330	509	466
18:00	213	290	300	344	343	308	264	298	295
19:00	154	181	214	235	234	193	216	204	204
20:00	107	130	150	160	151	168	120	140	141
21:00	55	100	117	89	134	143	79	99	102
22:00	39	38	38	48	83	92	38	49	54
23:00	24	19	17	10	45	48	14	23	25
Total	**8,027**	**8,349**	**8,995**	**9,183**	**8,915**	**6,975**	**6,364**	**8,694**	**8,115**
Heavy %	6.0%	6.0%	6.1%	6.5%	5.7%	3.0%	2.2%	6.1%	5.2%

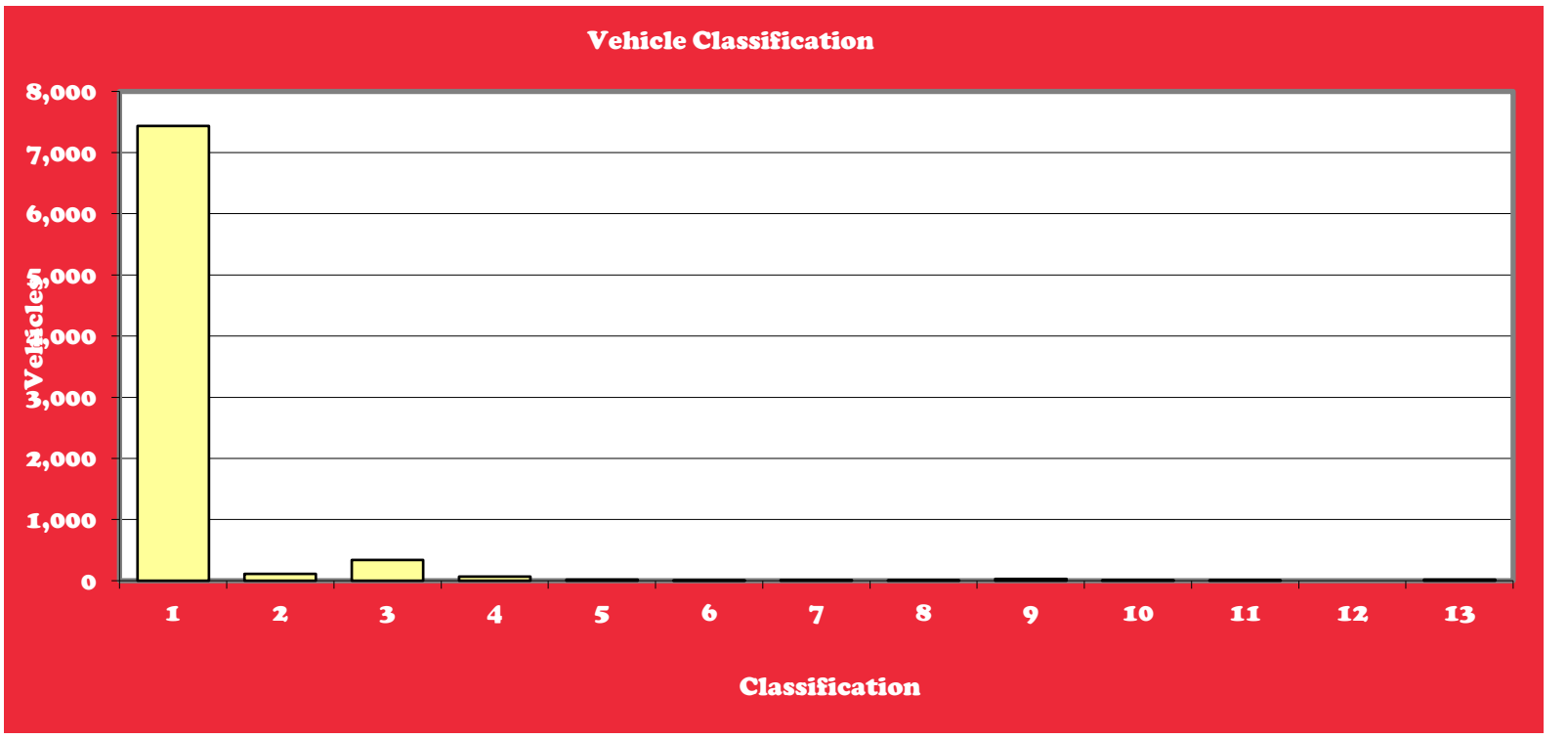


Hourly Classification Data

Research Analytics
Data Collection and Surveys

Street	Site 5, Tweed vallay Way		**AADT**	8,041	
Suburb	Murwillubah		**Average Speed**	53.5	
Location	Site 5, Murwillubah, Tweed vallay Way		**85th Percentile**	62	
Direction	Northbound		**Heavy Percentage**	5.9%	
Day	Monday	**Count No.** 5	**AM Peak**	8:00	708 vph
Date	09 Mar 2020	**Speed Limit** 60 km/h	**PM Peak**	15:00	712 vph
Start Date	Wednesday 04 Mar 2020				

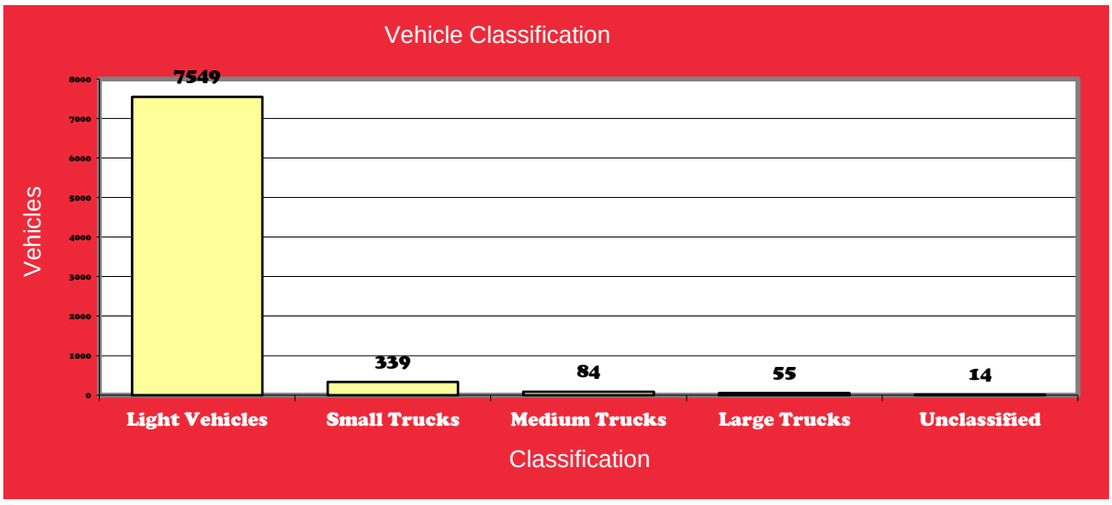
Hour Starting	Vehicle Classification														Speed	
	1	2	3	4	5	6	7	8	9	10	11	12	13	Total	Average	85%ile
0:00	8	0	1	0	0	0	0	0	1	0	0	0	0	10	57.0	0
1:00	5	0	0	0	0	0	0	0	1	0	0	0	0	6	49.0	0
2:00	4	0	2	0	0	0	0	0	0	0	0	0	0	6	66.1	0
3:00	19	0	0	0	0	0	0	0	0	0	0	0	0	19	64.9	82
4:00	51	1	3	1	0	0	0	0	0	0	0	0	0	56	58.5	72
5:00	195	2	6	2	0	0	0	0	0	0	0	0	0	205	59.2	70
6:00	455	8	21	1	1	0	0	0	0	0	0	0	0	486	55.0	64
7:00	511	13	32	8	1	1	3	1	3	0	0	0	0	573	54.2	63
8:00	653	9	33	7	1	0	0	0	4	0	0	0	1	708	53.5	62
9:00	602	10	25	5	2	1	0	1	1	0	0	0	0	647	52.8	61
10:00	584	10	26	5	0	0	1	1	2	1	0	0	3	633	52.6	61
11:00	504	9	30	9	1	1	1	0	1	0	1	0	1	558	52.8	61
12:00	598	7	24	4	4	0	2	0	2	0	0	0	2	643	52.1	61
13:00	528	11	29	6	0	1	1	0	2	0	0	0	2	580	53.2	63
14:00	493	4	33	9	1	2	2	0	5	0	0	0	2	551	53.5	62
15:00	663	10	31	3	2	1	1	0	0	0	0	0	1	712	52.9	61
16:00	568	8	17	3	1	0	2	0	1	0	0	0	0	600	53.2	62
17:00	435	6	8	4	0	0	0	0	1	0	0	0	1	455	54.1	63
18:00	208	1	4	0	0	0	0	0	0	0	0	0	0	213	53.3	64
19:00	146	1	4	1	0	0	0	0	2	0	0	0	1	155	53.3	63
20:00	102	1	3	1	0	0	0	0	0	0	0	0	0	107	52.7	65
21:00	49	1	2	1	0	0	0	0	2	0	0	0	0	55	54.3	67
22:00	33	0	5	0	0	0	0	0	1	0	0	0	0	39	57.3	70
23:00	22	1	0	0	0	0	0	0	1	0	0	0	0	24	62.4	103
Total	7,436	113	339	70	14	7	13	3	30	1	1	0	14	8,041	53.5	62
Class %	92	1	4	1	0	0	0	0	0	0	0	0	0			



Class Data Summary

Street	Site 5, Tweed vallay Way			**Light Vehicles**	93.9%
Location	Murwillubah			**Small Trucks**	4.2%
Count No.	Site 5, Murwillubah, Tweed vallay Way			**Medium Trucks**	1.0%
Direction	Northbound			**Large Trucks**	0.7%
Day	Monday			**Unclassified**	0.2%
Start Date	Wednesday	**AM Peak**	8:00		708 vph
Date	09 Mar 2020	**PM Peak**	15:00		712 vph

Hour Starting	Vehicle Classification					
	Light Vehicles	Small Trucks	Medium Trucks	Large Trucks	Unclassified	Total
0:00	8	1	0	1	0	10
1:00	5	0	0	1	0	6
2:00	4	2	0	0	0	6
3:00	19	0	0	0	0	19
4:00	52	3	1	0	0	56
5:00	197	6	2	0	0	205
6:00	463	21	2	0	0	486
7:00	524	32	9	8	0	573
8:00	662	33	8	4	1	708
9:00	612	25	7	3	0	647
10:00	594	26	5	5	3	633
11:00	513	30	10	4	1	558
12:00	605	24	8	4	2	643
13:00	539	29	6	4	2	580
14:00	497	33	10	9	2	551
15:00	673	31	5	2	1	712
16:00	576	17	4	3	0	600
17:00	441	8	4	1	1	455
18:00	209	4	0	0	0	213
19:00	147	4	1	2	1	155
20:00	103	3	1	0	0	107
21:00	50	2	1	2	0	55
22:00	33	5	0	1	0	39
23:00	23	0	0	1	0	24
Total	**7549**	**339**	**84**	**55**	**14**	**8041**



Light Vehicles – Classes 1 to 2

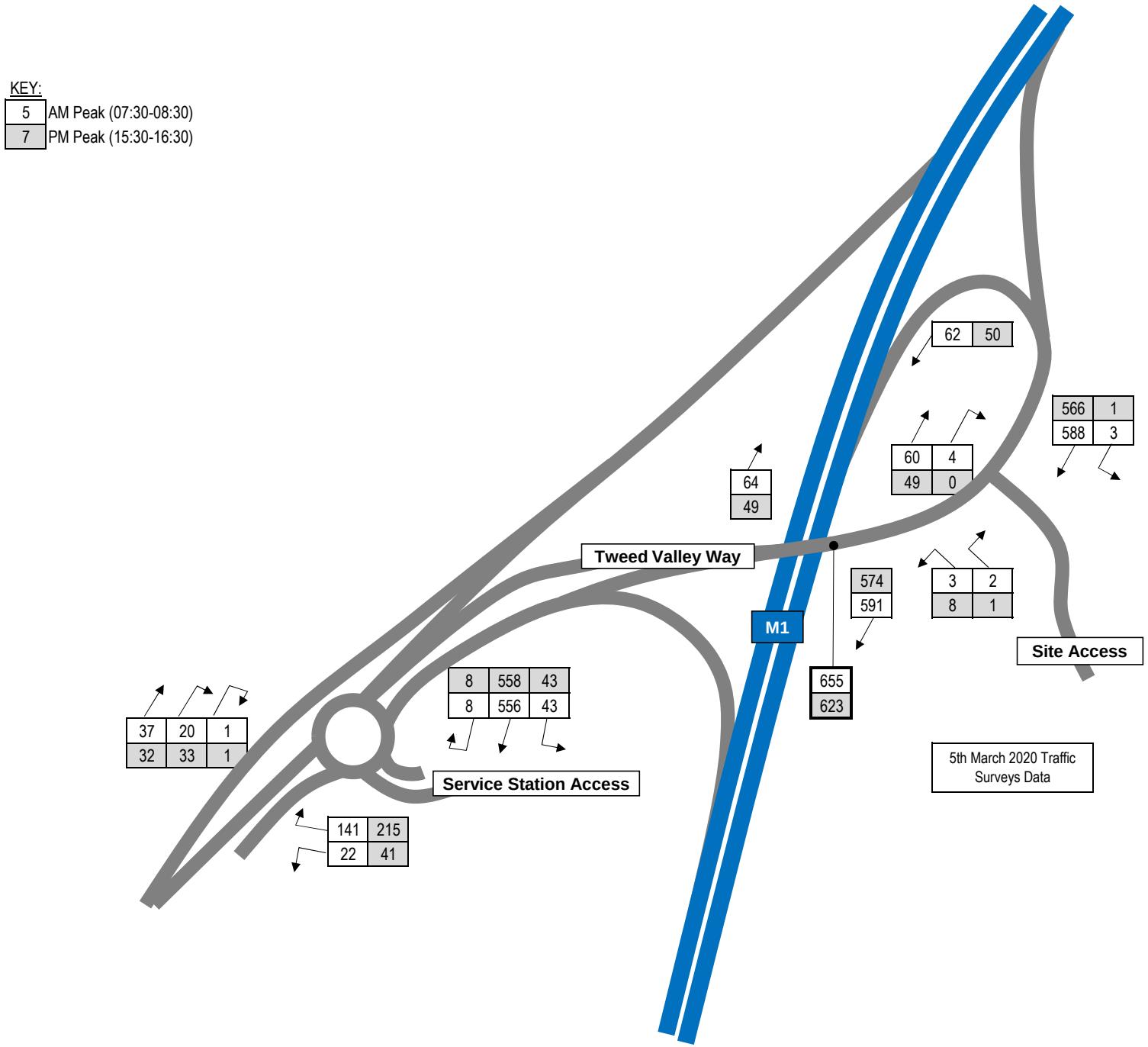
Small Trucks – Class 3

Medium Trucks – Classes 4 to 5

Large Trucks – Classes 6 to 12

Unclassified – Class 13

Appendix C – Trip Distribution Diagrams



BE190043_Tweed Sand Plant

Figure 1a - 2020 Traffic Survey AM and PM Peak Summary

BURCHILLS ENGINEERING SOLUTIONS

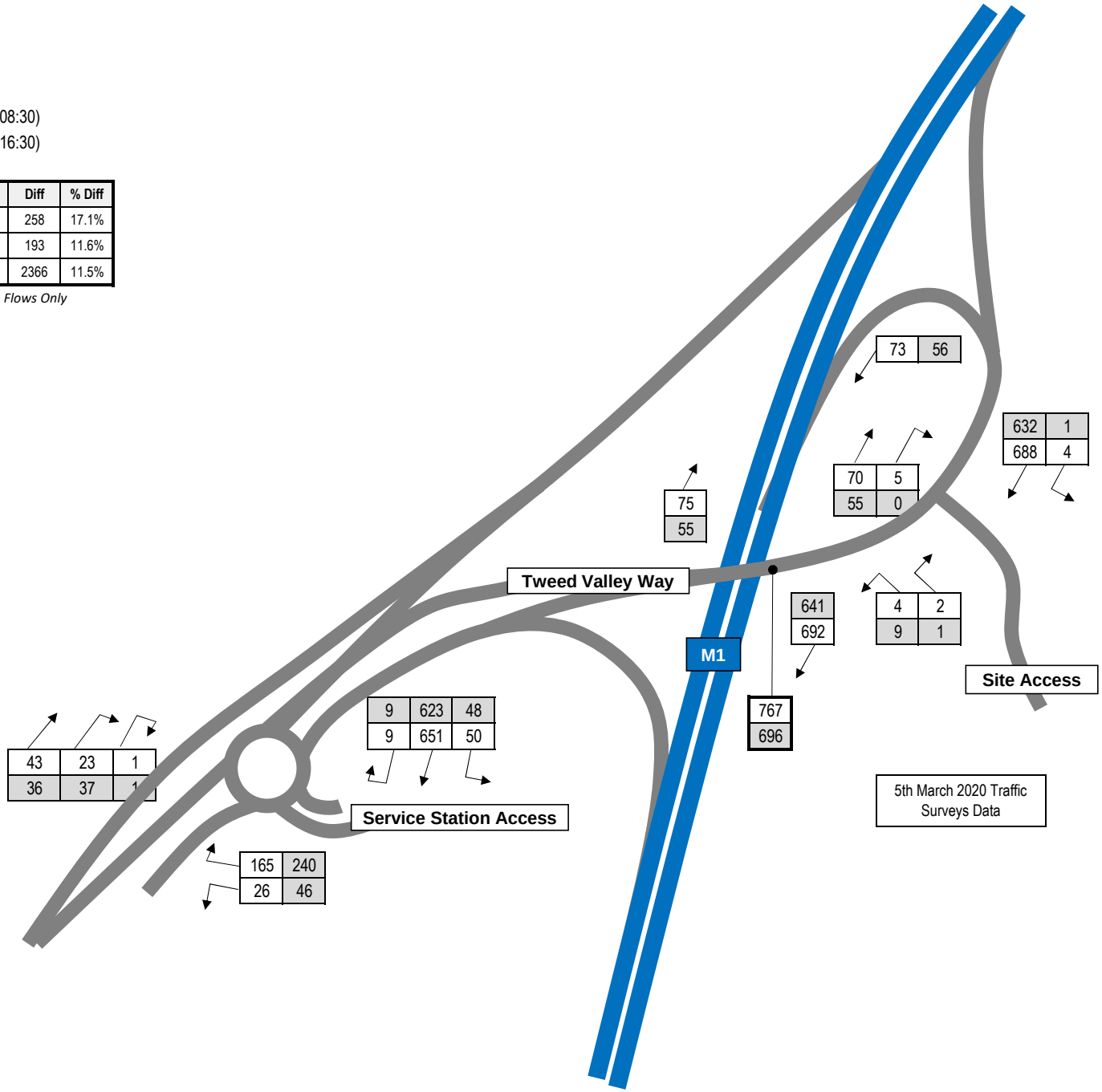
KEY:

5	AM Peak (07:30-08:30)
7	PM Peak (15:30-16:30)

Adjustment Factors

	Jan-19	Mar-19	Diff	% Diff
AM Peak	1770	1512	258	17.1%
PM Peak	1850	1657	193	11.6%
Daily	22981	20615	2366	11.5%

**Recorded Eastbound Direction Flows Only*



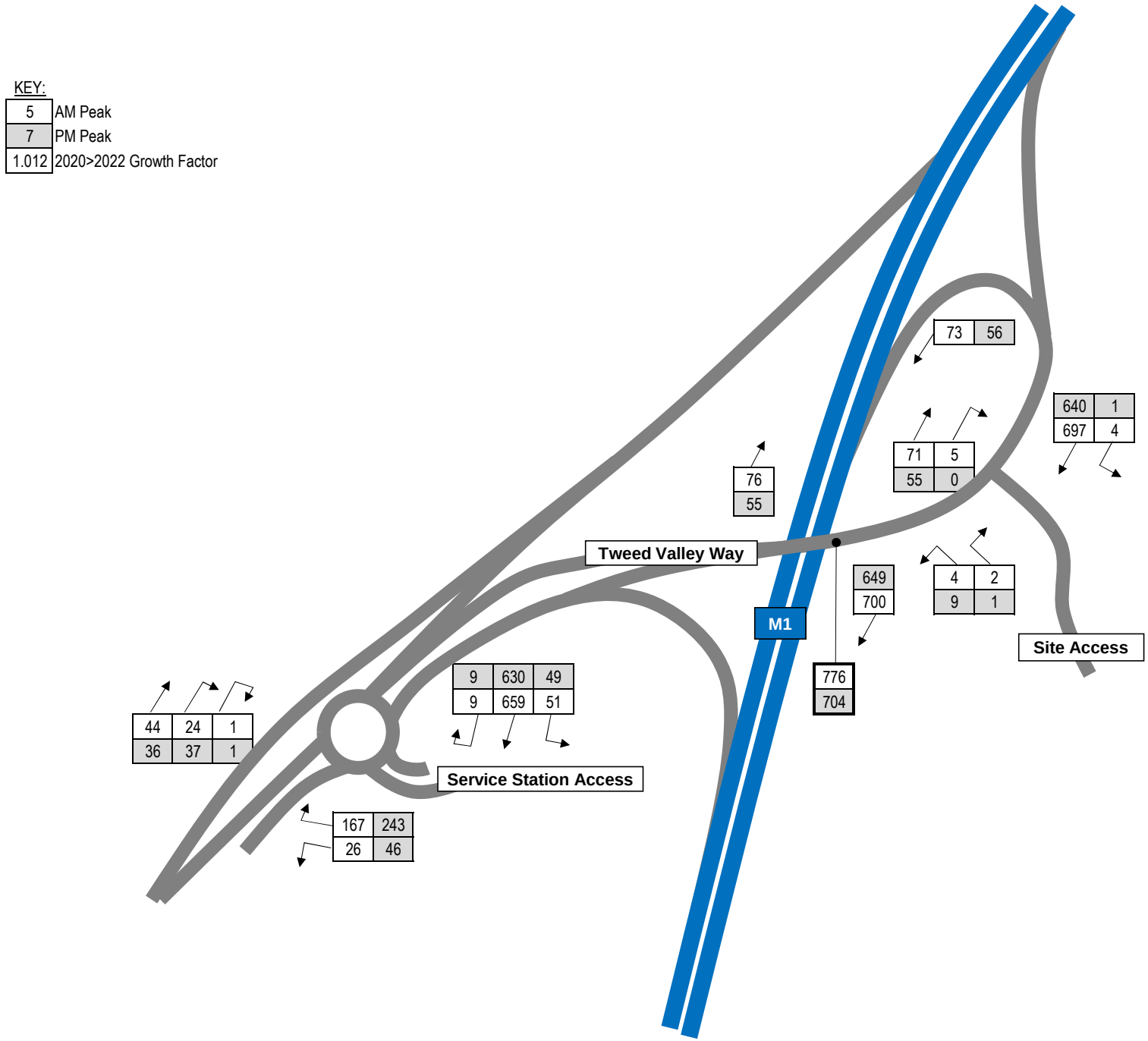
The M1 Pacific Motorway Eastbound Volumes (2019 Data)

month	Daily Total
January	22981
February	21703
March	20615
April	19970
May	20876
June	20013
July	21603
August	21024
September	21252
October	21521
November	21496
December	21539

BE190043_Tweed Sand Plant

Figure 1b - 2020 Traffic Survey AM and PM Peak Summary (Adjusted)

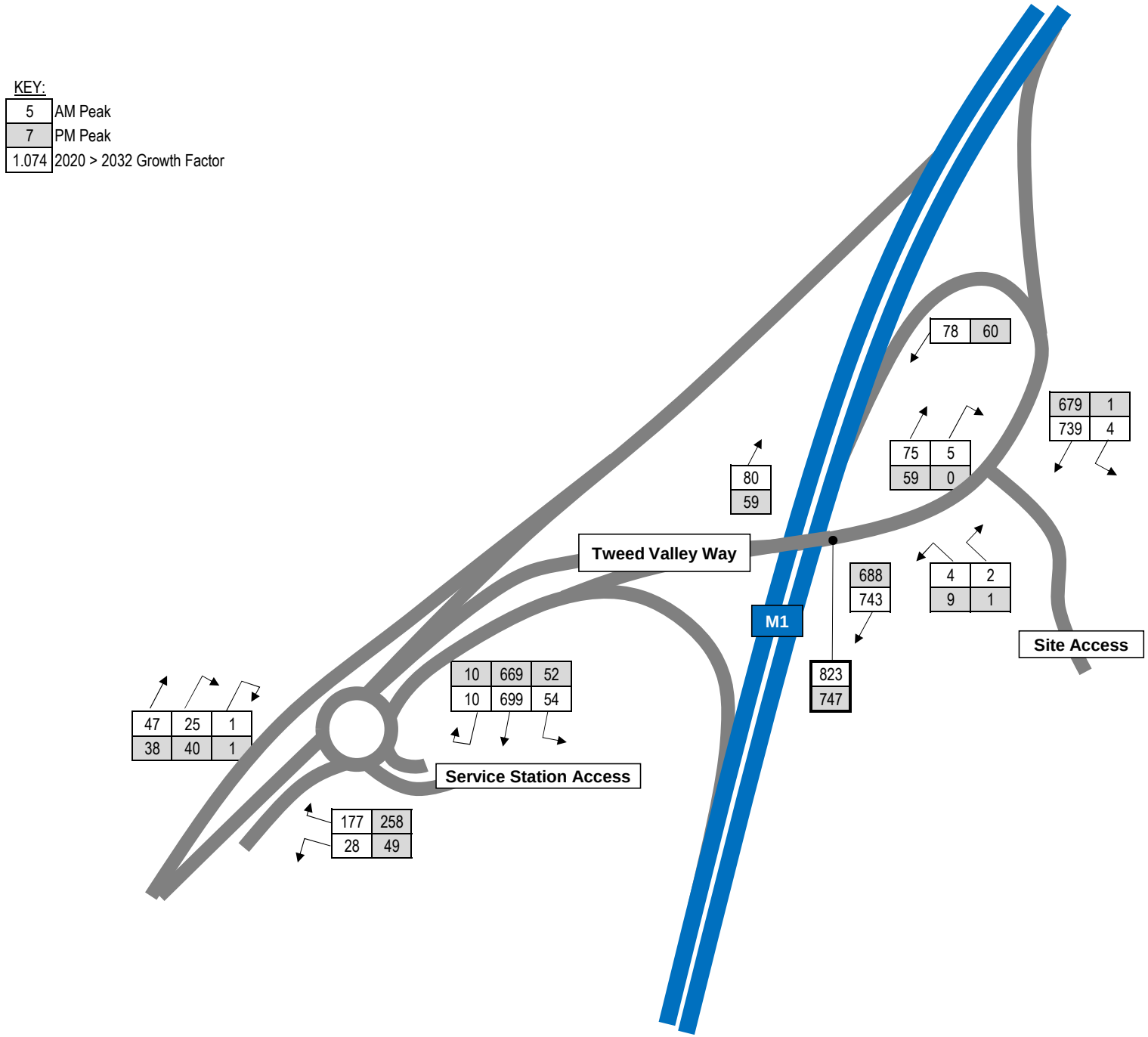
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 2 - 2022 Base Traffic Flows

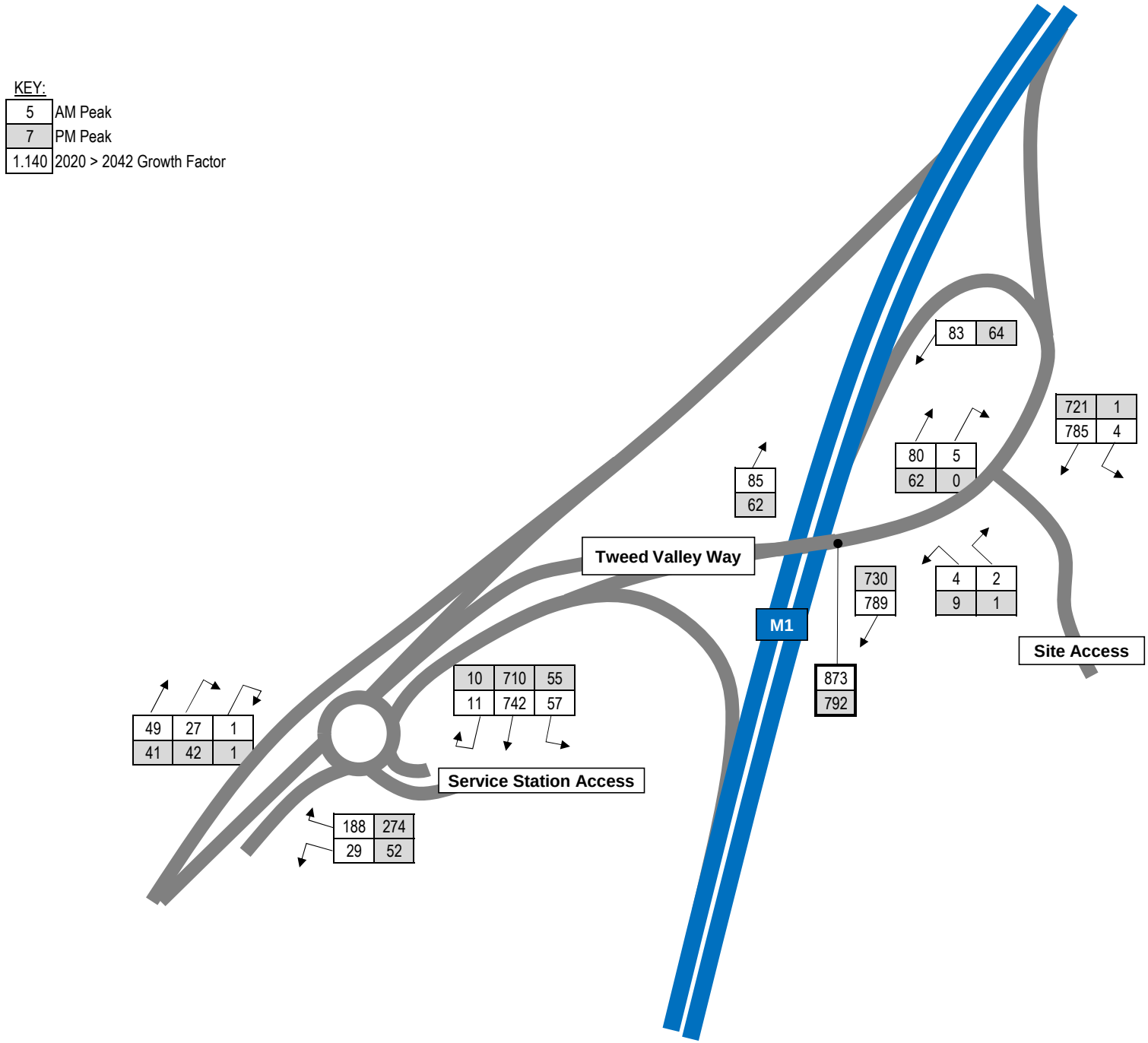
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 3 - 2032 Base Traffic Flows

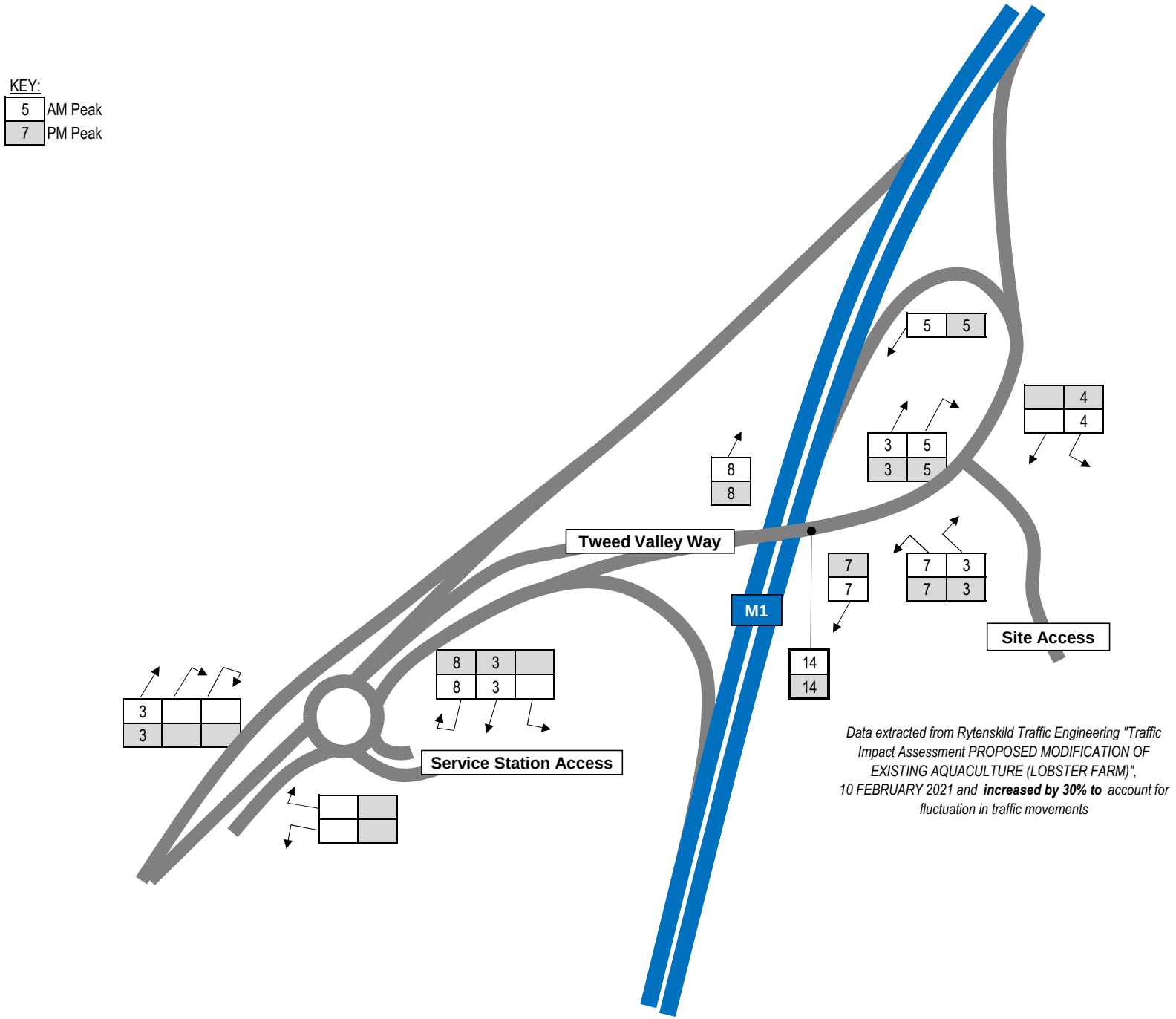
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

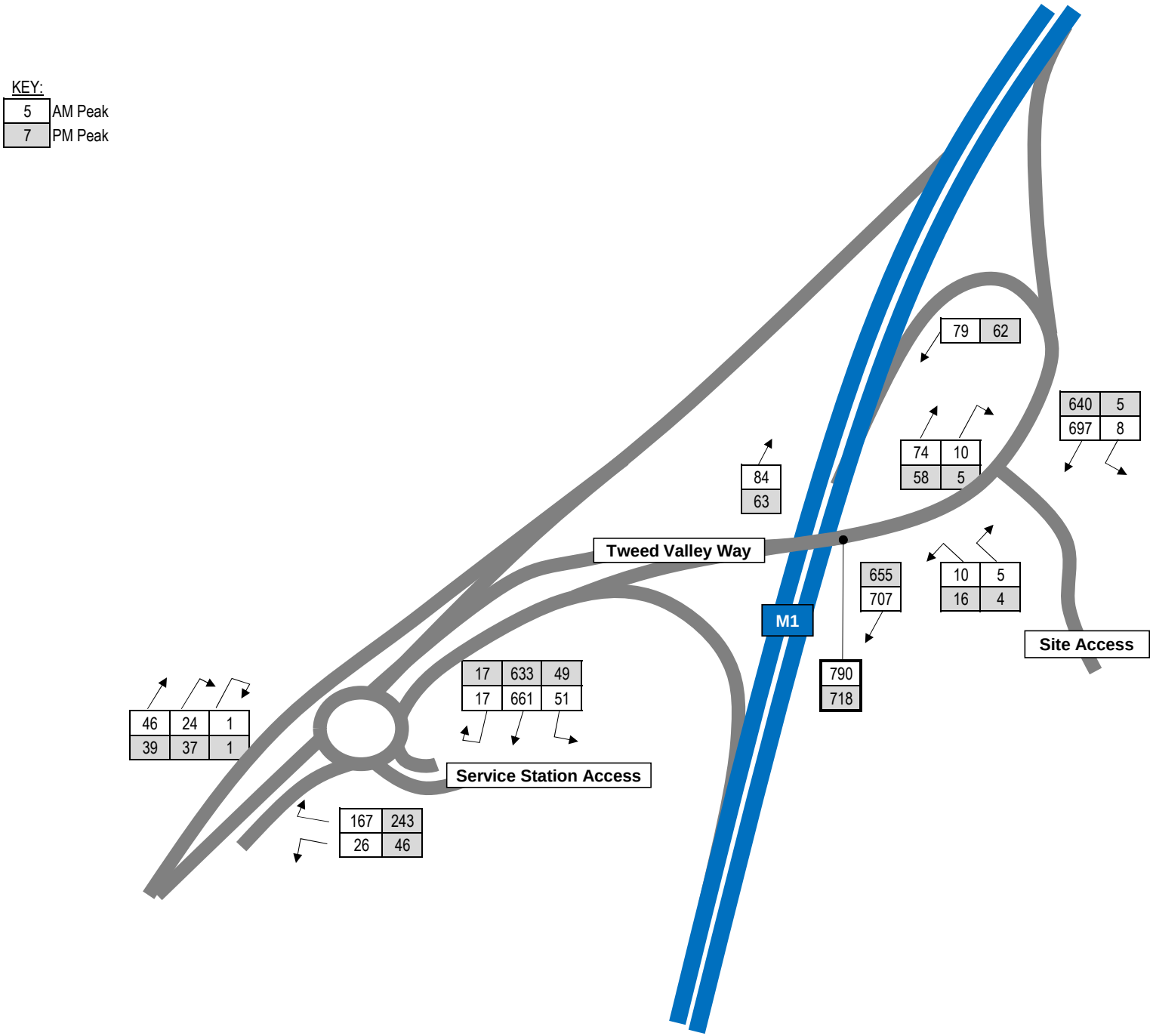
Figure 4 - 2042 Base Traffic Flows

BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

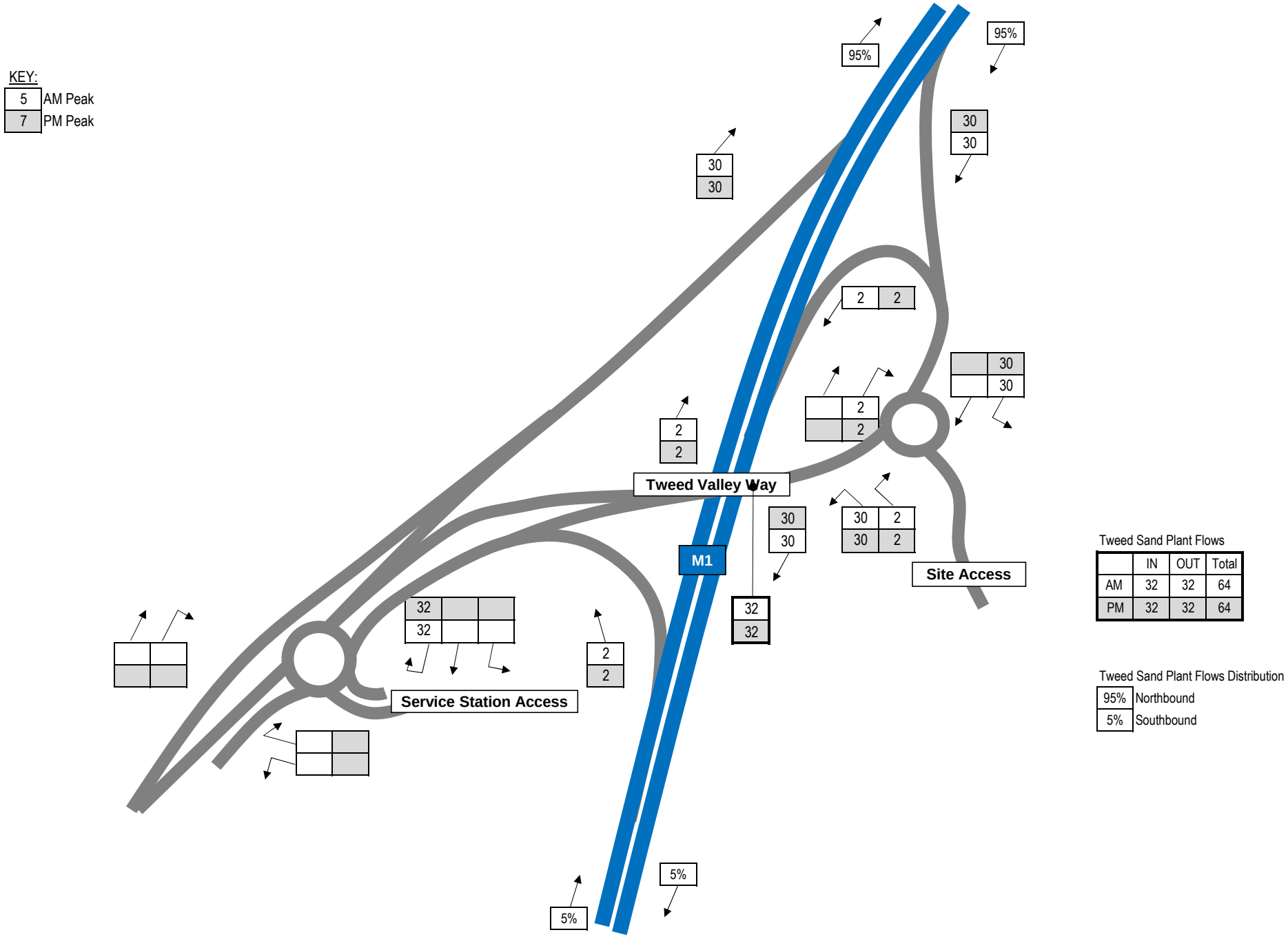
Figure 5 - Australian Bay Lobster Producers Limited (ABLP) Committed Development Traffic



BE190043_Tweed Sand Plant

Figure 6 - 2022 Base with Committed Traffic Flows

BURCHILLS ENGINEERING SOLUTIONS



Tweed Sand Plant Flows

	IN	OUT	Total
AM	32	32	64
PM	32	32	64

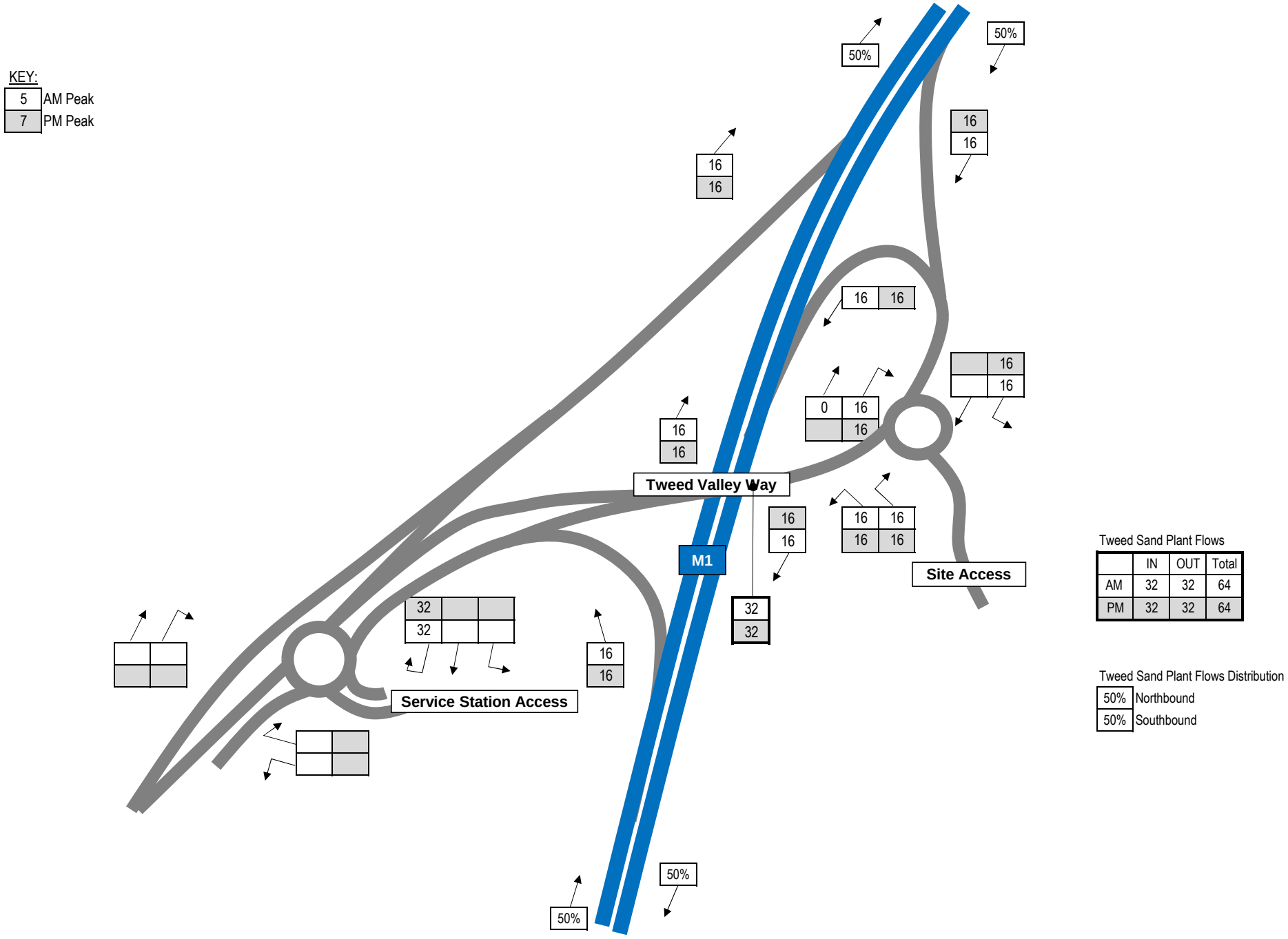
Tweed Sand Plant Flows Distribution

95%	Northbound
5%	Southbound

BE190043_Tweed Sand Plant

Figure 7 - Tweed Sand Plan Development Traffic Flows

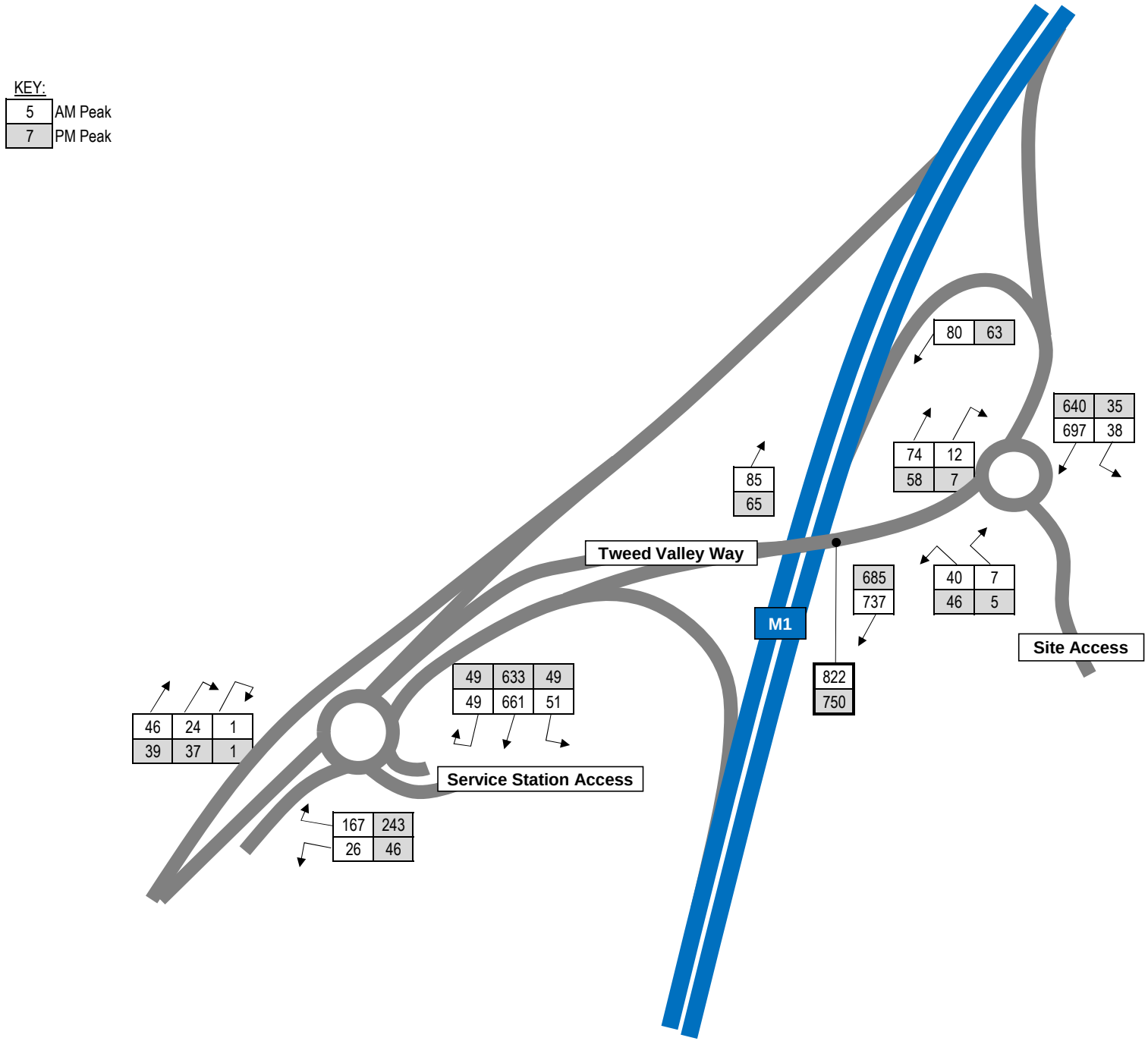
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 8 - Tweed Sand Plan Development Traffic Flows (Sensitivity Testing)

BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 9 - 2022 with Committed and Proposed Development Traffic Flows

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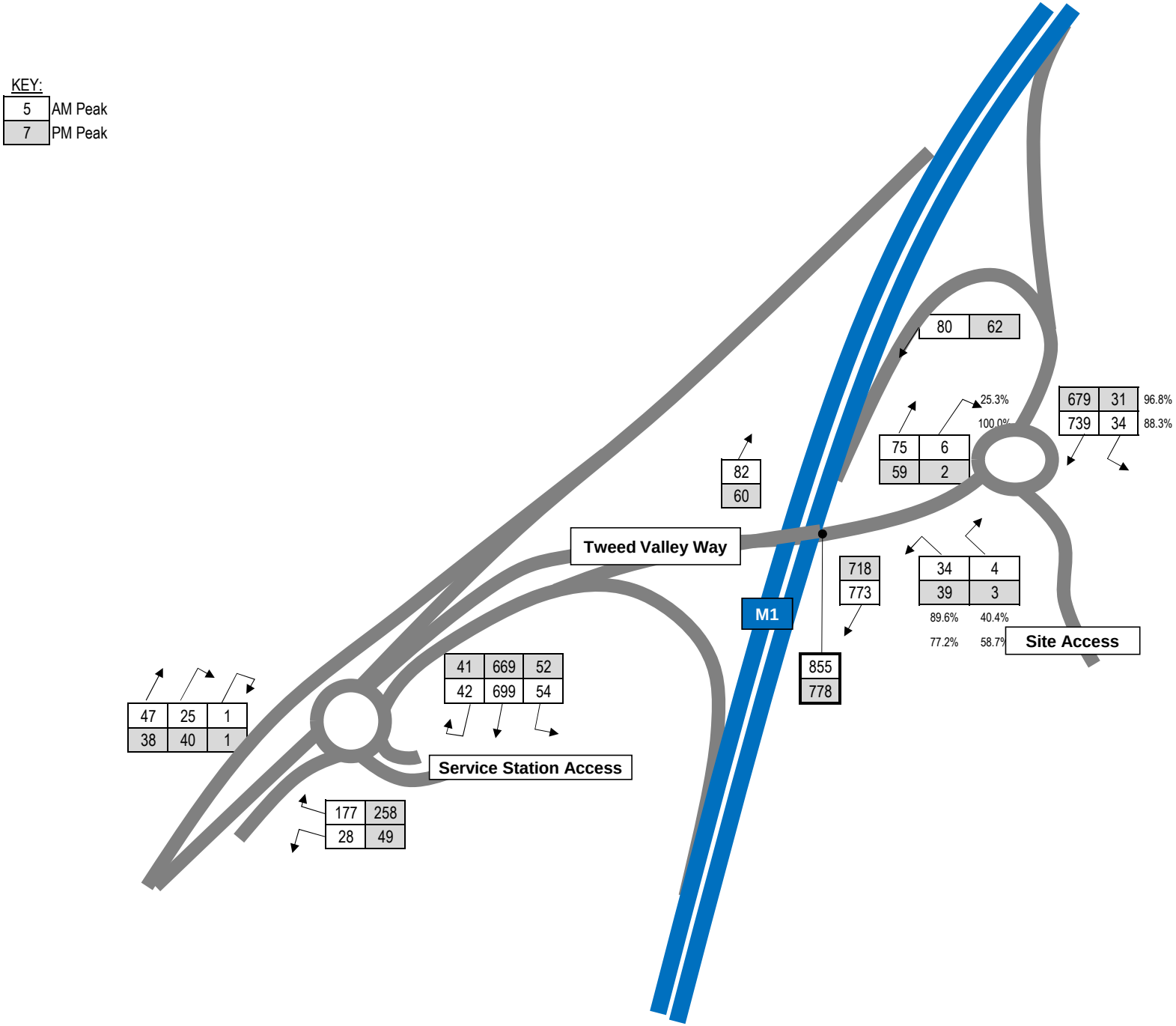
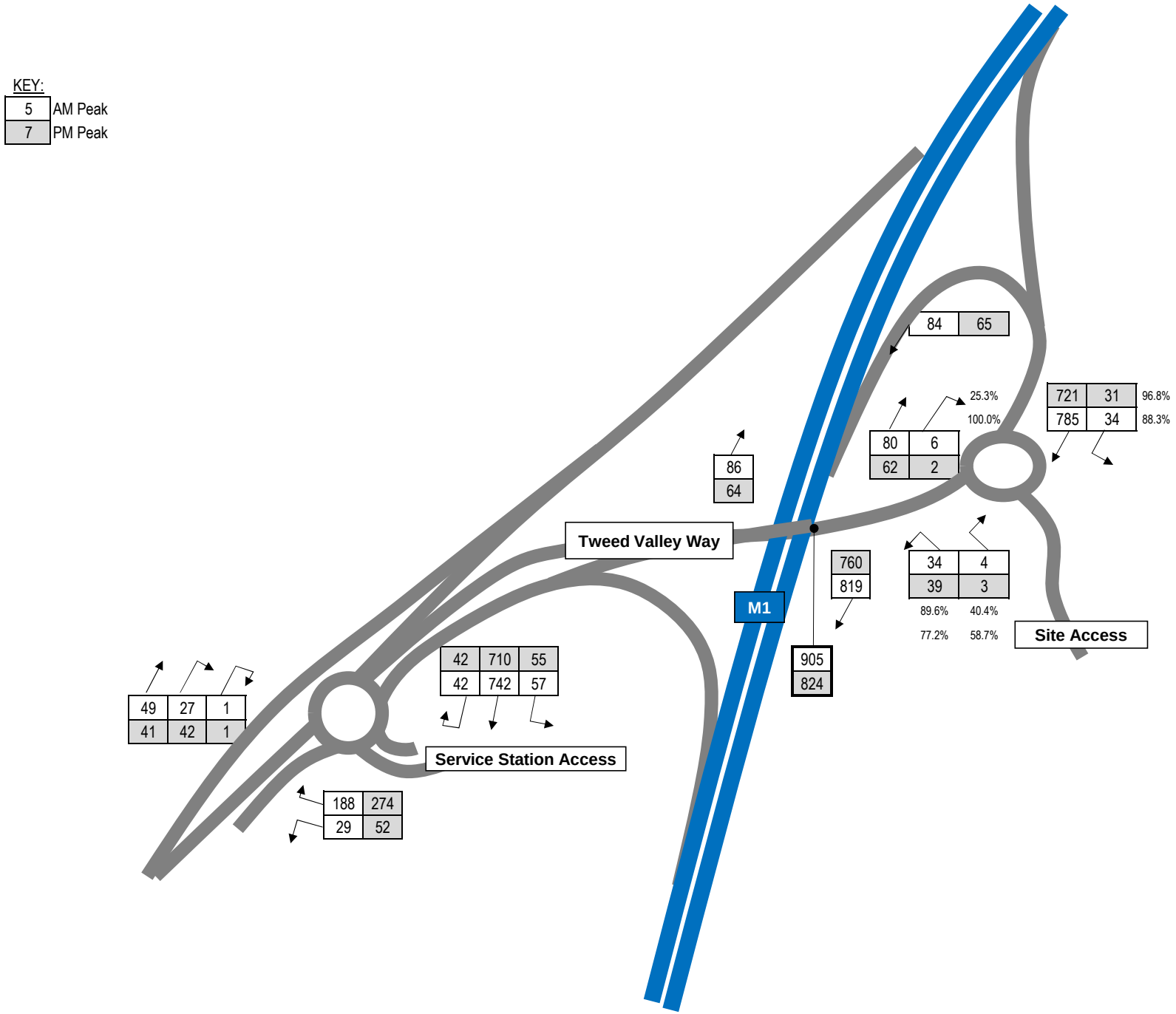


BE190043_Tweed Sand Plant

Figure 10 - 2032 Base with Proposed Development Traffic Flows

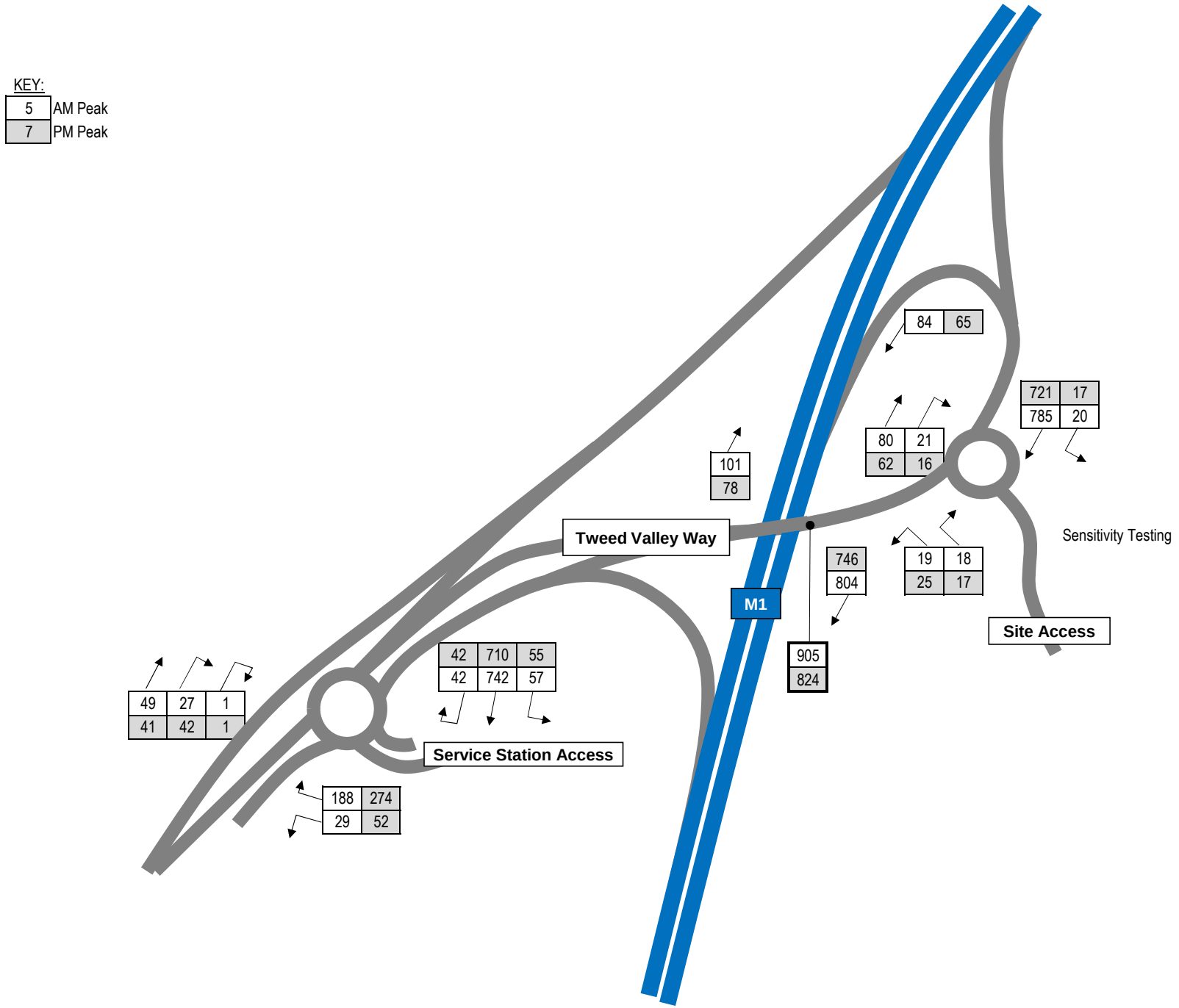
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 11 - 2042 Base with Proposed Development Traffic Flows

BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 12 - 2042 Base with Proposed Development Traffic Flows (Sensitivity Testing)

BURCHILLS ENGINEERING SOLUTIONS

Appendix D – Drivers Code of Conduct

TWEED SAND PLANT

MOD1 Operational Traffic Management Plan

Prepared for:

Hanson Construction Materials C/- Tweed Sand Plant
PO Box 2010
Kingscliff NSW 2487

SLR Ref: 620.12479-R02
Version No: v1.3
March 2019

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
Level 2, 15 Astor Terrace
Spring Hill QLD 4000 Australia
(PO Box 26 Spring Hill QLD 4004)
T: +61 7 3858 4800 F: +61 7 3858 4801
E: brisbane@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Hanson Construction Materials C/- Tweed Sand Plant (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
620.12479-R02-v0.4	Draft for Road Authority Review	1 November 2018	Chris Lawlor (Associate – Transport Advisory)	Jeffrey Baczynski (Principal – Transport Advisory)	Jeffrey Baczynski (Principal – Transport Advisory)
620.12479-R02-v1.2	Final	20 November 2018	Chris Lawlor (Associate – Transport Advisory)	Jeffrey Baczynski (Principal – Transport Advisory)	Jeffrey Baczynski (Principal – Transport Advisory)
620.12479-R02-v1.3	Revised Final based on DPE Feedback	7 March 2019	Chris Lawlor (Associate – Transport Advisory)	Jeffrey Baczynski (Principal – Transport Advisory)	Jeffrey Baczynski (Principal – Transport Advisory)

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1 Operational Traffic Management Plan Context

1.1 Background

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Hanson Construction Materials Pty Ltd (Hanson) to prepare an Operational Traffic Management Plan (Operational TMP) for Hanson's Tweed Sand Plant (TSP) operation in Cudgen, NSW.

The Operational TMP is required to satisfy Schedule 3 (*Specific Environmental Conditions*), Condition 25 (*Transport Management Plan*) of the Notice of Modification for Development Consent DA 152-6-2005 issued by the New South Wales (NSW) Department of Planning and Environment (DPE) on 20 August 2018. The notice was issued following an application lodged by Hanson on 7 February 2017 to change the site's condition from an annual extraction limit of 150,000 m^3 to transporting no more than 500,000 tonnes of product (sand) from the site per financial year. This modification will potentially result in increased haulage from the site, and therefore an Operational TMP is required to manage the potential traffic impacts associated with this change.

The Notice of Modification constitutes a revision of the Notice of Modification conditions issued in July 2006 for Phases 3 and 4 of TSP and requires the preparation and update of various management plans to guide management of the site.

1.2 Operational TMP Requirements

This Operational TMP has been prepared to satisfy the requirements of Schedule 3, Condition 25 of the Notice of Modification and in turn minimise the impact of site traffic on the safety and efficiency of the road network.

The specific requirements of the condition to prepare an Operational TMP are reproduced in Table 1. In addition, Table 1 details which section of this Operational TMP addresses each of the individual components identified within Condition 25, in order to validate that all components of the condition are addressed by this Operational TMP.

Further to this, Schedule 5 (*Environmental Management, Reporting and Auditing*), Condition 2 (*Management Plan Requirements*) of the Notice of Modification stipulates further generic requirements in relation to the preparation of management plans. The requirements of this condition are reproduced in Table 2 along with references to the sections of the Operational TMP that address each individual component.

This document has been prepared under the supervision of Jeffrey Baczynski, whom DPE has approved as 'a suitably qualified and experienced person'. A copy of this approval is included at Appendix A.

It is noted that the Operational TMP is not intended to replace the need to prepare Construction Traffic Management Plans to support the road upgrade works imposed under various conditions within the Notice of Modification. The required Construction Traffic Management Plans will be prepared at the time the upgrade work designs are prepared, which is appropriate given that the upgrade works are not required until certain triggers are met, which may mean that the works do not commence for potentially several years depending on commercial conditions. Nevertheless, a high level overview of the mitigation strategies potentially implemented as part of future Construction Traffic Management Plans is detailed herein.

Table 1 Operational TMP Requirements: Schedule 3, Condition 25

Item	Condition Requirement	TMP Section
25	*The Applicant must prepare a Traffic Management Plan for the development to the satisfaction of the Secretary. This plan must:*	
(a)	*be prepared by suitably qualified and experienced person/s whose appointment has been endorsed by the Secretary;*	Section 1.2 Appendix A
(b)	*be prepared in consultation with RMS and Council, and in accordance with the RTA – Traffic Control at Worksites Manual;*	Section 2
(c)	*describe the processes in place for the management of truck movements entering and exiting the site;*	Section 4
(d)	*prohibit trucks departing the site from turning right from Crescent Street to Tweed Coast Road;*	Section 4.3
(e)	*include a Drivers' Code of Conduct that includes:* • *details of the safe and quiet driving practices that must be used by drivers travelling to and from the quarry;* • *a map of the primary haulage route;* • *safety initiatives for haulage through residential areas, school zones and along school bus routes;* • *an induction process for vehicle operators and regular toolbox meetings;* • *complaints resolution and disciplinary procedures; and* • *details of community consultation measures for peak haulage periods.*	Section 4 Appendix C
(f)	*describe the measures to be put in place to ensure compliance with the Drivers' Code of Conduct;*	Section 5 & 6
(g)	*include details of the measures to be implemented to minimise traffic safety issues and disruption to local road users during road upgrade works; and*	Section 4.5
(h)	*propose measures to minimise the transmission of dust and tracking of material onto the surface of public roads from vehicles leaving the quarry.*	Section 4.4.3
-	*The Applicant must not commence operations under Modification 1 until the Traffic Management Plan is approved by the Secretary.*	
	The Applicant must implement the approved Traffic Management Plan as approved from time to time by the Secretary.	

Table 2 Generic Management Plan Requirements: Schedule 5, Condition 2

Item	Requirement	TMP Section
2	*The Applicant must ensure that the management plans required under this consent are prepared in accordance with any relevant guidelines, and include:*	
(a)	*a summary of relevant background or baseline data;*	Section 3.1
(b)	*a description of:* • *the relevant statutory requirements (including any relevant approval, licence or lease conditions);* • *any relevant limits or performance measures/criteria; and* • *the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the development or any management measures;*	Section 1.2, 3.2 & 3.3
(c)	*a description of the measures to be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;*	Section 4
(d)	*a program to monitor and report on the:* • *impacts and environmental performance of the development; and* • *effectiveness of any management measures (see (c) above);*	Section 6 & 7
(e)	*a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible.*	Section 6
(f)	*a program to investigate and implement ways to improve the environmental performance of the development over time;*	Section 7
(g)	*a protocol for managing and reporting any:* • *incidents;* • *complaints; and* • *non-compliances with statutory requirements;*	Section 5, 6, 7 & 8
(h)	*a protocol for periodic review of the plan; and*	Section 7
(i)	*a document control table that includes version numbers, dates when the management plan was prepared and reviewed, names and positions of the person/s who prepared and reviewed the management plan, a description of any revisions made and the date of the Secretary's approval.*	Document Control Table
	Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted for particular management plans.	-

2 Road Authority Consultation

2.1 Consultation Requirements

Schedule 5, Condition 6 (*Evidence of Consultation*) of the Notice of Modification states the following with regard to consultation for management plans:

"Where the conditions of this consent require consultation with an identified party, the Applicant must:

(a) consult with the relevant party prior to submitting the subject document to the Secretary for approval; and

(b) provide details of the consultation undertaken, including:

- ***the outcome of that consultation, matters resolved and unresolved;***
- ***and details of any disagreement remaining between the party consulted and the Applicant and how the Applicant has addressed any unresolved matters."***

Schedule 3, Condition 25 of the Notice of Modification requires that the Operational TMP ***"be prepared in consultation with RMS and Council",*** and therefore the Road and Maritime Services (RMS) and Tweed Shire Council (TSC) were contacted by SLR.

2.2 TSC Consultation

2.2.1 Initial Consultation

A representative of TSC (Colleen Forbes – Team Leader Development Assessment) responded to a SLR/Hanson consultation request by email on 2 October 2018, stating:

"With reference to the Traffic Management Plan for the Tweed Sand Quarry, Council's Traffic Engineer has reviewed Schedule 3 Condition 25 and Schedule 5 Condition 2 of DA152-6-2005 MOD1. Please be advised that TSC considers that the information required appears to be sufficient in breadth and scope. Accordingly, no additional traffic considerations are requested by TSC.

Please also be advised that TSC would like to receive a copy of the draft Plan for review / feedback prior to its submission to the Department."

A copy of this response from TSC is included at Appendix B. SLR provided a draft of this Operational TMP to TSC for review prior to submission with DPE.

2.2.2 Review of Draft Operational TMP

A representative of TSC (Colleen Forbes – Team Leader Development Assessment) confirmed the following review of the Operational TMP:

"Council's Traffic Engineer has briefly reviewed the draft TMP. No concerns / objections are raised from Council's perspective."

A copy of this response from TSC is included at Appendix B.

2.3 RMS Consultation

2.3.1 Initial Consultation

A representative of the RMS (Greg Sciffer – Development Assessment Officer – Northern Region) provided comments in response to a SLR/Hanson consultation request during a phone conversation with Glyn Cowie (SLR) on 27 September 2018. RMS's verbal advice is summarised in Table 3, followed by a response to each comment as to how these have been incorporated into the drafting of the Operational TMP.

Table 3 RMS Initial Consultation Summary

RMS Advice	SLR Response
RMS identified that the term 'Traffic Management Plan' is a term that is typically used when referring to managing the traffic associated with road construction activities rather than operational activities, and hence RMS would prefer that the document is instead referred to as an 'Operational Traffic Management Plan' or similar.	SLR agrees with the RMS's assertion that a condition to prepare a 'Traffic Management Plan' in isolation of greater details of the required content could potentially be confused with a requirement to prepare a plan that relates to managing traffic associated with road construction activities. This confusion could also be potentially exacerbated by Schedule 3, Condition 25(b) of the Notice of Modification, which includes a generic requirement for the TMP to be prepared "*in accordance with the RTA – Traffic Control at Worksites Manual*". Due to this potential for confusion, SLR has previously advocated the use of alternative terms such as "*Road Use Management Plan"* to identify where a TMP relates to the management of operational activities. In this instance, the naming of this TMP is, however, largely semantics as Schedule 3, Condition 25 of the Notice of Modification specifically stipulates the requirements of the plan and clearly articulates that these requirements relate to the operational activities associated with the site itself and not remote road construction activities, hence the generic reference to the worksite manual for example is not overly confusing in this instance. In response to this specific input received from RMS, this document has been referred to as *Tweed Sand Plant: MOD 1 Operational Traffic Management Plan (Operational TMP)* to minimise the potential for confusion.

RMS Advice	SLR Response
RMS provided a copy of a sample Operational Traffic Management Plan that has recently been prepared for another extractive industry project. The sample document provides guidance as to the style of TMP that RMS would prefer is prepared for TSP.	SLR appreciates RMS seeking to assist by providing a sample Operational Traffic Management Plan prepared for another project. The content of the *Tweed Sand Plant Operational TMP* is however dictated by the requirements of Schedule 3, Condition 25 of the Notice of Modification. It would therefore not necessarily be appropriate to replicate the structure of a plan prepared for another facility that responds to a different set of conditions and circumstances. In drafting the *Tweed Sand Plant Operational TMP,* SLR has specifically sought to ensure that the structure of the reporting and the aspects considered herein directly respond to the conditioned requirements (i.e. to aid verification that the conditioned requirements have been fully addressed). As a result, SLR has not directly replicated the structure of the sample reporting provided by RMS.
RMS offered to review the TMP prior to formal lodgement of the draft to DPE.	SLR has provided a draft of this Operational TMP to RMS for review prior to submission with DPE.

2.3.2 Review of Draft Operational TMP

A representative of the RMS (Greg Sciffer – Development Assessment Officer – Northern Region) provided the comments detailed in Table 4 on the 6 November 2018 following review of the Draft Operational TMP. Table 4 also provides a response as to how this feedback has been incorporated into the drafting of the final Operational TMP.

Table 4 RMS Draft Operational TMP Summary

RMS Advice	SLR Response
The Drivers Code of Conduct should include: • Safety initiatives for haulage through residential areas, school zones and along school bus routes. • Regular toolbox meetings • Details of community consultation measures for peak haulage periods	During the current and historic planning application process the minimisation of impacts on residential areas and school zones has been considered and hence the adopted safety initiative was that the defined haulage route would exclude access through Cudgen Village except for local deliveries for example. Additional commentary has been added to Section 4.3 (Haulage Route) to reflect this safety initiative in response to the feedback provided. In relation to toolbox meetings no trucks are based at TSP so it is not possible to hold toolbox meetings involving drivers. TSP does however hold regular toolbox meetings, but the only attendees are site personnel. No change has been made in relation to community consultation measures as this is already considered to be sufficiently dealt with within Section 8.1 that details the Community Consultative Committee arrangements for the site.
Details of measures to be implemented to minimise traffic safety issues and disruption to local road users during road upgrade works.	The Operational TMP is not intended to replace the future need to prepare Construction Traffic Management Plans associated with any external road works delivered by Hanson. In response to the feedback provided by RMS this limitation of the Operational TMP has been clarified by additional commentary being added to Section 1.2. It is however premature to include the Construction Traffic Management Plan considerations within this Operational TMP as the design of the upgrade works to which the Construction Traffic Management Plans relate have not been prepared and are not required to be prepared until certain output thresholds are met as detailed in Section 3.2. It is not possible for example to prepare Traffic Control Plans (TCPs) that are a component of the Construction Traffic Management Plans in the absence of at least conceptual design drawings. This approach is appropriate in this instance as the external works are not required to be completed prior to commencement of use, but rather once certain output thresholds are exceeded, which may not occur for several years depending on commercial conditions. Nevertheless, a high level overview of the mitigation strategies potentially implemented as part of future Construction Traffic Management Plans is provided in Section 4.5 of this document.
Measures to minimise tracking of materials onto the surface of public roads.	In response to this feedback additional commentary has been added to Section 4.2 to identify that a shaker grid is provided on exit to minimise the tracking of materials onto the surface of public roads.

3 Project Overview

3.1 Site Details

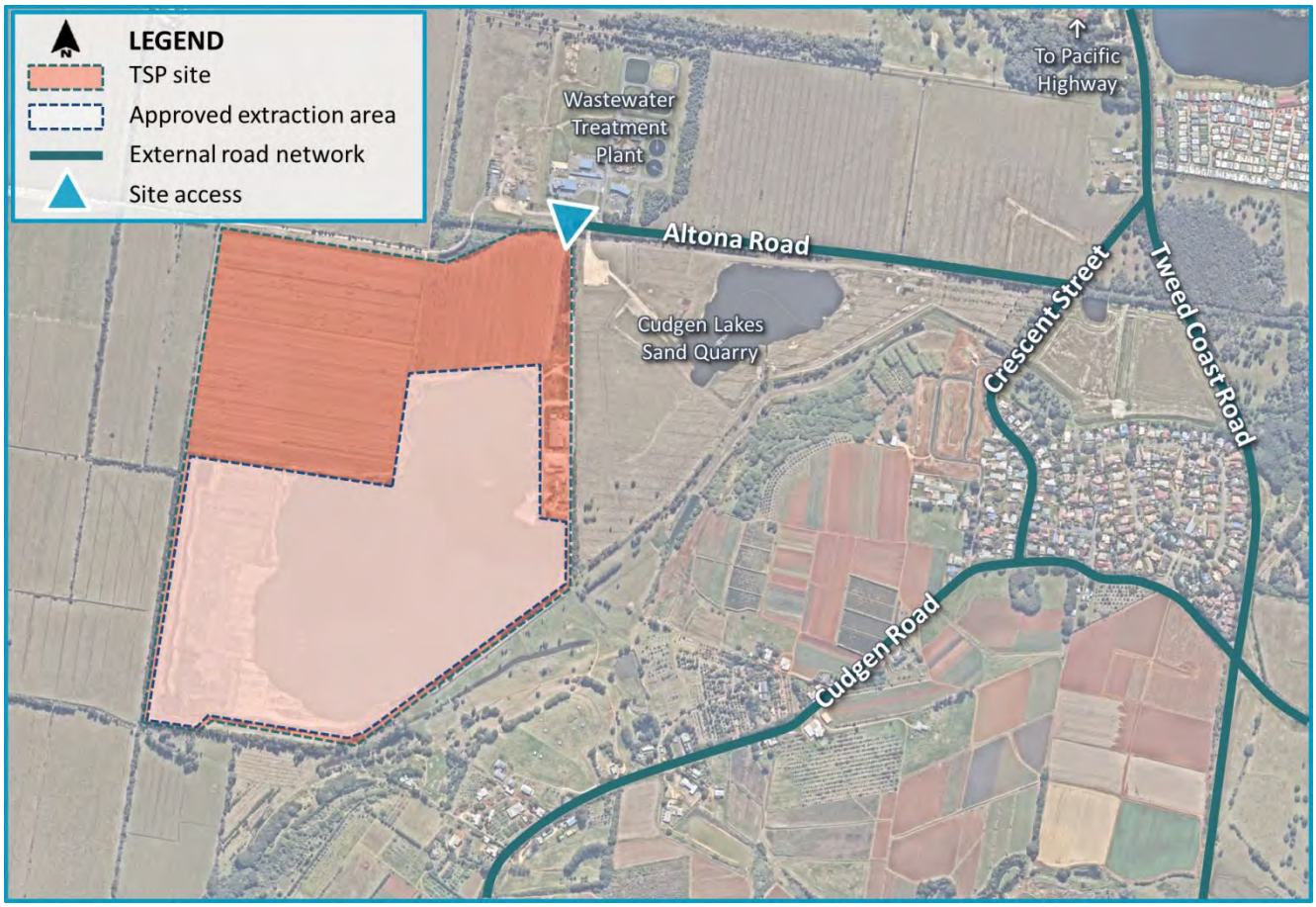
TSP is located off Altona Road in Cudgen, Northern NSW. The site is formally described as Lot Plans 22DP1082435, 23DP1077509 and 494DP720450, with a total area of approximately 77 hectares (ha), of which 46 hectares (ha) form the approved extraction area. An overview of TSP and the surrounding area is presented on Figure 1.

Sand extraction has been undertaken on the site since 1983, with Hanson taking over operation of the existing site in 2005. TSP operates a single dredge unit which is linked to an onshore wash plant via a floating flow line. Sand product is processed through the wash plant, stock piled and loaded via a front end loader into standard highway trucks. Loaded trucks pass across the site weighbridge (logging product weight and truck departure date/time), exit the site, and then follow the standard haul route of Altona Road, Crescent Street, Tweed Coast Road, and the Pacific Highway to their ultimate destination.

TSP is located within the Tweed Valley flood plain and is surrounded by the following land uses/receptors:

- **North**: Tweed Shire Council's wastewater treatment facility, the proposed Carbrook Sands Quarry isolated residential receptors; agricultural land (cane, grazing), Pacific Motorway and township of Chinderah in the distance (approximately 2 km);
- **East**: Cudgen Lake Sand Quarry (Cudgen Lakes), township of Cudgen (approximately 1 km), Township of Kingscliff in the distance (approximately 3 km);
- **South**: Residential receptors located along Cudgen Road ridge;
- **West**: Australian Bay Lobster Producers Pty Ltd, Melaleuca Station Memorial Gardens and Crematorium, Pacific Motorway, agricultural land (cane, grazing).

Figure 1 TSP and Surrounding Area



Source: Nearmap. Note: Site bounds indicative only.

3.2 Road Use Conditions

Schedule 3, Condition 20 of the Notice of Modification requires that the ***"Applicant must ensure that all heavy vehicle access to and from the site is via the Tweed Coast Road/Crescent Road (sic)/Altona Road route. Heavy vehicles must not travel via Crescent Street through Cudgen Village, except for local deliveries to Cudgen Village."*** Furthermore, Schedule 3, Condition 25 (d) of the Notice of Modification requires that the Operational TMP ***"prohibits trucks departing the site from turning right from Crescent Street to Tweed Coast Road".***

Schedule 2, Condition 9 also requires certain upgrades, which are discussed subsequently herein, to be completed before the applicant can dispatch more than 10 laden trucks from the site in any hour. Following completion of these upgrades and the relevant notification requirements as outlined in Schedule 2, Condition 22 the applicant may dispatch up to 18 laden trucks from TSP in any given hour.

Schedule 2, Condition 16 and Schedule 3, Condition 22 impose obligations on the applicant to contribute towards road maintenance activities relating specifically to Altona Road and also the broader local road network.

Schedule 2, Condition 10 details the permissible hours of operation as detailed in Section 3.5 of the Operational TMP.

3.3 Operating Conditions

Relevant to the Operational TMP Schedule 3, Condition 24 requires that:

"The Applicant must:

(a) provide sufficient parking on the site for all project-related traffic and visitors, in accordance with any applicable Council parking code and ensure that no on street parking is undertaken;

(b) ensure that on-site parking and pedestrian facilities are adequately signposted;

(c) ensure that all laden trucks entering or exiting the site have their loads covered;

(d) ensure that all laden trucks exiting the site are cleaned of material that may fall from vehicles, before leaving the site;

(e) use its best endeavours to ensure that appropriate signage is displayed on all trucks used to transport quarry products from the development so they can be easily identified by road users; and

(f) keep accurate records of all laden truck movements to and from the site and publish a summary of these records on its website every month."

3.4 Surrounding Road Network

3.4.1 Altona Road

Altona Road extends approximately 1km from the TSP access to Crescent Street, and incorporates a rural formation with varying seal width. The western section of Altona Road, extending for approximately 400m from the TSP access east towards Crescent Street, incorporates approximately a 6.0m-6.5m wide seal. The remaining approximately 600m long section of Altona Road that ultimately intersects with Crescent Street incorporates approximately a 3.5m wide seal and three passing bays located on the northern (outbound) side of the seal.

Signage is installed on Altona Road near its intersection with Crescent Street and 150m east of the TSP access advising drivers of the presence of soft road edges, the presence of three passing bays and requiring that vehicles give-way to trucks. Additional signage is also currently installed advising that no sand trucks are permitted on Altona Road before 7am (NSW time). The current posted speed limit on Altona Road is 40km/h.

Schedule 3, Condition 21 and 22 of the Notice of Modification also impose obligations on the applicant to contribute towards providing two additional passing bays along Altona Road and contribute towards the maintenance of Altona Road.

3.4.2 Crescent Street

Crescent Street extends approximately 900m from Tweed Coast Road to Cudgen Road. The northern section of Crescent Street extending approximately 250m between the Tweed Coast Road intersection and the Altona Road intersection incorporates a rural formation with approximately an 8m wide seal. The southern section of Crescent Street which extends for approximately 650m between the Altona Road intersection and the Cudgen Road intersection has a varying width and formation with a Gross Load Limit of 14.5t also applicable to this southern section.

Schedule 3, Condition 20 of the Notice of Modification requires that heavy vehicles must not travel via Crescent Street through Cudgen Village, except for local deliveries to Cudgen Village.

3.4.3 Tweed Coast Road

Tweed Coast Road extends approximately 1.5km from Crescent Street to the Pacific Motorway. Tweed Coast Road also extends much further south to Wooyung. The section of Tweed Coast Road between Crescent Street and the Pacific Motorway incorporates approximately a 7.5m wide seal, centre and edge line markings.

Schedule 3, Condition 25 (d) prohibits trucks departing TSP from turning right from Crescent Street into Tweed Coast Road (i.e. southbound). Furthermore, Schedule 3, Condition 23 (d) of the Notice of Modification also imposes obligations on the applicant to contribute towards upgrading of the existing Tweed Coast Road/Crescent Street intersection to include an acceleration lane for vehicles turning left out of the western Crescent Street approach to Tweed Coast Road (northbound), and right from the northern Tweed Coast Road (i.e. southbound) approach into Crescent Street (westbound).

3.5 Permissible Hours of Operation

Schedule 2, Condition 10 of the Notice of Modification states the hours within which TSP may operate. These are reproduced in Table 5.

Table 5 Schedule 2 Condition 10 – Hours of Operation

Activity	Permissible Hours[1]
Quarrying operations (excluding loading and dispatch of trucks)	• 7 am to 5 pm Monday to Friday; • 7 am to 4 pm Saturday; and • At no time on Sundays or public holidays
Loading and dispatch of trucks	• 7 am to 5 pm Monday to Friday; • 7 am to 12 pm Saturday; and • At no time on Sundays or public holidays
Maintenance	• May be conducted at any time, provided that these activities are not audible at any privately-owned residence

Note 1: These hours of operation relate to a NSW operating site which will be one hour ahead of Queensland during daylight saving periods (relevant to interstate truck movements).

In addition to the Hours of Operation stated in Table 5 above, Schedule 2 Condition 11 of the Notice of Modification states:

"The following activities may be carried out outside the hours specified in [Table 5] ***above:***

(a) delivery or dispatch of materials as requested by Police or other public authorities; and

(b) emergency work to avoid the loss of lives, property or to prevent environmental harm.

In such circumstances, the Applicant must notify the Secretary and affected residents prior to undertaking the activities, or as soon as is practical thereafter."

4 Heavy Vehicle Management

This Operational TMP provides additional details to supplement the Hanson *Tweed Sand Plant: Drivers' Code of Conduct* document, which is included at Appendix C. As part of the mandatory site induction required for drivers entering TSP, all drivers are required to read the *Tweed Sand Plant: Drivers' Code of Conduct* and this Operational TMP. Drivers are to complete and sign the *Confirmation of Understanding* provided within the *Tweed Sand Plant: Drivers' Code of Conduct*, and return to an authorised TSP staff member for secure storage onsite.

4.1 General Requirements

All heavy vehicle drivers hauling sand products from TSP must abide by the following:

- Undertake a site induction carried out by an authorised TSP staff member or suitably qualified person under the direction of the site manager;
- All drivers must hold a valid driver's licence which is appropriate for the class of vehicle under their operation;
- All drivers must comply with Chain of Responsibility legislation;
- All drivers are required to operate vehicles in a safe and courteous manner, within and external to TSP;
- All drivers are to comply with the instructions of authorised site personnel when within TSP;
- Any accidents, incidents, complaints, hazards, spillages or near misses must be reported immediately to the site manager. This includes incidents along the designated haulage route on the external road network; and
- Appropriate signage is to be displayed on all trucks used to transport product from TSP so that they can be readily identified by road users.

4.2 Site Management

The following procedures are to be observed by all heavy vehicle drivers accessing TSP:

- Haulage heavy vehicle access to TSP is to be restricted to the following hours (noting that these hours are more restrictive than the permissible hours detailed in Section 3.5 to minimise the potential for non-compliance with the permissible hours):
    - 7:15AM – 4:45PM Monday to Friday (NSW time);
    - 7:15AM – 11:45AM Saturday (NSW time).
- Hanson has a drug and alcohol policy which includes random testing;
- Drivers are to obey all site signage and the directions of TSP staff;
- All site mobile equipment has right of way at all times;
- Vehicles entering TSP are to be registered, roadworthy, and of sound mechanical condition. Hanson may request to inspect any vehicle or request maintenance records for any vehicle. Hanson reserves the right to prohibit any vehicle from TSP should there be any indication that the vehicle is not roadworthy or safe to operate;
- Upon entry to TSP, drivers are required to communicate with the loader operator on UHF channel 19 prior to entering the stockpile area;

- Drivers are to remain within the truck cabin unless instructed by a loader driver;
- Prior to leaving TSP, vehicles are to be weighed using the on-site weighbridge. Vehicles are required to be within the legal Gross Vehicle Mass (GVM) limit before being permitted to leave TSP;
- A shaker grid is installed at the site entry/exit such that all vehicles, including loaded trucks, must pass over the grid prior to leaving site, to minimise the tracking of materials onto the surface of public roads. The layout and fencing of the site is such that the shaker grid cannot be bypassed.

4.3 Haulage Route

To minimise the safety impact on residential areas and school zones the designated haulage route for heavy vehicles for TSP is Altona Road, Crescent Street, Tweed Coast Road and the Pacific Highway. This haulage route is mapped on Figure 2.

Figure 2 TSP Standard Haulage Route

Source: Nearmap. Note: Site bounds indicative only.

Drivers are to abide by the following instructions at each of the specific locations identified:

1. **Altona Road:**
   - Altona Road is not to be accessed by trucks prior to 7:00AM (NSW time) on any day;

- Heavy vehicles travelling outbound from TSP along Altona Road (eastbound) are to give way using the provided passing bays. Heavy vehicle drivers travelling inbound to TSP along Altona Road (westbound) are to centre vehicles on the carriageway to avoid the soft shoulders on either side, and are to provide adequate passing clearance to any vehicles propped in the passing bays; and
- All vehicles must observe the posted speed limit on Altona Road (40km/h).

2. **Crescent Street/Altona Road intersection:**
   - All trucks must STOP at the corner of Altona Road and Crescent Street after exiting TSP;
   - Heavy vehicles leaving TSP are not permitted to turn right from Altona Road onto Crescent Street (with the exception of making local deliveries to Cudgen Village); and
   - Any vehicle turning right from Altona Road onto Crescent Street to access Cudgen Village must also observe the sign posted load limit (Gross Load Limit 14.5t).
3. **Crescent Street/Tweed Coast Road:** Heavy vehicles leaving TSP are not permitted to turn right from Crescent Street onto Tweed Coast Road.

Through minimising haulage along roads in the vicinity of the site that include either school zones or that facilitate lower speed residential property access, the designated haulage route minimises the safety impacts on residential areas and school zones through limiting the potential for haulage vehicles to interact with the following:

- Students walking or cycling to school, or boarding/alighting buses;
- Pedestrians and children around residential properties;
- Vehicles or cyclists entering or leaving residential property accesses.

The typical framework applied to risk management seeks to (1) Avoid; (2) Manage, and (3) Mitigate risks (in order of preference). By avoiding residential areas and school zones, the proposed haulage route is consistent with this framework.

As noted, haulage vehicles may be required on occasion to make local deliveries to residential areas or travel past school zones. Safety impacts on residential areas and school zones in these instances will be managed through the driving standards detailed in Section 4.4, and through the *Tweed Sand Plant: Drivers' Code of Conduct*, which is included at Appendix C.

4.4 Driving Standards

4.4.1 Speed Management

Posted speed limits along the haulage route indicated on Figure 2 are as follows:

- Within the subject site: 30km/h;
- Altona Road: 40km/h;
- Crescent Street: 80km/h; and
- Tweed Coast Road: 80km/h / 60km/h.

Drivers are to observe posted speed limits at all times, and vehicle speeds should be adjusted in consideration of the road environment (e.g. geometry and traffic conditions) and prevailing weather conditions (e.g. rain and fog).

4.4.2 Heavy Vehicle Noise Management

To limit heavy vehicle noise associated with TSP haulage activities, drivers are to abide by the following requirements:

- Vehicle access to TSP is to be via the designated haulage route of Altona Road - Crescent Street - Tweed Coast Road - Pacific Motorway;
- Trucks slowing to use the Altona Road/Crescent Street and Crescent Street/Tweed Coast Road intersections are not to use engine or compression braking systems (when accessed from either direction) except where required for safety reasons;
- Posted speed limits on the external road network are to be observed, and vehicle speeds are to be restricted to 30km/h within TSP site;
- TSP is not to be accessed by heavy vehicles outside of the site operating hours (loading and dispatch of trucks) as follows:
    - 7:15AM – 4:45PM Monday to Friday (NSW time);
    - 7:15AM – 11:45AM Saturday (NSW time).
- Vehicles are to be turned off when not in use.

4.4.3 Heavy Vehicle Load Restraint and Dust Suppression

To minimise the potential for load spillages and dust production, drivers are required to act in accordance with the following measures:

- Drivers are to ensure their load is legal, secure and side bars, draw bar and tailgate are clear of material;
- Drivers are to ensure that vehicle tailgates are locked following any tipping activities;
- Drivers are to ensure that all loads are tarped prior to leaving TSP. The tarp must cover the whole body without air gaps;
- Haul road watering will be conducted within TSP site on a regular basis to supress dust as per Schedule 3, Condition 5 (*Operating* Conditions) of the Notice of Modification:

  "The Applicant must:

  (a) Implement best management practise to minimise the dust emissions of the development, including routinely watering haul roads being used by heavy vehicles and equipment".

- Drivers are to report excessive haul road dust (i.e. internal to TSP) to the site manager.

4.5 Construction Traffic Management Plans for Road Upgrade Works

Conditions 21, 22, and 23 of Schedule 3 of the Notice of Modification require that road upgrade works and/or maintenance works be undertaken at a future stage should certain output thresholds be exceeded, as detailed in Section 3.2 of this document. Should these works be triggered at a future stage, Construction Traffic Management Plans and associated Traffic Control Plans would be required to manage any operational or safety impacts of construction activities associated with the works.

Given that the upgrade works are not yet required, conceptual designs of the upgrade works have not been prepared, and hence no detailed assessment of the likely requirements can be undertaken at this stage. Nevertheless, a high level overview of the mitigation strategies that could potentially be implemented as part of future Construction Traffic Management Plans or Traffic Control Plans, which may be required to support future upgrade works, are discussed below.

4.5.1 Altona Road Upgrade and Maintenance Works

Schedule 3, Condition 21 and 22 of the Notice of Modification impose obligations on the applicant to contribute towards providing two additional passing bays along Altona Road and contribute towards the maintenance of Altona Road.

At a high level, upgrade or maintenance works on Altona Road have the potential to impact users of Altona Road and potentially also Crescent Street. To manage any safety impacts during future road upgrade works, and also to minimise the disruption to local road users, the future Construction Traffic Management Plans associated with the upgrade works may therefore need to consider the following:

- Conceptual design of the proposed upgrade works;
- Traffic demand profiles and speed environment of Altona Road and Crescent Street;
- Consultation with Tweed Shire Council and local Stakeholders (i.e. landowners of adjacent properties accessed off Altona Road) so that construction works can be scheduled to occur at times which minimise inconvenience and disturbance for local road users and landholders;
- Traffic Control Plans that are prepared by a suitably qualified person in accordance with the following relevant references:
    - *Traffic control at work sites: Technical Manual* (RMS, 2018);
    - *Australian Standard 1742.3, Manual of uniform traffic control devices - Traffic control for works on roads.*

4.5.2 Tweed Coast Road/Crescent Street Intersection Upgrade Works

Schedule 3, Condition 23 of the Notice of Modification also imposes obligations on the applicant to upgrade the existing Tweed Coast Road/Crescent Street intersection to include an acceleration lane for vehicles turning left out of the western Crescent Street approach to Tweed Coast Road (northbound), and right from the northern Tweed Coast Road (i.e. southbound) approach into Crescent Street (westbound). Should these works be triggered at a future stage, Construction Traffic Management Plans and associated Traffic Control Plans would be required to manage any operational or safety impacts associated with the works.

At a high level, upgrade works at the Tweed Coast Road/Crescent Street intersection have the potential to impact users of Tweed Coast Road and Crescent Street. To manage any safety impacts during potential future road upgrade works, and also to minimise the disruption to local road users, the future Construction Traffic Management Plans associated with the upgrade works may therefore need to consider the following:

- Conceptual design of the proposed upgrade works;
- Traffic demand profiles and speed environment of Tweed Coast Road and Crescent Street;
- Consultation with road authorities to ensure that construction works are scheduled to occur at times which minimises inconvenience and disturbance for local road users and landholders;
- Consideration of the need for the temporary installation of Variable Messaging Signage (VMS) in appropriate locations in the vicinity of the Tweed Coast Road/Crescent Street intersection for a period prior to the construction works occurring to alert motorists to the timing of the upgrade works, and that delays could be expected. This would enable motorists to allow for delays (i.e. start journey earlier), travel outside construction periods, or select an alternate travel route;
- Traffic Control Plans that are prepared by a suitably qualified person in accordance with the following relevant references:
    - *Traffic control at work sites: Technical Manual* (RMS, 2018);
    - *Australian Standard 1742.3, Manual of uniform traffic control devices - Traffic control for works on roads.*

5 Incident Reporting

5.1 Relevant Conditions

Schedule 5, Conditions 9 to 11 of the Notice of Modification requires the following:

9. ***"The Department must be notified in writing to compliance@planning.nsw.gov.au immediately after the Applicant becomes aware of an incident.***

10. ***Within 7 days of the date of the incident, the Applicant must provide the Secretary and any relevant agencies with a detailed report on the incident, and such further reports as may be requested. This report must include the time and date of the incident, details of the incident, measures implemented to prevent re-occurrence and must identify any non-compliance with this consent.***

11. ***Any written requirements of the Secretary or relevant public authority (as determined by the Secretary) which may be given at any point in time, to address the cause or impact of an incident must be complied with and within any timeframe specified by the Secretary or relevant public authority."***

In accordance with the Definition section of the Notice of Modification, an 'Incident' is defined as:

"A set of circumstances that:

i. causes or threatens to cause material harm to the environment; or

ii. results in non-compliance with this consent."

For the purposes of this Operational TMP, it is foreseen that the most likely cause for a potential 'incident' will be due to a non-compliance with the hourly truck dispatch limit criteria detailed in Section 3.2, use of sections of the road network not approved for haulage as also detailed in Section 3.2 or alternatively haulage that occurs outside the permissible hours identified in Section 3.5.

6 Protocol for Managing Complaints and/or Non-Compliances

6.1 Managing Complaints

All complaints received regarding traffic movements associated with TSP will be responded to within three dispatch days following receipt of the complaint. Dispatch days are taken to be those days during which loading and dispatch of trucks is approved to occur as detailed in Section 3.5.

TSP will keep a record of any complaint made to the site or to any employee or to agent/contractor of TSP in relation to traffic associated with TSP. Records will include:

- Date and time of the complaint;
- Method by which the complaint was made;
- Personal details of the complainant (if provided);
- Nature of the complaint and location;
- The driver/heavy vehicle details;
- Action taken by TSP and any follow up actions;
- If no action was taken, the reason why no action was taken; and
- A copy of the reply made to the complainant.

The Hanson website will include Contact Details and a Complaints Register, in accordance with Schedule 5, Condition 16 of the Notice of Modification.

6.2 Compliance Monitoring and Non-Compliance Response Procedure

Compliance of this Operational TMP with the Notice of Modification conditions will be measured according to the following performance indicators:

- Compliance with the hourly traffic volume dispatch criterion detailed in Section 3.2;
- An authorised TSP staff member or suitably qualified person under the direction of the site manager will undertake formal observations of compliance at yearly intervals;
- Contractor and employee awareness of this Operational TMP; and
- The frequency and nature of complaints reported to TSP in relation to traffic associated with TSP.

Incident reporting is to be undertaken as per the requirements in Section 5.1. In the event of non-compliance, the following actions will be undertaken:

- Establish the details in relation to the incident (location, vehicle, driver etc.);
- Confirm that the reported incident is therefore actually related to a vehicle associated with TSP;
- Conduct an investigation into why the incident occurred and evaluate the effectiveness of the current mitigation strategy; and
- Report details of any non-compliance to DPE in accordance with Section 5.1.

Should any driver be found to have acted in breach of the *Tweed Sand Plant: Drivers' Code of Conduct*, through either the formal complaint process detailed above, or through observations by authorised TSP personnel, disciplinary action will be taken, which could include the following:

- Verbal notification (if possible) and written confirmation to the driver of non-compliance with the *Tweed Sand Plant: Drivers' Code of Conduct*;
- Refusal to load affected trucks and direction to the driver to leave the site;
- Implementation of a temporary ban of the affected vehicle or driver until such time as sufficient evidence has been provided to authorised TSP staff that the breach has been rectified and/or will not occur again;
- In the case of a serious breach or repeated non-compliance with the *Tweed Sand Plant: Drivers' Code of Conduct,* a permanent site ban of the affected vehicle or driver will be considered.

7 Periodic Review

This Operational TMP shall be reviewed and revised and/or updated, in accordance with Schedule 5, Condition 4 of the Notice of Modification, within three (3) months of any of the following:

- The submission of an incident report under Schedule 5, Condition 10;
- The submission of an Annual Review under Schedule 5, Condition 13;
- The submission of an Audit report under Schedule 5, Condition 14; or
- The approval of any modification to the conditions of the Notice of Modification.

Where a review results in revisions to the Operational TMP, within six weeks of the review the revised Operational TMP will be submitted for DPE approval.

Review of this Operational TMP will also take place if monitoring records indicate that it is warranted, or in the event of any significant change to the form of the external road network from that contemplated herein.

8 Community Consultation and Performance Monitoring

8.1 Community Consultative Committee

Schedule 5, Condition 8 of the Notice of Modification states that TSP must operate a Community Consultative Committee (CCC) for the site. The CCC must be operated in general accordance with DPE's *Community Consultative Committee Guidelines: State Significant Projects* (2016), for the duration of TSP operations and for at least 6 months following the completion of TSP operations. TSP already has an existing CCC in place that meets biannually.

The CCC is to facilitate communication, consultation and information sharing between TSP and the local community.

8.2 Public Performance Reporting

Schedule 3, Condition 24 (f) of the Notice of Modification requires that TSP keep accurate records of all laden truck movements to and from the site and publish a summary of these records on its website every month.

APPENDIX A

DPE Approval of Expert

Planning Services
Resource Assessments
Contact: Genevieve Seed
Phone: (02) 9274 6489
Email: genevieve.seed@planning.nsw.gov.au

Mr Murray Graham
Development Manager
Hanson Construction Materials Pty Ltd
PO Box 1636
Toombul QLD 4012

Dear Mr Graham,

Tweed Sand Quarry (DA 152-6-2005)
Approval of Experts

I refer to your email dated 19 September 2018, seeking the approval of various experts to prepare management plans for the Tweed Sand Quarry, including:

- Adam McArthur, Phoebe Chapman and Nicole Davis from JWA Ecological, to prepare the Rehabilitation Management Plan; and
- Jeff Baczynski of SLR, to prepare the Transport Management Plan.

The Secretary has approved the appointment of these experts.

Should you have any enquiries in relation to this matter, please contact Genevieve Seed.

Yours sincerely,

20/9/18

Megan Dawson
A/Director
Resource Assessments
as nominee of the Secretary

APPENDIX B

Evidence of Consultation

Jeffrey Baczynski

From: Colleen Forbes <CForbes@tweed.nsw.gov.au>
Sent: Wednesday, 7 November 2018 3:49 PM
To: Glyn Cowie
Cc: Jeffrey Baczynski; Graham, Murray (Skygate) AUS; Erin Holton (holton.el@access.gs); Chris Lawlor
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Hi Glyn,

Council's Traffic Engineer has briefly reviewed the draft TMP. No concerns / objections are raised from Council's perspective.

Regards,
Colleen

Colleen Forbes
Team Leader Development Assessment

TWEED SHIRE COUNCIL

p (02) 6670 2596

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From: Glyn Cowie [mailto:gcowie@slrconsulting.com]
Sent: Friday, 2 November 2018 2:03 PM
To: Colleen Forbes
Cc: Jeffrey Baczynski; Graham, Murray (Skygate) AUS; Erin Holton (holton.el@access.gs); Chris Lawlor
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Hi Colleen,

Thank you for your below response.

Further to your request, please see attached the draft Traffic Management Plan for TSP. We would appreciate your review and any feedback you have so this can be considered prior to Hanson's submission to DPE.

Please note that due to the current time critical nature of the TMP, we would appreciate your feedback no later than COB Friday 9 November 2018.

Should you have any questions that you'd wish to discuss over the phone, please don't hesitate to contact either Jeff Baczynski (07 3858 4800) or myself (0438 763 516).

Kind regards,
Glyn

From: Colleen Forbes <CForbes@tweed.nsw.gov.au>
Sent: Tuesday, 2 October 2018 12:14 PM
To: Glyn Cowie <gcowie@slrconsulting.com>
Cc: Jeffrey Baczynski <jbaczynski@slrconsulting.com>; Graham, Murray (Skygate) AUS <Murray.Graham@hanson.com.au>
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Dear Glyn,

With reference to the Traffic Management Plan for the Tweed Sand Quarry, Council's Traffic Engineer has reviewed **Schedule 3 Condition 25** and **Schedule 5 Condition 2 of DA152-6-2005 MOD1**. Please be advised that TSC considers that the information required appears to be sufficient in breadth and scope. Accordingly, no additional traffic considerations are requested by TSC.

Please also be advised that TSC would like to receive a copy of the draft Plan for review / feedback prior to its submission to the Department.

Regards,
Colleen

Colleen Forbes
Team Leader Development Assessment

TWEED SHIRE COUNCIL

p (02) 6670 2596

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From: Glyn Cowie [mailto:gcowie@slrconsulting.com]
Sent: Monday, 24 September 2018 4:15 PM
To: Colleen Forbes
Cc: Jeffrey Baczynski; Graham, Murray (Skygate) AUS
Subject: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Hi Colleen,

You would be aware of the recently approved Tweed Sand Plant (TSP) MOD1 approval relating to an increase in extraction limit and associated heavy vehicle numbers. In accordance with the approved MOD1 *Notice for Modification Development Consent* (DA 152-6-2005 dated 20 August 2018, 'the Consent'), a traffic management plan is required to be prepared for the development to the satisfaction of the Secretary (DPE). SLR Consulting has been engaged by Hanson Construction Materials (HCM, the operator of TSP) to prepare a traffic management plan in accordance with the Consent.

The specific requirements for the traffic management plan are detailed in Schedule 3 Condition 25 of the Consent, which are copied below.

Transport Management Plan

25. The Applicant must prepare a Traffic Management Plan for the development to the satisfactio Secretary. This plan must:
    (a) be prepared by suitably qualified and experienced person/s whose appointment has been e by the Secretary;
    (b) be prepared in consultation with RMS and Council, and in accordance with the *RTA – Traffi at Worksites Manual*;
    (c) describe the processes in place for the management of truck movements entering and e site;
    (d) prohibit trucks departing the site from turning right from Crescent Street to Tweed Coast R
    (e) include a Drivers' Code of Conduct that includes:
        - details of the safe and quiet driving practices that must be used by drivers travelling to the quarry;
        - a map of the primary haulage route;
        - safety initiatives for haulage through residential areas, school zones and along sc routes;
        - an induction process for vehicle operators and regular toolbox meetings;
        - complaints resolution and disciplinary procedures; and
        - details of community consultation measures for peak haulage periods.
    (f) describe the measures to be put in place to ensure compliance with the Drivers' Code of C
    (g) include details of the measures to be implemented to minimise traffic safety issues and disr local road users during road upgrade works; and
    (h) propose measures to minimise the transmission of dust and tracking of material onto the s public roads from vehicles leaving the quarry.

In addition to Schedule 3 Condition 25, Schedule 5 Condition 2 details the broader requirements for management plans supporting this MOD1. These are copied below.

Management Plan Requirements

2. The Applicant must ensure that the management plans required under this consent are pre accordance with any relevant guidelines, and include:
   (a) a summary of relevant background or baseline data;
   (b) a description of:
      - the relevant statutory requirements (including any relevant approval, licence or lease cc
      - any relevant limits or performance measures/criteria; and
      - the specific performance indicators that are proposed to be used to judge the performa guide the implementation of, the development or any management measures;
   (c) a description of the measures to be implemented to comply with the relevant statutory requ limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
      - impacts and environmental performance of the development; and
      - effectiveness of any management measures (see (c) above);
   (e) a contingency plan to manage any unpredicted impacts and their consequences and to er ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as
   (f) a program to investigate and implement ways to improve the environmental performan development over time;
   (g) a protocol for managing and reporting any:
      - incidents;
      - complaints; and
      - non-compliances with statutory requirements;
   (h) a protocol for periodic review of the plan; and
   (i) a document control table that includes version numbers, dates when the management prepared and reviewed, names and positions of the person/s who prepared and revi management plan, a description of any revisions made and the date of the Secretary's ap

Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted fo management plans.

With regard to specific traffic management plan requirements, it is stated that the plan must be prepared in consultation with Council. To satisfy this requirement, this email serves to commence that consultation. We kindly request a response to the following two (2) points:

1. Could you please confirm whether you require any additional considerations into developing the traffic management plan above those specifically stated in the Consent and copied into this email? If you do, could you please state your considerations.
2. Do you request a copy of the draft plan for review/feedback prior to HCM's submission to DPE for ultimate approval?

I appreciate your response on this matter. Please note that in accordance with the Consent, HCM must not commence operations under the Consent until a traffic management plan has been approved by DPE. The Stakeholder consultation process will need to be completed prior to HCM submitting the traffic management plan for approval. As the traffic management plan is considered critical path, I would appreciate your response as soon as practical.

Please do not hesitate to contact me should you wish to discuss further.

Kind regards,
Glyn

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Jeffrey Baczynski

From: Glyn Cowie
Sent: Tuesday, 6 November 2018 11:44 AM
To: SCIFFER Greg
Cc: Development Northern; Gen Seed; Jeffrey Baczynski; Graham, Murray (Skygate) AUS; Erin Holton (holton.el@access.gs)
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Thank you Greg for your prompt feedback.

Our Principal Transport Consultant, Jeff Baczynski, will review your below points and be in touch should he wish to discuss further.

Kind regards,
Glyn

Glyn Cowie
Associate - Acoustics & Vibration

d 20819
m +61 438 763 516
o +61 7 3858 4800
e gcowie@slrconsulting.com

SLR Consulting Australia Pty Ltd
Ground Floor, 194 Varsity Parade, Varsity Lakes, QLD, 4227

From: SCIFFER Greg <Greg.SCIFFER@rms.nsw.gov.au>
Sent: Tuesday, 6 November 2018 11:24 AM
To: Glyn Cowie <gcowie@slrconsulting.com>
Cc: Development Northern <development.northern@rms.nsw.gov.au>; Gen Seed <genevieve.seed@planning.nsw.gov.au>
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Glyn

Thank s for the opportunity to comment on the Draft OTMP for Tweed Sand Plant. Generally the Draft OTMP has addressed most of requirements of Schedule 3, Condition 25. The following comments are provided for your consideration:

1. The Drivers Code of Conduct should include:
   - Safety initiatives for haulage through residential areas, school zones and along school bus routes.
   - Regular toolbox meetings
   - Details of community consultation measures for peak haulage periods

2. Details of measures to be implemented to minimise traffic safety issues and disruption to local road users during road upgrade works.

3. Measures to minimise tracking of materials onto the surface of public roads.

Regards
Greg Sciffer
Development Assessment Officer
Northern Region

From: Glyn Cowie [mailto:gcowie@slrconsulting.com]
Sent: Friday, 2 November 2018 2:08 PM
To: SCIFFER Greg
Cc: Jeffrey Baczynski; Chris Lawlor; Graham, Murray (Skygate) AUS; Erin Holton (holton.el@access.gs)
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Hi Greg,

Further to the below email, and your verbal request, please see attached the draft Operational Traffic Management Plan for TSP. We would appreciate your review and any feedback you have so this can be considered prior to Hanson's submission to DPE.

Please note that due to the current time critical nature of the TMP, we would appreciate your feedback no later than COB Friday 9 November 2018.

We also note the example OTMP that you provided following our discussion. Please note that this OTMP has been drafted to specifically address the relevant conditions of the TSP Notice of Modification. Those specific conditions are referenced in Section 1.2 of the attached.

Should you have any questions that you'd wish to discuss over the phone, please don't hesitate to contact either Jeff Baczynski (07 3858 4800) or myself (0438 763 516).

Kind regards,
Glyn

From: SCIFFER Greg <Greg.SCIFFER@rms.nsw.gov.au>
Sent: Thursday, 27 September 2018 9:31 AM
To: Glyn Cowie <gcowie@slrconsulting.com>
Subject: RE: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Glyn

I have been reviewing, preparing advice and liaising with DEP for RMS regarding Tweed Sand Quarry. Could you ring me on 02 6604 9328 to discuss your email before RMS formally replies.

Thanks
Greg Sciffer
Development Assessment Officer
Northern Region

From: Glyn Cowie [mailto:gcowie@slrconsulting.com]
Sent: Monday, 24 September 2018 4:17 PM
To: Development Northern
Cc: Jeffrey Baczynski; Graham, Murray (Skygate) AUS
Subject: 620.12479 - Tweed Sand Plant MOD1 - Traffic Management Plan Stakeholder Consultation

Attn: Liz Smith/John Perkins.

Hi Liz/John,

You may be aware of the recently approved Tweed Sand Plant (TSP) MOD1 approval relating to an increase in extraction limit and associated heavy vehicle numbers. In accordance with the approved MOD1 *Notice for Modification Development Consent* (DA 152-6-2005 dated 20 August 2018, 'the Consent'), a traffic management plan is required to be prepared for the development to the satisfaction of the Secretary (DPE). SLR Consulting has

been engaged by Hanson Construction Materials (HCM, the operator of TSP) to prepare a traffic management plan in accordance with the Consent.

The specific requirements for the traffic management plan are detailed in Schedule 3 Condition 25 of the Consent, which are copied below.

Transport Management Plan

25. The Applicant must prepare a Traffic Management Plan for the development to the satisfactio Secretary. This plan must:
    (a) be prepared by suitably qualified and experienced person/s whose appointment has been e by the Secretary;
    (b) be prepared in consultation with RMS and Council, and in accordance with the *RTA – Traffi at Worksites Manual*;
    (c) describe the processes in place for the management of truck movements entering and e site;
    (d) prohibit trucks departing the site from turning right from Crescent Street to Tweed Coast R
    (e) include a Drivers' Code of Conduct that includes:
        - details of the safe and quiet driving practices that must be used by drivers travelling to the quarry;
        - a map of the primary haulage route;
        - safety initiatives for haulage through residential areas, school zones and along sc routes;
        - an induction process for vehicle operators and regular toolbox meetings;
        - complaints resolution and disciplinary procedures; and
        - details of community consultation measures for peak haulage periods.
    (f) describe the measures to be put in place to ensure compliance with the Drivers' Code of C
    (g) include details of the measures to be implemented to minimise traffic safety issues and disr local road users during road upgrade works; and
    (h) propose measures to minimise the transmission of dust and tracking of material onto the s public roads from vehicles leaving the quarry.

In addition to Schedule 3 Condition 25, Schedule 5 Condition 2 details the broader requirements for management plans supporting this MOD1. These are copied below.

Management Plan Requirements

2. The Applicant must ensure that the management plans required under this consent are pre accordance with any relevant guidelines, and include:
   (a) a summary of relevant background or baseline data;
   (b) a description of:
      - the relevant statutory requirements (including any relevant approval, licence or lease cc
      - any relevant limits or performance measures/criteria; and
      - the specific performance indicators that are proposed to be used to judge the performa guide the implementation of, the development or any management measures;
   (c) a description of the measures to be implemented to comply with the relevant statutory requ limits, or performance measures/criteria;
   (d) a program to monitor and report on the:
      - impacts and environmental performance of the development; and
      - effectiveness of any management measures (see (c) above);
   (e) a contingency plan to manage any unpredicted impacts and their consequences and to er ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as
   (f) a program to investigate and implement ways to improve the environmental performan development over time;
   (g) a protocol for managing and reporting any:
      - incidents;
      - complaints; and
      - non-compliances with statutory requirements;
   (h) a protocol for periodic review of the plan; and
   (i) a document control table that includes version numbers, dates when the management prepared and reviewed, names and positions of the person/s who prepared and revi management plan, a description of any revisions made and the date of the Secretary's ap

Note: The Secretary may waive some of these requirements if they are unnecessary or unwarranted fo management plans.

With regard to specific traffic management plan requirements, it is stated that the plan must be prepared in consultation with RMS. To satisfy this requirement, this email serves to commence that consultation. We kindly request a response to the following two (2) points:

1. Could you please confirm whether you require any additional considerations into developing the traffic management plan above those specifically stated in the Consent and copied into this email? If you do, could you please state your considerations.
2. Do you request a copy of the draft plan for review/feedback prior to HCM's submission to DPE for ultimate approval?

I appreciate your response on this matter. Please note that in accordance with the Consent, HCM must not commence operations under the Consent until a traffic management plan has been approved by DPE. The Stakeholder consultation process will need to be completed prior to HCM submitting the traffic management plan for approval. As the traffic management plan is considered critical path, I would appreciate your response as soon as practical.

Please do not hesitate to contact me should you wish to discuss further.

Kind regards,
Glyn

NSW GOVERNMENT | Transport Roads & Maritime Services

Before printing, please consider the environment

Before printing, please consider the environment

IMPORTANT NOTICE: This email and any attachment to it are intended only to be read or used by the named addressee. It is confidential and may contain legally privileged information. No confidentiality or privilege is waived or lost by any mistaken transmission to you. Roads and Maritime Services is not responsible for any unauthorised alterations to this email or attachment to it. Views expressed in this message are those of the individual sender, and are not necessarily the views of Roads and Maritime Services. If you receive this email in error, please immediately delete it from your system and notify the sender. You must not disclose, copy or use any part of this email if you are not the intended recipient.

APPENDIX C

Tweed Sand Plant: Drivers' Code of Conduct

Site Specific Requirements:

- All trucks must only access site via Tweed Coast Rd/Crescent St/Altona Rd (see map below).
- No trucks are permitted on Altona Road before **7:00am** NSW time.
- Trucks are not permitted to turn right from Crescent Street onto Tweed Coast Road.
- **UHF 19** must be used to communicate with sales loader.
- Operating Hours for sales:
  Mon – Fri = 7:15am to 4:45pm NSW time
  Saturday = 7:15am to 11:45am NSW time
- Maximum speed limits:
  *Altona Road = **40kmh***
  *Sand Plant site = **30kmh***
- Tweed Sand Plant is a 'No Smoking' site.
- In addition to this Drivers' Code, drivers are required to read the *Tweed Sand Plant: MOD1 Operational Traffic Management Plan* prepared by SLR. A copy will be kept onsite and made available to drivers as part of the site induction.

<u>Note</u>: Non-compliance with any directive included in this Drivers' Code, either on or off site, may lead to refusal to load truck and/or further disciplinary action against the driver.

Site Contact Details:

Manager: John McQueen, ph. 0407 180 038

Hanson
HEIDELBERGCEMENT Group

Hanson Construction Materials Pty Ltd

Tweed Sand Plant

Drivers' Code of Conduct

Updated: March 2019

Tweed Sand Plant – Drivers' Code of Conduct

Transport routes may require travel through, or in close proximity to residential areas. Hanson has made a commitment to local authorities and the local community to undertake all activities including delivery of product in a manner which protects the environment and amenity of the local community.

It must be remembered that your driving behaviour is the Company image that the general public see and if tarnished, can severely impact our reputation with the local community.

All heavy vehicle drivers are required to be responsible, professional and drive in accordance with this Drivers' Code.

Hanson will enforce this code and follow up on any complaints. Breaches or blatant disregard of the Drivers' Code of Conduct may lead to exclusion from site and/or further disciplinary action.

This Drivers' Code of Conduct is required to be read and completed by all drivers; signed confirmation will be held on site.

- *Professional road courtesy must be displayed at all times towards other road users. Drivers must obey all signage, given directions and instructions.*
- *The use of engine brakes is prohibited in residential areas in close proximity to all Hanson sites.*
- *All loads with material <150mm must be tarped prior to exiting site. The tarp must cover the total surface of the truck and trailer body.*
- *All loads must be secure, with drawbars, tailgates and side combings cleaned down prior to leaving site.*
- *All drivers must comply with current Chain of Responsibility legislation.*
- *All site mobile equipment (FEL, dump truck, water truck, etc) has right of way at all times.*
- ***POSITIVE COMMUNICATION MUST** be established when approaching any site vehicle, mobile equipment or machine and/or before entering the site vehicle's work area.*
- *All trucks entering site must be fully maintained and roadworthy.*
- *No truck will be allowed to leave site if weight is in excess of the Registered Gross Mass of the vehicle.*
- *You must remain in the truck cabin whilst being loaded unless directed otherwise by the loader driver. Apply park brake if leaving vehicle.*
- *No children are allowed on site, including in truck cabins. Any vehicle containing children will not be loaded (organised school visits and apprentices under 18 are excluded).*
- *Inappropriate or unnecessary use of UHF radios is not permitted, so as to allow clear and concise communications on site.*
- *Steel cap boots and high visibility clothing must be worn on site at all times. Hard hats must be worn if exiting truck.*
- *Hanson has a Drug and Alcohol Policy which includes random testing. If you refuse to be tested you will not be loaded.*
- *No soil, fill or other materials are to be brought onto site without the Site Manager's prior approval. All trucks must be free of soil build-up prior to entering site.*
- *All trucks must drive through the wheel wash and/or across the shaker grid when exiting any site where installed, to remove loose material from tyres and truck body.*
- *No truck maintenance or repairs are to be performed on site without Site Manager's approval.*
- *Any litter must be placed in litter bins on site.*
- *Any accidents, incidents, complaints, hazards, spillages or near misses that occur on or off site, must be reported to the Site Manager as soon as possible after the occurrence.*

Hanson Construction Materials Pty Ltd

Tweed Sand Plant

Drivers' Code of Conduct

Confirmation of Understanding

I, _____ *(print)*

of _____ *(company)*

have read/had explained to me, the Tweed Sand Plant Drivers' Code of Conduct and understand my obligations with regard to its content.

I further confirm I will comply with all requirements of the Tweed Sand Plant Drivers' Code of Conduct.

Signed: _____

Date: _____

Endorsed By: _____
(Hanson Representative)

Please detach and retain in site files

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
5 Foelsche Street
Darwin NT 0800
Australia
T: +61 8 8998 0100
F: +61 2 9427 8200

GOLD COAST
Ground Floor, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Suite 2, 2 Domville Avenue
Hawthorn VIC 3122
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

ROCKHAMPTON
rockhampton@slrconsulting.com
M: +61 407 810 417

SYDNEY
2 Lincoln Street
Lane Cove NSW 2066
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TAMWORTH
PO Box 11034
Tamworth NSW 2340
Australia
M: +61 408 474 248
F: +61 2 9427 8200

TOWNSVILLE
Level 1, 514 Sturt Street
Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

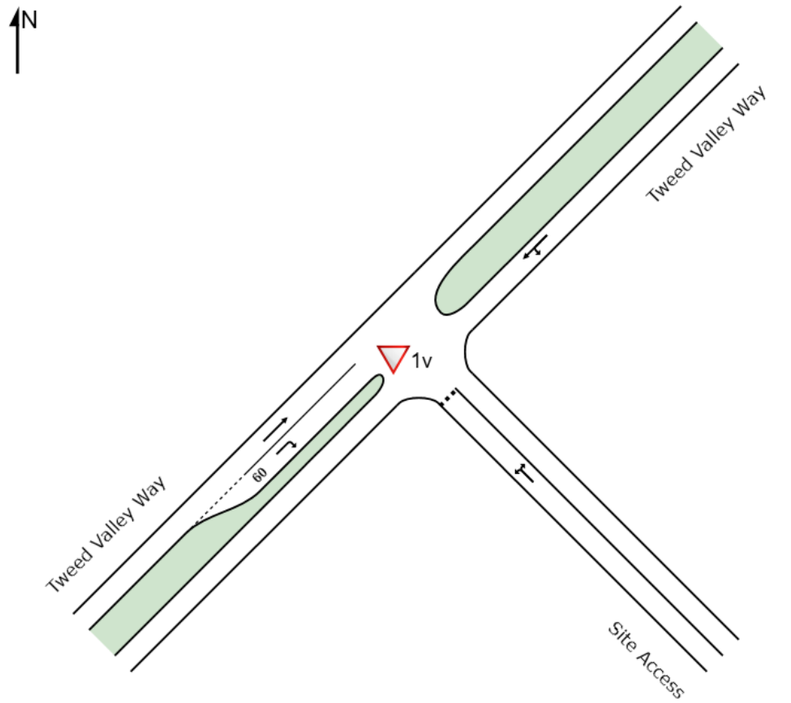
AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: +64 27 441 7849

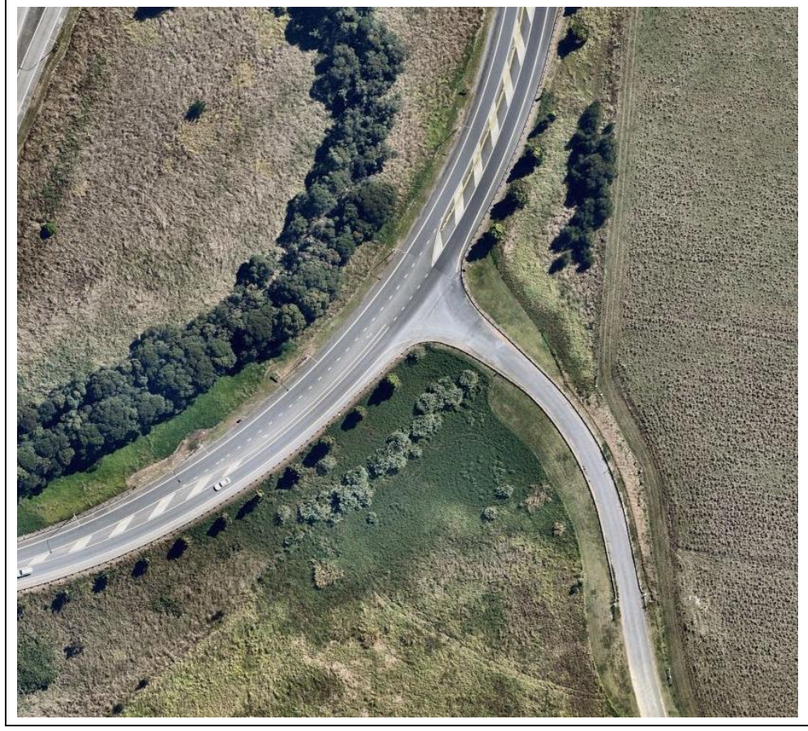
NELSON
5 Duncan Street
Port Nelson 7010
New Zealand
T: +64 274 898 628

NEW PLYMOUTH
Level 2, 10 Devon Street East
New Plymouth 4310
New Zealand
T: +64 0800 757 695

Appendix E – Intersection Performance Summaries

Tweed Valley Way / Australian Bay Lobster Producers Access – 2020 Base





MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2020 AM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	4	33.3	4	33.3	0.026	11.4	LOS B	0.1	0.9	0.77	0.86	0.77	43.7
2	R2	2	100.0	2	100.0	0.026	35.2	LOS E	0.1	0.9	0.77	0.86	0.77	41.3
Approach		6	55.5	6	55.5	0.026	19.3	LOS C	0.1	0.9	0.77	0.86	0.77	42.9
NorthEast: Tweed Valley Way														
3	L2	4	5.6	4	5.6	0.393	5.7	LOS A	0.0	0.0	0.00	0.00	0.00	57.8
4	T1	688	5.6	724	5.6	0.393	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		692	5.6	728	5.6	0.393	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	70	21.7	74	21.7	0.047	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	5	50.0	5	50.0	0.011	12.7	LOS B	0.0	0.4	0.68	0.76	0.68	46.6
Approach		75	23.6	79	23.6	0.047	0.9	NA	0.0	0.4	0.05	0.05	0.05	58.9
All Vehicles		773	7.7	814	7.7	0.393	0.4	NA	0.1	0.9	0.01	0.01	0.01	59.4

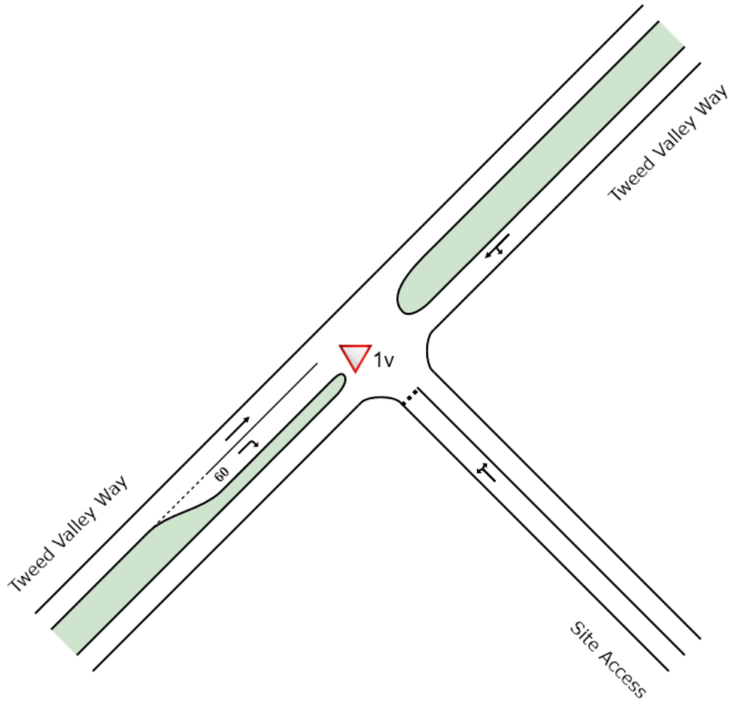
MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2020 PM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	9	39.3	9	39.3	0.024	10.9	LOS B	0.1	0.8	0.65	0.78	0.65	47.4
2	R2	1	100.0	1	100.0	0.024	28.5	LOS D	0.1	0.8	0.65	0.78	0.65	44.8
Approach		10	45.4	11	45.4	0.024	12.7	LOS B	0.1	0.8	0.65	0.78	0.65	47.1
NorthEast: Tweed Valley Way														
3	L2	1	100.0	1	100.0	0.359	6.9	LOS A	0.0	0.0	0.00	0.00	0.00	52.7
4	T1	630	5.6	663	5.6	0.359	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		631	5.7	664	5.7	0.359	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	55	21.4	58	21.4	0.037	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	1	0.0	1	0.0	0.001	8.4	LOS A	0.0	0.0	0.57	0.60	0.57	50.9
Approach		56	21.0	59	21.0	0.037	0.2	NA	0.0	0.0	0.01	0.01	0.01	59.8
All Vehicles		697	7.5	734	7.5	0.359	0.3	NA	0.1	0.8	0.01	0.01	0.01	59.5



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2022 AM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	26	13.6	27	13.6	0.267	5.6	LOS A	1.1	10.0	0.59	0.83	0.59	51.3
6	R2	167	24.1	176	24.1	0.267	13.0	LOS B	1.1	10.0	0.59	0.83	0.59	53.5
6u	U	1	0.0	1	0.0	0.267	14.5	LOS B	1.1	10.0	0.59	0.83	0.59	56.3
Approach		194	22.6	204	22.6	0.267	12.1	LOS B	1.1	10.0	0.59	0.83	0.59	53.2
NorthEast: Tweed Valley Way														
7	L2	52	11.6	55	11.6	0.264	3.1	LOS A	1.8	13.8	0.14	0.26	0.14	57.2
8	T1	674	6.3	709	6.3	0.264	2.4	LOS A	1.8	13.8	0.15	0.28	0.15	59.9
9u	U	49	85.7	52	85.7	0.264	13.6	LOS B	1.7	15.9	0.16	0.31	0.16	59.5
Approach		775	11.7	816	11.7	0.264	3.2	LOS A	1.8	15.9	0.15	0.28	0.15	59.7
SouthWest: Tweed Valley Way														
2	T1	46	28.6	48	28.6	0.069	3.7	LOS A	0.4	3.3	0.46	0.49	0.46	56.0
3	R2	24	5.0	25	5.0	0.069	10.8	LOS B	0.4	3.3	0.46	0.49	0.46	57.1
3u	U	1	0.0	1	0.0	0.069	13.3	LOS B	0.4	3.3	0.46	0.49	0.46	59.7
Approach		71	20.2	75	20.2	0.069	6.2	LOS A	0.4	3.3	0.46	0.49	0.46	56.4
All Vehicles		1040	14.3	1095	14.3	0.267	5.1	LOS A	1.8	15.9	0.25	0.40	0.25	58.1

MOVEMENT SUMMARY

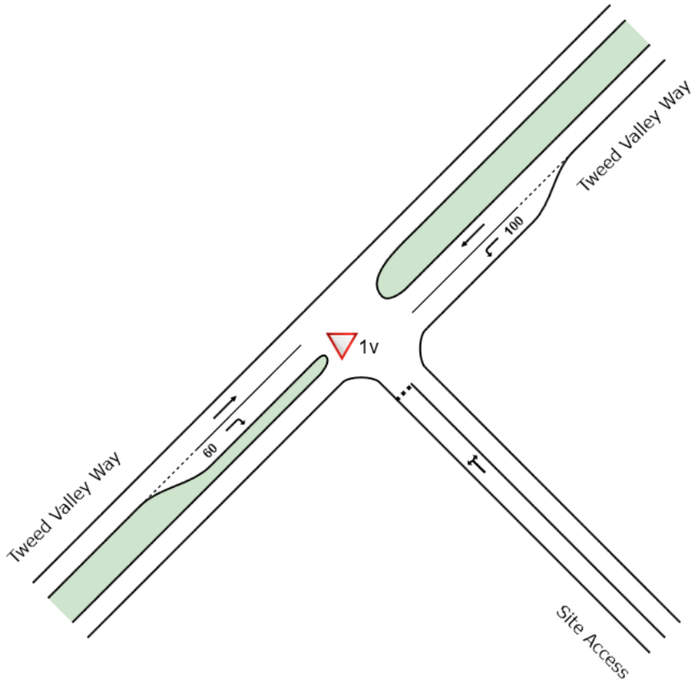
Site: 1 [Tweed Valley Way / Service Station 2022 PM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	46	5.1	48	5.1	0.368	5.6	LOS A	1.7	14.1	0.62	0.86	0.65	51.5
6	R2	243	15.6	256	15.6	0.368	13.0	LOS B	1.7	14.1	0.62	0.86	0.65	53.9
6u	U	1	0.0	1	0.0	0.368	14.8	LOS B	1.7	14.1	0.62	0.86	0.65	56.4
Approach		290	13.9	305	13.9	0.368	11.8	LOS B	1.7	14.1	0.62	0.86	0.65	53.6
NorthEast: Tweed Valley Way														
7	L2	50	17.1	53	17.1	0.262	3.2	LOS A	1.8	14.1	0.19	0.27	0.19	56.8
8	T1	646	7.3	680	7.3	0.262	2.5	LOS A	1.8	14.1	0.19	0.29	0.19	59.6
9u	U	49	87.8	52	87.8	0.262	13.9	LOS B	1.6	16.1	0.21	0.33	0.21	59.1
Approach		745	13.2	784	13.2	0.262	3.3	LOS A	1.8	16.1	0.20	0.29	0.20	59.4
SouthWest: Tweed Valley Way														
2	T1	39	18.9	41	18.9	0.077	3.9	LOS A	0.4	3.7	0.52	0.55	0.52	55.4
3	R2	37	12.7	39	12.7	0.077	11.4	LOS B	0.4	3.7	0.52	0.55	0.52	56.1
3u	U	1	0.0	1	0.0	0.077	13.7	LOS B	0.4	3.7	0.52	0.55	0.52	58.9
Approach		77	15.7	81	15.7	0.077	7.6	LOS A	0.4	3.7	0.52	0.55	0.52	55.8
All Vehicles		1112	13.6	1171	13.6	0.368	5.8	LOS A	1.8	16.1	0.33	0.46	0.34	57.4



MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2022WD AM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	40	39	42	97.5	0.483	55.0	LOS F	1.8	33.9	0.92	1.08	1.23	29.0
2	R2	5	5	5	100.0	0.483	69.1	LOS F	1.8	33.9	0.92	1.08	1.23	28.8
Approach		45	44	47	97.8	0.483	56.5	LOS F	1.8	33.9	0.92	1.08	1.23	28.9
NorthEast: Tweed Valley Way														
3	L2	38	34	40	89.5	0.050	6.9	LOS A	0.0	0.0	0.00	0.57	0.00	48.7
4	T1	697	39	734	5.6	0.396	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		735	73	774	9.9	0.396	0.5	NA	0.0	0.0	0.00	0.03	0.00	59.0
SouthWest: Tweed Valley Way														
5	T1	74	20	78	27.0	0.052	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	12	10	13	83.3	0.067	24.5	LOS C	0.2	2.9	0.81	0.93	0.81	39.5
Approach		86	30	91	34.9	0.067	3.4	NA	0.2	2.9	0.11	0.13	0.11	55.9
All Vehicles		866	147	912	17.0	0.483	3.7	NA	1.8	33.9	0.06	0.09	0.08	55.7

MOVEMENT SUMMARY

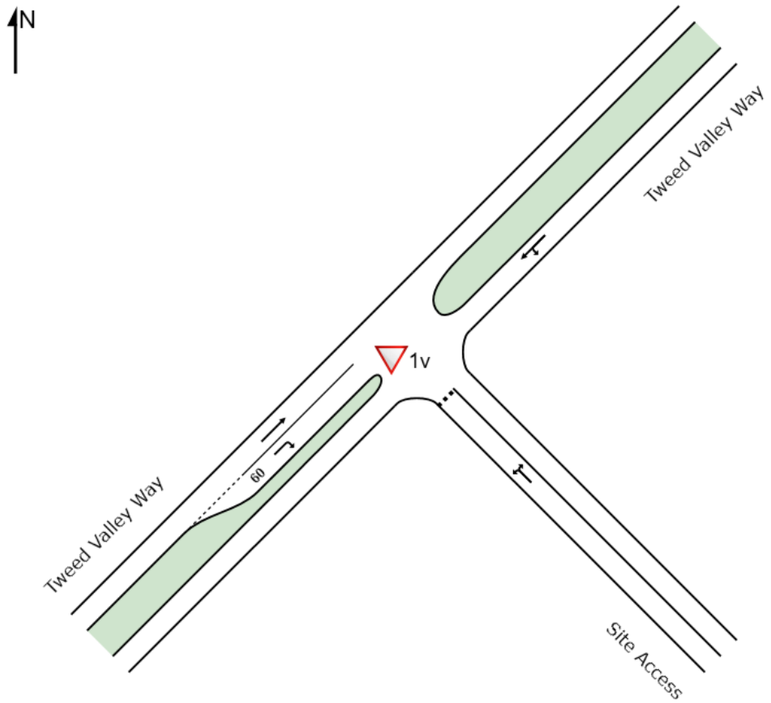
Site: 1v [Tweed Valley Way / Site Access 2022WD PM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	48	42	51	87.5	0.354	34.4	LOS D	1.3	23.0	0.86	1.02	1.06	35.7
2	R2	3	2	3	66.7	0.354	36.5	LOS E	1.3	23.0	0.86	1.02	1.06	36.1
Approach		51	44	54	86.3	0.354	34.5	LOS D	1.3	23.0	0.86	1.02	1.06	35.8
NorthEast: Tweed Valley Way														
3	L2	35	33	37	94.3	0.048	7.0	LOS A	0.0	0.0	0.00	0.57	0.00	48.5
4	T1	640	38	674	5.9	0.365	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		675	71	711	10.5	0.365	0.5	NA	0.0	0.0	0.00	0.03	0.00	59.0
SouthWest: Tweed Valley Way														
5	T1	58	16	61	27.6	0.041	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	7	7	7	100.0	0.042	25.7	LOS D	0.1	2.1	0.80	0.92	0.80	38.0
Approach		65	23	68	35.4	0.042	2.8	NA	0.1	2.1	0.09	0.10	0.09	56.5
All Vehicles		791	138	833	17.4	0.365	2.9	NA	1.3	23.0	0.06	0.10	0.08	56.4

Tweed Valley Way / Australian Bay Lobster Producers Access – 2032 Base



MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2032 AM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	4	35.8	4	35.8	0.031	12.5	LOS B	0.1	1.0	0.81	0.90	0.81	42.1
2	R2	2	100.0	2	100.0	0.031	41.8	LOS E	0.1	1.0	0.81	0.90	0.81	40.0
Approach		6	57.2	6	57.2	0.031	22.3	LOS C	0.1	1.0	0.81	0.90	0.81	41.4
NorthEast: Tweed Valley Way														
3	L2	4	0.0	4	0.0	0.422	5.7	LOS A	0.0	0.0	0.00	0.00	0.00	58.1
4	T1	739	5.6	778	5.6	0.422	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		743	5.6	782	5.6	0.422	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	75	21.7	79	21.7	0.050	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	5	53.7	5	53.7	0.013	14.2	LOS B	0.0	0.5	0.72	0.80	0.72	45.6
Approach		80	23.7	84	23.7	0.050	0.9	NA	0.0	0.5	0.05	0.05	0.05	58.8
All Vehicles		829	7.7	873	7.7	0.422	0.4	NA	0.1	1.0	0.01	0.01	0.01	59.4

MOVEMENT SUMMARY

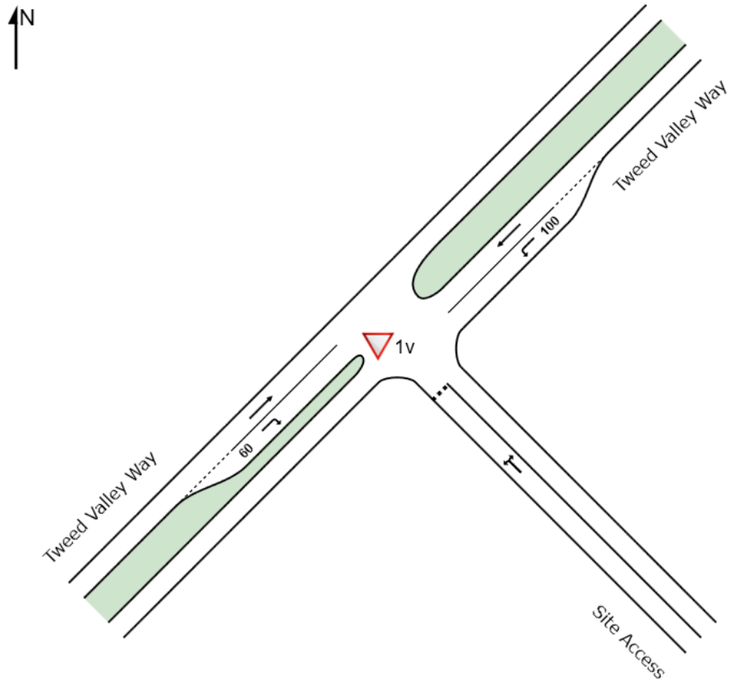
Site: 1v [Tweed Valley Way / Site Access 2032 PM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	9	42.2	9	42.2	0.023	12.0	LOS B	0.1	0.7	0.66	0.79	0.66	47.7
2	R2	1	0.0	1	0.0	0.023	13.6	LOS B	0.1	0.7	0.66	0.79	0.66	48.7
Approach		10	38.0	11	38.0	0.023	12.1	LOS B	0.1	0.7	0.66	0.79	0.66	47.8
NorthEast: Tweed Valley Way														
3	L2	1	100.0	1	100.0	0.388	7.0	LOS A	0.0	0.0	0.00	0.00	0.00	52.7
4	T1	679	5.9	715	5.9	0.388	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		680	6.0	716	6.0	0.388	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	59	21.4	62	21.4	0.039	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	1	0.0	1	0.0	0.001	8.9	LOS A	0.0	0.0	0.59	0.62	0.59	50.6
Approach		60	21.0	63	21.0	0.039	0.2	NA	0.0	0.0	0.01	0.01	0.01	59.8
All Vehicles		750	7.7	789	7.7	0.388	0.3	NA	0.1	0.7	0.01	0.01	0.01	59.5

Tweed Valley Way / Australian Bay Lobster Producers Access – 2032 Base with Proposed Development



MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2032WD AM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	36	33	38	91.7	0.490	66.1	LOS F	1.7	34.4	0.94	1.08	1.23	27.0
2	R2	2	2	2	100.0	0.490	78.1	LOS F	1.7	34.4	0.94	1.08	1.23	26.7
Approach		38	35	40	92.1	0.490	66.7	LOS F	1.7	34.4	0.94	1.08	1.23	26.9
NorthEast: Tweed Valley Way														
3	L2	34	30	36	88.2	0.046	7.0	LOS A	0.0	0.0	0.00	0.57	0.00	48.7
4	T1	739	41	778	5.5	0.420	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		773	71	814	9.2	0.420	0.5	NA	0.0	0.0	0.00	0.02	0.00	59.1
SouthWest: Tweed Valley Way														
5	T1	75	18	79	24.0	0.051	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	6	6	6	100.0	0.052	35.1	LOS E	0.2	2.6	0.86	0.95	0.86	34.6
Approach		81	24	85	29.6	0.052	2.6	NA	0.2	2.6	0.06	0.07	0.06	56.9
All Vehicles		892	130	939	14.6	0.490	3.5	NA	1.7	34.4	0.05	0.07	0.06	56.0

MOVEMENT SUMMARY

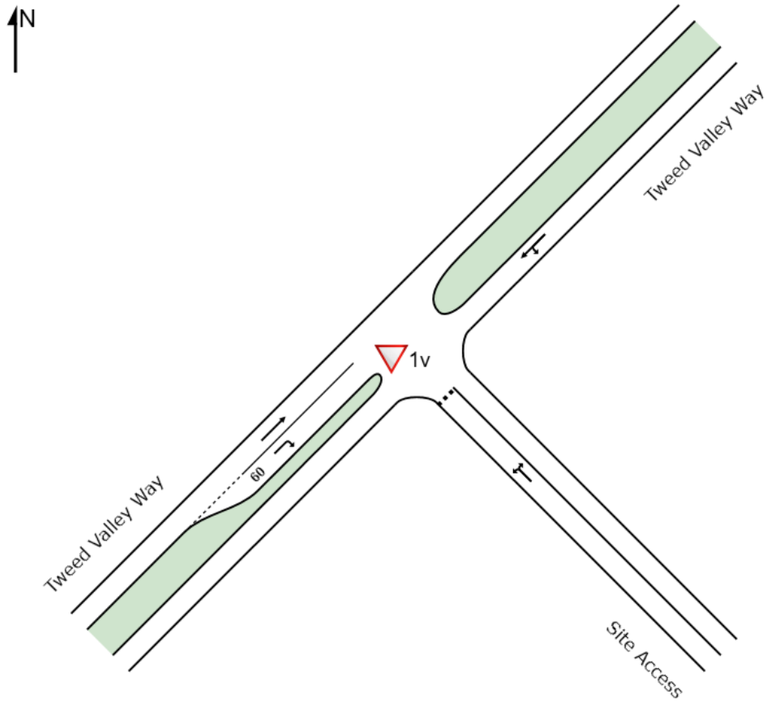
Site: 1v [Tweed Valley Way / Site Access 2032WD PM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	41	36	43	87.8	0.372	42.7	LOS E	1.3	24.3	0.89	1.03	1.10	33.4
2	R2	3	0	3	0.0	0.372	23.3	LOS C	1.3	24.3	0.89	1.03	1.10	35.5
Approach		44	36	46	81.8	0.372	41.4	LOS E	1.3	24.3	0.89	1.03	1.10	33.5
NorthEast: Tweed Valley Way														
3	L2	31	31	33	100.0	0.045	7.1	LOS A	0.0	0.0	0.00	0.57	0.00	47.2
4	T1	679	40	715	5.9	0.387	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		710	71	747	10.0	0.387	0.4	NA	0.0	0.0	0.00	0.02	0.00	59.0
SouthWest: Tweed Valley Way														
5	T1	59	26	62	44.1	0.047	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	2	2	2	100.0	0.024	46.9	LOS E	0.1	1.6	0.88	0.95	0.88	30.7
Approach		61	28	64	45.9	0.047	1.6	NA	0.1	1.6	0.03	0.03	0.03	58.2
All Vehicles		815	135	858	16.6	0.387	2.7	NA	1.3	24.3	0.05	0.08	0.06	56.6

Tweed Valley Way / Australian Bay Lobster Producers Access – 2042 Base



MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2042 AM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	4	33.3	4	33.3	0.037	13.5	LOS B	0.1	1.2	0.84	0.93	0.84	40.5
2	R2	2	100.0	2	100.0	0.037	50.9	LOS F	0.1	1.2	0.84	0.93	0.84	38.4
Approach		6	55.5	6	55.5	0.037	26.0	LOS D	0.1	1.2	0.84	0.93	0.84	39.8
NorthEast: Tweed Valley Way														
3	L2	4	0.0	4	0.0	0.454	5.7	LOS A	0.0	0.0	0.00	0.00	0.00	58.0
4	T1	795	5.6	837	5.6	0.454	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
Approach		799	5.6	841	5.6	0.454	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.6
SouthWest: Tweed Valley Way														
5	T1	80	21.6	84	21.6	0.053	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	5	50.0	5	50.0	0.015	15.3	LOS C	0.1	0.5	0.76	0.83	0.76	45.1
Approach		85	23.3	89	23.3	0.053	0.9	NA	0.1	0.5	0.04	0.05	0.04	58.8
All Vehicles		890	7.6	937	7.6	0.454	0.4	NA	0.1	1.2	0.01	0.01	0.01	59.3

MOVEMENT SUMMARY

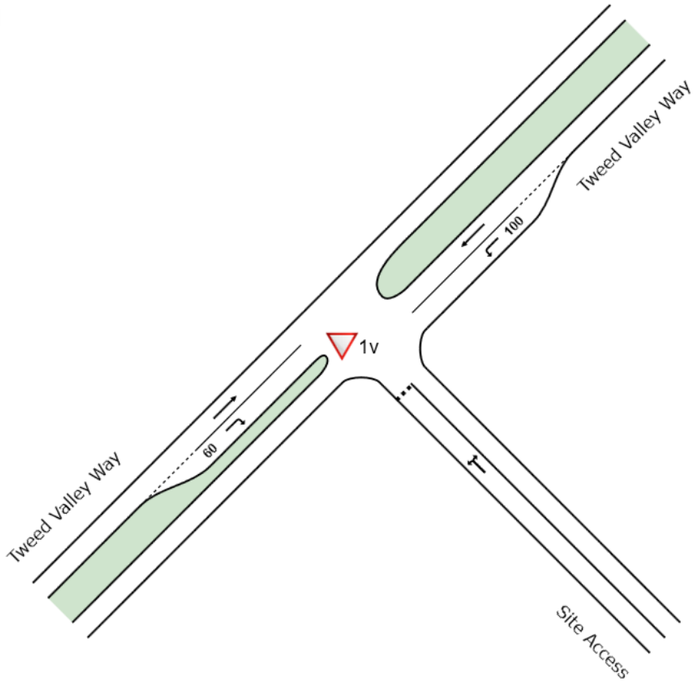
Site: 1v [Tweed Valley Way / Site Access 2042 PM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	9	39.3	9	39.3	0.024	12.6	LOS B	0.1	0.8	0.69	0.82	0.69	47.4
2	R2	1	0.0	1	0.0	0.024	14.8	LOS B	0.1	0.8	0.69	0.82	0.69	48.3
Approach		10	35.4	11	35.4	0.024	12.8	LOS B	0.1	0.8	0.69	0.82	0.69	47.5
NorthEast: Tweed Valley Way														
3	L2	1	100.0	1	100.0	0.412	7.0	LOS A	0.0	0.0	0.00	0.00	0.00	52.6
4	T1	721	5.9	759	5.9	0.412	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		722	6.0	760	6.0	0.412	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	62	21.4	65	21.4	0.041	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	1	0.0	1	0.0	0.002	9.3	LOS A	0.0	0.0	0.61	0.63	0.61	50.3
Approach		63	21.1	66	21.1	0.041	0.2	NA	0.0	0.0	0.01	0.01	0.01	59.8
All Vehicles		795	7.6	837	7.6	0.412	0.3	NA	0.1	0.8	0.01	0.01	0.01	59.5

Tweed Valley Way / Australian Bay Lobster Producers Access – 2042 Base with Proposed Development



MOVEMENT SUMMARY

Site: 1v [Tweed Valley Way / Site Access 2042WD AM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	36	35	38	97.2	0.668	107.4	LOS F	2.4	51.0	0.97	1.17	1.46	20.6
2	R2	2	2	2	100.0	0.668	114.4	LOS F	2.4	51.0	0.97	1.17	1.46	20.5
Approach		38	37	40	97.4	0.668	107.7	LOS F	2.4	51.0	0.97	1.17	1.46	20.6
NorthEast: Tweed Valley Way														
3	L2	34	30	36	88.2	0.046	7.0	LOS A	0.0	0.0	0.00	0.57	0.00	48.7
4	T1	785	44	826	5.6	0.446	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		819	74	862	9.0	0.446	0.5	NA	0.0	0.0	0.00	0.02	0.00	59.1
SouthWest: Tweed Valley Way														
5	T1	80	17	84	21.3	0.054	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	6	3	6	50.0	0.037	25.9	LOS D	0.1	1.5	0.84	0.94	0.84	39.5
Approach		86	20	91	23.3	0.054	1.8	NA	0.1	1.5	0.06	0.07	0.06	57.9
All Vehicles		943	131	993	13.9	0.668	4.9	NA	2.4	51.0	0.04	0.07	0.06	54.8

MOVEMENT SUMMARY

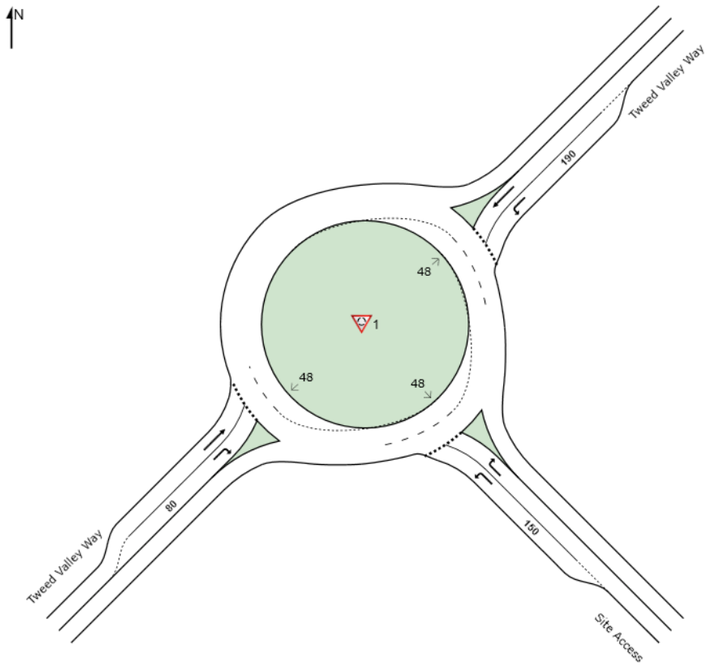
Site: 1v [Tweed Valley Way / Site Access 2042WD PM (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
1	L2	41	36	43	87.8	0.431	52.1	LOS F	1.5	28.8	0.92	1.06	1.17	30.6
2	R2	1	0	1	0.0	0.431	28.1	LOS D	1.5	28.8	0.92	1.06	1.17	32.3
Approach		42	36	44	85.7	0.431	51.5	LOS F	1.5	28.8	0.92	1.06	1.17	30.6
NorthEast: Tweed Valley Way														
3	L2	31	31	33	100.0	0.045	7.1	LOS A	0.0	0.0	0.00	0.57	0.00	47.2
4	T1	721	42	759	5.8	0.410	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		752	73	792	9.7	0.410	0.4	NA	0.0	0.0	0.00	0.02	0.00	59.1
SouthWest: Tweed Valley Way														
5	T1	62	15	65	24.2	0.042	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	2	2	2	100.0	0.029	54.8	LOS F	0.1	1.9	0.90	0.96	0.90	28.8
Approach		64	17	67	26.6	0.042	1.7	NA	0.1	1.9	0.03	0.03	0.03	58.0
All Vehicles		858	126	903	14.7	0.431	3.0	NA	1.5	28.8	0.05	0.07	0.06	56.4

Tweed Valley Way / Australian Bay Lobster Producers Access Rdb – 2022WD



MOVEMENT SUMMARY

Site: 1 [2022WD AM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	34	33	36	97.1	0.118	15.1	LOS B	0.5	11.6	0.69	0.80	0.69	47.6
6	R2	4	4	4	100.0	0.016	22.3	LOS B	0.1	1.1	0.67	0.76	0.67	45.1
Approach		38	37	40	97.4	0.118	15.8	LOS B	0.5	11.6	0.69	0.79	0.69	47.3
NorthEast: Tweed Valley Way														
7	L2	34	30	36	88.2	0.050	3.7	LOS A	0.2	4.1	0.07	0.34	0.07	55.6
8	T1	785	44	826	5.6	0.468	2.4	LOS A	2.9	21.9	0.07	0.24	0.07	60.6
Approach		819	74	862	9.0	0.468	2.5	LOS A	2.9	21.9	0.07	0.24	0.07	60.4
SouthWest: Tweed Valley Way														
2	T1	80	17	84	21.3	0.058	2.5	LOS A	0.3	2.8	0.06	0.23	0.06	60.6
3	R2	6	3	6	50.0	0.008	10.2	LOS A	0.0	0.5	0.07	0.55	0.07	54.0
Approach		86	20	91	23.3	0.058	3.0	LOS A	0.3	2.8	0.06	0.25	0.06	60.0
All Vehicles		943	131	993	13.9	0.468	3.0	LOS A	2.9	21.9	0.09	0.26	0.09	59.7

MOVEMENT SUMMARY

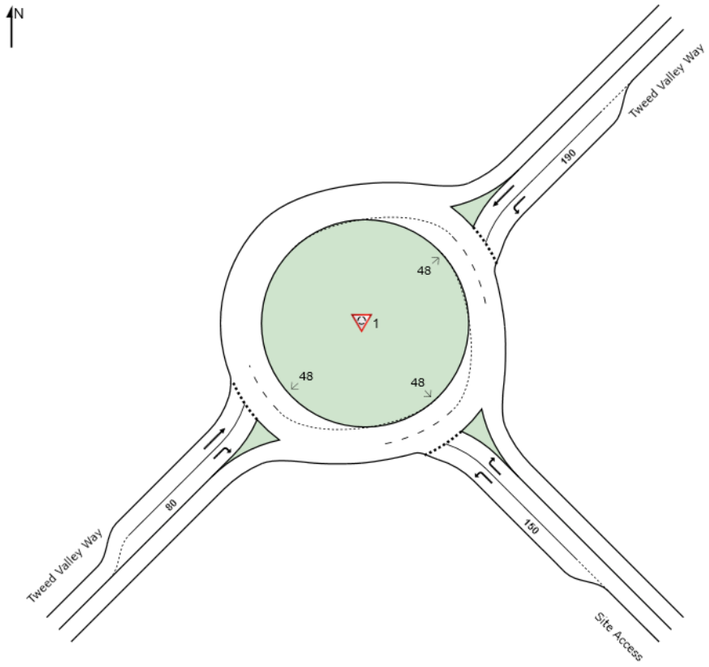
Site: 1 [2022WD PM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	46	40	48	87.0	0.109	10.2	LOS A	0.5	9.0	0.62	0.73	0.62	50.9
6	R2	5	4	5	80.0	0.015	18.0	LOS B	0.1	0.9	0.61	0.71	0.61	48.5
Approach		51	44	54	86.3	0.109	10.9	LOS A	0.5	9.0	0.62	0.73	0.62	50.7
NorthEast: Tweed Valley Way														
7	L2	35	35	37	100.0	0.046	3.6	LOS A	0.2	2.2	0.08	0.34	0.08	55.2
8	T1	640	38	674	6.0	0.379	2.4	LOS A	2.1	15.2	0.07	0.24	0.07	60.6
Approach		675	73	711	10.9	0.379	2.5	LOS A	2.1	15.2	0.07	0.24	0.07	60.3
SouthWest: Tweed Valley Way														
2	T1	58	16	61	27.6	0.044	2.5	LOS A	0.2	2.2	0.06	0.23	0.06	60.5
3	R2	7	7	7	100.0	0.010	10.7	LOS A	0.0	0.7	0.07	0.52	0.07	51.8
Approach		65	23	68	35.4	0.044	3.4	LOS A	0.2	2.2	0.06	0.26	0.06	59.4
All Vehicles		791	140	833	17.8	0.379	3.1	LOS A	2.1	15.2	0.11	0.27	0.11	59.5

Tweed Valley Way / Australian Bay Lobster Producers Access Rdb – 2032WD



MOVEMENT SUMMARY

Site: 1 [2032WD AM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	34	31	36	91.2	0.106	13.4	LOS A	0.4	10.0	0.67	0.78	0.67	48.7
6	R2	4	4	4	100.0	0.015	21.5	LOS B	0.1	1.1	0.66	0.75	0.66	45.5
Approach		38	35	40	92.1	0.106	14.3	LOS A	0.4	10.0	0.67	0.78	0.67	48.3
NorthEast: Tweed Valley Way														
7	L2	34	30	36	88.2	0.051	3.8	LOS A	0.2	4.1	0.08	0.34	0.08	55.6
8	T1	739	41	778	5.5	0.443	2.4	LOS A	2.6	19.9	0.07	0.24	0.07	60.6
Approach		773	71	814	9.2	0.443	2.5	LOS A	2.6	19.9	0.07	0.24	0.07	60.4
SouthWest: Tweed Valley Way														
2	T1	75	18	79	24.0	0.055	2.5	LOS A	0.3	2.7	0.06	0.23	0.06	60.5
3	R2	6	6	6	100.0	0.009	10.7	LOS A	0.0	0.6	0.07	0.51	0.07	51.7
Approach		81	24	85	29.6	0.055	3.1	LOS A	0.3	2.7	0.06	0.25	0.06	59.7
All Vehicles		892	130	939	14.6	0.443	3.0	LOS A	2.6	19.9	0.10	0.26	0.10	59.7

MOVEMENT SUMMARY

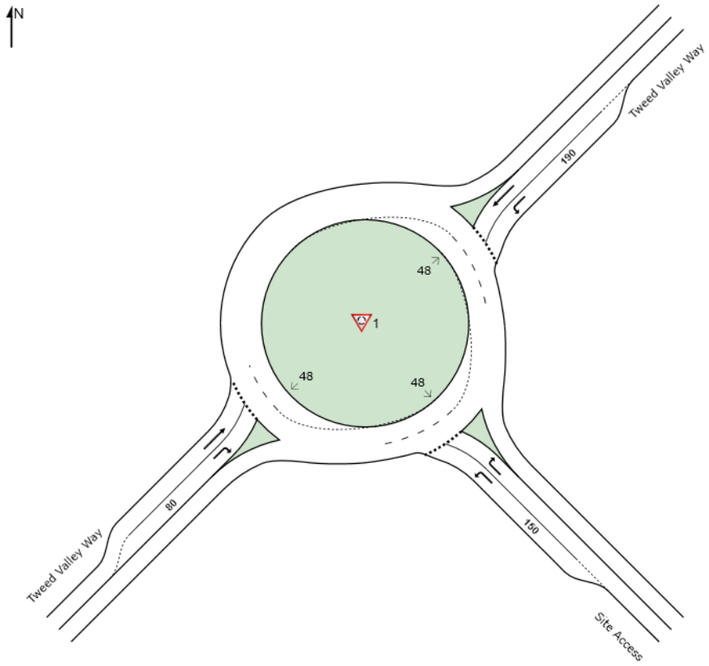
Site: 1 [2032WD PM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	39	34	41	87.2	0.104	11.6	LOS A	0.4	9.1	0.64	0.76	0.64	50.0
6	R2	5	2	5	40.0	0.012	16.8	LOS B	0.0	0.7	0.61	0.71	0.61	50.0
Approach		44	36	46	81.8	0.104	12.1	LOS A	0.4	9.1	0.64	0.75	0.64	50.0
NorthEast: Tweed Valley Way														
7	L2	31	31	33	100.0	0.046	3.8	LOS A	0.2	3.9	0.05	0.34	0.05	54.7
8	T1	679	40	715	5.9	0.403	2.4	LOS A	2.3	17.2	0.04	0.23	0.04	60.8
Approach		710	71	747	10.0	0.403	2.4	LOS A	2.3	17.2	0.04	0.24	0.04	60.5
SouthWest: Tweed Valley Way														
2	T1	59	26	62	44.1	0.051	2.6	LOS A	0.2	2.9	0.06	0.23	0.06	60.3
3	R2	2	2	2	100.0	0.003	10.9	LOS A	0.0	0.3	0.07	0.50	0.07	51.1
Approach		61	28	64	45.9	0.051	2.8	LOS A	0.2	2.9	0.06	0.24	0.06	59.9
All Vehicles		815	135	858	16.6	0.403	3.0	LOS A	2.3	17.2	0.08	0.27	0.08	59.8

Tweed Valley Way / Australian Bay Lobster Producers Access Rdb – 2042WD



MOVEMENT SUMMARY

Site: 1 [2042WD AM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	34	33	36	97.1	0.118	15.1	LOS B	0.5	11.6	0.69	0.80	0.69	47.6
6	R2	4	4	4	100.0	0.016	22.3	LOS B	0.1	1.1	0.67	0.76	0.67	45.1
Approach		38	37	40	97.4	0.118	15.8	LOS B	0.5	11.6	0.69	0.79	0.69	47.3
NorthEast: Tweed Valley Way														
7	L2	34	30	36	88.2	0.050	3.7	LOS A	0.2	4.1	0.07	0.34	0.07	55.6
8	T1	785	44	826	5.6	0.468	2.4	LOS A	2.9	21.9	0.07	0.24	0.07	60.6
Approach		819	74	862	9.0	0.468	2.5	LOS A	2.9	21.9	0.07	0.24	0.07	60.4
SouthWest: Tweed Valley Way														
2	T1	80	17	84	21.3	0.058	2.5	LOS A	0.3	2.8	0.06	0.23	0.06	60.6
3	R2	6	3	6	50.0	0.008	10.2	LOS A	0.0	0.5	0.07	0.55	0.07	54.0
Approach		86	20	91	23.3	0.058	3.0	LOS A	0.3	2.8	0.06	0.25	0.06	60.0
All Vehicles		943	131	993	13.9	0.468	3.0	LOS A	2.9	21.9	0.09	0.26	0.09	59.7

MOVEMENT SUMMARY

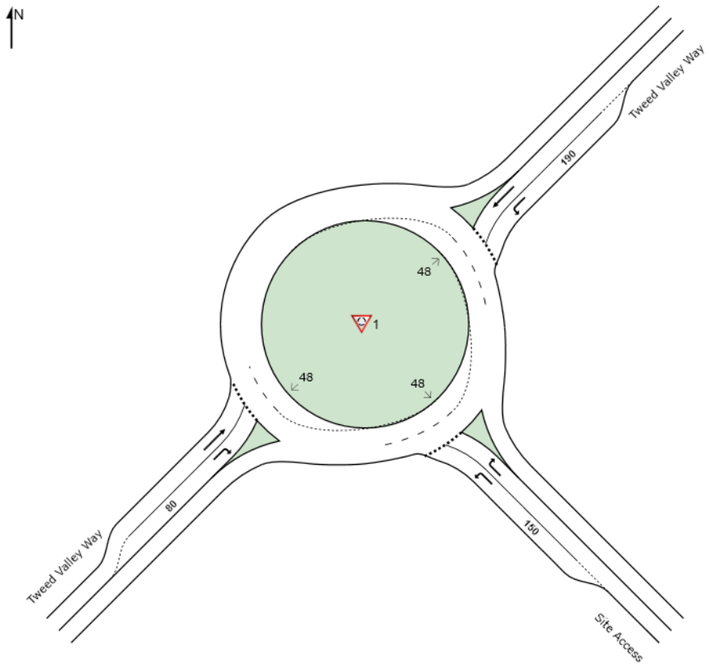
Site: 1 [2042WD PM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	39	34	41	87.2	0.108	12.2	LOS A	0.4	9.6	0.66	0.77	0.66	49.5
6	R2	3	2	3	66.7	0.011	20.9	LOS B	0.0	0.8	0.65	0.74	0.65	47.0
Approach		42	36	44	85.7	0.108	12.8	LOS A	0.4	9.6	0.66	0.77	0.66	49.3
NorthEast: Tweed Valley Way														
7	L2	31	31	33	100.0	0.046	3.8	LOS A	0.2	3.9	0.05	0.34	0.05	54.7
8	T1	721	42	759	5.8	0.428	2.4	LOS A	2.5	18.7	0.04	0.23	0.04	60.8
Approach		752	73	792	9.7	0.428	2.4	LOS A	2.5	18.7	0.04	0.24	0.04	60.5
SouthWest: Tweed Valley Way														
2	T1	62	15	65	24.2	0.045	2.5	LOS A	0.2	2.2	0.05	0.23	0.05	60.6
3	R2	2	2	2	100.0	0.003	10.9	LOS A	0.0	0.3	0.06	0.50	0.06	51.2
Approach		64	17	67	26.6	0.045	2.7	LOS A	0.2	2.2	0.05	0.24	0.05	60.2
All Vehicles		858	126	903	14.7	0.428	3.0	LOS A	2.5	18.7	0.07	0.26	0.07	59.9

Tweed Valley Way / Australian Bay Lobster Producers Access Rdb – 2042WD (Sensitivity Testing)



MOVEMENT SUMMARY

Site: 1 [2042WD PM Peak (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	39	34	41	87.2	0.108	12.2	LOS A	0.4	9.6	0.66	0.77	0.66	49.5
6	R2	3	2	3	66.7	0.011	20.9	LOS B	0.0	0.8	0.65	0.74	0.65	47.0
Approach		42	36	44	85.7	0.108	12.8	LOS A	0.4	9.6	0.66	0.77	0.66	49.3
NorthEast: Tweed Valley Way														
7	L2	31	31	33	100.0	0.046	3.8	LOS A	0.2	3.9	0.05	0.34	0.05	54.7
8	T1	721	42	759	5.8	0.428	2.4	LOS A	2.5	18.7	0.04	0.23	0.04	60.8
Approach		752	73	792	9.7	0.428	2.4	LOS A	2.5	18.7	0.04	0.24	0.04	60.5
SouthWest: Tweed Valley Way														
2	T1	62	15	65	24.2	0.045	2.5	LOS A	0.2	2.2	0.05	0.23	0.05	60.6
3	R2	2	2	2	100.0	0.003	10.9	LOS A	0.0	0.3	0.06	0.50	0.06	51.2
Approach		64	17	67	26.6	0.045	2.7	LOS A	0.2	2.2	0.05	0.24	0.05	60.2
All Vehicles		858	126	903	14.7	0.428	3.0	LOS A	2.5	18.7	0.07	0.26	0.07	59.9

MOVEMENT SUMMARY

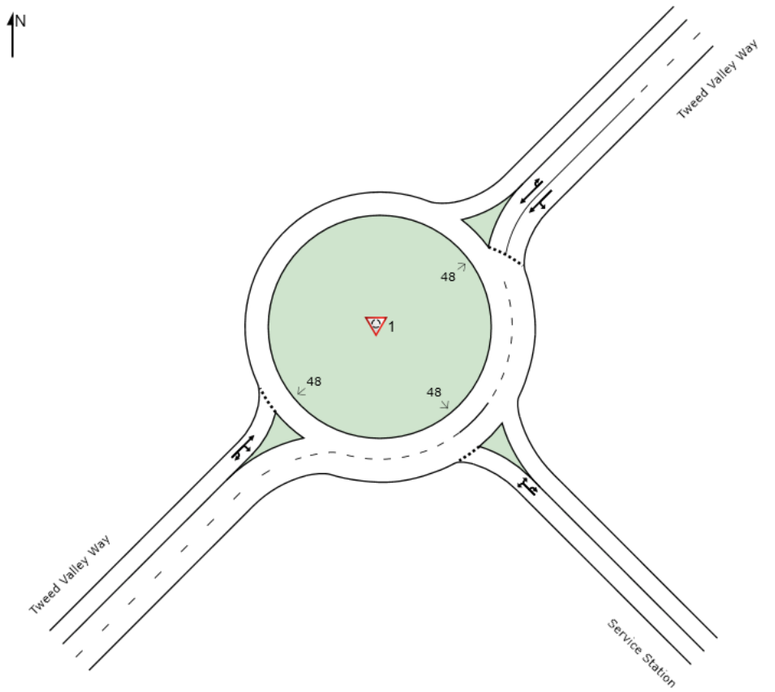
Site: 1 [2042WD PM Peak - Sensitivity (Site Folder: General)]

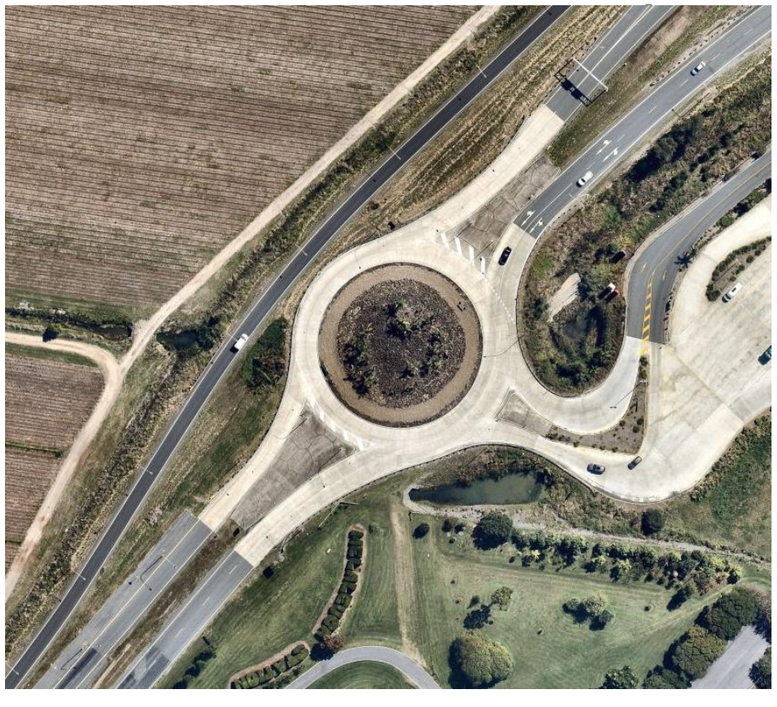
Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	25	19	26	76.0	0.063	10.7	LOS A	0.3	5.2	0.66	0.72	0.66	50.7
6	R2	17	16	18	94.1	0.072	23.3	LOS B	0.3	6.6	0.68	0.85	0.68	45.2
Approach		42	35	44	83.3	0.072	15.8	LOS B	0.3	6.6	0.67	0.77	0.67	48.2
NorthEast: Tweed Valley Way														
7	L2	17	17	18	100.0	0.027	4.2	LOS A	0.1	2.3	0.16	0.35	0.16	54.0
8	T1	721	43	759	6.0	0.454	2.5	LOS A	2.9	22.0	0.17	0.25	0.17	59.9
Approach		738	60	777	8.1	0.454	2.6	LOS A	2.9	22.0	0.17	0.26	0.17	59.8
SouthWest: Tweed Valley Way														
2	T1	62	14	65	22.6	0.048	2.6	LOS A	0.2	2.2	0.15	0.25	0.15	59.9
3	R2	16	16	17	100.0	0.025	11.3	LOS A	0.1	2.5	0.18	0.50	0.18	50.4
Approach		78	30	82	38.5	0.048	4.4	LOS A	0.2	2.5	0.16	0.30	0.16	57.6
All Vehicles		858	125	903	14.6	0.454	3.4	LOS A	2.9	22.0	0.19	0.29	0.19	58.9

Tweed Valley Way / Service Station Roundabout – 2020 Surveyed Base





MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2020 AM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	26	13.6	27	13.6	0.272	5.5	LOS A	1.1	10.5	0.57	0.82	0.57	51.3
6	R2	165	24.1	174	24.1	0.272	13.0	LOS B	1.1	10.5	0.57	0.82	0.57	53.6
6u	U	1	0.0	1	0.0	0.272	14.3	LOS B	1.1	10.5	0.57	0.82	0.57	56.3
Approach		192	22.6	202	22.6	0.272	12.0	LOS B	1.1	10.5	0.57	0.82	0.57	53.3
NorthEast: Tweed Valley Way														
7	L2	50	5.6	53	5.6	0.230	3.1	LOS A	1.5	11.4	0.13	0.26	0.13	57.4
8	T1	651	6.3	685	6.3	0.230	2.4	LOS A	1.5	11.4	0.14	0.26	0.14	60.0
9u	U	9	52.0	9	52.0	0.230	13.0	LOS B	1.4	11.4	0.15	0.26	0.15	61.4
Approach		710	6.8	747	6.8	0.230	2.6	LOS A	1.5	11.4	0.14	0.26	0.14	59.8
SouthWest: Tweed Valley Way														
2	T1	43	28.6	45	28.6	0.064	3.4	LOS A	0.3	3.2	0.41	0.46	0.41	56.3
3	R2	23	5.0	24	5.0	0.064	10.4	LOS B	0.3	3.2	0.41	0.46	0.41	57.4
3u	U	1	0.0	1	0.0	0.064	13.0	LOS B	0.3	3.2	0.41	0.46	0.41	60.0
Approach		67	20.1	71	20.1	0.064	5.9	LOS A	0.3	3.2	0.41	0.46	0.41	56.7
All Vehicles		969	10.9	1020	10.9	0.272	4.7	LOS A	1.5	11.4	0.24	0.38	0.24	58.1

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2020 PM (Site Folder: General)]

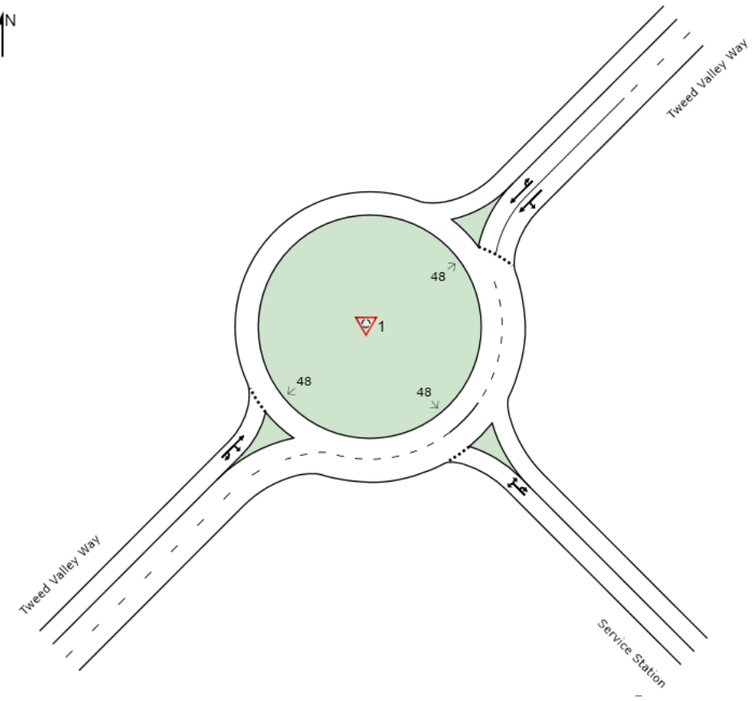
Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	46	15.6	48	15.6	0.333	5.7	LOS A	1.4	11.3	0.57	0.80	0.57	51.4
6	R2	240	5.1	253	5.1	0.333	12.0	LOS B	1.4	11.3	0.57	0.80	0.57	54.4
6u	U	1	0.0	1	0.0	0.333	14.4	LOS B	1.4	11.3	0.57	0.80	0.57	56.5
Approach		287	6.8	302	6.8	0.333	11.0	LOS B	1.4	11.3	0.57	0.80	0.57	53.9
NorthEast: Tweed Valley Way														
7	L2	48	17.1	51	17.1	0.229	3.2	LOS A	1.5	11.8	0.18	0.27	0.18	56.9
8	T1	623	7.3	656	7.3	0.229	2.5	LOS A	1.5	11.8	0.19	0.27	0.19	59.6
9u	U	9	60.4	9	60.4	0.229	13.4	LOS B	1.4	11.6	0.20	0.28	0.20	60.7
Approach		680	8.7	716	8.7	0.229	2.7	LOS A	1.5	11.8	0.19	0.27	0.19	59.5
SouthWest: Tweed Valley Way														
2	T1	36	18.9	38	18.9	0.071	3.4	LOS A	0.4	3.4	0.45	0.52	0.45	55.7
3	R2	37	12.7	39	12.7	0.071	10.9	LOS B	0.4	3.4	0.45	0.52	0.45	56.4

Tweed Valley Way / Service Station Roundabout – 2022 Base with Lobster Farm Committed Development



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2022 PM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	46	15.6	48	15.6	0.333	5.7	LOS A	1.4	11.3	0.57	0.80	0.57	51.4
6	R2	240	5.1	253	5.1	0.333	12.0	LOS B	1.4	11.3	0.57	0.80	0.57	54.4
6u	U	1	0.0	1	0.0	0.333	14.4	LOS B	1.4	11.3	0.57	0.80	0.57	56.5
Approach		287	6.8	302	6.8	0.333	11.0	LOS B	1.4	11.3	0.57	0.80	0.57	53.9
NorthEast: Tweed Valley Way														
7	L2	48	17.1	51	17.1	0.229	3.2	LOS A	1.5	11.8	0.18	0.27	0.18	56.9
8	T1	623	7.3	656	7.3	0.229	2.5	LOS A	1.5	11.8	0.19	0.27	0.19	59.6
9u	U	9	60.4	9	60.4	0.229	13.4	LOS B	1.4	11.6	0.20	0.28	0.20	60.7
Approach		680	8.7	716	8.7	0.229	2.7	LOS A	1.5	11.8	0.19	0.27	0.19	59.5
SouthWest: Tweed Valley Way														
2	T1	36	18.9	38	18.9	0.071	3.4	LOS A	0.4	3.4	0.45	0.52	0.45	55.7
3	R2	37	12.7	39	12.7	0.071	10.9	LOS B	0.4	3.4	0.45	0.52	0.45	56.4

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2022 PM (Site Folder: General)]

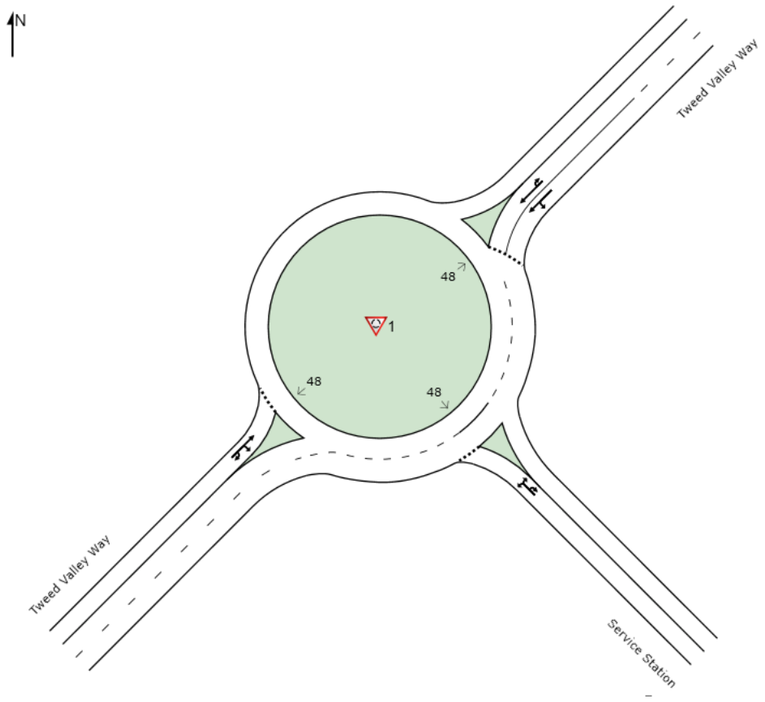
Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	46	5.1	48	5.1	0.370	5.4	LOS A	1.7	14.4	0.60	0.85	0.63	51.6
6	R2	243	15.6	256	15.6	0.370	12.9	LOS B	1.7	14.4	0.60	0.85	0.63	54.0
6u	U	1	0.0	1	0.0	0.370	14.6	LOS B	1.7	14.4	0.60	0.85	0.63	56.5
Approach		290	13.9	305	13.9	0.370	11.7	LOS B	1.7	14.4	0.60	0.85	0.63	53.6
NorthEast: Tweed Valley Way														
7	L2	49	17.1	52	17.1	0.232	3.2	LOS A	1.5	12.1	0.18	0.27	0.18	56.8
8	T1	630	7.3	663	7.3	0.232	2.5	LOS A	1.5	12.1	0.19	0.27	0.19	59.6
9u	U	9	60.4	9	60.4	0.232	13.4	LOS B	1.5	11.8	0.20	0.28	0.20	60.7
Approach		688	8.7	724	8.7	0.232	2.7	LOS A	1.5	12.1	0.19	0.27	0.19	59.4
SouthWest: Tweed Valley Way														
2	T1	36	18.9	38	18.9	0.073	3.6	LOS A	0.4	3.6	0.48	0.53	0.48	55.6
3	R2	37	12.7	39	12.7	0.073	11.0	LOS B	0.4	3.6	0.48	0.53	0.48	56.3

Tweed Valley Way / Service Station Roundabout – 2022 Base with Committed and Proposed Development



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2022WD AM (Site Folder: General)]

Tweed Valley Way / Service Station
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	26	13.6	27	13.6	0.267	5.6	LOS A	1.1	10.0	0.59	0.83	0.59	51.3
6	R2	167	24.1	176	24.1	0.267	13.0	LOS B	1.1	10.0	0.59	0.83	0.59	53.5
6u	U	1	0.0	1	0.0	0.267	14.5	LOS B	1.1	10.0	0.59	0.83	0.59	56.3
Approach		194	22.6	204	22.6	0.267	12.1	LOS B	1.1	10.0	0.59	0.83	0.59	53.2
NorthEast: Tweed Valley Way														
7	L2	52	11.6	55	11.6	0.264	3.1	LOS A	1.8	13.8	0.14	0.26	0.14	57.2
8	T1	674	6.3	709	6.3	0.264	2.4	LOS A	1.8	13.8	0.15	0.28	0.15	59.9
9u	U	49	85.7	52	85.7	0.264	13.6	LOS B	1.7	15.9	0.16	0.31	0.16	59.5
Approach		775	11.7	816	11.7	0.264	3.2	LOS A	1.8	15.9	0.15	0.28	0.15	59.7
SouthWest: Tweed Valley Way														
2	T1	46	28.6	48	28.6	0.069	3.7	LOS A	0.4	3.3	0.46	0.49	0.46	56.0
3	R2	24	5.0	25	5.0	0.069	10.8	LOS B	0.4	3.3	0.46	0.49	0.46	57.1
3u	U	1	0.0	1	0.0	0.069	13.3	LOS B	0.4	3.3	0.46	0.49	0.46	59.7
Approach		71	20.2	75	20.2	0.069	6.2	LOS A	0.4	3.3	0.46	0.49	0.46	56.4
All Vehicles		1040	14.3	1095	14.3	0.267	5.1	LOS A	1.8	15.9	0.25	0.40	0.25	58.1

MOVEMENT SUMMARY

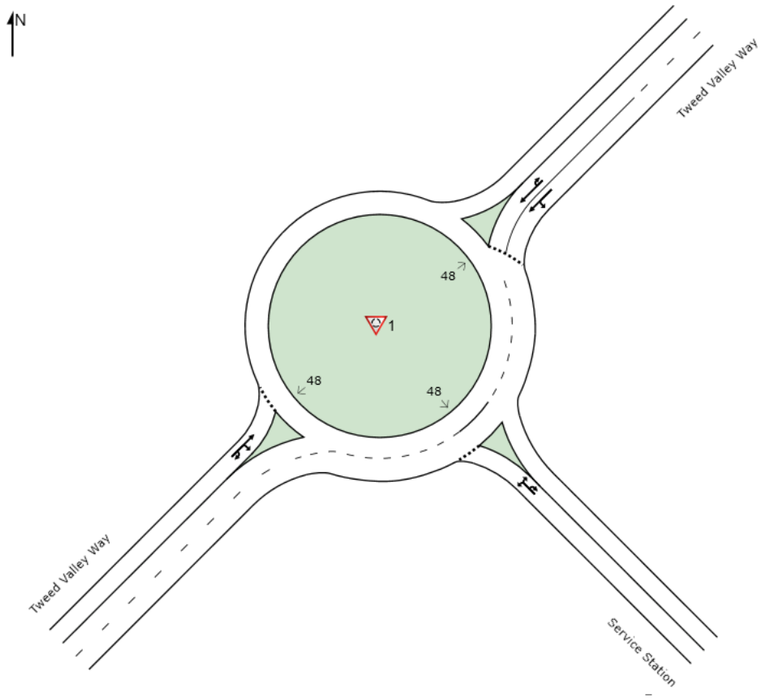
Site: 1 [Tweed Valley Way / Service Station 2022WD PM (Site Folder: General)]

Tweed Valley Way / Service Station
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	46	5.1	48	5.1	0.368	5.6	LOS A	1.7	14.1	0.62	0.86	0.65	51.5
6	R2	243	15.6	256	15.6	0.368	13.0	LOS B	1.7	14.1	0.62	0.86	0.65	53.9
6u	U	1	0.0	1	0.0	0.368	14.8	LOS B	1.7	14.1	0.62	0.86	0.65	56.4
Approach		290	13.9	305	13.9	0.368	11.8	LOS B	1.7	14.1	0.62	0.86	0.65	53.6
NorthEast: Tweed Valley Way														
7	L2	50	17.1	53	17.1	0.262	3.2	LOS A	1.8	14.1	0.19	0.27	0.19	56.8
8	T1	646	7.3	680	7.3	0.262	2.5	LOS A	1.8	14.1	0.19	0.29	0.19	59.6
9u	U	49	87.8	52	87.8	0.262	13.9	LOS B	1.6	16.1	0.21	0.33	0.21	59.1
Approach		745	13.2	784	13.2	0.262	3.3	LOS A	1.8	16.1	0.20	0.29	0.20	59.4
SouthWest: Tweed Valley Way														
2	T1	39	18.9	41	18.9	0.077	3.9	LOS A	0.4	3.7	0.52	0.55	0.52	55.4
3	R2	37	12.7	39	12.7	0.077	11.4	LOS B	0.4	3.7	0.52	0.55	0.52	56.1
3u	U	1	0.0	1	0.0	0.077	13.7	LOS B	0.4	3.7	0.52	0.55	0.52	58.9
Approach		77	15.7	81	15.7	0.077	7.6	LOS A	0.4	3.7	0.52	0.55	0.52	55.8
All Vehicles		1112	13.6	1171	13.6	0.368	5.8	LOS A	1.8	16.1	0.33	0.46	0.34	57.4

Tweed Valley Way / Service Station Roundabout – 2032 Base



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2032 AM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	28	13.6	29	13.6	0.297	5.7	LOS A	1.2	11.6	0.59	0.83	0.59	51.2
6	R2	177	24.1	186	24.1	0.297	13.2	LOS B	1.2	11.6	0.59	0.83	0.59	53.4
6u	U	1	0.0	1	0.0	0.297	14.4	LOS B	1.2	11.6	0.59	0.83	0.59	56.2
Approach		206	22.6	217	22.6	0.297	12.2	LOS B	1.2	11.6	0.59	0.83	0.59	53.1
NorthEast: Tweed Valley Way														
7	L2	54	11.6	57	11.6	0.247	3.1	LOS A	1.6	12.6	0.14	0.26	0.14	57.2
8	T1	699	5.9	736	5.9	0.247	2.4	LOS A	1.6	12.6	0.15	0.26	0.15	59.9
9u	U	10	12.5	11	12.5	0.247	12.5	LOS B	1.6	12.2	0.15	0.27	0.15	63.1
Approach		763	6.4	803	6.4	0.247	2.6	LOS A	1.6	12.6	0.15	0.26	0.15	59.7
SouthWest: Tweed Valley Way														
2	T1	47	24.3	49	24.3	0.069	3.3	LOS A	0.4	3.4	0.43	0.47	0.43	56.3
3	R2	25	5.0	26	5.0	0.069	10.5	LOS B	0.4	3.4	0.43	0.47	0.43	57.4
3u	U	1	0.0	1	0.0	0.069	13.0	LOS B	0.4	3.4	0.43	0.47	0.43	60.0
Approach		73	17.4	77	17.4	0.069	5.9	LOS A	0.4	3.4	0.43	0.47	0.43	56.8
All Vehicles		1042	10.4	1097	10.4	0.297	4.8	LOS A	1.6	12.6	0.25	0.39	0.25	58.0

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2032 PM (Site Folder: General)]

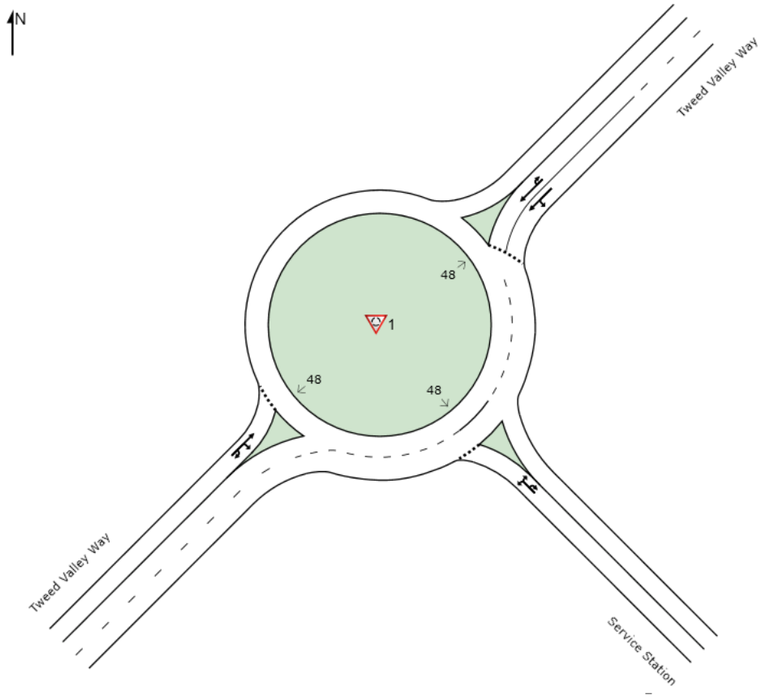
Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	49	5.1	52	5.1	0.410	6.0	LOS A	2.0	17.0	0.64	0.88	0.71	51.2
6	R2	258	15.6	272	15.6	0.410	13.5	LOS B	2.0	17.0	0.64	0.88	0.71	53.6
6u	U	1	0.0	1	0.0	0.410	15.1	LOS B	2.0	17.0	0.64	0.88	0.71	56.0
Approach		308	13.9	324	13.9	0.410	12.3	LOS B	2.0	17.0	0.64	0.88	0.71	53.2
NorthEast: Tweed Valley Way														
7	L2	58	17.1	61	17.1	0.266	3.2	LOS A	1.8	13.6	0.19	0.27	0.19	56.8
8	T1	754	7.0	794	7.0	0.266	2.5	LOS A	1.8	13.6	0.20	0.27	0.20	59.5
9u	U	11	26.2	12	26.2	0.266	12.7	LOS B	1.8	13.1	0.21	0.28	0.21	62.3
Approach		823	8.0	866	8.0	0.266	2.7	LOS A	1.8	13.6	0.20	0.27	0.20	59.4
SouthWest: Tweed Valley Way														
2	T1	38	13.1	40	13.1	0.076	3.5	LOS A	0.4	3.7	0.49	0.54	0.49	55.6
3	R2	40	12.7	42	12.7	0.076	11.1	LOS B	0.4	3.7	0.49	0.54	0.49	56.3
3u	U	1	0.0	1	0.0	0.076	13.4	LOS B	0.4	3.7	0.49	0.54	0.49	59.0
Approach		79	12.7	83	12.7	0.076	7.5	LOS A	0.4	3.7	0.49	0.54	0.49	56.0
All Vehicles		1210	9.8	1274	9.8	0.410	5.5	LOS A	2.0	17.0	0.33	0.44	0.35	57.4

Tweed Valley Way / Service Station Roundabout – 2032 Base with Proposed Development



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2032WD AM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	28	13.6	29	13.6	0.288	5.8	LOS A	1.2	10.9	0.60	0.83	0.60	51.2
6	R2	177	24.1	186	24.1	0.288	13.2	LOS B	1.2	10.9	0.60	0.83	0.60	53.4
6u	U	1	0.0	1	0.0	0.288	14.7	LOS B	1.2	10.9	0.60	0.83	0.60	56.2
Approach		206	22.6	217	22.6	0.288	12.2	LOS B	1.2	10.9	0.60	0.83	0.60	53.1
NorthEast: Tweed Valley Way														
7	L2	54	11.6	57	11.6	0.276	3.1	LOS A	1.9	14.6	0.15	0.26	0.15	57.2
8	T1	699	5.9	736	5.9	0.276	2.4	LOS A	1.9	14.6	0.15	0.28	0.15	59.8
9u	U	54	83.7	57	83.7	0.276	13.7	LOS B	1.7	17.3	0.16	0.32	0.16	59.4
Approach		807	11.5	849	11.5	0.276	3.2	LOS A	1.9	17.3	0.15	0.28	0.15	59.6
SouthWest: Tweed Valley Way														
2	T1	47	24.3	49	24.3	0.070	3.8	LOS A	0.4	3.4	0.48	0.50	0.48	56.0
3	R2	25	5.0	26	5.0	0.070	10.9	LOS B	0.4	3.4	0.48	0.50	0.48	57.1
3u	U	1	0.0	1	0.0	0.070	13.4	LOS B	0.4	3.4	0.48	0.50	0.48	59.6
Approach		73	17.4	77	17.4	0.070	6.3	LOS A	0.4	3.4	0.48	0.50	0.48	56.4
All Vehicles		1086	14.0	1143	14.0	0.288	5.1	LOS A	1.9	17.3	0.26	0.40	0.26	58.0

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2032WD PM (Site Folder: General)]

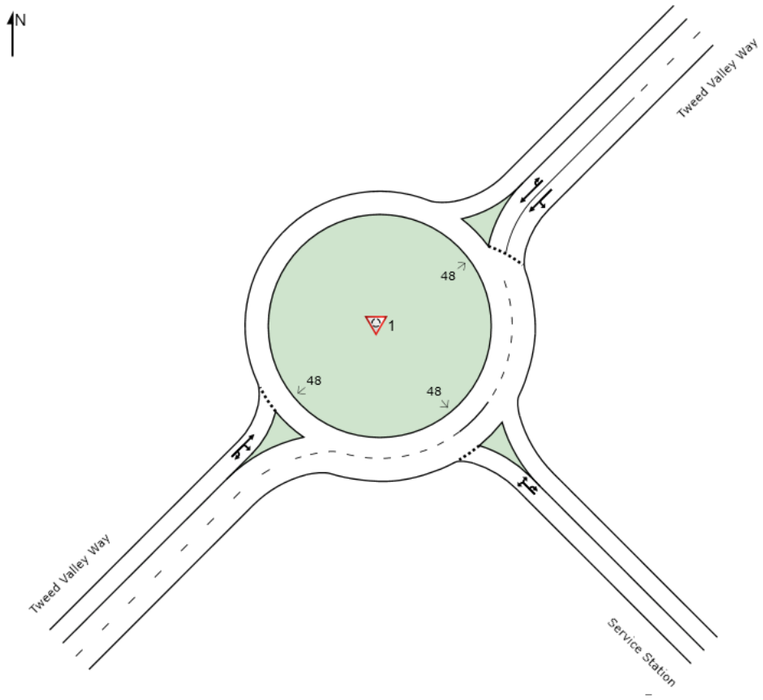
Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	49	5.1	52	5.1	0.398	5.9	LOS A	1.9	16.0	0.64	0.88	0.70	51.3
6	R2	258	15.6	272	15.6	0.398	13.3	LOS B	1.9	16.0	0.64	0.88	0.70	53.7
6u	U	1	0.0	1	0.0	0.398	15.2	LOS B	1.9	16.0	0.64	0.88	0.70	56.2
Approach		308	13.9	324	13.9	0.398	12.1	LOS B	1.9	16.0	0.64	0.88	0.70	53.3
NorthEast: Tweed Valley Way														
7	L2	54	17.1	57	17.1	0.278	3.3	LOS A	1.9	15.4	0.20	0.27	0.20	56.7
8	T1	699	7.1	736	7.1	0.278	2.5	LOS A	1.9	15.4	0.21	0.29	0.21	59.4
9u	U	41	62.1	43	62.1	0.278	13.7	LOS B	1.8	16.7	0.23	0.32	0.23	59.9
Approach		794	10.6	836	10.6	0.278	3.2	LOS A	1.9	16.7	0.21	0.29	0.21	59.2
SouthWest: Tweed Valley Way														
2	T1	38	13.1	40	13.1	0.079	3.8	LOS A	0.4	3.8	0.52	0.56	0.52	55.4
3	R2	40	12.7	42	12.7	0.079	11.4	LOS B	0.4	3.8	0.52	0.56	0.52	56.1
3u	U	1	0.0	1	0.0	0.079	13.6	LOS B	0.4	3.8	0.52	0.56	0.52	58.9
Approach		79	12.7	83	12.7	0.079	7.8	LOS A	0.4	3.8	0.52	0.56	0.52	55.8
All Vehicles		1181	11.6	1243	11.6	0.398	5.8	LOS A	1.9	16.7	0.34	0.46	0.36	57.3

Tweed Valley Way / Service Station Roundabout – 2042 Base



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2042WD PM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	49	5.1	52	5.1	0.398	5.9	LOS A	1.9	16.0	0.64	0.88	0.70	51.3
6	R2	258	15.6	272	15.6	0.398	13.3	LOS B	1.9	16.0	0.64	0.88	0.70	53.7
6u	U	1	0.0	1	0.0	0.398	15.2	LOS B	1.9	16.0	0.64	0.88	0.70	56.2
Approach		308	13.9	324	13.9	0.398	12.1	LOS B	1.9	16.0	0.64	0.88	0.70	53.3
NorthEast: Tweed Valley Way														
7	L2	54	17.1	57	17.1	0.278	3.3	LOS A	1.9	15.4	0.20	0.27	0.20	56.7
8	T1	699	7.1	736	7.1	0.278	2.5	LOS A	1.9	15.4	0.21	0.29	0.21	59.4
9u	U	41	62.1	43	62.1	0.278	13.7	LOS B	1.8	16.7	0.23	0.32	0.23	59.9
Approach		794	10.6	836	10.6	0.278	3.2	LOS A	1.9	16.7	0.21	0.29	0.21	59.2
SouthWest: Tweed Valley Way														
2	T1	38	13.1	40	13.1	0.079	3.8	LOS A	0.4	3.8	0.52	0.56	0.52	55.4
3	R2	40	12.7	42	12.7	0.079	11.4	LOS B	0.4	3.8	0.52	0.56	0.52	56.1
3u	U	1	0.0	1	0.0	0.079	13.6	LOS B	0.4	3.8	0.52	0.56	0.52	58.9
Approach		79	12.7	83	12.7	0.079	7.8	LOS A	0.4	3.8	0.52	0.56	0.52	55.8
All Vehicles		1181	11.6	1243	11.6	0.398	5.8	LOS A	1.9	16.7	0.34	0.46	0.36	57.3

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2042 PM (Site Folder: General)]

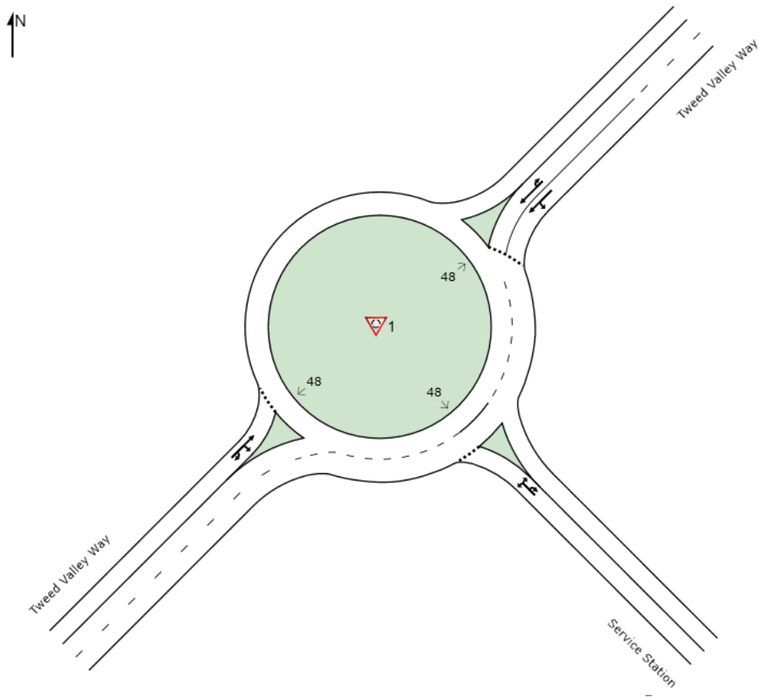
Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	52	5.1	55	5.1	0.429	6.0	LOS A	2.1	18.1	0.64	0.88	0.72	51.1
6	R2	274	15.6	288	15.6	0.429	13.6	LOS B	2.1	18.1	0.64	0.88	0.72	53.5
6u	U	1	0.0	1	0.0	0.429	15.2	LOS B	2.1	18.1	0.64	0.88	0.72	56.0
Approach		327	13.9	344	13.9	0.429	12.4	LOS B	2.1	18.1	0.64	0.88	0.72	53.1
NorthEast: Tweed Valley Way														
7	L2	55	17.1	58	17.1	0.255	3.2	LOS A	1.7	13.8	0.16	0.26	0.16	57.0
8	T1	710	6.7	747	6.7	0.255	2.5	LOS A	1.7	13.8	0.17	0.26	0.17	59.8
9u	U	10	26.2	11	26.2	0.255	12.7	LOS B	1.7	13.3	0.17	0.27	0.17	62.3
Approach		775	7.7	816	7.7	0.255	2.7	LOS A	1.7	13.8	0.16	0.26	0.16	59.6
SouthWest: Tweed Valley Way														
2	T1	41	13.1	43	13.1	0.068	3.6	LOS A	0.4	3.3	0.50	0.51	0.50	56.0
3	R2	27	12.7	28	12.7	0.068	11.2	LOS B	0.4	3.3	0.50	0.51	0.50	56.7
3u	U	1	0.0	1	0.0	0.068	13.4	LOS B	0.4	3.3	0.50	0.51	0.50	59.5
Approach		69	12.8	73	12.8	0.068	6.7	LOS A	0.4	3.3	0.50	0.51	0.50	56.3
All Vehicles		1171	9.7	1233	9.7	0.429	5.6	LOS A	2.1	18.1	0.32	0.45	0.34	57.4

Tweed Valley Way / Service Station Roundabout – 2042 Base with Proposed Development



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2042WD AM (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	29	13.6	31	13.6	0.308	5.9	LOS A	1.3	11.9	0.62	0.84	0.62	51.1
6	R2	188	24.1	198	24.1	0.308	13.3	LOS B	1.3	11.9	0.62	0.84	0.62	53.3
6u	U	1	0.0	1	0.0	0.308	14.8	LOS B	1.3	11.9	0.62	0.84	0.62	56.1
Approach		218	22.6	229	22.6	0.308	12.4	LOS B	1.3	11.9	0.62	0.84	0.62	53.0
NorthEast: Tweed Valley Way														
7	L2	57	11.6	60	11.6	0.288	3.1	LOS A	2.0	15.6	0.16	0.26	0.16	57.1
8	T1	742	5.9	781	5.9	0.288	2.5	LOS A	2.0	15.6	0.16	0.28	0.16	59.8
9u	U	42	91.1	44	91.1	0.288	13.8	LOS B	1.9	17.8	0.17	0.30	0.17	59.2
Approach		841	10.5	885	10.5	0.288	3.1	LOS A	2.0	17.8	0.16	0.28	0.16	59.6
SouthWest: Tweed Valley Way														
2	T1	49	24.3	52	24.3	0.077	3.9	LOS A	0.4	3.8	0.49	0.51	0.49	55.9
3	R2	27	5.0	28	5.0	0.077	10.9	LOS B	0.4	3.8	0.49	0.51	0.49	57.0
3u	U	1	0.0	1	0.0	0.077	13.4	LOS B	0.4	3.8	0.49	0.51	0.49	59.5
Approach		77	17.2	81	17.2	0.077	6.5	LOS A	0.4	3.8	0.49	0.51	0.49	56.4
All Vehicles		1136	13.3	1196	13.3	0.308	5.1	LOS A	2.0	17.8	0.27	0.40	0.27	58.0

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2042WD PM (Site Folder: General)]

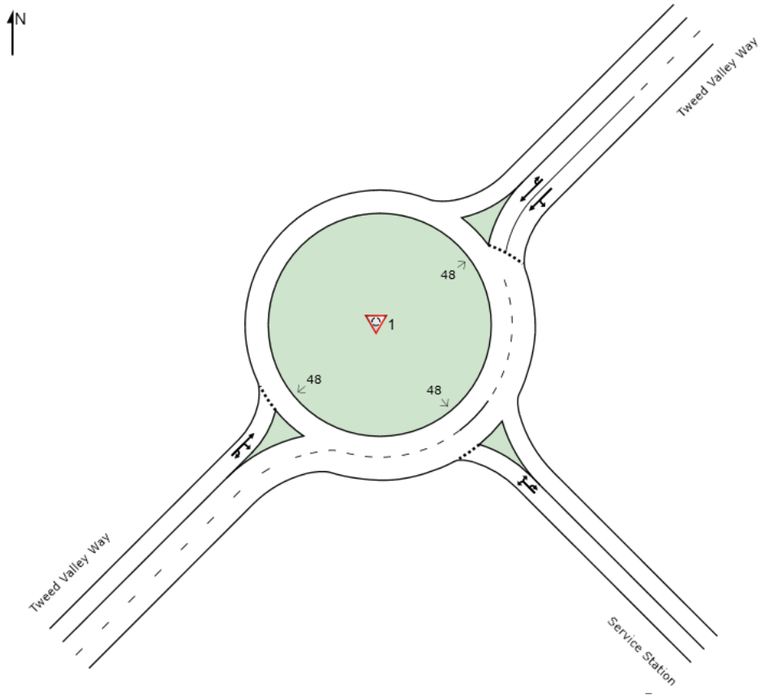
Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	52	5.1	55	5.1	0.425	6.1	LOS A	2.1	17.7	0.65	0.89	0.74	51.1
6	R2	274	15.6	288	15.6	0.425	13.6	LOS B	2.1	17.7	0.65	0.89	0.74	53.5
6u	U	1	0.0	1	0.0	0.425	15.4	LOS B	2.1	17.7	0.65	0.89	0.74	56.0
Approach		327	13.9	344	13.9	0.425	12.4	LOS B	2.1	17.7	0.65	0.89	0.74	53.1
NorthEast: Tweed Valley Way														
7	L2	55	17.1	58	17.1	0.281	3.3	LOS A	2.0	15.5	0.20	0.27	0.20	56.7
8	T1	710	6.7	747	6.7	0.281	2.5	LOS A	2.0	15.5	0.21	0.29	0.21	59.5
9u	U	42	97.7	44	97.7	0.281	14.2	LOS B	1.8	17.6	0.23	0.32	0.23	58.7
Approach		807	12.1	849	12.1	0.281	3.2	LOS A	2.0	17.6	0.21	0.29	0.21	59.3
SouthWest: Tweed Valley Way														
2	T1	41	13.1	43	13.1	0.084	3.9	LOS A	0.5	4.0	0.55	0.57	0.55	55.3
3	R2	42	12.7	44	12.7	0.084	11.5	LOS B	0.5	4.0	0.55	0.57	0.55	56.0
3u	U	1	0.0	1	0.0	0.084	13.8	LOS B	0.5	4.0	0.55	0.57	0.55	58.7
Approach		84	12.7	88	12.7	0.084	7.9	LOS A	0.5	4.0	0.55	0.57	0.55	55.7
All Vehicles		1218	12.7	1282	12.7	0.425	6.0	LOS A	2.1	17.7	0.35	0.47	0.38	57.2

Tweed Valley Way / Service Station Roundabout – 2042 Base with Proposed Development Sensitivity



MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2042WD AM - Sensitivity (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	29	13.6	31	13.6	0.333	6.3	LOS A	1.4	13.6	0.63	0.86	0.66	50.7
6	R2	188	24.1	198	24.1	0.333	13.9	LOS B	1.4	13.6	0.63	0.86	0.66	52.9
6u	U	1	0.0	1	0.0	0.333	14.9	LOS B	1.4	13.6	0.63	0.86	0.66	55.6
Approach		218	22.6	229	22.6	0.333	12.9	LOS B	1.4	13.6	0.63	0.86	0.66	52.6
NorthEast: Tweed Valley Way														
7	L2	57	11.6	60	11.6	0.288	3.1	LOS A	2.0	15.7	0.16	0.26	0.16	57.1
8	T1	742	5.9	781	5.9	0.288	2.5	LOS A	2.0	15.7	0.16	0.28	0.16	59.8
9u	U	42	91.1	44	91.1	0.288	13.8	LOS B	1.9	17.8	0.17	0.30	0.17	59.2
Approach		841	10.5	885	10.5	0.288	3.1	LOS A	2.0	17.8	0.16	0.28	0.16	59.6
SouthWest: Tweed Valley Way														
2	T1	49	24.3	52	24.3	0.079	3.9	LOS A	0.4	3.9	0.50	0.51	0.50	55.9
3	R2	27	5.0	28	5.0	0.079	10.9	LOS B	0.4	3.9	0.50	0.51	0.50	56.9
3u	U	1	0.0	1	0.0	0.079	13.5	LOS B	0.4	3.9	0.50	0.51	0.50	59.5
Approach		77	17.2	81	17.2	0.079	6.5	LOS A	0.4	3.9	0.50	0.51	0.50	56.3
All Vehicles		1136	13.3	1196	13.3	0.333	5.2	LOS A	2.0	17.8	0.28	0.40	0.28	57.9

MOVEMENT SUMMARY

Site: 1 [Tweed Valley Way / Service Station 2042WD PM - Sensitivity (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

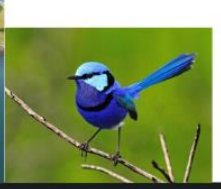
Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	52	5.1	55	5.1	0.421	6.1	LOS A	2.0	17.3	0.64	0.89	0.73	51.1
6	R2	274	15.6	288	15.6	0.421	13.5	LOS B	2.0	17.3	0.64	0.89	0.73	53.5
6u	U	1	0.0	1	0.0	0.421	15.4	LOS B	2.0	17.3	0.64	0.89	0.73	56.0
Approach		327	13.9	344	13.9	0.421	12.4	LOS B	2.0	17.3	0.64	0.89	0.73	53.1
NorthEast: Tweed Valley Way														
7	L2	55	17.1	58	17.1	0.276	3.2	LOS A	1.9	15.2	0.16	0.26	0.16	57.0
8	T1	710	6.7	747	6.7	0.276	2.5	LOS A	1.9	15.2	0.17	0.28	0.17	59.8
9u	U	42	97.7	44	97.7	0.276	13.9	LOS B	1.8	17.3	0.18	0.30	0.18	59.0
Approach		807	12.1	849	12.1	0.276	3.1	LOS A	1.9	17.3	0.17	0.28	0.17	59.6
SouthWest: Tweed Valley Way														
2	T1	41	13.1	43	13.1	0.069	3.9	LOS A	0.4	3.3	0.54	0.54	0.54	55.8
3	R2	27	12.7	28	12.7	0.069	11.5	LOS B	0.4	3.3	0.54	0.54	0.54	56.5
3u	U	1	0.0	1	0.0	0.069	13.8	LOS B	0.4	3.3	0.54	0.54	0.54	59.3
Approach		69	12.7	73	12.7	0.069	7.0	LOS A	0.4	3.3	0.54	0.54	0.54	56.1
All Vehicles		1203	12.7	1266	12.7	0.421	5.8	LOS A	2.0	17.3	0.32	0.46	0.34	57.4

Appendix F – Economic Evaluation

BURCHILLS
ENGINEERING SOLUTIONS



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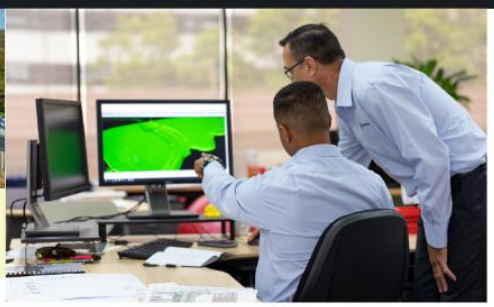

Proposed TSP Haulage Route
Economic Evaluation

Client: Hanson Construction Materials Pty Ltd
Project No: BE190043
Document No: BE190043-RP-EE-02

October 2021

Document Control Record

Prepared by:	Aga Szewczak
Position:	Senior Traffic Engineer
Signed:	
Date:	25 October 2021

Approved by:	Dale Kleimeyer
Position:	Principal Engineer – RPEQ
Signed:	
Date:	25 October 2021

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Recipients are responsible for eliminating all superseded documents in their possession

Coote Burchills Engineering Pty Ltd ACN: 166 942 365

Level 2, 26 Marine Parade SOUTHPORT QLD 4215
PO Box 3766, Australia Fair SOUTHPORT QLD 4215
Telephone: +61 7 5509 6400

Level 14, 167 Eagle Street BRISBANE QLD 4000
PO Box 83, BRISBANE QLD 4000
Telephone: +61 7 3606 0201

Email: admin@burchills.com.au

Executive Summary

Introduction

Burchills Engineering Solutions have been appointed by Hanson Construction Materials Pty Ltd (Hanson) to prepare an Economic Evaluation of the proposed haulage route associated with the expansion of its Tweed Sand Plant (TSP) located in Cudgen, New South Wales ('the Site').

The existing haulage route from the site to the M1 Pacific Motorway is via Tweed Coast Road (TCR) to the east, which is a key north-south rural arterial road in the area connecting a number of small coastal towns to the M1 Pacific Motorway.

The proposed haulage route is via a new internal haul road to Tweed Valley Way (TVW) and the M1 Pacific Motorway to the west of the site. As part of the proposed new haulage route, it is proposed to upgrade the existing Tweed Valley Way / Australian Bay Lobster Producers (ABLP) priority intersection to a roundabout.

The need for private access to the interchange and the relative merits of supporting a direct access, versus the comparative outcome of previously approved access arrangement via Tweed Coast Road is relevant to the Consent Authority's consideration of Clause 101 of the SEPP Infrastructure. To quantify the potential benefits of removing heavy vehicle demand from Tweed Coast Road (TCR), a comparative economic analysis of impacts introduced to the Tweed Valley Way interchange in terms of delay and/or safety has been prepared.

It is noted that the proposed Tweed Valley Way roundabout has potential to provide a safer access arrangement for existing approved uses but will generate a delay to through traffic movements. These costs may be offset by savings in heavy vehicle demand on Tweed Coast Road and at the Chinderah interchange over the life of the project.

Economic Appraisal Methodology

The economic appraisal of the proposed haulage route via Tweed Valley Way (Project Case) including the construction of a new roundabout, has been evaluated over a 30-year evaluation period against Base Case which includes haulage route via Tweed Coast Road. Project Case includes removal of all Hanson Trucks from Tweed Coast Road.

The evaluation was conducted using cost-benefit analysis (CBA) framework that applies a discounted cash flow technique to assess the future net benefits of a Project Case against Base Case. CBA includes only benefits to the Tweed Shire Council residents and public, Tweed Shire Council and NSW State Government. Any benefits acquired by Hanson with respect to shorter travel distances have not been included. The analysis includes maintenance costs associated with the proposed new Tweed Valley Way roundabout over the life of the project but excludes the capital costs covered by Hanson.

As part of the CBA, SIDRA traffic modelling was undertaken to determine average intersection delays for the Base Case and Project Case. The evaluation was undertaken in accordance with National and NSW economic frameworks.

Figure 1.0 below shows Base Case and Project Case TSP haulage routes via Tweed Coast Road and Tweed Valley Way respectively.

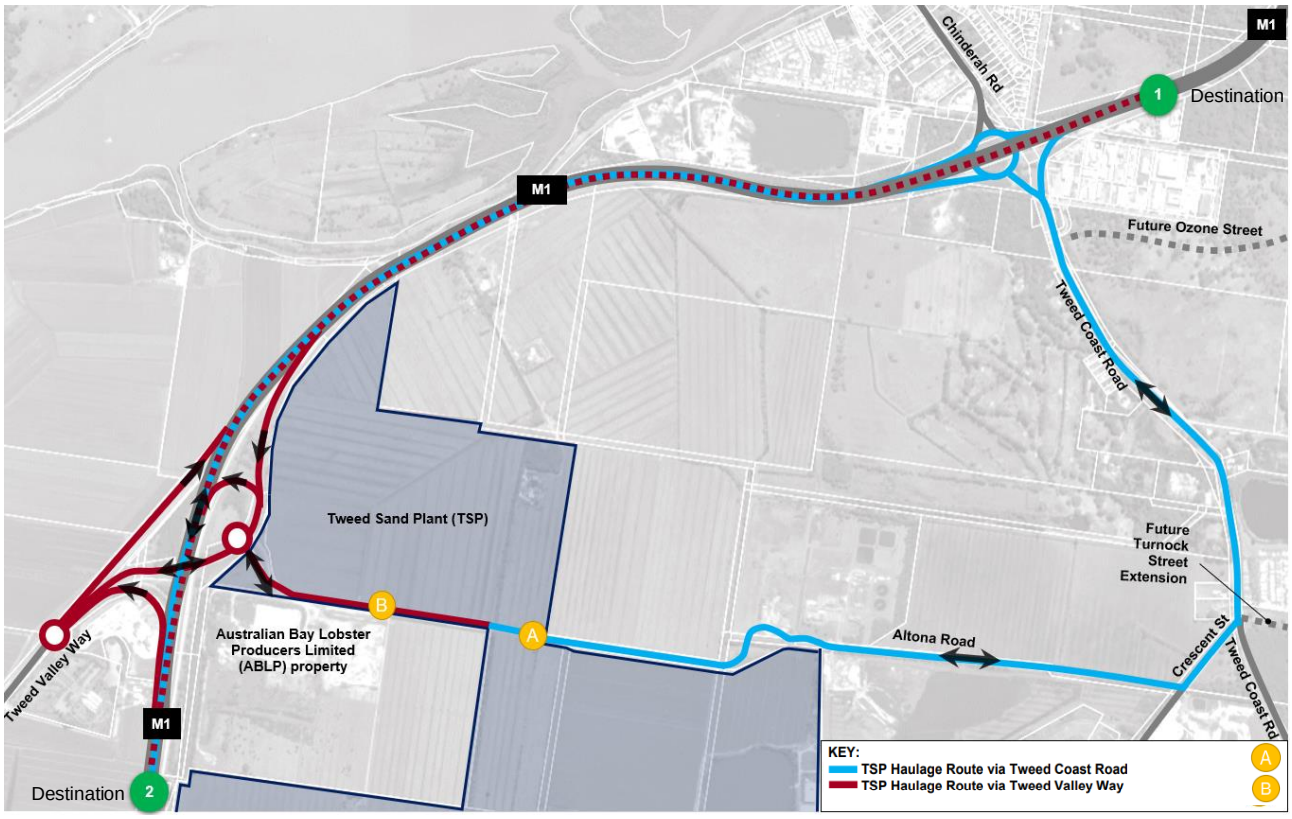


Figure 1.0 Base Case and Project Case Haulage Route to the M1 Pacific Motorway

Traffic Forecast

To inform SIDRA modelling, traffic count data was sourced for the following intersections:

Intersection	Survey Year	AM Peak Volumes	PM Peak Volumes
Existing Haulage Route via Tweed Coast Road			
Pacific Motorway / Tweed Coast Road interchange	2018	2,336	2,365
Tweed Coast Road / Morton Street priority intersection	2018	1,930	1,961
Tweed Coast Road / Morton Street priority intersection	2018	1,931	1,965
Tweed Coast Road / Crescent Street priority intersection	2016	1,546	1,480
Altona Road / Crescent Street priority intersection	2016	122	69
Proposed Haulage Route via Tweed Valley Way			
Tweed Valley Way / Australian Bay Lobster Producers	2020	660	625
Tweed Valley Way / Service Station Roundabout	2020	828	931

Background traffic growth in the area was calculated for each haulage route, based on the recorded AADT data and 2041 traffic volumes extracted from the Tweed Strategic Transport Model (2041 medium yield Scenario 6).

The recorded AADT volumes and 2041 Tweed Strategic Transport Model volumes used for the calculation of the growth rates for Tweed Coast Road and Tweed Valley Way are shown below.

Road	Survey Year	Recorded AADT	2041 Strategic Model AADT*	Compound growth p.a.
Tweed Coast Road	2018	17,757	34,280	2.90%
Tweed Valley Way	2020	14,740	16,710	0.60%

** Medium Yield Scenario 6*

Base Case and Project Case

The proposed haulage route via Tweed Valley Way including the Tweed Valley Way / Australian Bay Lobster Producers intersection upgrade to a roundabout (Project Case), was tested against the haulage route via Tweed Coast Road (Base Case) using SIDRA traffic modelling software and considering the broader network operations as follows:

- Base Case – Tweed Sand Plant haulage route via Tweed Coast Road and no access to Tweed Valley Way; and
- Project Case – Tweed Sand Plant haulage route via Tweed Valley Way including the Tweed Valley Way / Australian Bay Lobster Producers intersection upgrades. Project Case includes removal of all Hanson trucks from Tweed Coast Road.

Both Base Case and Project Case include traffic volumes associated with the expansion of the existing Tweed Sand Plant (950,000 tpa sand production rate per annum).

Traffic Modelling

Comprehensive traffic modelling studies were undertaken to inform the Cost-Benefit Analysis of the preferred haulage route (Project Case) in comparison with the existing haulage route (Base Case).

Given the project's proximity to the existing and planned major state-controlled roads, the forensic traffic modelling analysis in 2032 and 2042 includes Tweed Coast Road upgrade works from 2-lanes to 4-lanes including individual intersection upgrade works.

SIDRA modelling was undertaken for the morning peak and afternoon peak based on the available intersections traffic count data for the following intersection:

- Altona Road / Crescent Street priority intersection;
- Tweed Coast Road / Crescent Street intersection;
- Tweed Coast Road / Ozone Street extension intersection;
- Tweed Coast Road / M1 Pacific Motorway Interchange intersection;
- Tweed Valley Way / Australian Bay Lobster Producers intersection; and
- Tweed Valley Way / Service Station Roundabout.

The key performance criteria considered as part of the network assessment is intersection average delay (s). A comparison of the travel time benefits along Tweed Coast Road and Tweed Valley Way for the Base Case and Project Case shows the combined AM and PM peak travel time benefit achieved along Tweed Coast Road and additional delay cost along Tweed Valley Way post-development.

Project Costs

The preliminary cost estimates for the proposed roundabout were used for the Economic Appraisal. The above costs were used to establish likely maintenance costs associated with the new roundabout over the 30-years asset design life.

It is important to note that the Benefit Cost Ratio analysis doesn't use the construction cost for the roundabout as Hanson will carry the upgrade works.

The preliminary estimated construction cost for the proposed roundabout is shown in table below.

Cost	Total Construction Cost (Undiscounted, 2021 prices)
Project Case - Roundabout Upgrade	$4,800,000

For appraisal purposes, it has been assumed that design and construction will occur between 2021 and 2022.

The roundabout would be constructed with a durable 30-year design life concrete pavement and maintainable one in four batters. However, for robust assessment a 1% maintenance cost has been adopted. A summary of the ongoing maintenance costs for the proposed roundabout are shown in table below.

Cost	Total Maintenance Cost (Undiscounted, 2021 prices)
Project Case – Roundabout Maintenance Costs	$1,440,000

Tweed Valley Way in the vicinity of the ABLP access intersection is currently subject to 80km/h speeds. The proposed roundabout includes the introduction of a 60km/h speed limit at the approach to the roundabout which will result in additional delays for through traffic along Tweed Valley Way. The above has been included in the assessment in addition to SIDRA intersection delay assessment. A summary of the Tweed Valley Way Travel Time Cost is presented in table below.

Cost	Total Tweed Valley Way Travel Time Cost (Undiscounted, 2021 prices)
Travel Time Cost along Tweed Valley Way	$1,107,887

Project Benefits

CBA includes only benefits to the Tweed Shire Council residents and public, Tweed Shire Council and NSW State Government. Any benefits acquired by Hanson with respect to shorter travel distances have not been included.

The Tweed Shire Council strategic modelling shows that traffic along TCR increases significantly as a result of residential and business growth in the area. Local congestion and delays can be expected into the future as the volume of traffic increases. Removing TSP trucks from Tweed Coast Road will generate substantial benefits to road users, particularly through savings in travel time, reduction in crash costs and environmental benefits. Benefits to local authority include reduction in Tweed Coast

Road Maintenance Costs. As part of this economic analysis, potential benefits were quantitatively evaluated against the Base Case. Benefits quantified include:

- Travel Time Saving along Tweed Coast Road;
- Safety Benefits;
- Environmental Benefits; and
- Tweed Coast Road Maintenance Cost Reduction.

The summary of project benefits and costs are presented in table below.

Economic Results	Total (Undiscounted, 2021 prices)	Present Value (7% discount)
Costs		
Travel Time Cost along Tweed Valley Way	$1,107,887	$453,685
Proposed Roundabout Maintenance Cost	$1,440,000	$595,634
Total Cost	**$2,547,887**	**$1,049,319**
Benefits		
Travel Time Saving along Tweed Coast Road	$4,289,900	$1,269,772
Tweed Coast Road Maintenance Cost Reduction	$1,001,193	$474,300
Net Safety Benefits	$269,120	$94,197
Net Environmental Benefits	$1,806,952	$747,418
Total Benefit	**$7,367,165**	**$2,585,686**
Net Benefit (NPV @7%)		**$1,536,367**

The present value of benefits associated with Project Case were calculated over a 30-year evaluation period based on a seven per cent real discount rate.

Economic Appraisal Results

Cost-benefit analysis has determined that the project will generate a Present Value (PV) total of $2.59M in benefits at a Present Value cost of $1.05M above the Base Case, providing a NPV of $1.54M and a Benefit-Cost Ratio (BCR) of 2.46. The majority of benefits relate to travel time savings along Tweed Coast Road via a reduction in travel time, maintenance costs reduction, environmental and safety benefits.

Sensitivity testing of the BCR inputs identified a BCR range of 1.64 to 3.70 for the following tests:

- The NPV discount rate was tested at 3%, 7% (original assessment) and 10%;
- The benefit was reduced by 20% and cost increased by 20%; and
- The benefit was increased by 20% and cost reduced by 20%.

Conclusions

This Economic Evaluation assessment has demonstrated that the proposed Tweed Sand Plant haulage route via Tweed Valley Way including upgrade of the Tweed Valley Way / ABLP intersection

does provide economic benefits to the local community which outweighs its cost to residents, Local and State Governments.

Table of Contents

Tables

Figures

Appendices

1. Introduction

1.1 Project Scope

Burchills Engineering Solutions have been appointed by Hanson Construction Materials Pty Ltd (Hanson) to prepare an Economic Evaluation of the proposed haulage route associated with the expansion of its Tweed Sand Plant (TSP) located in Cudgen, New South Wales ('the Site').

The proposed haulage route is via a new internal haul road to Tweed Valley Way and the M1 Pacific Motorway to the west of the site. As part of the proposed new haulage route, it is proposed to upgrade the existing Tweed Valley Way / Australian Bay Lobster Producers (ABLP) priority intersection to a roundabout.

This Economic Evaluation reports the results of the comprehensive studies, which include traffic modelling, cost estimation and cost-benefit analysis.

1.2 Project Overview

1.2.1 Proposed Development

The proposed development includes the expansion of the existing Tweed Sand Plant (TSP) located at Altona Road, Cudgen. The total area for the future Tweed Sand Plant site would be approximately 236ha and result in an increase in the sand production rate from the current limit of 500,000 tonnes per annum (tpa) to 950,000 tpa.

The following options have been assessed for the proposed development:

- Base Case – Tweed Sand Plant haulage route via Tweed Coast Road; and
- Project Case – Tweed Sand Plant haulage route via Tweed Valley Way including the Tweed Valley Way / Australian Bay Lobster Producers intersection upgrades.

Both Base Case and Project Case include traffic volumes associated with the expansion of the existing Tweed Sand Plant (950,000 tpa sand production rate per annum).

1.2.2 Base Case Haulage Route via Tweed Coast Road

The Base Case TSP haulage route to the M1 Pacific Motorway is via Tweed Coast Road, which is a key north-south rural arterial road in the area connecting a number of small coastal towns to the M1 Pacific Motorway.

Figure 1.1 below shows the Base Case TSP haulage route.

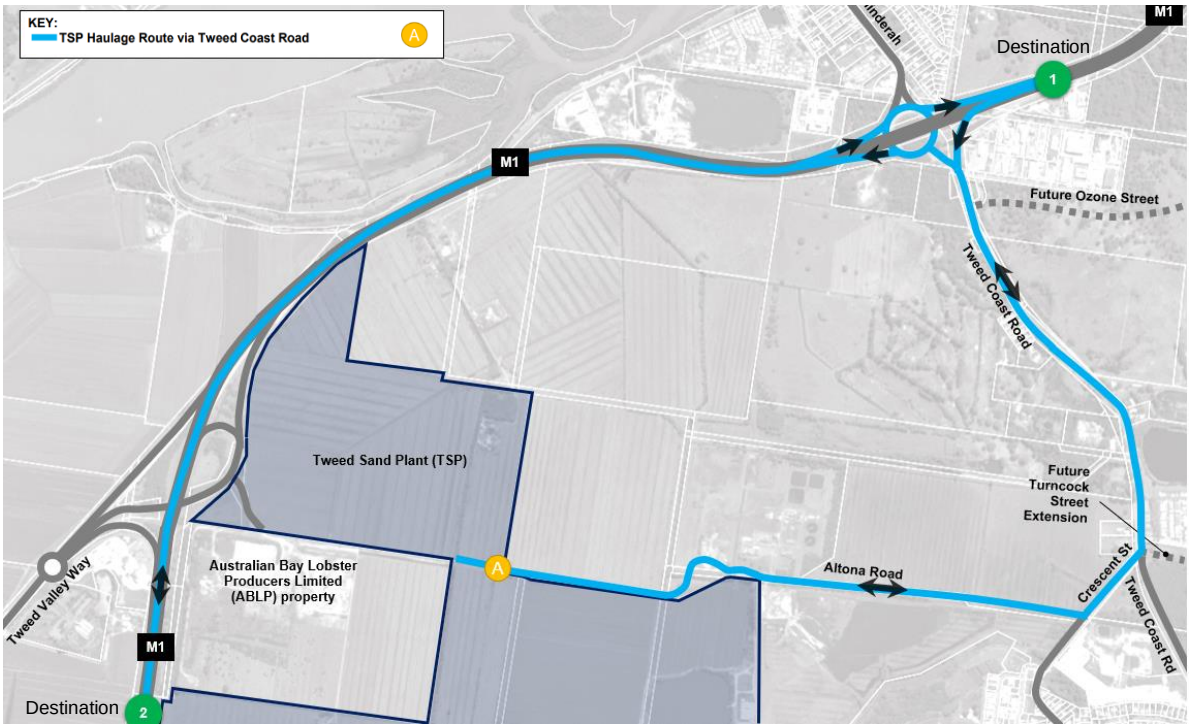


Figure 1.1 Base Case Haulage Route to the M1 Pacific Motorway

1.2.3 Project Case Haulage Route via Tweed Valley Way

The proposed TSP haulage route to the M1 Pacific Motorway is via Tweed Valley Way to the west from the site as shown in Figure 1.2 below.

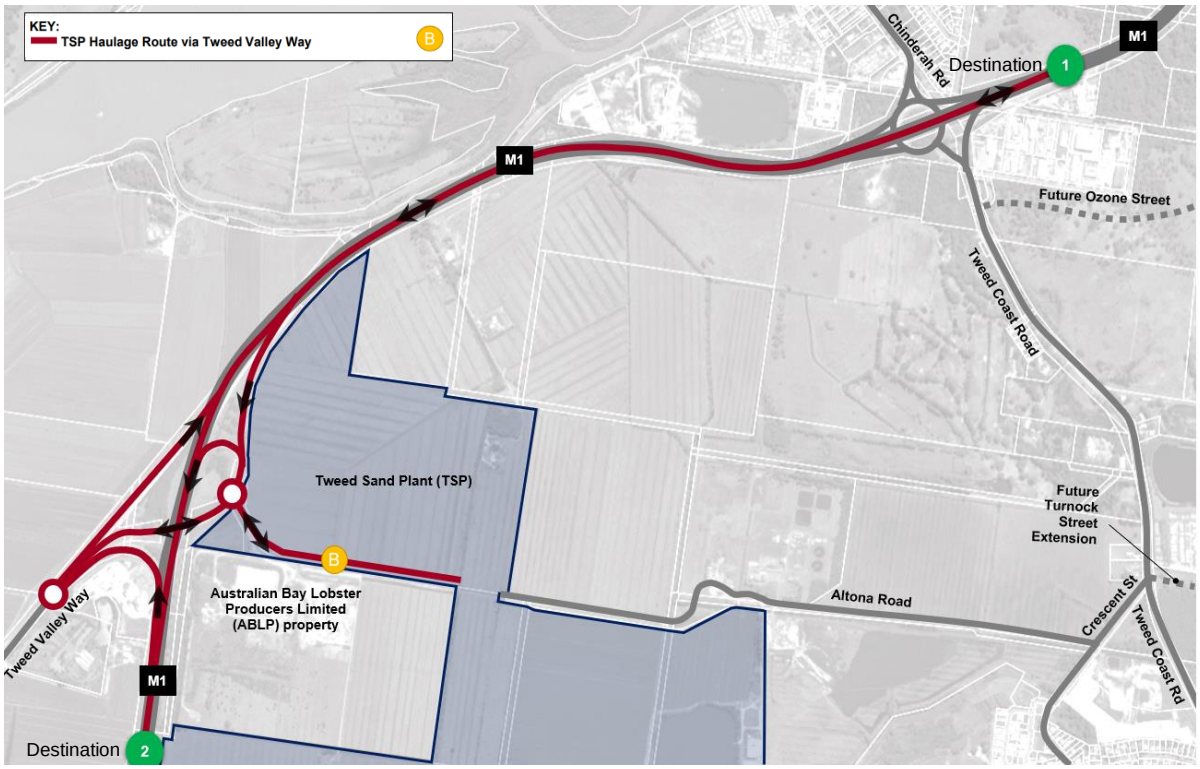


Figure 1.2 Project Case Haulage Route to the M1 Pacific Motorway

As part of the new haulage route, it is proposed to upgrade the existing Tweed Valley Way / Australian Bay Lobster Producers (ABLP) priority intersection to a roundabout.

1.2.4 Haulage Route Comparison

Table 1.1 and Figure 1.3 below shows a comparison between the base case and the project case TSP haulage route via Tweed Coast Road and Tweed Valley Way respectively.

Table 1.1 Base Case and Project Case Haulage Route to the M1 Pacific Motorway (kilometres)

Base Case Haulage Route A via Tweed Coast Road					Project Case Haulage Route B via Tweed Valley Way				
Haulage Route A length to destinations 1 & 2 (km)	M1 North		M1 South		Haulage Route B length to destinations 1 & 2 (km)	M1 North		M1 South	
	To	From	To	From		To	From	To	From
	1		2			1		2	
Internal Road	0.12	0.12	0.12	0.12	Internal Road	0.77	0.77	0.77	0.77
Altona Rd Unsealed	0.52	0.52	0.52	0.52	M1 west of access	0.25	N/A	N/A	0.30
Altona Road Sealed	1.43	1.43	1.43	1.43	Tweed Valley Way	0.57	N/A	N/A	0.81
Crescent Street	0.24	0.24	0.24	0.24	M1 off ramp	N/A	0.76	N/A	488
Tweed Coast Road	1.42	1.42	1.42	1.42	M1 on ramp	923	N/A	0.71	N/A
M1 off ramp	N/A	0.67	N/A	0.74	Along M1	2.96	2.67	3.29	N/A
M1 on ramp	1.03	N/A	0.55	N/A	**Total**	**5.47**	**4.20**	**1.81**	**2.36**
Along M1	N/A	N/A	2.94	2.91	**Difference**	**0.71**	**-0.20**	**-5.41**	**-5.02**
Total	**4.76**	**4.40**	**7.22**	**7.38**					

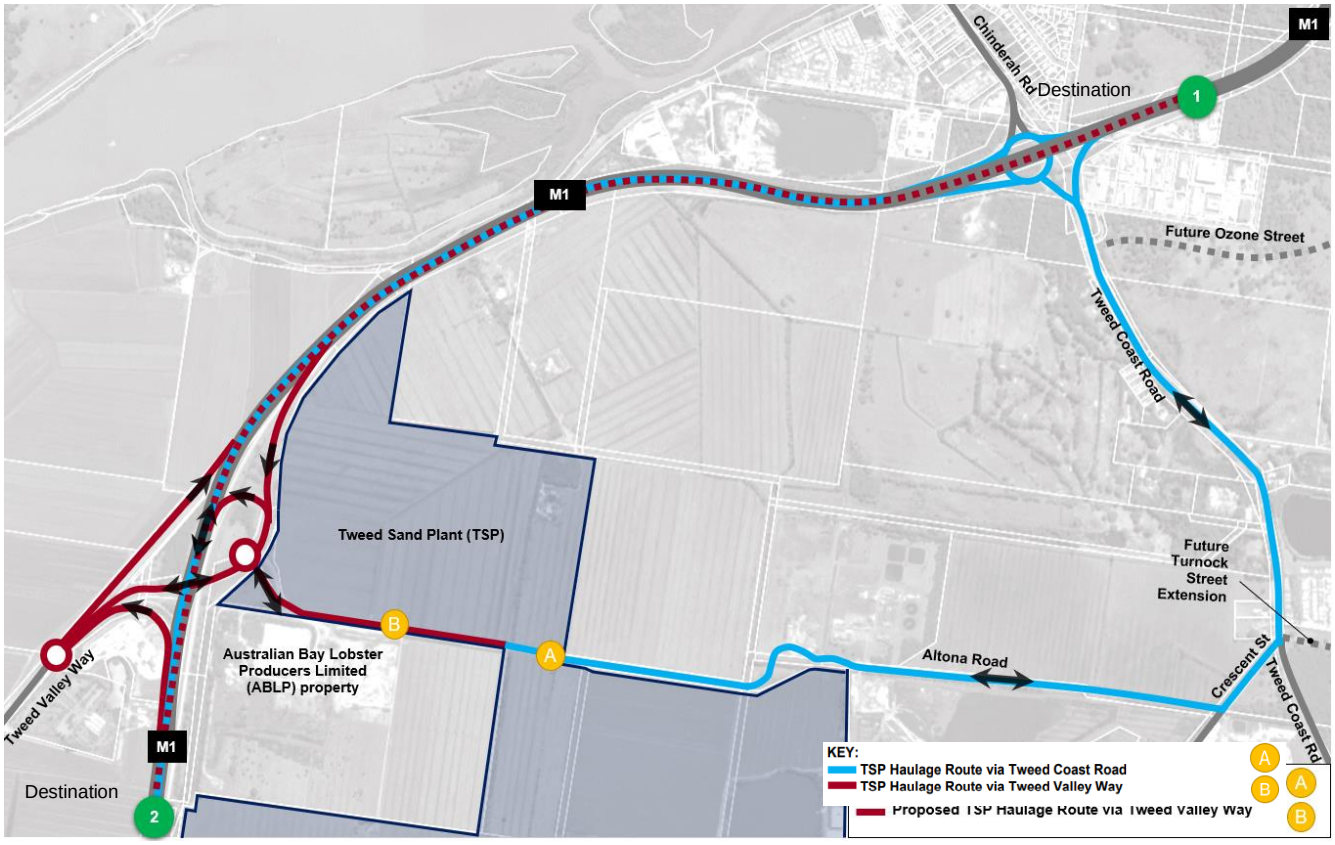


Figure 1.3 Base Case and Project Case - Haulage Route to the M1 Pacific Motorway

In summary, the Base Case haulage route via Tweed Coast Road is more than 5km longer than the proposed haulage route via Tweed Coast Road for trips to and from the south.

Trips from the north via Tweed Valley Way are approximately 200m shorter, directly accessed from the M1 off ramp with no impact onto the other local roads. Trips to the north via Tweed Valley are slightly longer, but there is significant reduction of number of trips along Urban Roads in comparison to the existing haulage route.

1.3 Scope of this Report

The structure of this report is summarised below:

Section 2 **Related Projects**

Outlines relevant future road upgrade works along TCR and TVW.

Section 3 **Traffic Demands**

Estimate the increase in traffic generated by the proposed development.

Section 4 **Traffic Modelling Overview**

Describes methodology adopted for the traffic modelling

Section 5 **Project Costs**

Reports the results of the preliminary cost estimate of the Project Case.

Section 6 **Project Benefits**

Outlines anticipated benefits for Project Case.

Section 7 **Economic Appraisal**

Outlines the Benefit Cost Ratio (BCR) calculations undertaken for Project Case.

Section 8 **Conclusions**

Provides a summary of the report, including the project impacts and benefits.

Section 9 **References**

1.4 Definitions

Table 1.2 below presents a list of abbreviations used in this document

Table 1.2 List of Abbreviations

Abbreviation	Definition
AADT	Annual Average Daily Traffic Volume
ABS	Australian Bureau of Statistics
AM	Ante Meridiem (before midday)
AS	Australian Standards
AWE	Average Weekly Earnings
ATAP	Australian Transport Assessment and Planning
BCR	Benefit Cost Ratio
CBA	Cost-Benefit Analysis
CBD	Central Business District
CBR	California Bearing Ratio
COVID-19	The Coronavirus Disease of 2019
CPI	Consumer Price Index
EMME	Equilibre Multimodal/Multimodal Equilibrium
GIS	Geographic Information System
LGIP	Local Government Infrastructure Plan
LOS	Level of Service
NPV	Net Present Value
PM	Post Meridiem (after midday)
TCR	Tweed Coast Road
TfNSW	Transport for New South Wales
TVW	Tweed Valley Way
VHT	Vehicle Hours Travelled
VKT	Vehicle Kilometres Travelled
VPD	Vehicles per Day
VTTS	Value of Travel Time Savings

2. Related Projects

2.1 Tweed Coast Road / Pacific Motorway (M1) Interchange Upgrade

The current 2017 Tweed Road Development Strategy (TRDS) was developed in 2017 and provides the Tweed Shire's Road network requirements to cater for long term growth.

It is worth noting that the TRDS is based on practical rather than "aspirational" road network infrastructure (i.e. which can be funded, and which can provide practical benefits to the Tweed community within the expected timeframes). Findings rely on projected changes in demographics, economics and land use patterns.

The recommendations within the 2017 Tweed Road Development Strategy (TRDS) document relating to the proposed development are discussed in this section.

Table 2.1 and Figure 2.1 below shows the recommended upgrade to the Pacific Motorway / Tweed Coast Road interchange sourced from the 2017 TRDS report.

Table 2.1 Tweed Coast Road / Pacific Motorway (M1) Interchange Upgrade

ID#	Recommendation	Road Authority	Priority/ Trigger	Inclusions	Issue/s Addressed	Comments
32	Upgrade Pacific Highway/ Tweed Coast Road interchange	RMS/ TSC	Medium Term	Southbound off-ramp (Item 35) access to Morton St and short additional lane on roundabout between northbound motorway on and off ramps.	Removes weave to access Morton St (Issue 13). Increase intersection capacity and improve operations and safety.	

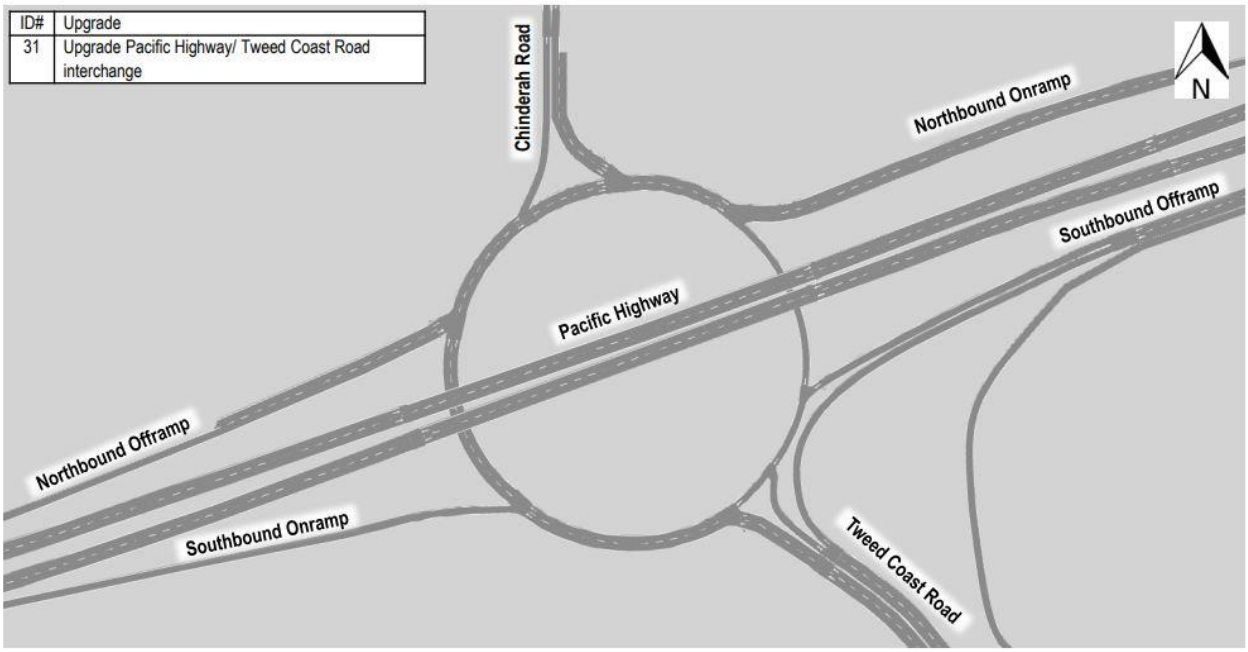


Figure 2.1 Proposed Upgrades to the Tweed Coast Road / M1 Interchange

In addition to the above, the TRDS document recommends widening the existing Tweed Coast Road from 2-lanes to 4-lanes along an approximately 6.2km section between the M1 interchange and Casuarina Way Intersection. The proposed Tweed Coast Road upgrade works have been estimated to cost $4,542,800 *(Source: Tweed Road Contribution Plan (TRCP) 2011 V6.0 Schedule 5).*

For the traffic analysis, it has been assumed that the Tweed Coast Road upgrades including the M1 interchange upgrade works will be completed by 2032. The 2032 cost for the Tweed Coast Road upgrade has been estimated to be $6,549,162 from Crescent Street north to the M1 Interchange.

2.2 Tweed Coast Road / Ozone Street Intersection Upgrade

The 2017 Tweed Road Development Strategy (TRDS) recommends Ozone Street extension, which is required to provide additional network capacity necessary to cater for a growing population in the area. The (TRDS) proposes a new road between Elrond Drive and Ozone Street, which will reduce reliance on the Cudgen Road intersection. For the purposes of the traffic analysis, it has been assumed that the above upgrade works will be completed by 2032.

Figure 2.2 below shows the planned new infrastructure, which includes a new roundabout with Tweed Coast Road to the west, a new roundabout with Rotuma Street and a new roundabout with Elrond Drive.

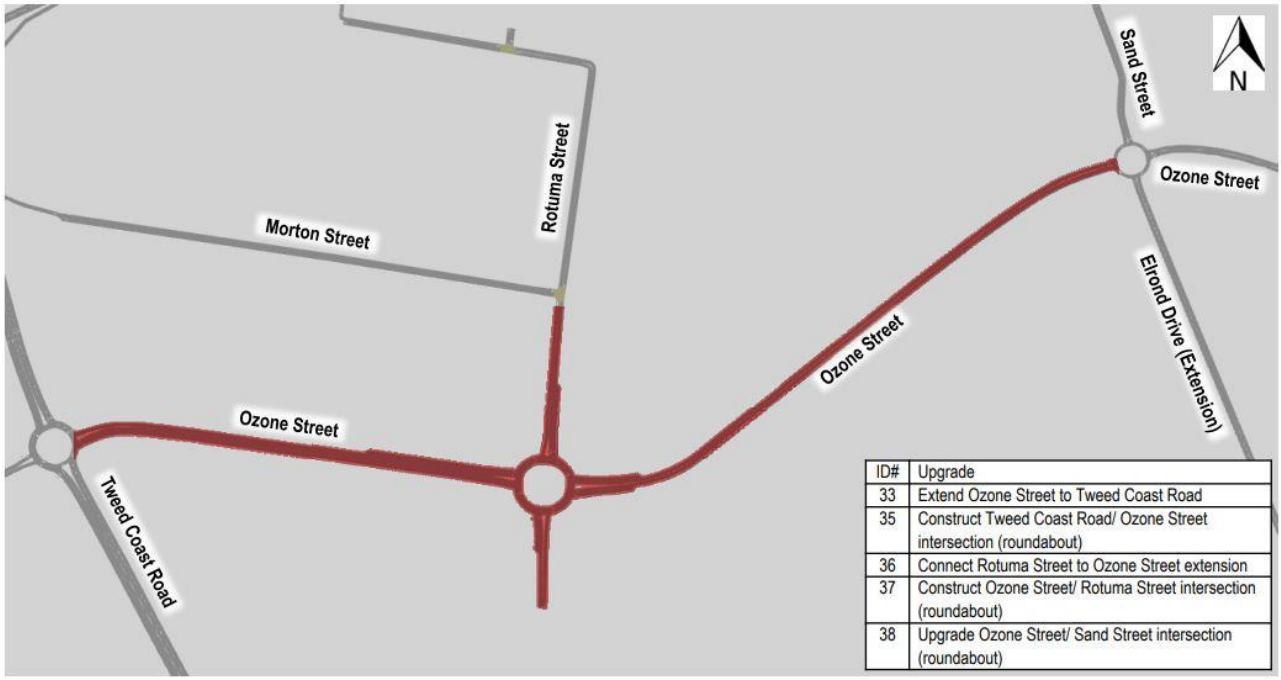


Figure 2.2 Proposed Ozone Street Extension (Source: 2017 TRDS report)

2.3 Tweed Coast Road / Crescent Street Intersection Upgrade

The 2017 Tweed Road Development Strategy (TRDS) also recommends the Tweed Coast Road / Crescent Street intersection upgrade to a 2-lane roundabout as shown in Figure 2.3. The above will provide additional network capacity, especially along Tweed Coast Road.

As part of the TRDS, a new east-west link between south Kingscliff and Tweed Coast Road will be established, aimed to cater for future development in the area and increasing capacity of Tweed Coast Road / Cudgen Road intersection.

Figure 2.3 Proposed Turnock Street Extension (Source: 2017 TRDS report)

For the purposes of the traffic analysis, it has been assumed that the above upgrade works will be completed by 2032. Tweed Coast Road intersection upgrade works costs included in the estimate.

3. Traffic Demands

In order to assess the relative impact of the proposal on the surrounding road network, it is necessary to define the existing traffic demands on the road network and estimate future traffic demands on key intersections.

This section of the report details the existing Tweed Sand Plant haulage route via Tweed Coast Road and forecasts these to the future assessment years. These volumes represent the “Base Case”.

The traffic generated by the proposed development is distributed via Tweed Valley Way. These volumes area forecasts to the future assessment years. These volumes represent the “Project Case”.

3.1 Background Traffic

3.1.1 Traffic Survey Counts Peak Hours

Traffic count data were sourced for the intersections along the existing (Base Case) and proposed haulage route (Project Case). The AM and PM peak hours are shown in the following Figure 3.1.

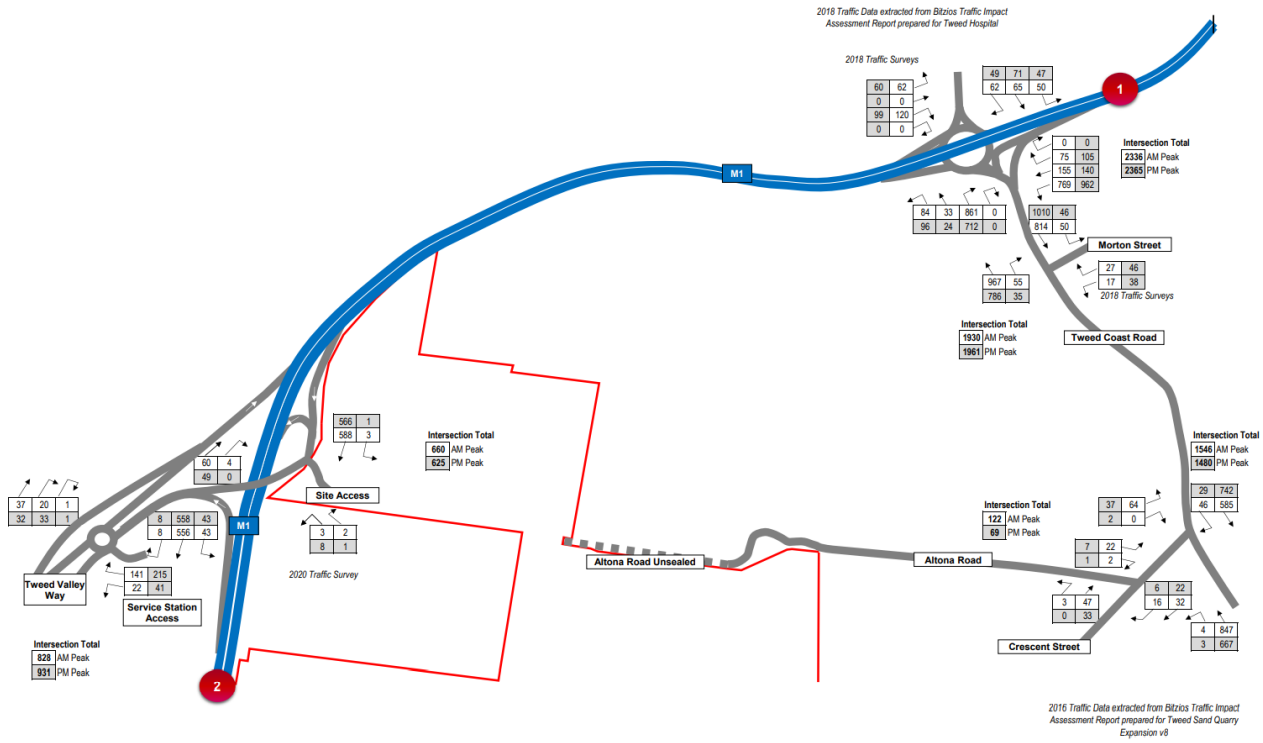


Figure 3.1 Traffic Surveys (AM and PM Peak)

The existing Tweed Sant Plant volumes have been subtracted from Figure 3.1. Figure 3.2 below shows the NET Survey Traffic Flows (without existing TSP truck volumes).

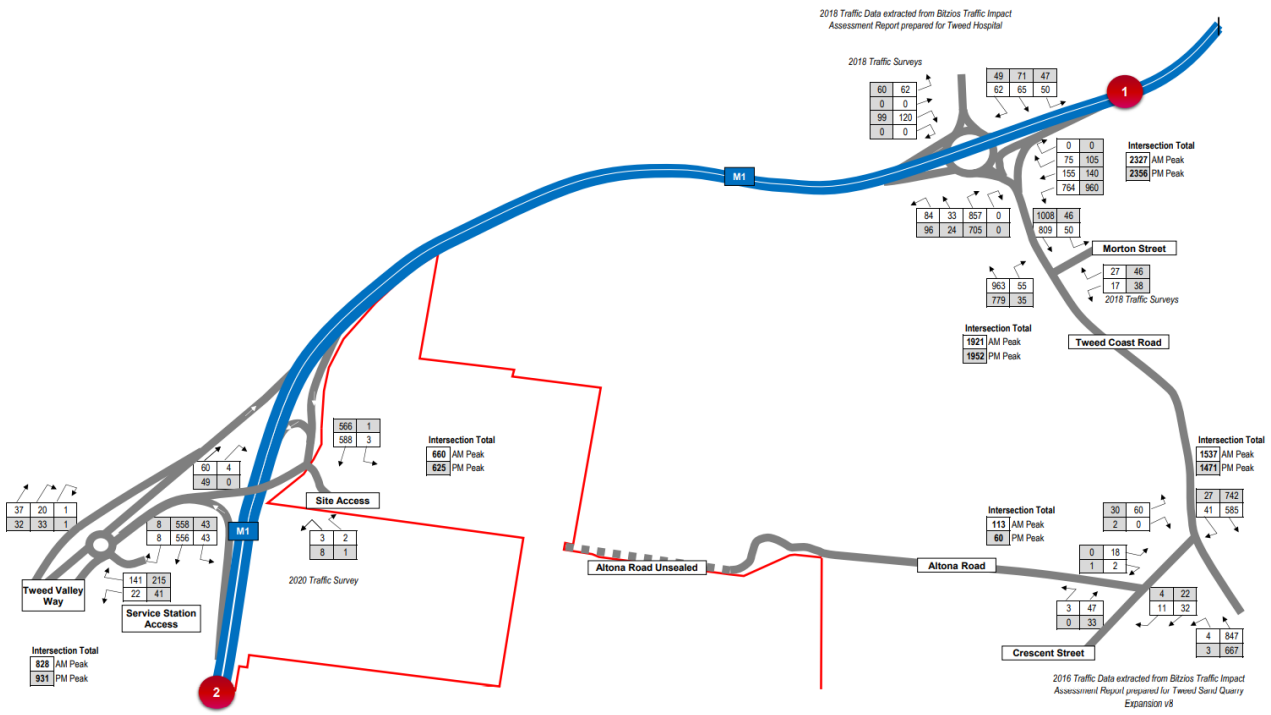


Figure 3.2 NET Traffic Surveys (AM and PM Peak)

3.1.2 Background Traffic Growth Rates

Background traffic growth in the area was calculated for each haulage route, based on the recorded AADT data and 2041 traffic forecast volumes extracted from the Tweed Strategic Transport Model (2041 medium yield Scenario 6).

Table 3.1 below shows the recorded AADT volumes and 2041 Tweed Strategic Transport Model volumes used for the calculation of the growth rates for Tweed Coast Road and Tweed Valley Way.

Table 3.1 Background Growth Rates

Road	Survey Year	Recorded AADT	2041 Strategic Model AADT*	Compound growth p.a.
Tweed Coast Road	2018	17,757	34,280	2.90%
Tweed Valley Way	2020	14,740	16,710	0.60%

** Medium Yield Scenario 6*

3.1.3 Future Year Traffic Volumes

Growth factors summarised in Table 3.2 have been applied to the surveyed traffic flows (Figure 4.1) to identify the future traffic flows in 2022, 2032 and 2033. The resultant future traffic for the year of 2022, 2032 and 2042 AM and PM peak hours are contained in Appendix A to this report.

3.2 Tweed Sand Plant Development Traffic

3.2.1 Estimated Development Traffic Generation

The proposed development includes the expansion of the existing Tweed Sand Plant (TSP), which results in an increase in sand production rate from the current limit of 500,000 tonnes per annum (tpa) to 950,000 tpa. Table 3.2 below shows the forecast development trips:

Table 3.2 Forecast TSP Redevelopment Truck Movements (Peak Hour)

Extraction	Plant	In	Out	Two-way
950,000	Forecast Tweed Sand Plant Redevelopment	32	32	64

Table 3.3 below shows forecast project development daily truck movements estimated pro-rata based on the TSP truck volumes recorded in 2021-2021 and yearly sand extraction of 214,932 tonnes.

Table 3.3 Forecast Tweed Sand Plant Redevelopment Truck Movements

Year	Recorded Two-way Volumes	Recorded Yearly Sand Extraction (Tonnes)	Recorded Minimum Load per truck (Tonnes)	Recorded Maximum Load per truck (Tonnes)	Average Load per truck (Tonnes)	Future Extraction (Tonnes)	Forecast Two Way Volumes based on 950,000 extraction tonnes (pro-rata)
2020-2021	11,780	214,932	11.02	40.94	36.49	950,000	**52,068**

In summary, the proposed TPS expansion site is forecast to generate approximately 52,068 two-way vehicles per year.

In/Out Directional Split

Trip distribution for the proposed TSP expansion is summarised as follows:

- Northbound 95%
- Southbound 5%

3.2.2 Base Case Development Trip Distribution

Figure 3.3 below shows the proposed development trip distribution via Tweed Coast Road.

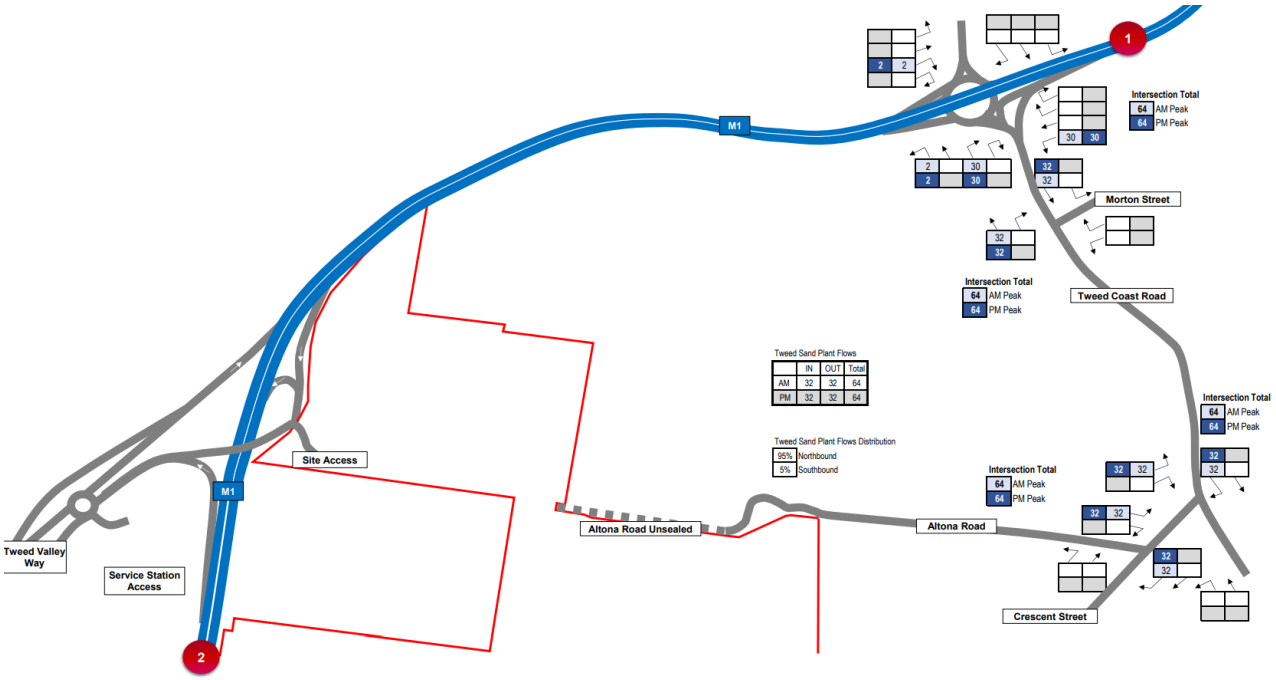


Figure 3.3 Base Case Development Traffic Flows

3.2.3 Project Case Development Trip Distribution

Figure 3.4 below shows the proposed development trip distribution via Tweed Valley Way.

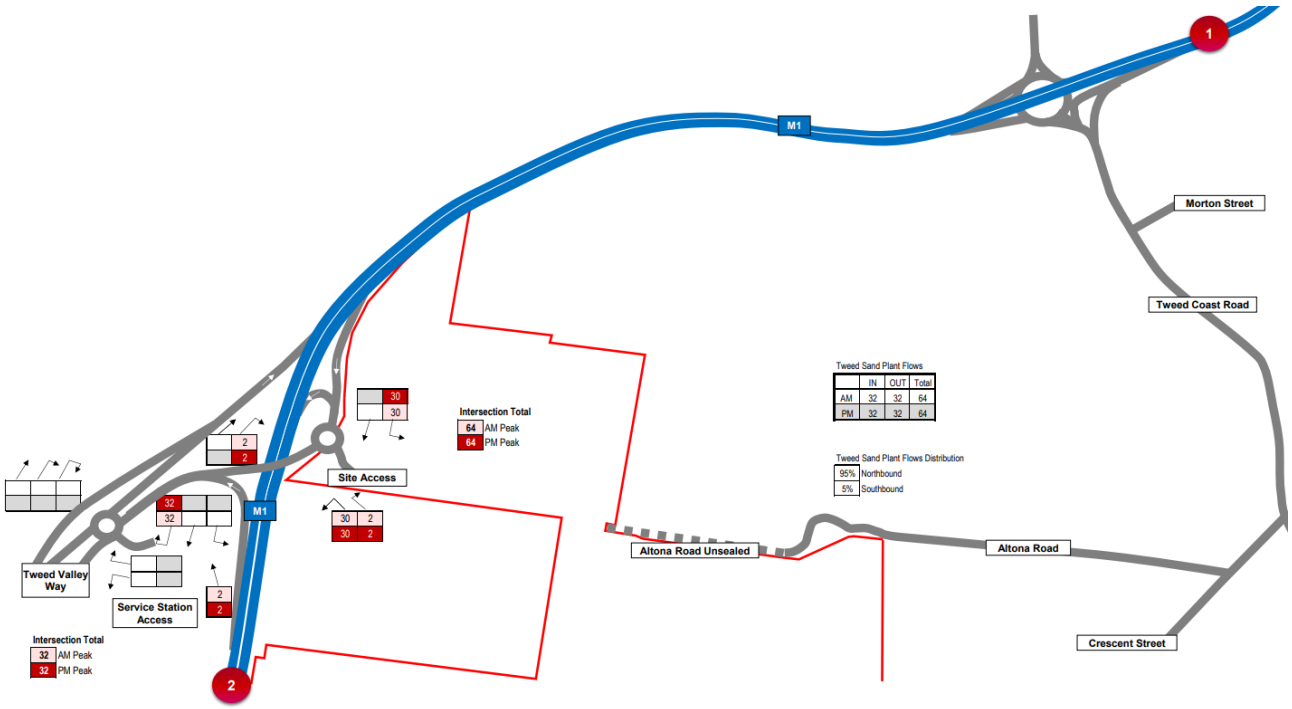


Figure 3.4 Project Case Development Traffic Flows

3.3 Base Case

The Base Case traffic demands for the 2022, 2032 and 2042 design years are shown in Figure 3.5 , Figure 3.6 and Figure 3.7 respectively.

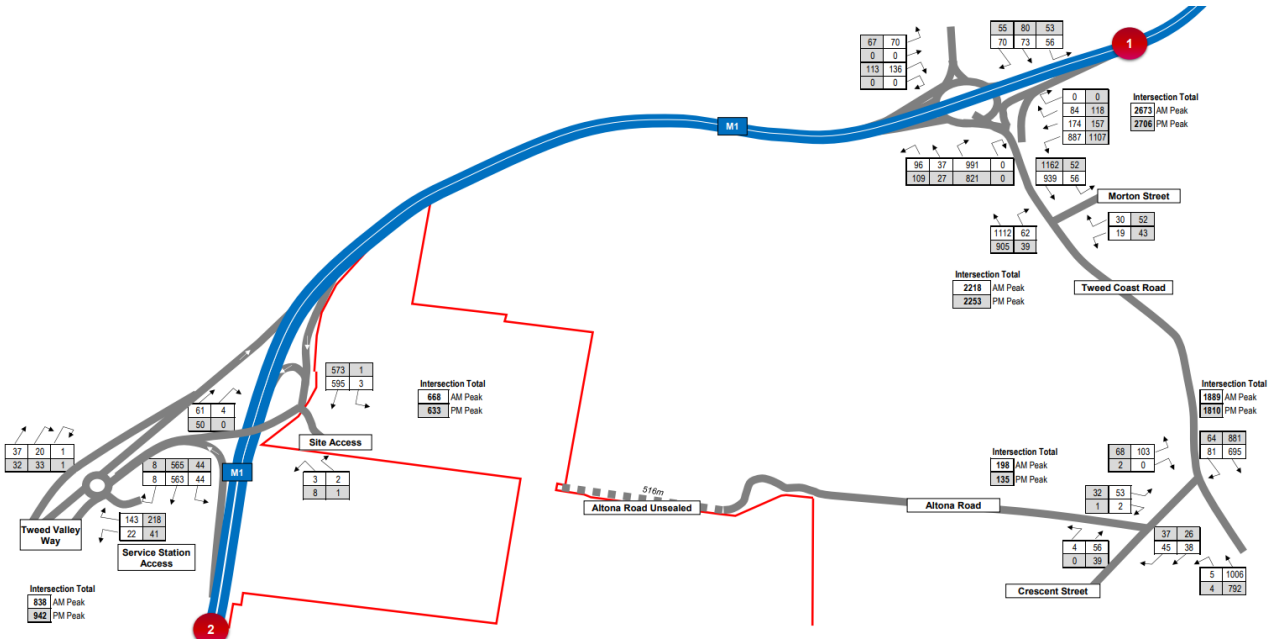


Figure 3.5 2022 Base Case Traffic Flows

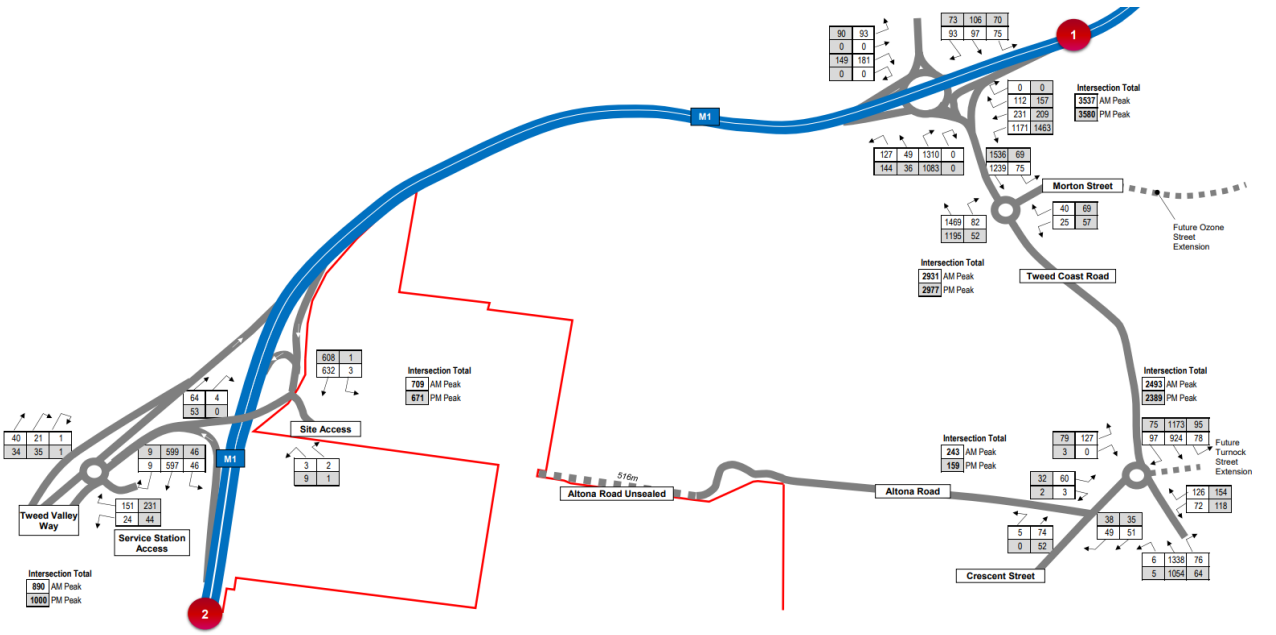


Figure 3.6 2032 Base Case Traffic Flows

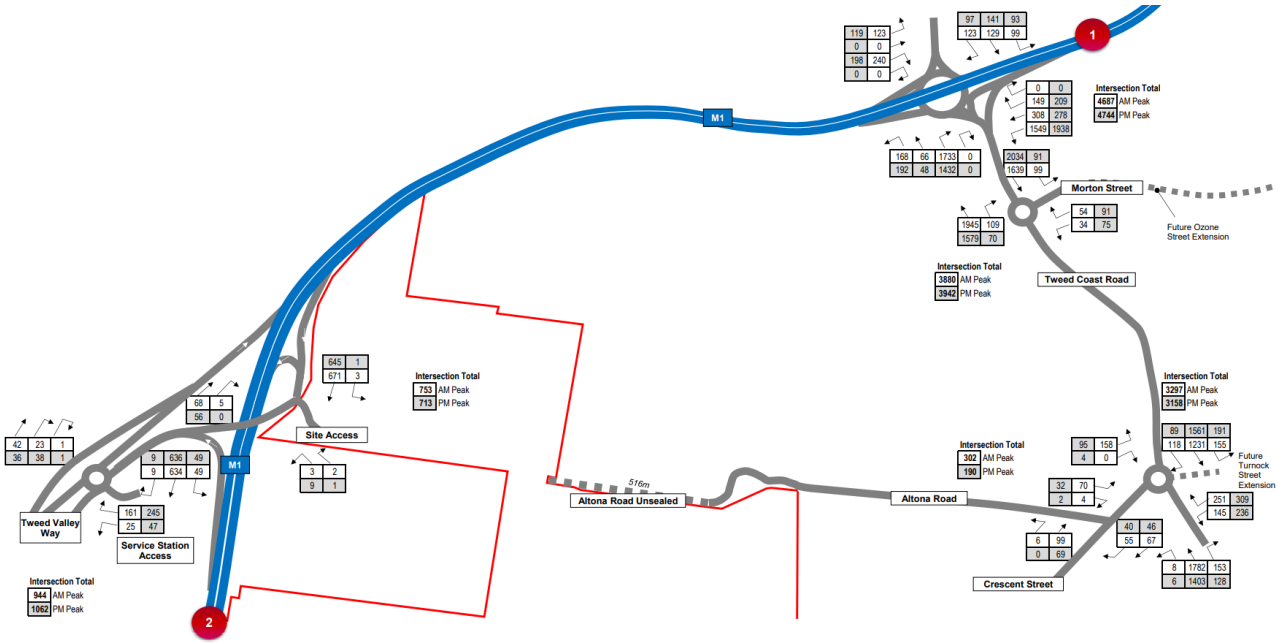


Figure 3.7 2042 Base Case Traffic Flows

3.4 Project Case

The Project Case traffic demands for the 2022, 2032 and 2042 design years are shown in Figure 3.8, Figure 3.9 and Figure 3.10.

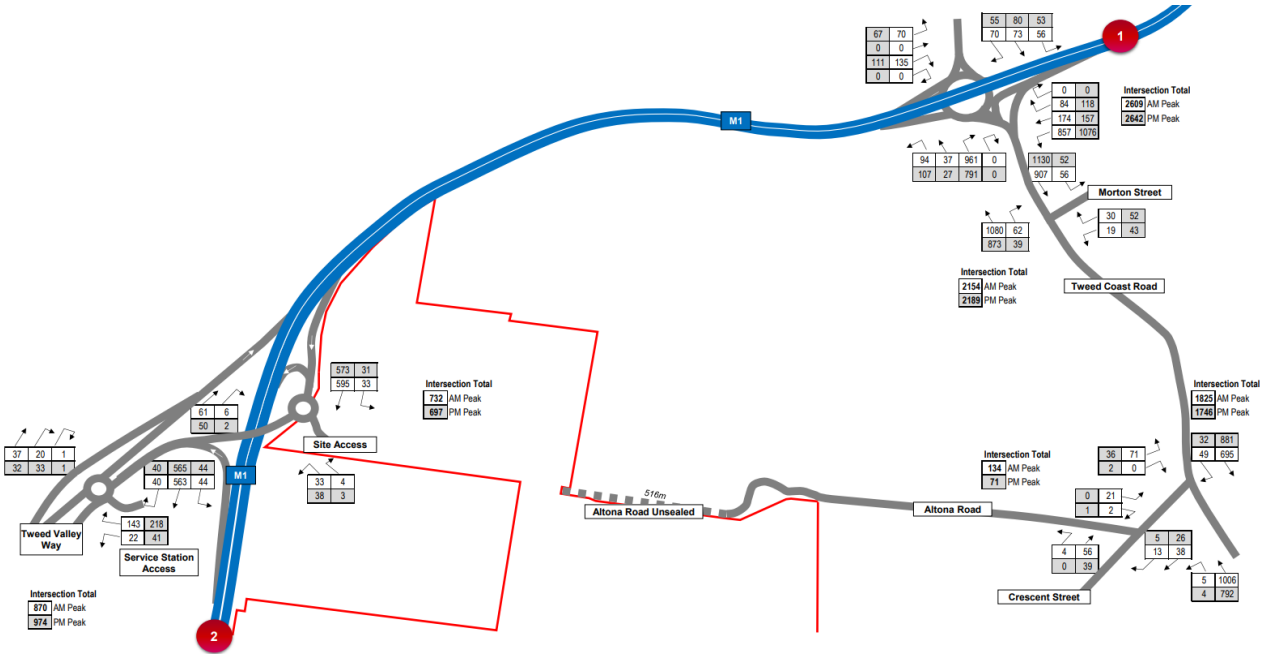


Figure 3.8 2022 Project Case Traffic Flows

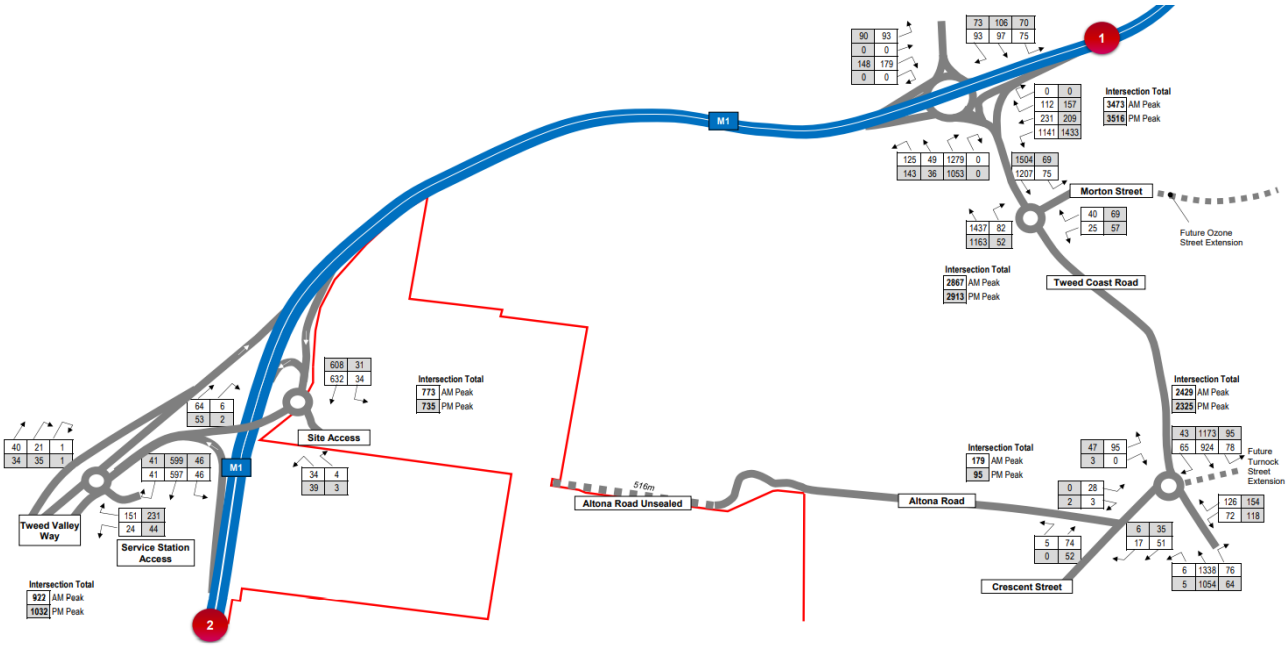


Figure 3.9 2032 Project Case Traffic Flows

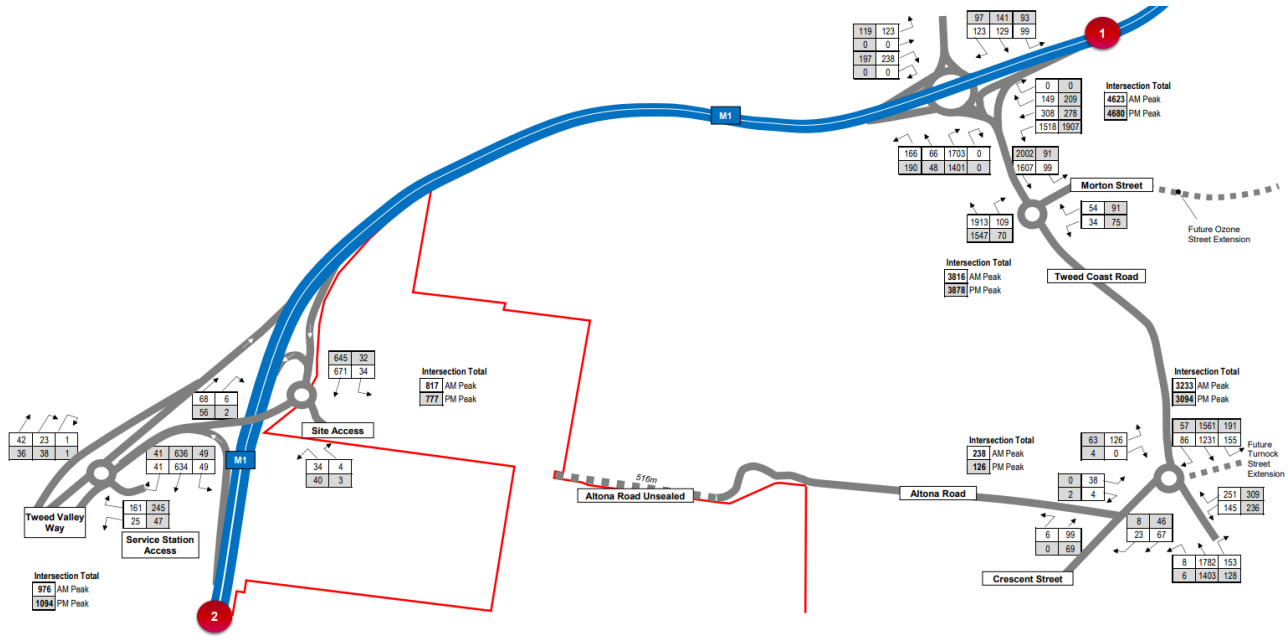


Figure 3.10 2042 Project Case Traffic Flows

All traffic flow diagrams provided in Appendix A.

4. Traffic Modelling Overview

4.1 Overview

The outcomes and recommendations of this Economic Evaluation are based on forensic traffic modelling, including all known impacts.

Capacity analysis of the surrounding intersections has been carried out utilising SIDRA INTERSECTION 9 traffic modelling software. This is an advanced micro-analytical traffic evaluation tool that employs lane-by-lane and vehicle drive models and can assess intersections within a network.

The key performance criteria considered are Degree of Saturation (DOS), Delays and Queuing. For a priority-controlled intersection, a DOS in excess of 80% is considered over capacity, 85% for roundabouts and 90% for signalised intersections. A DOS of 90% is the recommended upper limit as above this value performance quickly deteriorates. For priority-controlled intersections, a delay up to 42 seconds is considered satisfactory and a delay greater than 56 seconds is considered over capacity (*Guide to Traffic Generating Developments*, Roads and Traffic Authority, 2002, Tab. 4.2). Acceptable queue lengths are determined on a site-by-site basis, considering available storage.

A key assessment criterion adopted for the evaluation of the network performance includes average interaction delay.

Traffic modelling has been undertaken for the Base Case (existing haulage route via Tweed Coast Road) and the Project Case (proposed haulage route via Tweed Valley Way).

Key Network Statistics are shown in Table 4.1, Table 4.2 and Table 4.3 for the 2022, 2032 and 2042 assessment years respectively.

Table 4.1 2022 Key Network Statistics

Intersection	AM Peak			PM Peak			AM	PM	AM	PM
	Delay	Light Veh	Heavy Veh	Delay	Light Veh	Heavy Veh	Light Veh	Light Veh	Heavy Veh	Heavy Veh
	seconds	veh/hour	veh/hour	seconds	veh/hour	veh/hour	Annual Delay in Peak Hours (hours)			
2022 Base Case										
Crescent Street / Altona Road	3.9	124	74	4.0	70	65	35.1	20.3	20.9	18.9
Tweed Coast Road / Crescent Street	9.0	1765	123	2.2	1674	136	1,151.5	266.9	80.5	21.8
Tweed Coast Rd / M1 Interchange	7.5	2463	210	6.3	2538	167	1,338.9	1,159.0	114.2	76.4
Tweed Valley Way / ABLP Site Access	0.3	608	60	0.3	576	57	13.2	12.5	1.3	1.2
Approach to the rdb delay due to the speed limit change	11.6	608	60	11.6	576	57	511.3	484.1	50.2	47.6
Tweed Valley Way / Service Station	4.6	735	103	5.2	839	103	244.9	316.2	34.4	38.9
TOTAL	**36.9**	**6304**	**630**	**29.6**	**6273**	**585**	**3,295.0**	**2,258.9**	**301.4**	**204.8**
2022 Project Case										
Crescent Street / Altona Road	1.8	124	10	0.6	70	1	16.2	3.0	1.3	0.1
Tweed Coast Road / Crescent Street	1.0	1765	59	0.7	1674	72	127.9	84.9	4.3	3.7
Tweed Coast Rd / M1 Interchange	7.2	2463	146	6.1	2538	103	1,285.3	1,122.2	76.2	45.7
Tweed Valley Way / ABLP Site Access	3.0	608	124	3.0	576	121	132.2	125.2	26.9	26.2
Approach to the rdb delay due to the speed limit change	15.5	608	124	15.5	576	121	683.2	646.9	139.0	135.6
Tweed Valley Way / Service Station	5.0	735	135	5.6	839	135	266.2	340.5	49.0	54.9
TOTAL	**33.5**	**6304**	**598**	**31.5**	**6273**	**553**	**2,511.2**	**2,322.7**	**296.7**	**266.0**
Travel Time Savings (s)										
Intersection	**AM Peak Travel Time Savings (s)**			**PM Peak Travel Time Savings (s)**			**AM and PM Peak Total Travel Time Savings (s)**	**AM Annual Delay (hours)**	**PM Annual Delay (hours)**	**AM Annual Delay (hours)**	**PM Annual Delay (hours)**
								Light Veh	Light Veh	Heavy Veh	Heavy Veh
Crescent Street / Altona Road	-2.1			-3.4			-5.5	-18.9	-17.3	-19.6	-18.8
Tweed Coast Road / Crescent Street	-8.0			-1.5			-9.5	-1,023.5	-182.0	-76.2	-18.1
Tweed Coast Rd / M1 Interchange	-0.3			-0.2			-0.5	-53.6	-36.8	-38.0	-30.7
Tweed Valley Way / ABLP Site Access	2.7			2.7			5.4	119.0	112.7	25.6	25.0
Approach to the rdb delay due to the speed limit change	3.9			3.9			7.8	171.9	162.8	88.8	87.9
Tweed Valley Way / Service Station	0.4			0.4			0.8	21.3	24.3	14.6	16.0
TOTAL	**-3.4**			**1.9**			**-1.5**	**-783.8**	**63.7**	**-4.8**	**61.3**

Table 4.2 2032 Key Network Statistics

Intersection	AM Peak			PM Peak			AM	PM	AM	PM
	Delay	Light Veh	Heavy Veh	Delay	Light Veh	Heavy Veh	Light Veh	Light Veh	Heavy Veh	Heavy Veh
	seconds	veh/hour	veh/hour	seconds	veh/hour	veh/hour	Annual Delay in Peak Hours (hours)			
2032 Base Case										
Crescent Street / Altona Road	3.7	165	77	3.6	93	66	44.4	24.3	20.7	17.1
Tweed Coast Road / Crescent Street	6.8	2350	143	6.3	2228	160	1,158.0	1,017.3	70.5	73.2
Tweed Coast Road / Ozone Rd Extension	4.7	2755	176	4.8	2810	167	938.4	977.5	59.9	58.1
Tweed Coast Rd / M1 Interchange	8.6	3279	258	6.9	3379	201	2,043.6	1,689.6	161.0	100.7
Tweed Valley Way / ABLP Site Access	0.3	646	63	0.3	611	60	14.0	13.3	1.4	1.3
Approach to the rdb delay due to the speed limit change	11.6	646	63	11.6	611	60	542.8	513.9	53.3	50.6
Tweed Valley Way / Service Station	4.5	780	110	5.3	891	110	254.4	342.1	35.7	42.1
TOTAL	**40.2**	**10620**	**891**	**38.8**	**10623**	**824**	**4,995.5**	**4,578.0**	**402.6**	**343.1**
2032 Project Case										
Crescent Street / Altona Road	2.9	165	13	0.6	93	2	34.8	4.1	2.8	0.1
Tweed Coast Road / Crescent Street	5.5	2350	79	5.5	2228	96	936.6	888.1	31.5	38.4
Tweed Coast Road / Ozone Rd Extension	4.6	2755	112	4.7	2810	103	918.4	957.1	37.3	35.1
Tweed Coast Rd / M1 Interchange	8.2	3279	194	6.7	3379	137	1,948.5	1,640.6	115.5	66.7
Tweed Valley Way / ABLP Site Access	3.0	646	127	3.0	611	124	140.4	132.9	27.7	27.0
Approach to the rdb delay due to the speed limit change	15.5	646	127	15.5	611	124	725.3	686.7	143.1	139.5
Tweed Valley Way / Service Station	4.9	780	142	5.6	891	142	277.0	361.4	50.3	57.5
TOTAL	**44.6**	**10620**	**795**	**41.6**	**10623**	**728**	**4,981.0**	**4,671.0**	**408.2**	**364.2**
BENEFITS										
Intersection	**AM Peak Travel Time Savings (s)**			**PM Peak Travel Time Savings (s)**			**AM and PM Peak Total Travel Time Savings (s)**		**AM Annual**	**PM Annual**
							Light Veh	**Light Veh**	**Heavy Veh**	**Heavy Veh**
Crescent Street / Altona Road	-0.8			-3.0			-3.8	-9.6	-20.3	-17.9	-17.0
Tweed Coast Road / Crescent Street	-1.3			-0.8			-2.1	-221.4	-129.2	-39.0	-34.8
Tweed Coast Road / Ozone Rd Extension	-0.1			-0.1			-0.2	-20.0	-20.4	-22.6	-23.0
Tweed Coast Rd / M1 Interchange	-0.4			-0.2			-0.6	-95.0	-49.0	-45.5	-34.0
Tweed Valley Way / ABLP Site Access	2.7			2.7			5.4	126.3	119.6	26.3	25.7
Approach to the rdb delay due to the speed limit change	3.9			3.9			7.8	182.5	172.8	89.8	88.9
Tweed Valley Way / Service Station	0.4			0.3			0.7	22.6	19.4	14.5	15.4
TOTAL	**4.4**			**2.8**			**7.2**	**-14.6**	**93.0**	**5.6**	**21.1**

Table 4.3 2042 Key Network Statistics

Intersection	AM Peak			PM Peak			AM	PM	AM	PM
	Delay	Light Veh	Heavy Veh	Delay	Light Veh	Heavy Veh	Light Veh	Light Veh	Heavy Veh	Heavy Veh
	seconds	veh/hour	veh/hour	seconds	veh/hour	veh/hour	Annual Delay in Peak Hours (hours)			
2042 Base Case										
Crescent Street / Altona Road	3.5	220	81	3.3	124	66	55.9	29.7	20.7	15.8
Tweed Coast Road / Crescent Street	18.5	3128	169	10.6	2966	192	4,193.6	2,278.4	226.8	147.7
Tweed Coast Road / Ozone Rd Extension	5.2	3667	213	5.5	3741	201	1,381.9	1,491.2	80.3	80.1
Tweed Coast Rd / M1 Interchange	61.2	4364	323	11.3	4497	247	19,357.3	3,683.1	1,431.5	202.2
Tweed Valley Way / ABLP Site Access	0.3	685	67	0.4	649	64	14.9	18.8	1.5	1.9
Approach to the rdb delay due to the speed limit change	11.6	685	67	11.6	649	64	576.2	545.5	56.6	53.7
Tweed Valley Way / Service Station	4.6	828	116	5.3	945	116	276.0	363.1	38.8	44.7
TOTAL	**104.9**	**13578**	**1037**	**48.0**	**13572**	**950**	**25,855.8**	**8,409.8**	**1,856.0**	**546.1**
2042 Project Case										
Crescent Street / Altona Road	1.9	220	17	0.6	124	2	30.3	5.4	2.4	0.1
Tweed Coast Road / Crescent Street	11.4	3128	105	8.6	2966	128	2,584.2	1,848.5	86.9	80.0
Tweed Coast Road / Ozone Rd Extension	5.1	3467	149	5.3	3741	137	1,281.4	1,436.9	55.1	52.6
Tweed Coast Rd / M1 Interchange	45.4	4364	259	10.1	4497	183	14,359.8	3,292.0	851.3	133.9
Tweed Valley Way / ABLP Site Access	3.0	685	131	3.0	649	128	149.0	141.1	28.5	27.8
Approach to the rdb delay due to the speed limit change	15.5	685	131	15.5	649	128	769.9	728.9	147.5	143.6
Tweed Valley Way / Service Station	4.9	828	148	5.7	945	148	294.0	390.5	52.7	61.3
TOTAL	**87.2**	**13378**	**941**	**48.8**	**13572**	**854**	**19,468.7**	**7,843.4**	**1,224.4**	**499.3**

BENEFITS

Intersection	AM Peak Travel Time Savings (s)	PM Peak Travel Time Savings (s)	AM and PM Peak Total Travel Time Savings (s)	AM Annual Delay (hours)	PM Annual Delay (hours)	AM Annual Delay (hours)	PM Annual Delay (hours)
				Light Veh	Light Veh	Heavy Veh	Heavy Veh
Crescent Street / Altona Road	-1.6	-2.7	-4.3	-25.5	-24.3	-18.3	-15.7
Tweed Coast Road / Crescent Street	-7.1	-2.0	-9.1	-1,609.4	-429.9	-139.9	-67.8
Tweed Coast Road / Ozone Rd Extension	-0.1	-0.2	-0.3	-100.5	-54.2	-25.2	-27.5
Tweed Coast Rd / M1 Interchange	-15.8	-1.2	-17.0	-4,997.5	-391.1	-580.1	-68.3
Tweed Valley Way / ABLP Site Access	2.7	2.6	5.3	134.1	122.3	27.1	25.9
Approach to the rdb delay due to the speed limit change	3.9	3.9	7.8	193.7	183.4	90.9	89.9
Tweed Valley Way / Service Station	0.3	0.4	0.7	18.0	27.4	13.9	16.6
TOTAL	**-17.7**	**0.8**	**-16.9**	**-6,387.1**	**-566.4**	**-631.6**	**-46.8**

Table 4.4 below shows the annual hours travelled benefits.

Table 4.4 Traffic Modelling Annual Hour Travelled Savings

	Year	Base Case Annual Hrs AM and PM Peak		Project Case Annual Hrs AM and PM Peak		Benefit Annual Hrs AM and PM Peak	
		Light	Heavy	Light	Heavy	Light	Heavy
Entire Network	2022	5,554	506	4,834	563	720	-56
Entire Network	2032	9,574	746	9,652	772	-78	-27
Entire Network	2042	34,266	2,402	27,312	1,724	6,954	678

5. Project Costs

5.1.1 Construction Cost

Table 5.1 shows the construction cost estimates for the proposed roundabout works (Project Case).

Table 5.1 Construction Cost

Option	Total Construction Cost (Undiscounted, 2021 prices)
Project Case	$4,800,000

For appraisal purposes, it has been assumed that design / construction occurs between 2021 and 2022. Hanson is responsible for construction of the roundabout. Consequently, construction cost of the roundabout has been removed from the Economic Evaluation. This Economic Evaluation considers costs and benefits for local residents, the general public, Tweed Shire Council and NSW State Government only. Tweed Shire Council maintenance costs of the roundabout are included.

5.1.2 Operating Cost

The roundabout would be constructed with a durable 30-year design life concrete pavement and maintainable one in four batters. However, for robust assessment a 1% maintenance cost has been adopted. A summary of the ongoing maintenance costs for the proposed roundabout are shown in table below.

Table 5.2 Maintenance Cost

Option	Total Maintenance Cost (Undiscounted, 2021 prices)
Project Case	$1,440,000

5.1.3 Travel Time Cost along Tweed Valley Way

The proposed development will result in additional delays along Tweed Valley Way. Table 5.3 below shows additional Tweed Valley Way Travel Time Cost associated with the proposed haulage and new roundabout at the ABLP access. The delay analysis includes reduction of the through traffic speeds as well as individual intersection delay, which was determined based on SIDRA outputs.

Table 5.3 Tweed Valley Way Travel Time Cost

Year	Base Case		Project Case		Benefit		Annual Travel Time Costs($) (Undiscounted, 2021 prices)
	AM and PM Peak		AM and PM Peak		AM and PM Peak		
	Annual Delay (hrs) Light Vehicles	Annual Delay (hrs) Heavy Vehicles	Annual Delay (hrs) Light Vehicles	Annual Delay (hrs) Heavy Vehicles	Annual Delay (hrs) Light Vehicles	Annual Delay (hrs) Heavy Vehicles	
2022	1,582	174	2,194	432	612	258	$35,371
2031	1,680	184	2,324	445	643	261	$36,537
2041	1,795	197	2,474	461	679	264	$37,907

Over a 30-year evaluation period, the additional total travel time cost along Tweed Valley Way has been calculated as **$1,107,887** (undiscounted 2021 values).

6. Project Benefits

6.1 Quantifiable Benefits

6.1.1 Overview

CBA includes only benefits to the Tweed Shire Council residents and public, Tweed Shire Council and NSW State Government. Any benefits acquired by Hanson with respect to shorter travel distances have not been included.

The Tweed Shire Council strategic modelling shows that traffic along TCR is expected to increase significantly as a result of residential and business growth in the area. Local congestion and delays can be expected into the future as the volume of traffic increases. Removing TSP haulage trucks from TCR will generate substantial benefits to road users, particularly through savings in travel time, reduction in crash costs and environmental benefits. Benefits to Tweed Shire Council include reduction in Tweed Coast Road Maintenance Costs.

Project benefits have been calculated as the sum of the following:

- Travel Time Benefits - Travel Time Saving along Tweed Coast Road for light and heavy vehicles;
- Tweed Coast Road Maintenance Cost Reduction;
- Safety-Related Benefits; and
- Environmental Benefits.

6.1.2 Travel Time Benefits

The Value of Travel Time Savings (VTTS) is a dominant user benefit of road upgrade infrastructure projects. Research indicates that travel time savings can provide up to 80% of the total monetised benefits of road projects (Mackie et al. 2001a and BTE 1999a).

The following values of travel time of occupants have been used in the Travel Time Benefits estimates:

- Value of travel time (private) = **$17.89** per person hour
- Value of travel time (business) = **$58.27** per person hour

The above values of travel time for the occupants of a passenger car were calculated using the Average Weekly Earnings (AWE) extracted from the TfNSW Economic Parameter Values - Appendix E, 2020. The private travel time was valued at 40% of seasonally adjusted full time AWE for NSW.

Table 6.1 below shows the calculation of Value of Travel Time for light and heavy vehicles for peak hour times.

Table 6.1 Value of Travel Time for Light and Heavy Vehicles (Peak Hours)

Vehicle Type	Vehicle type in the fleet	Adjusted % for the weighted average calculation	Occupancy rate (persons /vehicle)	VTT for occupants		Total VTT (2021$ /vehicle-hr) weighted average
				$/person hr	S/vehicle hr	
Private Car	71.0%	73.95%	1.41	$17.89	$25.23	$31.90
Business Car	9.0%	9.38%	1.07	$58.27	$62.35	
Light commercial vehicle (LCV)	16.0%	16.67%	1.21	$36.65	$44.35	
Heavy commercial vehicle (HCV)	4.0%	100%	1.0	$61.47	$61.47	$61.47

Source: TfNSW "Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives"

Travel time savings were calculated by taking the difference between travel time costs for the Base Case along the Tweed Coast Road corridor and the Project Case utilising Tweed Valley Way.

Table 6.2 below shows a comparison of the annual peak hours (AM + PM) delay forecast (hrs) for Base Case and Project Case.

Table 6.2 Tweed Coast Road Travel Time Cost Saving

Year	Base Case Peak Hours Annual Delay (hrs)	Project Case Peak Hours Annual Delay (hrs)	Benefit Peak Hours Annual Delay (hrs)	Annual Delay Benefits ($) (Undiscounted, 2021 prices)
2022	4,304	2,771	1,533	$54,865
2032	8,454	7,656	799	$32,393
2042	34,676	26,101	8,575	$301,411

**Peak Hour Annual Volumes calculated utilising 260.9 volume expansion factor*

The year-by-year annual delays (hrs) benefits between the 2022, 2032, 2042 and 2052 assessment year, have been calculated by way of interpolation and extrapolation of the Base Case and Project Travel Demands results for 2022, 2032 and 2042 assessment years summarised in the above table.

Over the 30-year evaluation period, the total travel time saving along Tweed Coast Road corridor has been calculated as **$4,289,900** (undiscounted 2021 values).

6.1.3 Tweed Coast Road Maintenance Cost Reduction

The benefits of diverting traffic away from Tweed Coast Road were calculated based on the TfNSW recommendations summarized in Table 48 - Unit cost of road maintenance by vehicle types Economic Parameter Values – January 2020. Table 6.3 below shows summary of the forecast VKT along Tweed Coast Road corridor.

Table 6.3 Forecast VKT along Tweed Coast Road

Direction	North		South		Total
	From	To	From	To	
Distribution	95%	95%	5%	5%	N/A
Annual TSP Volumes	27,732	27,732	1,302	1,302	52,068
Tweed Coast Road Corridor Distance (km)	1.424	1.424	1.424	1.424	1.424

Tweed Coast Road VKT	35,219	35,219	1,854	1,854	74,144

Unit cost of 16.45 cents / VKT was applied to the total 74,144 VKT along Tweed Coast Road only.

Annual maintenance cost saving was calculated as $12,197. There are also additional $647,488 savings associated with the Tweed Coast Road upgrade from 2-lanes to 4-lanes due to the different pavement depth requirement.

Over the 30-year evaluation period, the Tweed Coast Road Maintenance Cost Reduction inclusive of reduced construction cost amounts to **$1,001,193** (undiscounted values).

6.1.4 Safety-Related Benefits

The network crash costs have been estimated based on the forecast TSP truck volumes along local roads for the Base Case and Project Case. The assessment contains the average accident cost for NSW and the accident rate for each road type.

Table 6.4 Forecast Crash Costs and Road Safety-Related Benefits

Year	Base Case Crash Cost	Project Case Crash Cost	Road Safety Benefits
2022	$32,033	$27,354	$4,679
2032*	$38,164	$27,354	$10,810
2042*	$38,164	$27,354	$10,810

**Includes Tweed Coast Road upgrade from rural 2-lane to urban 4-lane road*

The year-by-year annual benefits between the 2022 and 2052 assessment years, have been calculated by way of interpolation and extrapolation of the Base Case and Project Travel Demands results for 2022, 2032 and 2042 assessment years summarised in the above table.

Over the 30-year evaluation period, the total road safety benefits have been calculated as **$269,120** (undiscounted 2021 values). Appendix C details the Road Safety Benefits.

Table 6.5 below shows Crash Cost Benefit Calculation (Undiscounted, 2021 prices).

Table 6.5 Crash Cost Benefits

Network Crash Cost Saving

Link Name	Base Case									Project Case								
	VKT per year	MVKT per year	Road Type	Road Width Description	Crash Cost ($/year)	Fatal crash rate	Injury Crash Rate	crash cost ($)		VKT per year	MVKT per year	Road Type	Road Width Description	Crash Cost ($/year)	Fatal crash rate	Injury Crash Rate	crash cost ($)	
								Rural Fatal	Rural Injury								Rural Fatal	Rural Injury
Altona Road Unsealed	26,867	0.027	Local	Rural Single	$3,598	0.009	0.1254	$7,808,768	$507,553									
Altona Road Sealed	74,613	0.075	Local	Rural Single	$9,993	0.009	0.1254	$7,808,768	$507,553									
Crescent Street	12,288	0.012	Local	Rural Single	$1,646	0.009	0.1254	$7,808,768	$507,553									
Tweed Coast Road (existing 2-lanes)	74,144	0.074	Arterial	Rural Single	$9,930	0.009	0.1254	$7,808,768	$507,553									
M1 off-ramp / on-ramp and M1	51,270	0.051	Freeway	Rural Single	$6,866	0.009	0.1254	$7,808,768	$507,553	189,173	0.189	Freeway	Rural Single	$25,335	0.009	0.1254	$7,808,768	$507,553
Tweed Valley Way										15,071	0.015	Arterial	Rural Single	$2,018	0.009	0.1254	$7,808,768	$507,553
Total	**239,182**	**0.239**			**$32,033**					**204,244**	**0.204**			**$27,354**				

Tweed Coast Road Upgrade Crash Cost

Link Name	Base Case								
	VKT per year	MVKT per year	Road Type	Road Width Description	Crash Cost ($/year)	Fatal crash rate	Injury Crash Rate	crash cost ($/mvkt)	
								Rural Fatal	Rural Injury
Tweed Coast Road (proposed 4-lanes)	74,144	0.074	Arterial	Urban Divided	**$16,061**	0.0044	0.2513	$9,242,523	$700,151

Haulage Route via Tweed Coast Road	M1 North		M1 South		Annual VKT
	To	From	To	From	
Altona Road Unsealed	516	516	516	516	26,867
Altona Road Sealed	1,433	1,433	1,433	1,433	74,613
Crescent Street	236	236	236	236	12,288
Tweed Coast Road	1,424	1,424	1,424	1,424	74,144
M1	1,026	671	3,491	3,653	51,270
Total	4,635	4,280	7,100	7,262	239,182
Trip Distribution	95%	95%	5%	5%	
Annual TSP Volumes	24,732	24,732	1,302	1,302	
VKT	114,633	105,853	9,242	9,453	

Haulage Route via Tweed Valley Way	M1 North		M1 South		Annual VKT
	To	From	To	From	
Tweed Valley Way	567	0	0	805	15,071
M1 on/off ramp two way	4,128	3,425	1,037	785	189,173
Total	4,695	3,425	1,037	1,590	204,244
Trip Distribution	95%	95%	5%	5%	
Annual TSP Volumes	24,732	24,732	1,302	1,302	
VKT	116,117	84,708	1,350	2,070	

6.1.5 Environmental Benefits

The proposed haulage route via Tweed Valley Way has many environmental benefits associated with removal of 52,068 annual truck volumes from Tweed Coast Road.

The Environmental Benefits cover four environmental impact categories as follows:

- Air pollution;
- GHG emissions;
- Noise; and
- Water pollution.

The parameter values for environmental externalities were extracted from the *TfNSW Economic Parameters Values – Jan 2020* Table 39 and Table 40 for freight vehicles in urban and rural areas respectively.

Trucks activity levels have been characterized in terms of traffic volumes in vehicle-kilometers travelled (VKT). Annual VKT along Tweed Coast Road has been defined as the number of kilometers travelled by all Hanson Trucks during a year and it is expressed as VKT = number of vehicles x distance travelled. A comparison between the base case and the project case TSP haulage route via Tweed Coast Road and Tweed Valley Way was previously shown in Table 1.1 and Figure 1.3.

Table 6.6 below shows a summary of relevant data used for the assessment:

Table 6.6 Parameters for Environmental Benefits

Direction	North		South		Total
	From	To	From	To	
Distribution	95%	95%	5%	5%	N/A
Annual TSP Volumes	24,732	24,732	1,302	1,302	52,068
Base Case Distance (Urban TCR only) (km)	1.424	1.424	1.424	1.424	N/A
Base Case VKT (Urban TCR only)	35,219	35,219	1,854	1,854	74,144
Base Case Distance Rural (km)	3.334	2.979	5.799	5.961	18.073
Base Case VKT Rural	82,457	73,677	7,549	7,759	171,442
Project Case Distance Rural (km)	5.469	4.199	1.811	2.364	13.843
Project Case VKT Rural	135,260	103,850	2,357	3,077	244,545

In summary 74,144 VKT will be removed from Tweed Coast Road resulting in significant reduction in the environmental costs along Tweed Coast Road. Table 6.7 below shows a summary of the environmental benefits over a 30-year evaluation period. Appendix C details the Environmental Cost Benefits.

Table 6.7 Environmental Benefits

Roads	Base Case VKT	Project Case VKT	Change in VKT	Base Case Environmental Cost	Project Case Environmental Cost	Environmental Cost Benefit
Urban*	74,144	0	-74,144	$3,299,898	$1,492,946	$1,806,952
Rural	171,442	244,545	73,103			

**Tweed Coast Road only*

6.1.6 Project Benefits Summary

Table 6.8 below shows a summary of project benefits over a 30-year evaluation period.

Table 6.8 Project Benefits Summary

Project Benefits	Total (Undiscounted, 2021 prices)
Travel Time Saving along Tweed Coast Road	$4,289,900
Tweed Coast Rd Maintenance Cost Reduction	$1,001,193
Safety Benefits	$269,120
Environmental Benefits	$1,806,952
Total Benefit	**$7,367,165**

7. Economic Appraisal

7.1 Background

An economic assessment was undertaken for the proposed haulage route via Tweed Valley Way including the proposed new roundabout at the Tweed Valley Way Australian Bay Lobster Producers access intersection.

The Cost-Benefit Analysis (CBA) measures the incremental direct benefits associated with the proposed infrastructure upgrades required to obtain access via Tweed Valley Way and removal of Hanson trucks from Tweed Coast Road against a Base Case of future truck movements remaining via the existing Tweed Coast Road haulage route. The proposed roundabout upgrade project will be considered economically viable if the ratio of the overall benefits along Tweed Coast Road is demonstrated to exceed the estimated costs associated with additional delay along Tweed Coast Road and roundabout maintenance costs.

7.2 Reference Documents

The cost-benefit analysis generally complies with Australian Transport Assessment and Planning Guidelines (ATAP) guidelines, supplemented with data sourced from other documents. The following sources and guidelines were referenced to develop the CBA:

- Transport for NSW *"Cost-Benefit Analysis Guide"* (2019);
- Transport for NSW *"Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives" (2018)*
- Transport for NSW *"Economic Parameter Values"* (2020);
- Australian Transport Assessment and Planning Guidelines (ATAP), Transport and Infrastructure Council (2016), Commonwealth Department of Infrastructure and Regional Development;
- Building Queensland *"Business Case Development Framework – Cost-Benefit Analysis Guide"* (2016);
- Transport and Main Roads *"Cost-benefit Analysis Manual – Road Projects"* (2011) and *Project Cost Estimating Manual 7th (PCEM); and*
- Austroads.

7.3 Methodology

This adopted CBA process is summarised below:

- Identification of the costs and benefits that are expected for the Project Case (haulage route via Tweed Valley Way) compared with the 'Base Case' (haulage route via Tweed Coast Rd);
- Calculation/identification of the key values and parameters required for the CBA (e.g. discount rate, CPI, AWE, TTC);
- Forecast of future travel demand;
- Traffic modelling of the Base Case and Project Case;
- Estimate capital and ongoing costs over the 30-year evaluation horizon;
- Estimate the following benefits:

  - Travel Time Benefits and Costs using SIDRA transport modelling outputs;
  - Estimate reduced maintenance costs;
  - Estimate accidents reductions using accident rate history and VKT;
  - Estimate environmental benefits;
- Discount future benefits and costs;
- Estimate of the NPV and BCR; and
- CBA Sensitivity Testing based on different inputs (i.e. discount rate, increase/decrease of capital costs/benefits).

7.4 Selection of Decision Criteria

Two key decision criteria were estimated as part of this economic appraisal as follows:

- **Net Present Value (NPV)**

The Net Present Value (NPV) - the difference between present value of the benefits and the present value of operating costs taking into account the timing of benefits and costs.

Present Value (PV) has been calculated utilising the discount rate of 7% per annum. The above reflects the notion that future benefits and costs have less value compared to current benefits and costs. A positive Net Present Value means that the project is viable, with the opposite being true for a negative NPV.

- **Benefit-Cost Ratio (BCR):**

The Benefit-Cost Ratio (BCR) measures the return received per dollar of costs and is defined as the present value of benefits divided by the present value of total costs.

A project with BCR greater than one is considered economically viable, whereas a project with a BCR less than one indicates that a project is not viable.

7.5 Key Parameters and Assumptions

Key parameters and assumptions used in the analysis are discussed as follows:

- **Discount Rate:**

In line with Transport for NSW “Cost-Benefit Analysis Guide” (2019), 7% per annum real discount rate was adopted in the economic assessment to calculate present values. As part of this study, sensitivity tests were undertaken at the reduced discount rate (3%) and an increased discount rate (10%).

- **Evaluation Horizon:**

The likely opening year for the Project has been identified as 2022. Tweed Valley Way Roundabout built with concrete pavement has a design life of 30 years. Consequently, an evaluation horizon of 30 years from the project opening year has been adopted for this study.

Travel Demands between 2022, 2032 and 2042 have been estimated based on the Base Case and Project Case Travel Demands for 2022, 2032 and 2042 assessment years. The interpolation of benefits is also based on the demand forecast profile for the key assessment years.

- **Residual Value**

The economic life of the proposed infrastructure asset, which includes system infrastructure such as underground services, stormwater drainage and road pavement, involves a number of factors due to the design standards and construction materials incorporated. For the concrete pavement proposed, a design life of 30 years for new pavements has been adopted for the analysis.

As the project is not expected to have benefits beyond the 30-year evaluation period, a residual value has been assumed to be zero (0).

- **Base Case and Project Case**

The Base Case is defined as Tweed Sand Plant haulage route via Tweed Coast Road including additional TSP truck volumes associated with the TSP expansion.

The Project Case is defined as Tweed Sand Plant haulage route via Tweed Valley Way including Tweed Valley Way / Australian Bay Lobster Producers intersection upgrade to a roundabout. Traffic flows include all TSP truck volumes associated with the TSP future operations.

- **Key Input Values and Parameters**

The majority of key input values were adopted from the ATAP guidelines and indexed to the current year. When economic parameters were not available within ATAP or TfNSW guidelines, they were sourced from Austroads or TMR. Key input values and parameters used in the analysis are summarised in Table 7.1.

Table 7.1 Key Inputs and Reference Sources

Key Input	Value / Factor	Source
Net Present Value Discount Rate	7%	TfNSW Economic Parameter Values
Vehicle-hour Travelled	VHT	SIDRA modelling outputs
Forecast Traffic Volumes	vph	Refer Section 4
Peak hour to peak hour annual Expansion Factor	260.9	TMR Cost Benefit Analysis Manual
Value of Travel Time (Light)	$31.90	Calculated for peak hour only based on the TfNSW Economic Parameter Values
Value of Travel Time (Heavy)	$61.47	Calculated for peak hour only based on the TfNSW Economic Parameter Values
Vehicle Composition Percentage in peak hours: Private Business Light Commercial Vehicle Heavy Vehicle	 71.0% 9.0% 16.0% 4%	TfNSW Economic Parameter Values

Traffic modelling was undertaken using SIDRA traffic modelling software. It is important to note that SIDRA models produce estimates of travel for an AM and PM peak periods only. As per TfNSW *"Cost-Benefit Analysis Guide"* (2019), 'expansion' factors were used to estimate the impacts for AM and PM Peak hours, and 'annualisation' factors to estimate the impact for the entire year.

7.6 Economic Appraisal

Table 7.2 below summarises the results of the economic evaluation for the Project Case.

Table 7.2 Costs and Benefits Summary

Economic Results	Total (Undiscounted, 2021 prices)	Present Value (7% discount)
Costs		
Travel Time Cost along Tweed Valley Way	$1,107,887	$453,685
Proposed Roundabout Maintenance Cost	$1,440,000	$595,634
Total Cost	**$2,547,887**	**$1,049,319**
Benefits		
Travel Time Saving along Tweed Coast Road	$4,289,900	$1,269,772
Tweed Coast Rd Maintenance Cost Reduction	$1,001,193	$474,300
Net Safety Benefit	$269,120	$94,197
Net Environmental Benefit	$1,806,952	$747,418
Total Benefit	**$7,367,165**	**$2,585,686**

7.7 Benefit Cost Ratio

Table 7.3 summarises detailed NPV and BCR calculations for the project.

Table 7.3 BCR Calculations

Year			Cost			Benefits					NET BENEFIT (COST)
			Travel Time Cost along Tweed Valley Way	Proposed Roundabout Maintenance Cost	Total Cost	Travel Time Saving along Tweed Coast Road	Tweed Coast Rd Maintenance Cost Reduction	Safety Benefits	Environmental Benefits	Total Benefit	
2022	Base Year	0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
2023	Year 1	1	$35,500	$48,000	$83,500	$52,368	$12,197	$4,679	$60,232	$129,476	**$45,975**
2024	Year 2	2	$35,630	$48,000	$83,630	$49,871	$12,197	$4,679	$60,232	$126,979	**$43,349**
2025	Year 3	3	$35,760	$48,000	$83,760	$47,374	$12,197	$4,679	$60,232	$124,482	**$40,722**
2026	Year 4	4	$35,889	$48,000	$83,889	$44,878	$12,197	$4,679	$60,232	$121,985	**$38,096**
2027	Year 5	5	$36,019	$48,000	$84,019	$42,381	$12,197	$4,679	$60,232	$119,488	**$35,470**
2028	Year 6	6	$36,148	$48,000	$84,148	$39,884	$12,197	$4,679	$60,232	$116,991	**$32,843**
2029	Year 7	7	$36,278	$48,000	$84,278	$37,387	$12,197	$4,679	$60,232	$114,495	**$30,217**
2030	Year 8	8	$36,407	$48,000	$84,407	$34,890	$12,197	$4,679	$60,232	$111,998	**$27,591**
2031	Year 9	9	$36,537	$48,000	$84,537	$32,393	$12,197	$4,679	$60,232	$109,501	**$24,964**
2032	Year 10	10	$36,537	$48,000	$84,537	$32,393	$647,488	$10,810	$60,232	$750,923	**$666,386**
2033	Year 11	11	$36,674	$48,000	$84,674	$59,295	$12,197	$10,810	$60,232	$142,534	**$57,860**
2034	Year 12	12	$36,811	$48,000	$84,811	$86,197	$12,197	$10,810	$60,232	$169,435	**$84,624**
2035	Year 13	13	$36,948	$48,000	$84,948	$113,099	$12,197	$10,810	$60,232	$196,337	**$111,389**
2036	Year 14	14	$37,085	$48,000	$85,085	$140,000	$12,197	$10,810	$60,232	$223,239	**$138,154**
2037	Year 15	15	$37,222	$48,000	$85,222	$166,902	$12,197	$10,810	$60,232	$250,141	**$164,919**
2038	Year 16	16	$37,359	$48,000	$85,359	$193,804	$12,197	$10,810	$60,232	$277,042	**$191,683**
2039	Year 17	17	$37,496	$48,000	$85,496	$220,706	$12,197	$10,810	$60,232	$303,944	**$218,448**
2040	Year 18	18	$37,633	$48,000	$85,633	$247,607	$12,197	$10,810	$60,232	$330,846	**$245,213**
2041	Year 19	19	$37,770	$48,000	$85,770	$274,509	$12,197	$10,810	$60,232	$357,748	**$271,977**
2042	Year 20	20	$37,907	$48,000	$85,907	$301,411	$12,197	$10,810	$60,232	$384,649	**$298,742**
2043	Year 21	21	$37,222	$48,000	$85,222	$166,902	$12,197	$10,810	$60,232	$250,141	**$164,919**
2044	Year 22	22	$37,359	$48,000	$85,359	$193,804	$12,197	$10,810	$60,232	$277,042	**$191,683**
2045	Year 23	23	$37,496	$48,000	$85,496	$220,706	$12,197	$10,810	$60,232	$303,944	**$218,448**
2046	Year 24	24	$37,633	$48,000	$85,633	$247,607	$12,197	$10,810	$60,232	$330,846	**$245,213**
2047	Year 25	25	$37,770	$48,000	$85,770	$274,509	$12,197	$10,810	$60,232	$357,748	**$271,977**
2048	Year 26	26	$37,633	$48,000	$85,633	$247,607	$12,197	$10,810	$60,232	$330,846	**$245,213**
2049	Year 27	27	$37,496	$48,000	$85,496	$220,706	$12,197	$10,810	$60,232	$303,944	**$218,448**
2050	Year 28	28	$37,359	$48,000	$85,359	$193,804	$12,197	$10,810	$60,232	$277,042	**$191,683**
2051	Year 29	29	$37,222	$48,000	$85,222	$166,902	$12,197	$10,810	$60,232	$250,141	**$164,919**
2052	Year 30	30	$37,085	$48,000	$85,085	$140,000	$12,197	$10,810	$60,232	$223,239	**$138,154**
Total			**$1,107,887**	**$1,440,000**	**$2,547,887**	**$4,289,900**	**$1,001,193**	**$269,120**	**$1,806,952**	**$7,367,165**	**$4,819,278**
Proportion of total benefits						**58%**	**14%**	**4%**	**25%**	**100%**	

Table 7.4 Economic Appraisal Results (at 7% real discount rate)

Indicator	Project Case
Present Value Benefits	$2,585,686
Present Value Costs	$1,049,319
Net Present Value	**$1,536,367**
Benefit Cost Ratio (BCR)	**2.46**

The project is economically justifiable with a benefit cost ratio (BCR) of 2.46 and a net present value (NPV) of **$1,536,367.**

7.8 Sensitivity Analysis

It is important to note that all benefits and costs that are included in this economic appraisal are based on forecasts, which contain an element of uncertainty and therefore risk. For robust assessment, the CBA includes Sensitivity Testing undertaken based on various changes in the underlying assumptions. Table 7.5 below shows a summary of adopted sensitivity testing data variations.

Table 7.5 CBA Sensitivity Tests

Sensitivity Test	Discount rate	Capital Costs	Benefit Costs
Test 1	3%	N/A	N/A
Test 2	10%	N/A	N/A
Test 3	7%	+20%	-20%
Test 4	7%	-20%	+20%

Results of the Sensitivity Testing shows positive BCR under all scenarios tested as shown in Table 7.6 below.

Table 7.6 CBA Sensitivity Tests Results

	Test 1	Test 2	Test 3	Test 4
Sensitivity Testing	**@ 3%**	**@ 10%**	**@ 7%**	**@ 7%**
	N/A	N/A	PV Benefits -20% PV Cost +20%	PV Benefits +20% PV Cost -20%
Present Value Benefits	$4,500,563	$1,661,527	$2,068,549	$3,102,824
Present Value Costs	$1,661,527	$795,826	$1,259,183	$839,455
Net Present Value	$2,839,036	$1,033,039	$809,366	$2,263,368
Benefit Cost Ratio (BCR)	2.71	2.09	1.64	3.70

8. Conclusions

This report presents the economic evaluation using a cost benefit analysis framework for the proposed haulage route via Tweed Valley Way including the Tweed Valley Way / Australian Bay Lobster Producers (ABLP) intersection upgrade to a roundabout (Project Case). The Base Case haulage route is via Tweed Coast Road. Both options include all traffic volumes associated with the proposed expansion of the Tweed Sand Plant (TSP) enabling an increase in sand production rate from the current limit of 500,000 tonnes per annum (tpa) to 950,000 tpa.

The Tweed Shire Council strategic modelling shows that traffic along Tweed Coast Road is expected to increase significantly as a result of residential and business growth in the area. Local congestion and delays can be expected into the future as the volume of traffic increases.

Removing all TSP haulage trucks from Tweed Coast Road will generate substantial benefits to road users, particularly through savings in travel time, reduction in crash costs and environmental benefits. There is a further benefit to Tweed Shire Council via a reduction in Tweed Coast Road maintenance costs. As part of this economic analysis, potential benefits were quantitatively evaluated against a Base Case. Benefits quantified include:

- Travel Time Saving along Tweed Coast Road;
- Safety Benefits;
- Environmental Benefits; and
- Tweed Coast Road Maintenance Cost Reduction.

The summary of project benefits and costs are presented in the table below.

Economic Results	Total (Undiscounted, 2021 prices)	Present Value (7% discount)
Costs		
Travel Time Cost along Tweed Valley Way	$1,107,887	$453,685
Proposed Roundabout Maintenance Cost	$1,440,000	$595,634
Total Cost	**$2,547,887**	**$1,049,319**
Benefits		
Travel Time Saving along Tweed Coast Road	$4,289,900	$1,269,772
Tweed Coast Road Maintenance Cost Reduction	$1,001,193	$474,300
Net Safety Benefit	$269,120	$94,197
Net Environmental Benefit	$1,806,952	$747,418
Total Benefit	**$7,367,165**	**$2,585,686**

In summary, the project is economically justifiable with a benefit cost ratio (BCR) of 2.46 and a net present value (NPV) of **$1,536,367**. This Economic Evaluation assessment has demonstrated that the proposed Tweed Sand Plant haulage route via Tweed Valley Way including upgrade of the Tweed Valley Way / ABLP intersection does provide an overall economic benefit to the local community outweighing Local and State Government costs.

9. References

Transport for NSW Economic Parameter Values. September 2019

Australian Transport Assessment and Planning Guidelines

Building Queensland "Business Case Development Framework"

Transport for NSW *"Principles and Guidelines for Economic Appraisal of Transport Investment and Initiatives"* June 2018

Austroads *"Guide to Road Design - Part 4A"*

Austroads *"Guide to Road Design - Part 3"*

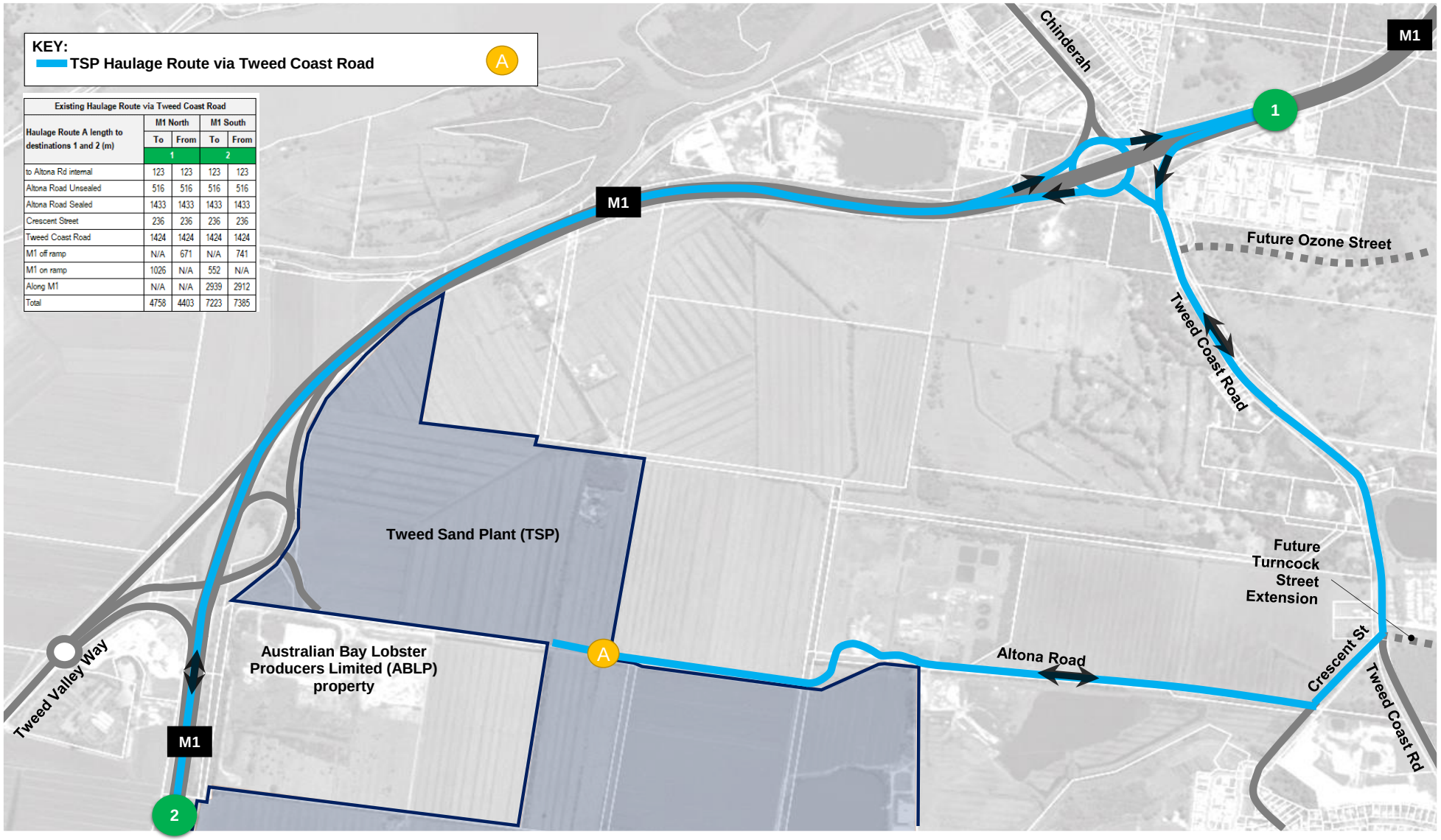
Tweed Shire Council *Revenue Policy and Statement 2021/2022*

Tweed Shire Council *Tweed Road Development Strategy*

TMR "Cost-benefit Analysis Manual – Road Projects", 2011

TMR "Project Cost Estimating Manual" Seventh Edition, July 2017

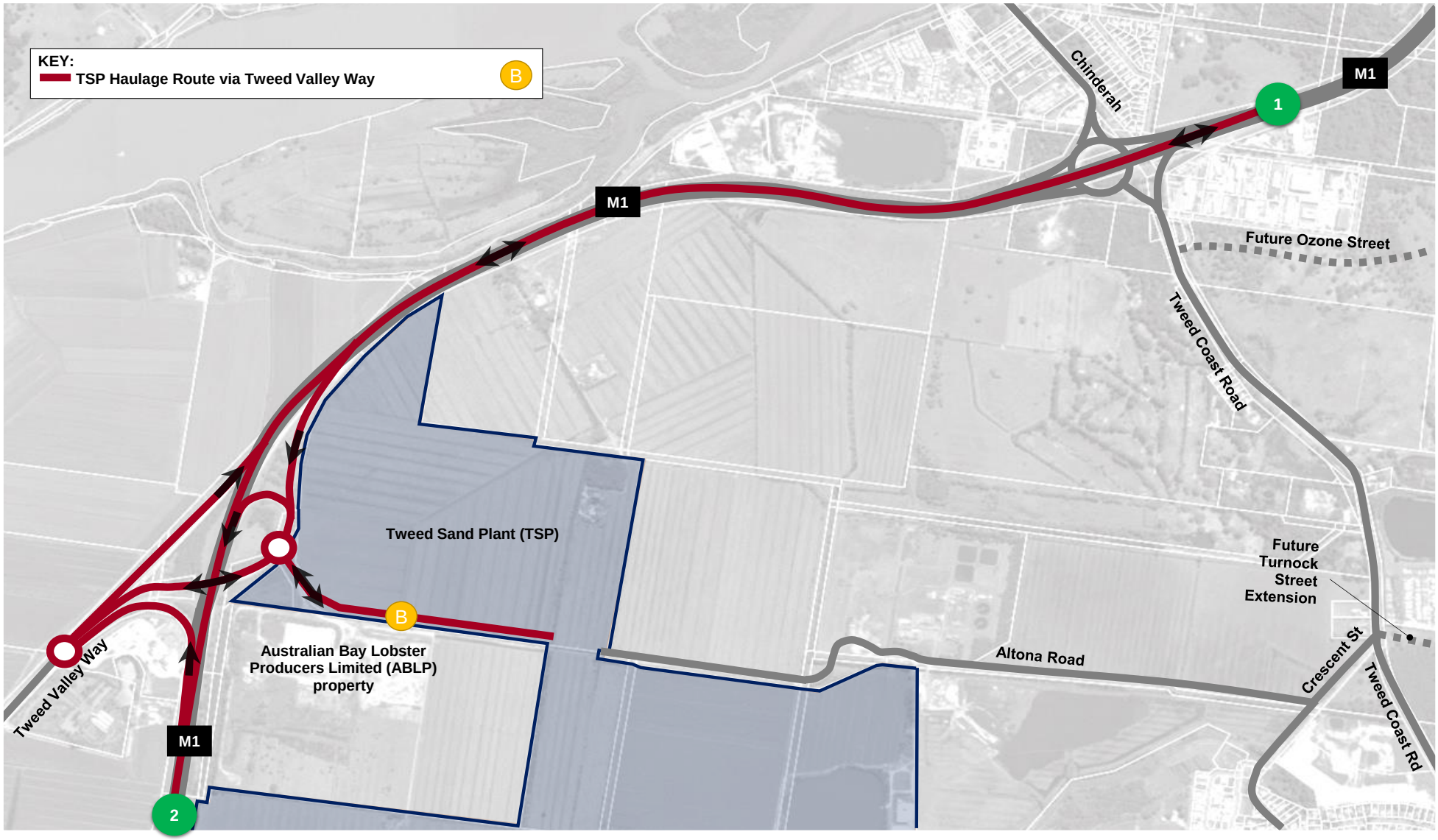
Appendix A – Traffic Flow Diagrams



BE190043_Tweed Sand Plant

Figure 1 - Haulage Route via Tweed Coast Road (Base Case)

BURCHILLS ENGINEERING SOLUTIONS



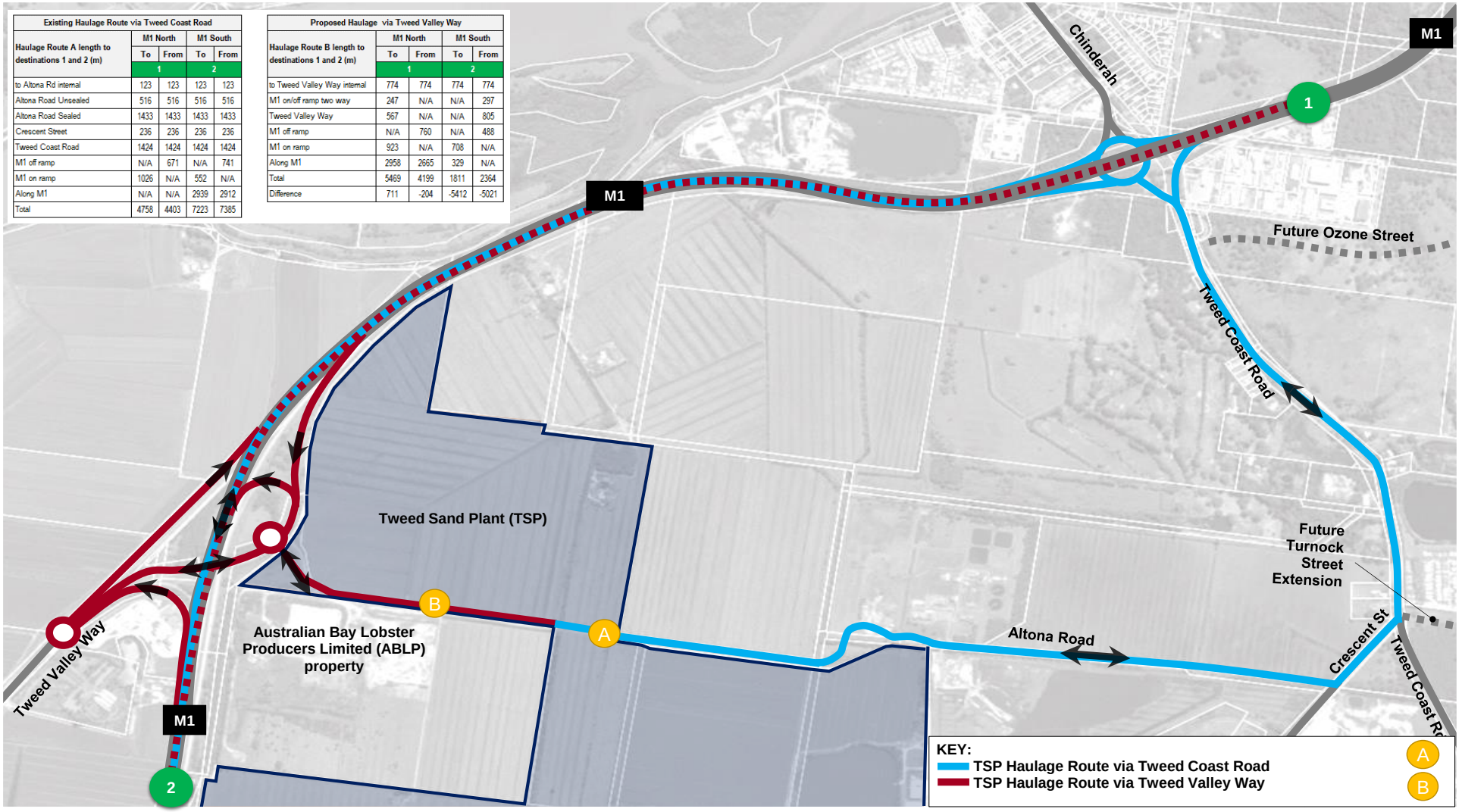
BE190043_Tweed Sand Plant

Figure 2 - Haulage Route via Tweed Valley Way (Project Case)

BURCHILLS ENGINEERING SOLUTIONS

Existing Haulage Route via Tweed Coast Road				
Haulage Route A length to destinations 1 and 2 (m)	M1 North		M1 South	
	To	From	To	From
	1		2	
to Altona Rd internal	123	123	123	123
Altona Road Unsealed	516	516	516	516
Altona Road Sealed	1433	1433	1433	1433
Crescent Street	236	236	236	236
Tweed Coast Road	1424	1424	1424	1424
M1 off ramp	N/A	671	N/A	741
M1 on ramp	1026	N/A	552	N/A
Along M1	N/A	N/A	2939	2912
Total	4758	4403	7223	7385

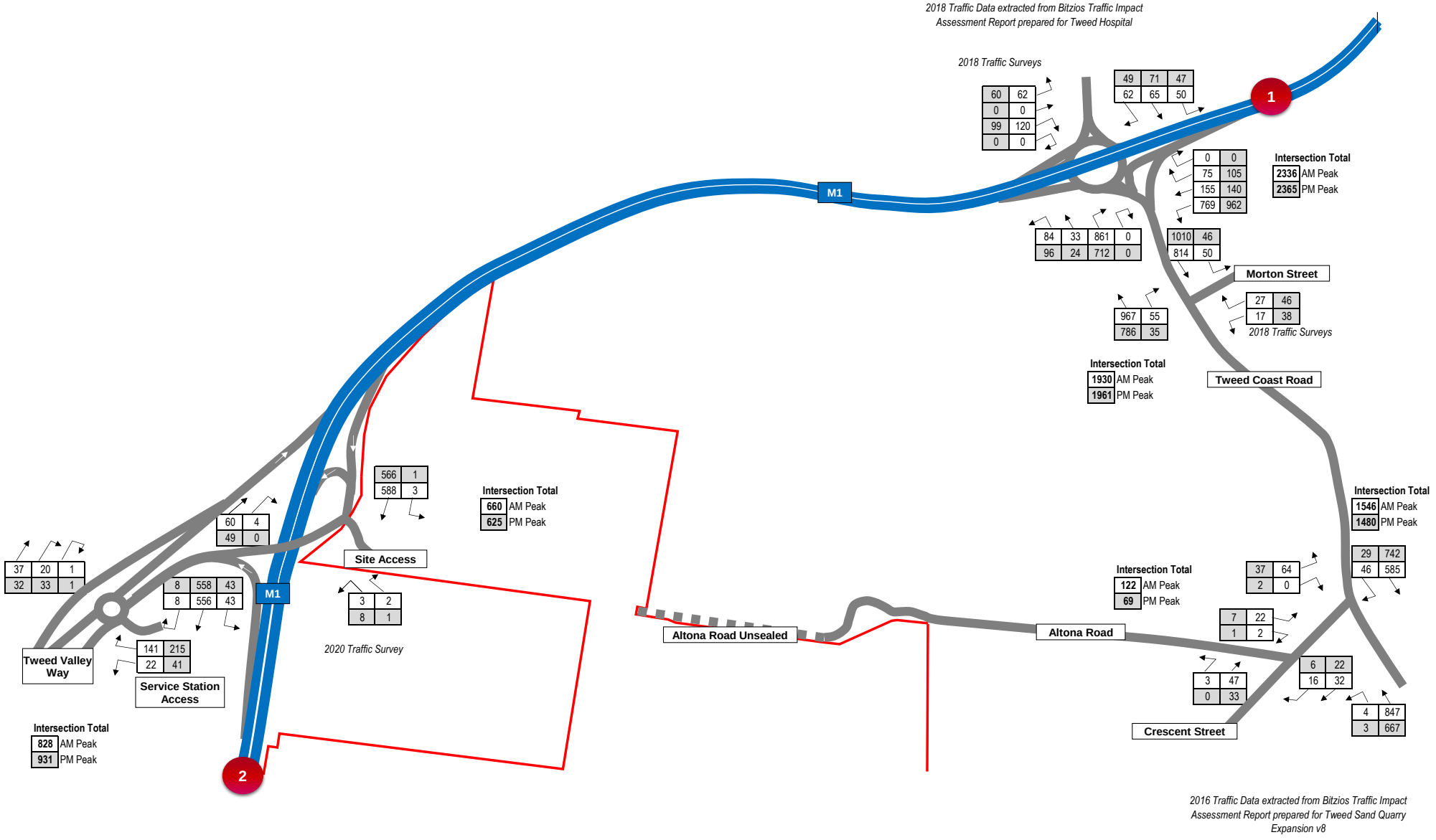
Proposed Haulage via Tweed Valley Way				
Haulage Route B length to destinations 1 and 2 (m)	M1 North		M1 South	
	To	From	To	From
	1		2	
to Tweed Valley Way internal	774	774	774	774
M1 on/off ramp two way	247	N/A	N/A	297
Tweed Valley Way	567	N/A	N/A	805
M1 off ramp	N/A	760	N/A	488
M1 on ramp	923	N/A	708	N/A
Along M1	2958	2665	329	N/A
Total	5469	4199	1811	2364
Difference	711	-204	-5412	-5021



BE190043_Tweed Sand Plant

Figure 3 - Haulage Route Comparison (Base Case vs Project Case)

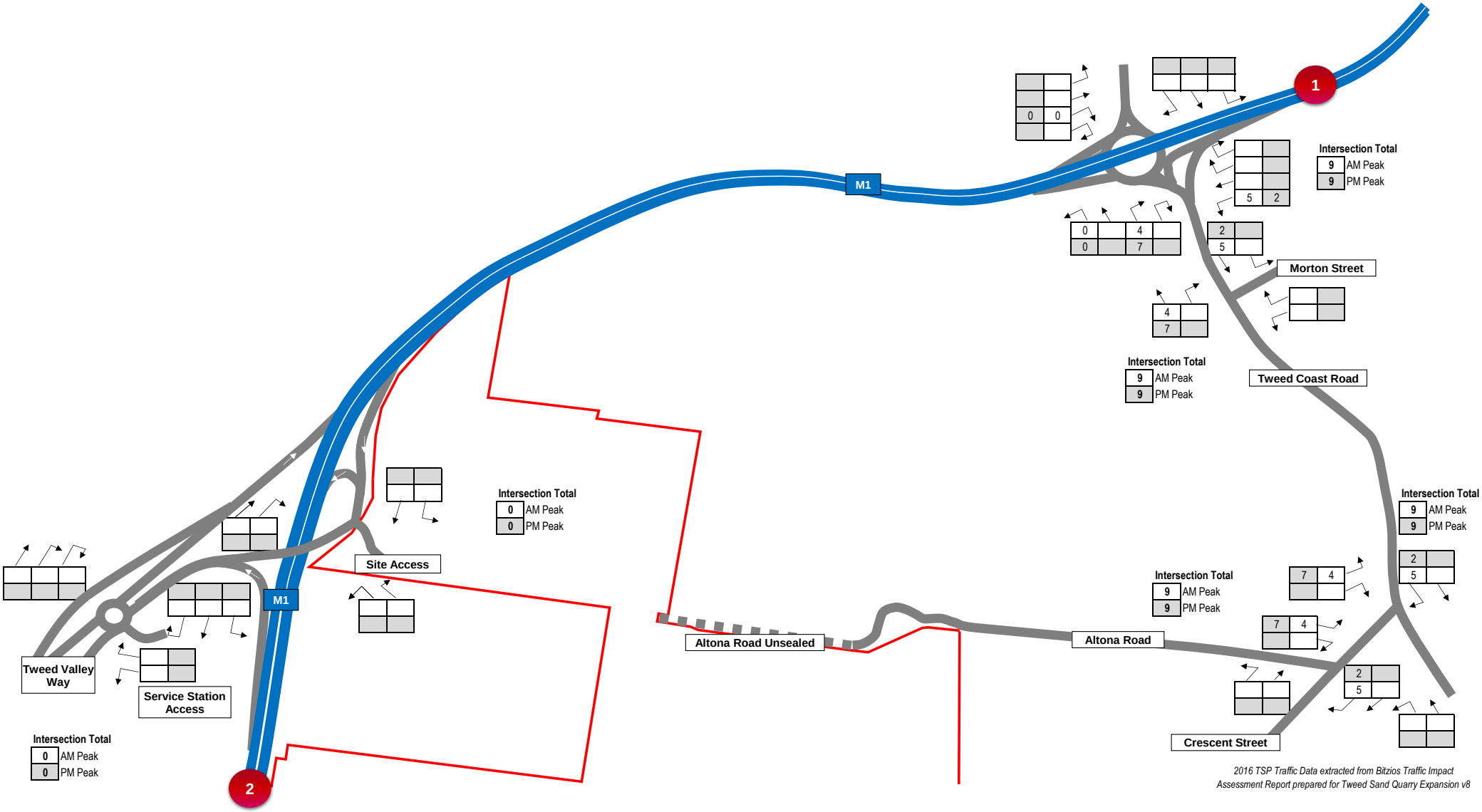
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 4 - Traffic Survey AM and PM Peak Summary

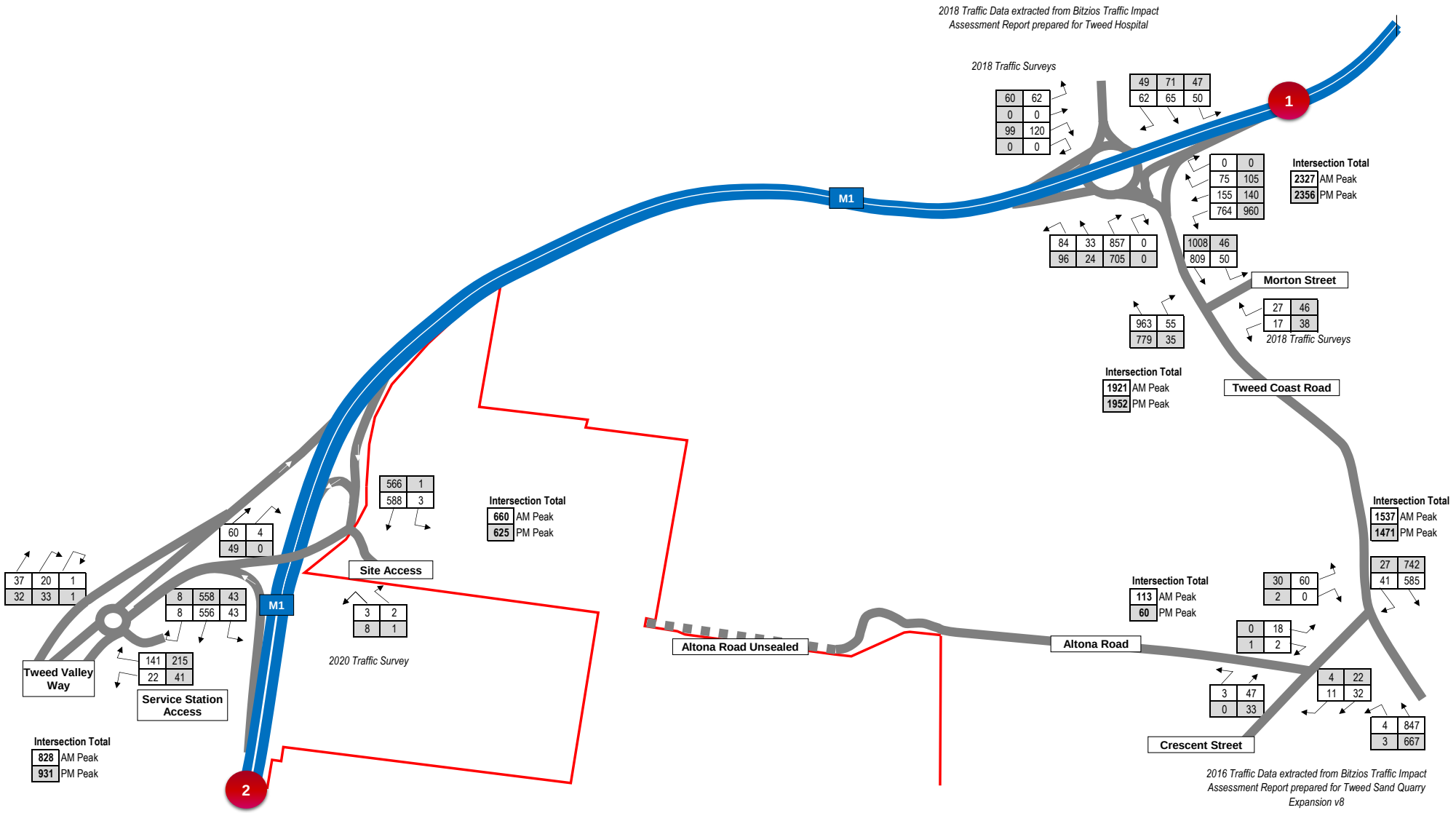
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 5 - 2016 Peak Hour Tweed Sand Plan Truck Movements

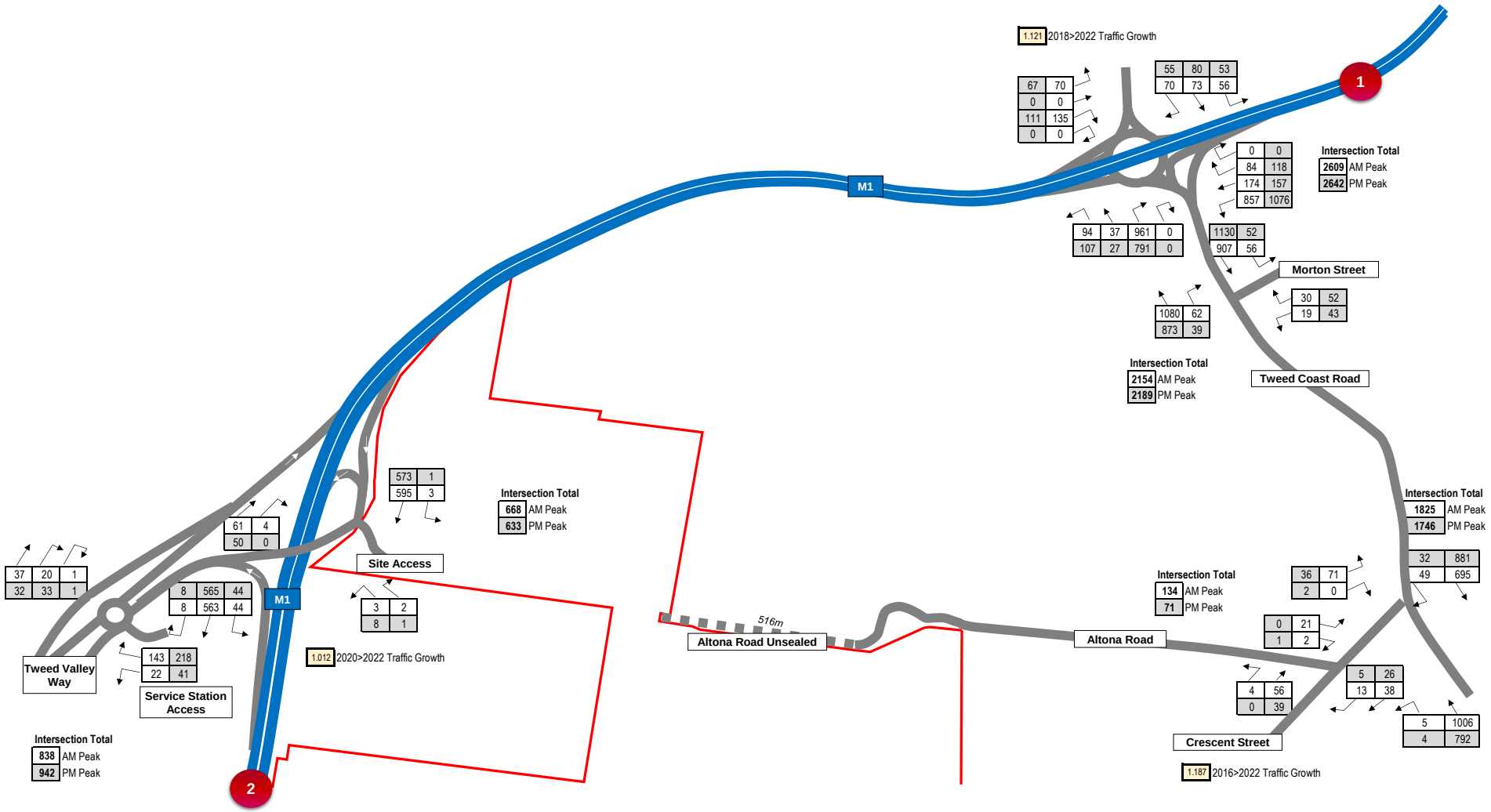
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 6 - Traffic Survey without TSP Truck Movements (AM and PM Peak Summary)

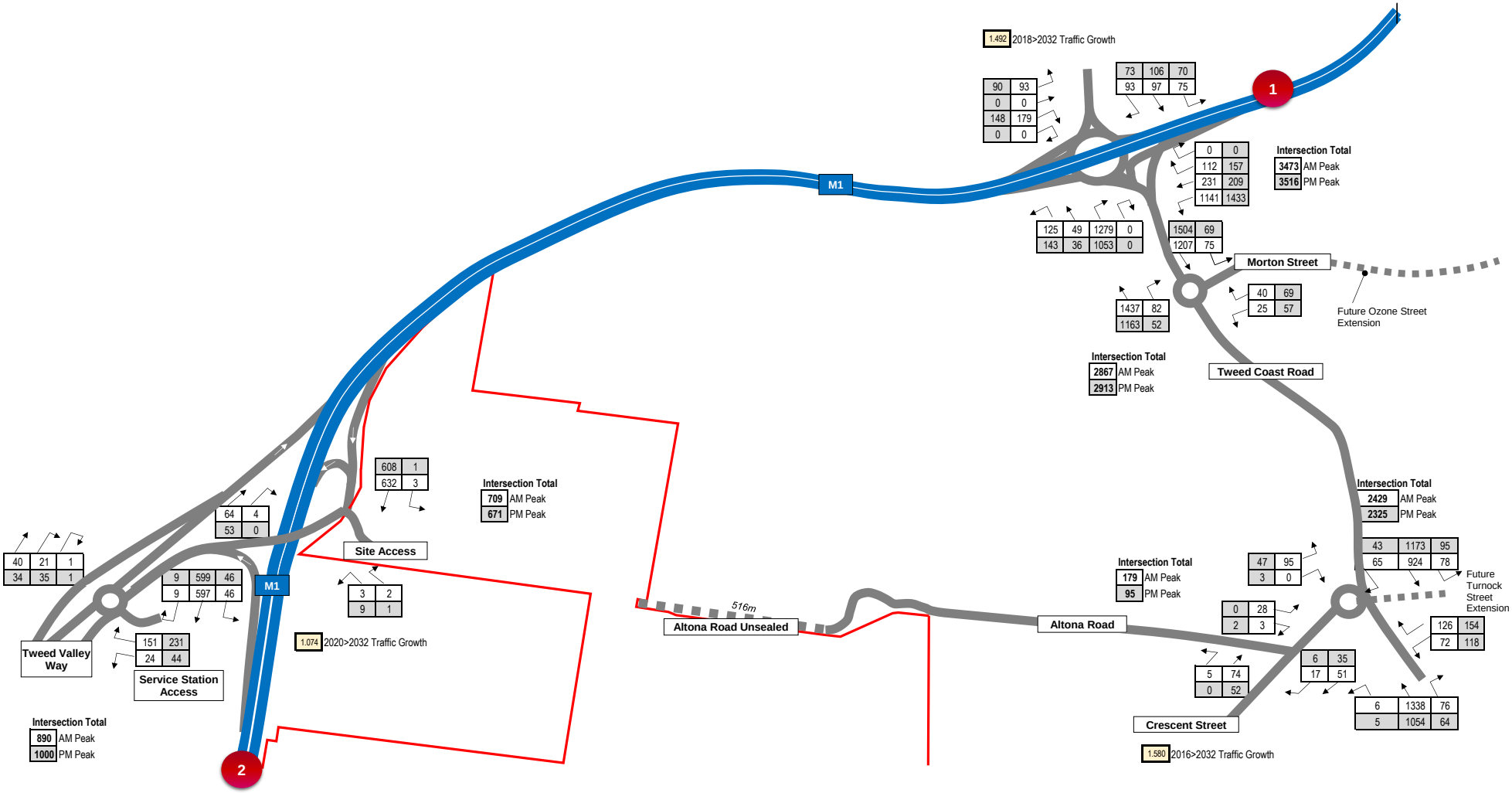
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 7 - 2022 Base Traffic Flows (without TSP Trucks)

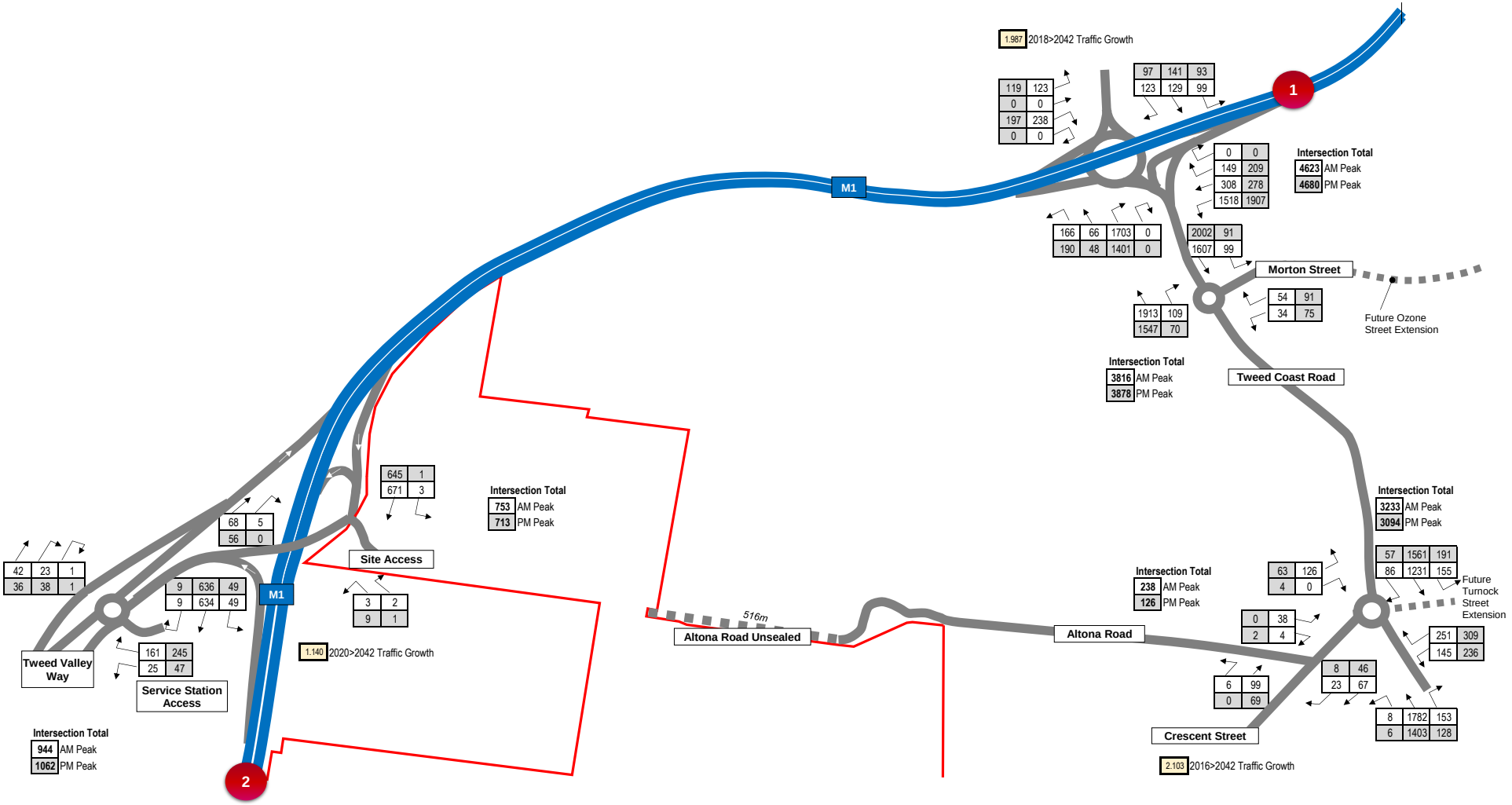
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 8 - 2032 Base Traffic Flows (without TSP Trucks)

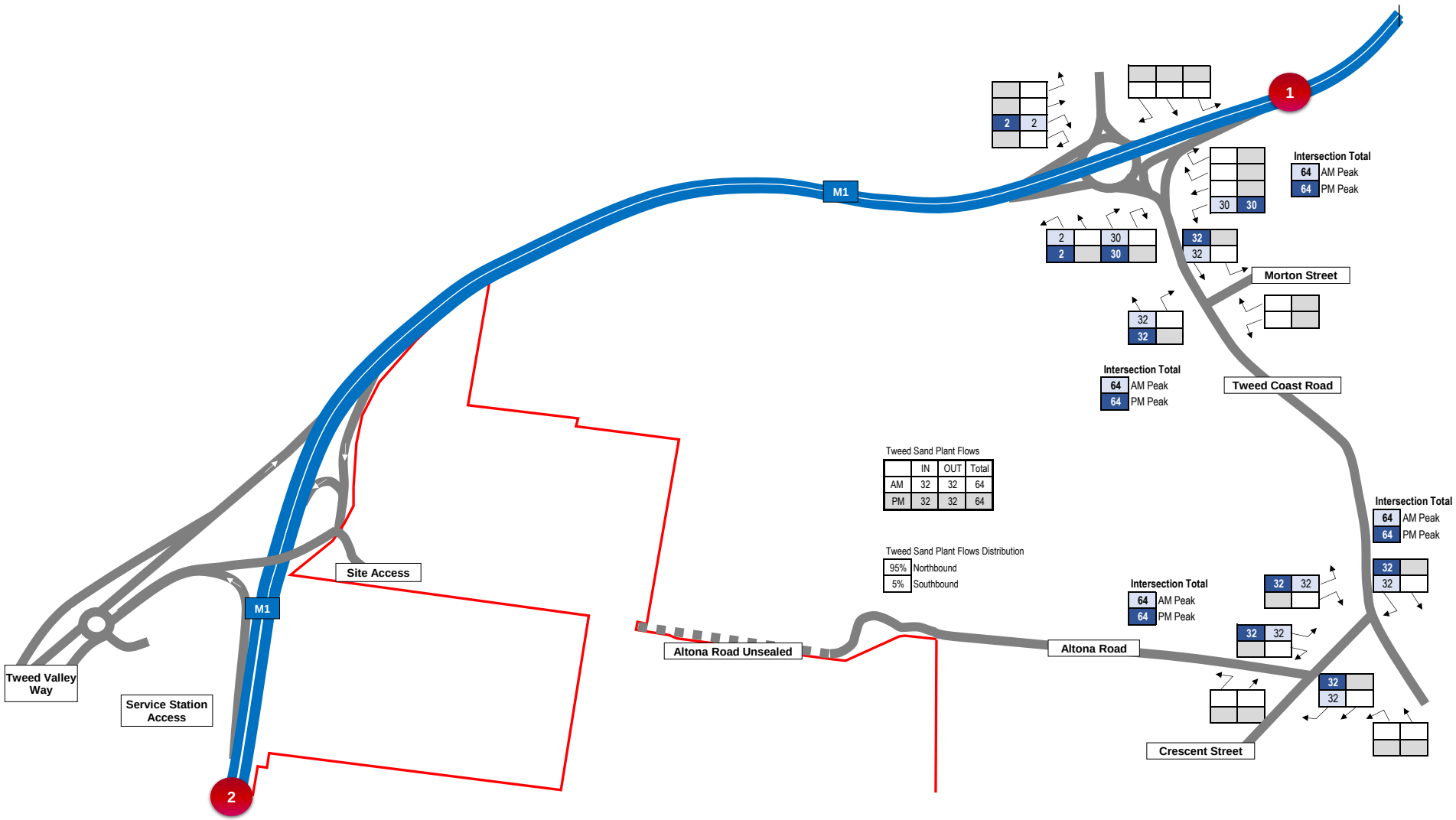
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 9 - 2032 Base Traffic Flows (without TSP Trucks)

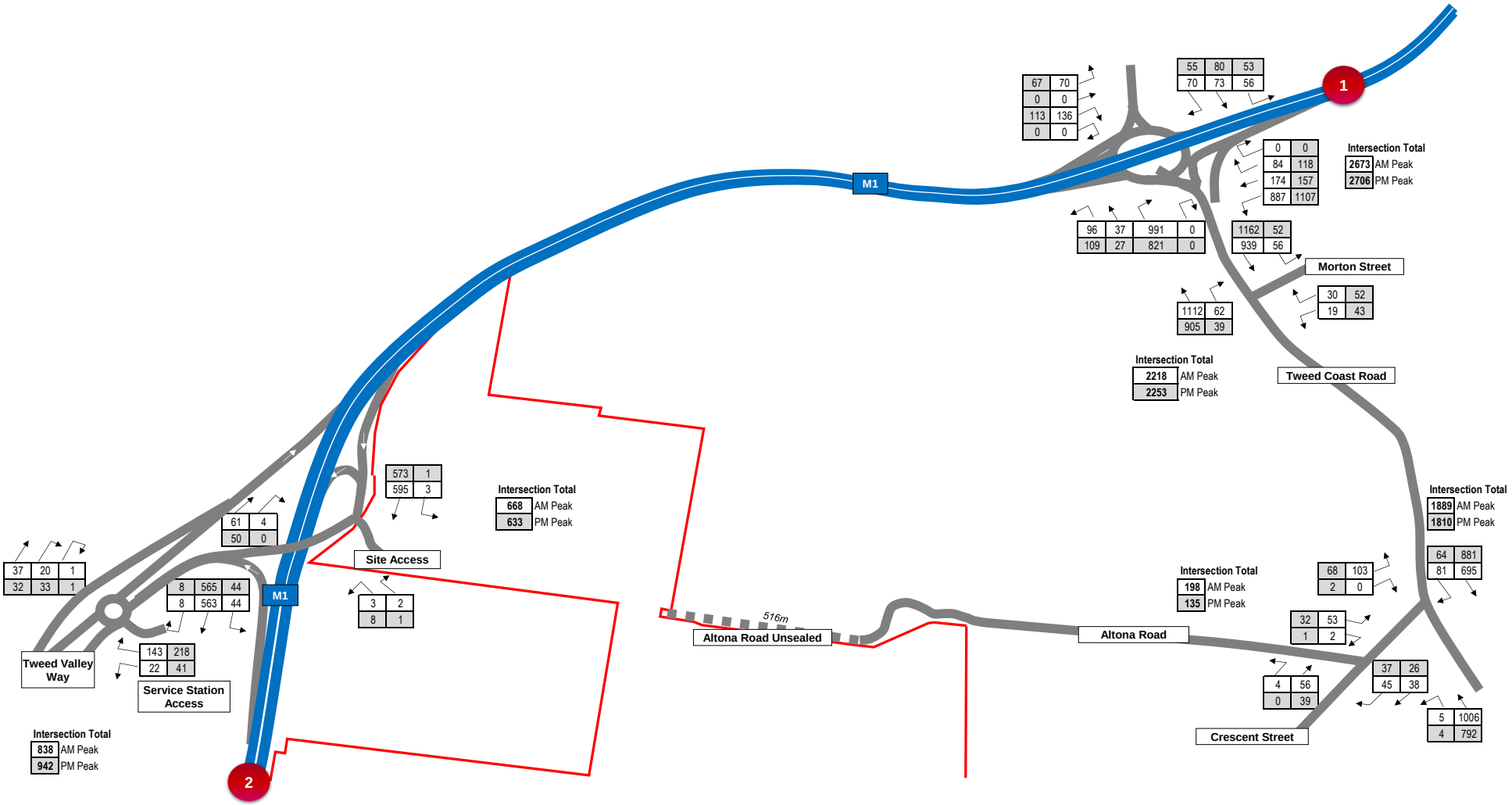
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 10 - TSP Trip Distribution via Tweed Coast Road (Base Case Haulage Route)

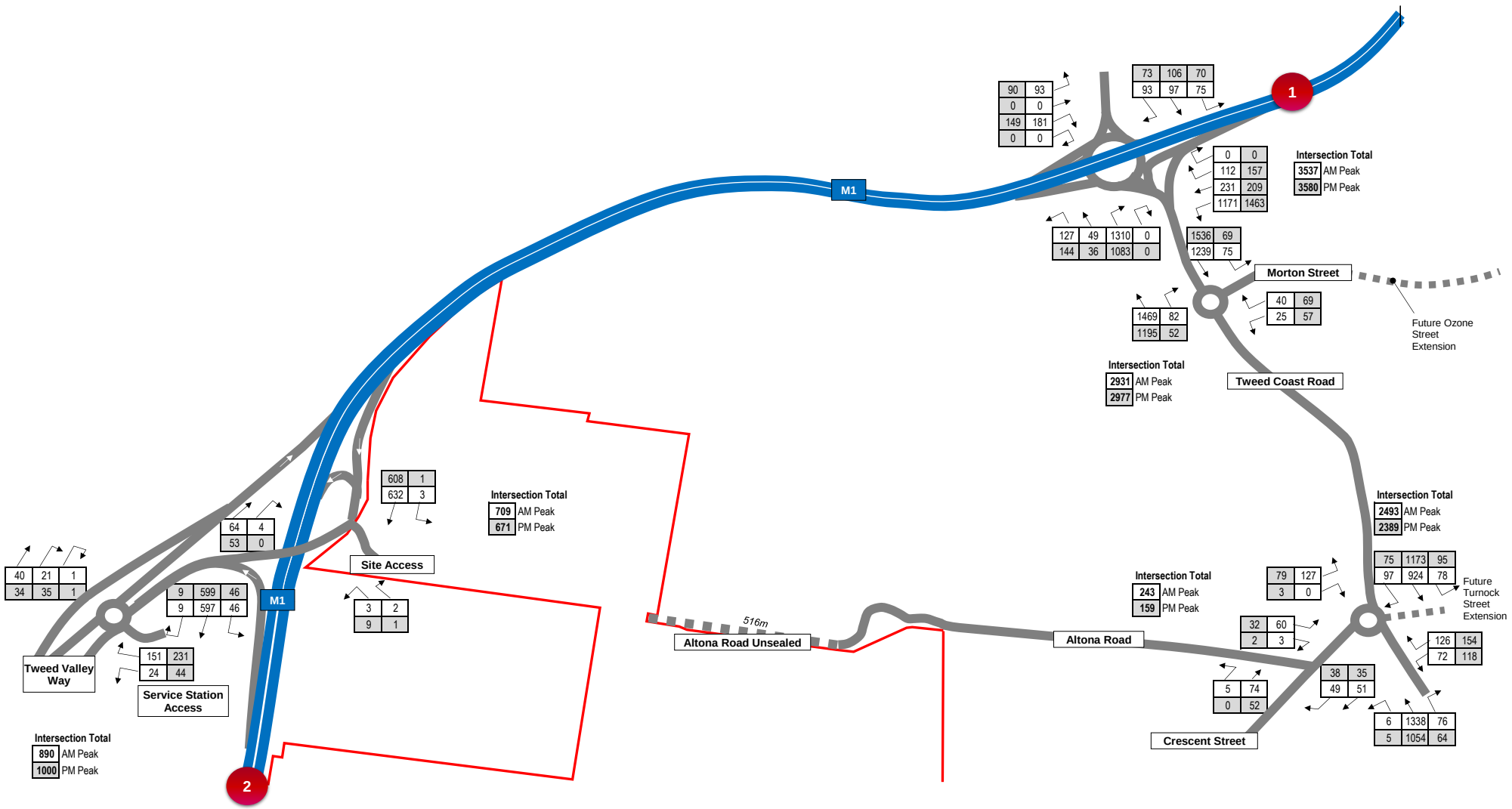
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 11 - 2022 with TSP Traffic - Distribution via Tweed Coast Road (Base Case Haulage Route)

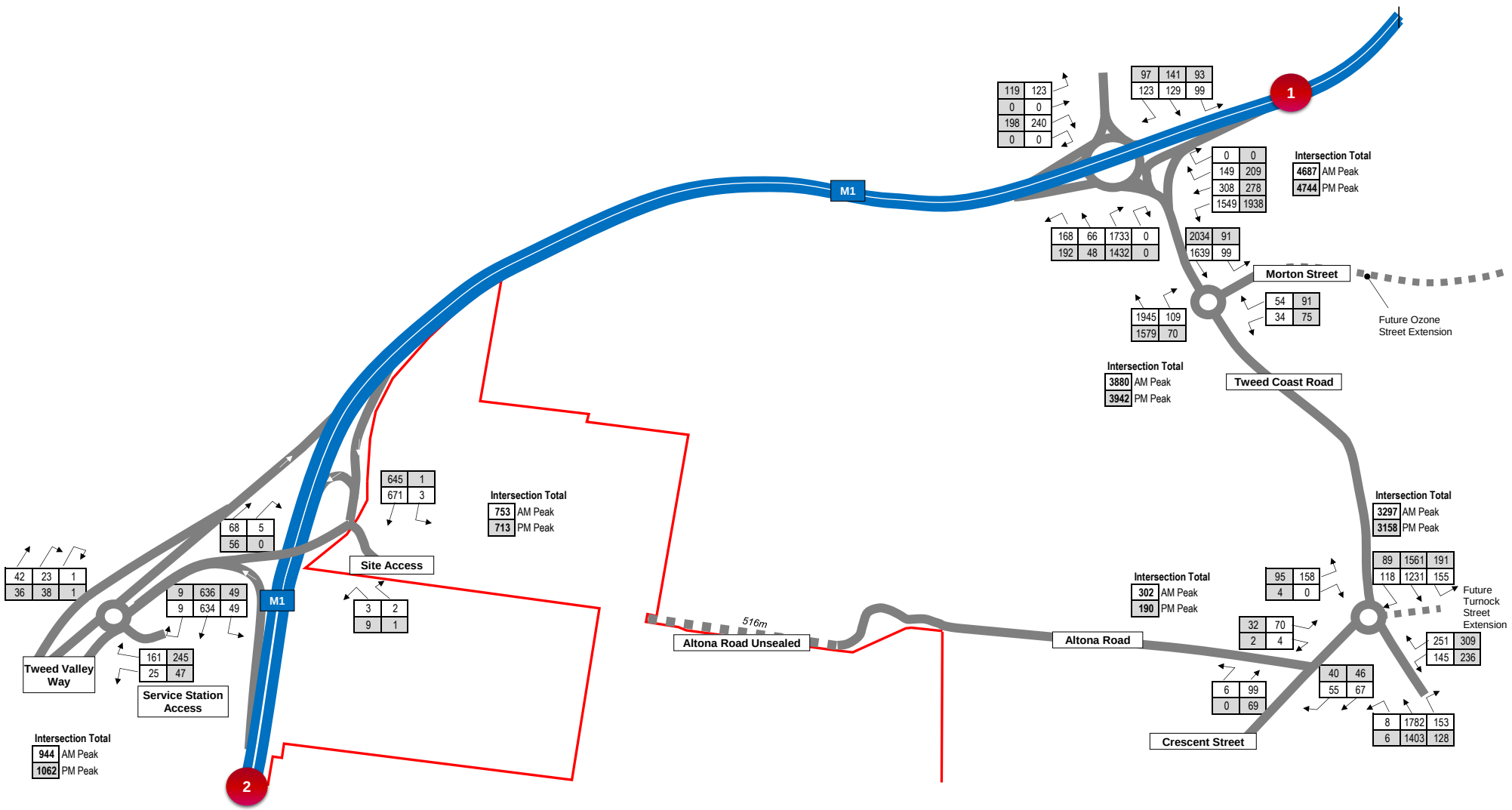
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 12 - 2032 with TSP Traffic - Distribution via Tweed Coast Road (Base Case Haulage Route)

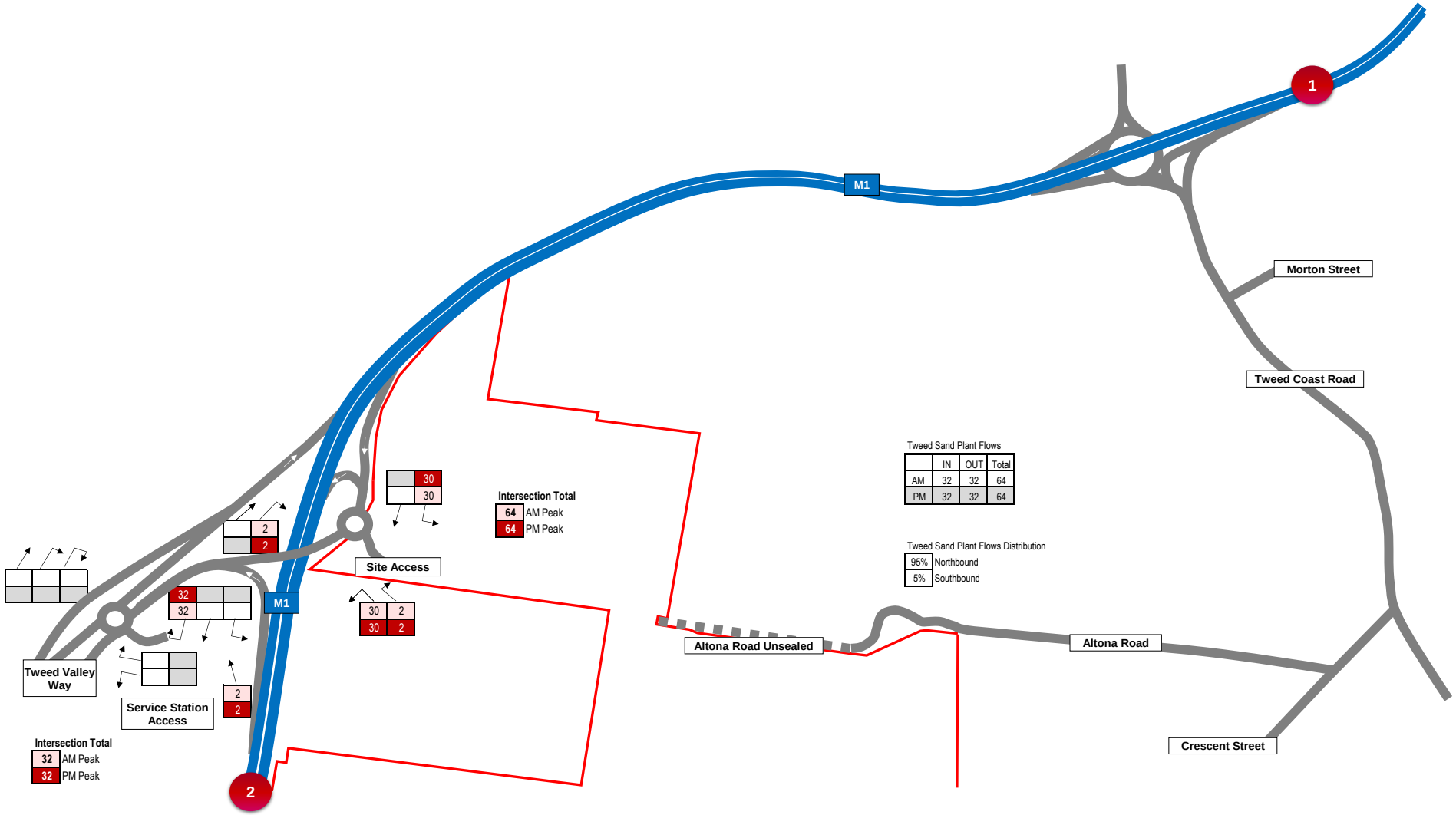
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 13 - 2042 with TSP Traffic - Distribution via Tweed Coast Road (Base Case Haulage Route)

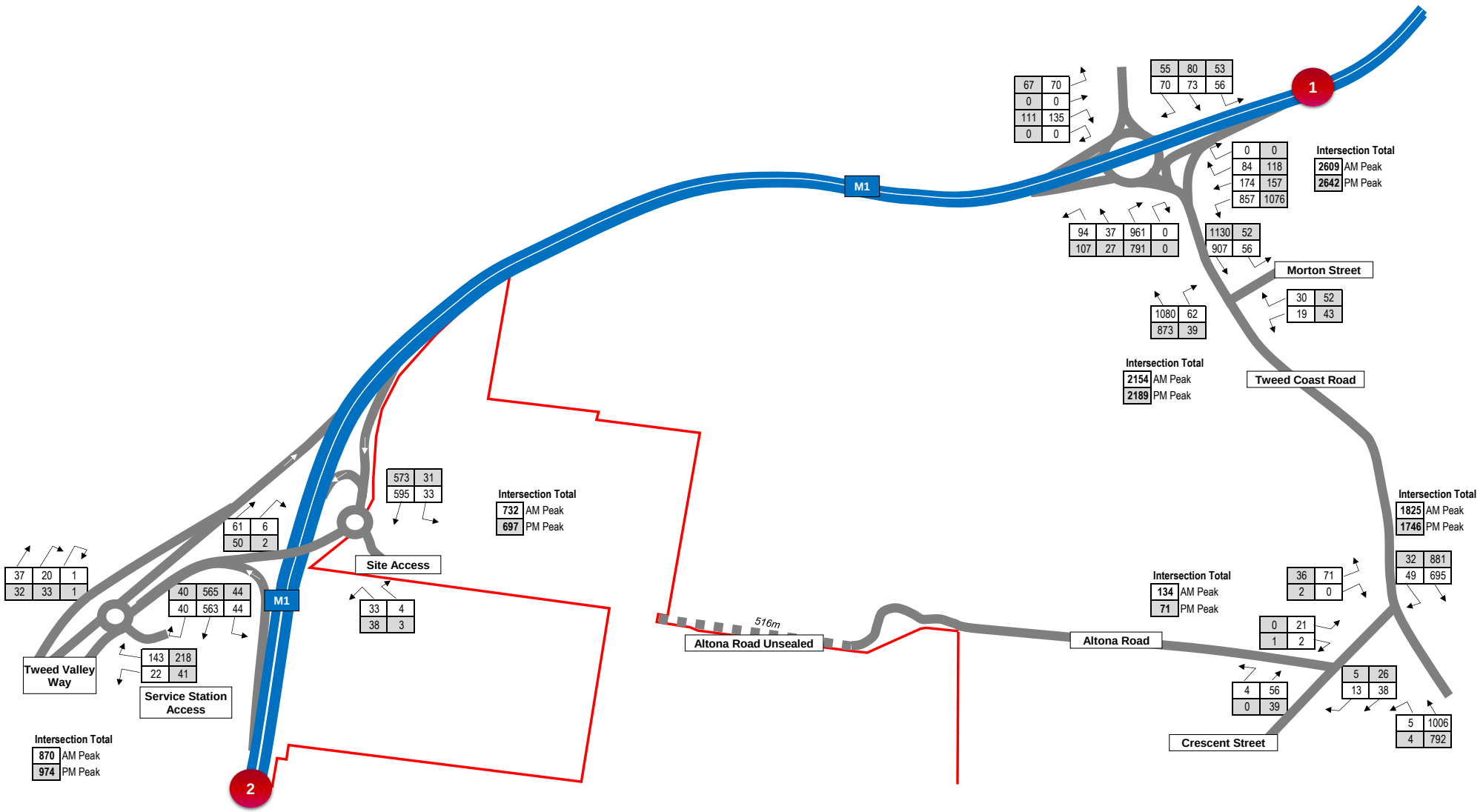
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 14 - TSP Trip Distribution via Tweed Valley Way (Project Case Haulage Route)

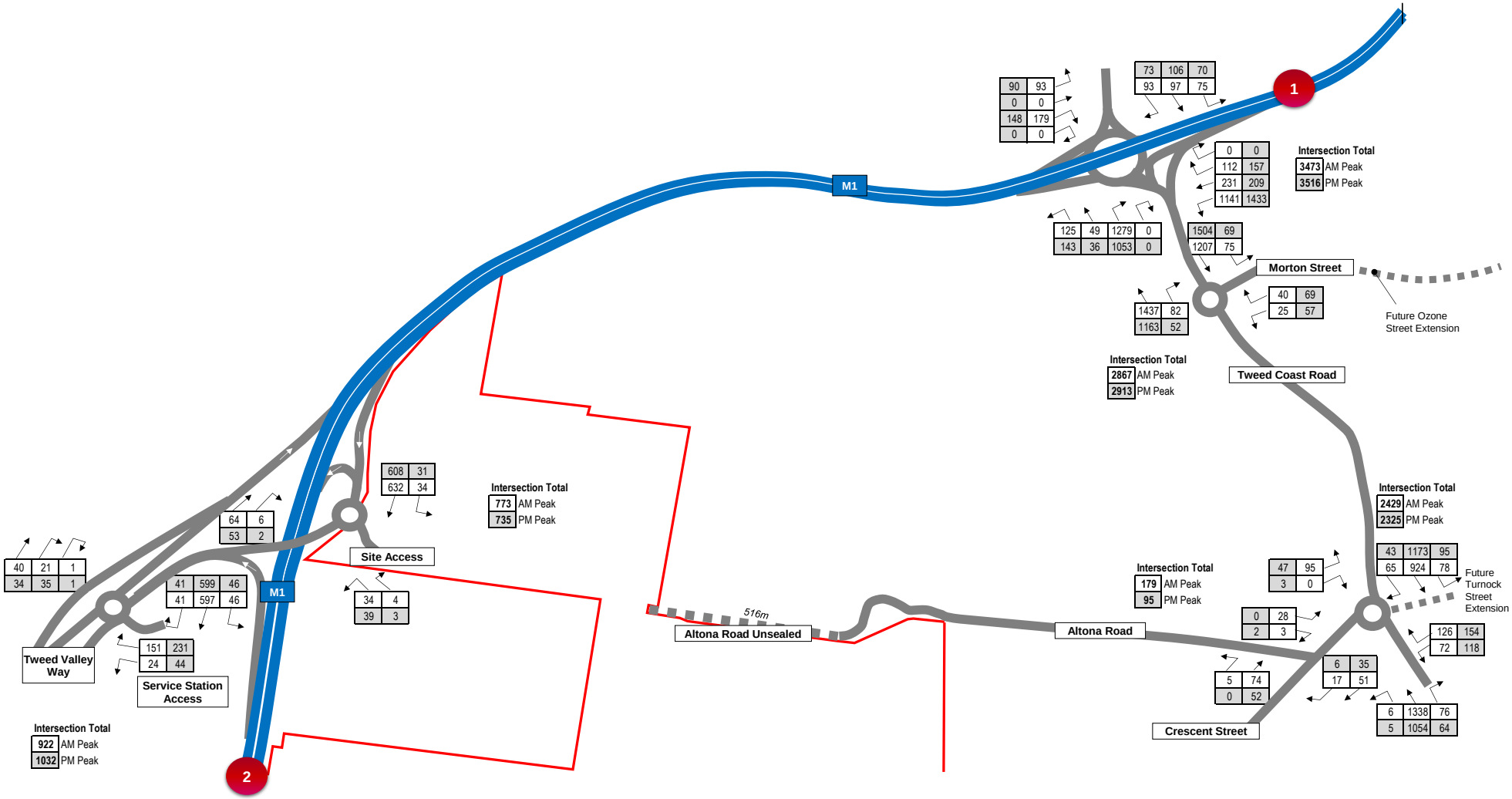
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 15 - 2022 with TSP Traffic - Distribution via Tweed Valley Way (Project Case Haulage Route)

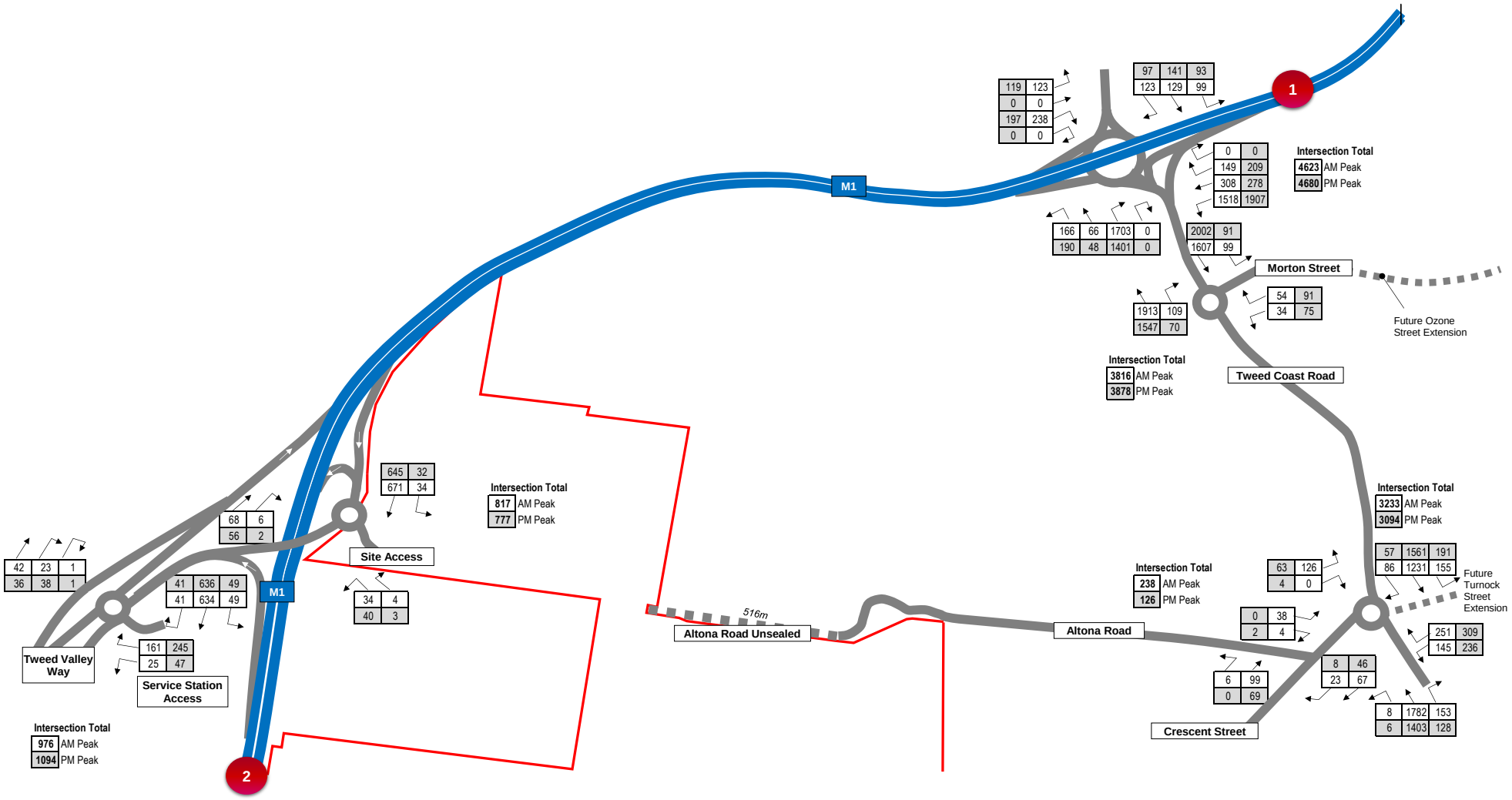
BURCHILLS ENGINEERING SOLUTIONS



BE190043_Tweed Sand Plant

Figure 16 - 2032 with TSP Traffic - Distribution via Tweed Valley Way (Project Case Haulage Route)

BURCHILLS ENGINEERING SOLUTIONS



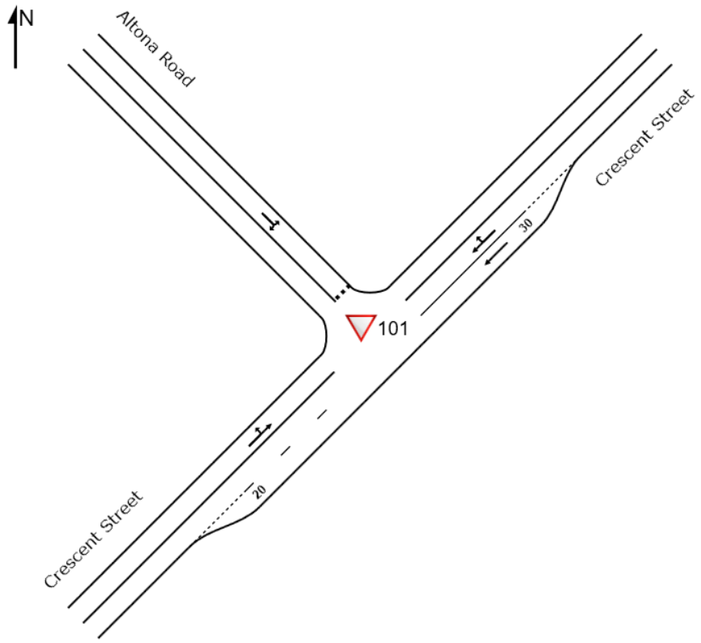
BE190043_Tweed Sand Plant

Figure 17 - 2042 with TSP Traffic - Distribution via Tweed Valley Way (Project Case Haulage Route)

BURCHILLS ENGINEERING SOLUTIONS

Appendix B – SIDRA Outputs

Altona Road / Crescent Street – 2022 Base Case



MOVEMENT SUMMARY

Site: 101 [1. Crescent St / Altona Rd 2022 AM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	38	0	40	0.0	0.074	0.3	LOS A	0.4	6.4	0.07	0.12	0.07	58.7
26	R2	45	36	47	80.0	0.074	7.6	LOS A	0.4	6.4	0.25	0.42	0.25	54.8
Approach		83	36	87	43.4	0.074	4.2	NA	0.4	6.4	0.16	0.28	0.16	55.6
NorthWest: Altona Road														
27	L2	53	38	56	71.7	0.076	7.3	LOS A	0.3	5.7	0.21	0.55	0.21	52.2
29	R2	2	0	2	0.0	0.076	6.6	LOS A	0.3	5.7	0.21	0.55	0.21	56.6
Approach		55	38	58	69.1	0.076	7.3	LOS A	0.3	5.7	0.21	0.55	0.21	52.4
SouthWest: Crescent Street														
30	L2	4	0	4	0.0	0.032	5.5	LOS A	0.0	0.0	0.00	0.04	0.00	59.2
31	T1	56	0	59	0.0	0.032	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.5
Approach		60	0	63	0.0	0.032	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.4
All Vehicles		198	74	208	37.4	0.076	3.9	NA	0.4	6.4	0.13	0.28	0.13	54.9

MOVEMENT SUMMARY

Site: 101 [1. Crescent St / Altona Rd 2022 PM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	38	0	40	0.0	0.071	0.2	LOS A	0.3	6.0	0.06	0.13	0.06	58.6
26	R2	45	33	47	73.3	0.071	7.2	LOS A	0.3	6.0	0.19	0.43	0.19	54.9
Approach		83	33	87	39.8	0.071	4.0	NA	0.3	6.0	0.13	0.29	0.13	55.7
NorthWest: Altona Road														
27	L2	53	32	56	60.4	0.071	6.9	LOS A	0.3	5.2	0.17	0.54	0.17	52.9
29	R2	2	0	2	0.0	0.071	6.4	LOS A	0.3	5.2	0.17	0.54	0.17	56.7
Approach		55	32	58	58.2	0.071	6.9	LOS A	0.3	5.2	0.17	0.54	0.17	53.1
SouthWest: Crescent Street														
30	L2	1	0	1	0.0	0.022	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
31	T1	39	0	41	0.0	0.022	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach		40	0	42	0.0	0.022	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		178	65	187	36.5	0.071	4.0	NA	0.3	6.0	0.11	0.31	0.11	54.9

Altona Rd / Crescent Street – 2022 Project Case

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2022 AM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	38	0	40	0.0	0.026	0.1	LOS A	0.1	0.7	0.08	0.13	0.08	58.3
26	R2	13	4	14	30.8	0.026	6.0	LOS A	0.1	0.7	0.11	0.18	0.11	57.4
Approach		51	4	54	7.8	0.026	1.6	NA	0.1	0.7	0.09	0.15	0.09	57.8
NorthWest: Altona Road														
27	L2	21	6	22	28.6	0.018	6.1	LOS A	0.1	0.6	0.15	0.54	0.15	55.0
29	R2	2	0	2	0.0	0.018	6.0	LOS A	0.1	0.6	0.15	0.54	0.15	56.7
Approach		23	6	24	26.1	0.018	6.1	LOS A	0.1	0.6	0.15	0.54	0.15	55.2
SouthWest: Crescent Street														
30	L2	4	0	4	0.0	0.032	5.5	LOS A	0.0	0.0	0.00	0.04	0.00	59.2
31	T1	56	0	59	0.0	0.032	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.5
Approach		60	0	63	0.0	0.032	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.4
All Vehicles		134	10	141	7.5	0.032	1.8	NA	0.1	0.7	0.06	0.17	0.06	57.4

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2022 PM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	26	0	27	0.0	0.015	0.0	LOS A	0.0	0.2	0.04	0.09	0.04	58.8
26	R2	5	1	5	20.0	0.015	5.8	LOS A	0.0	0.2	0.05	0.12	0.05	57.9
Approach		31	1	33	3.2	0.015	1.0	NA	0.0	0.2	0.04	0.10	0.04	58.5
NorthWest: Altona Road														
27	L2	1	0	1	0.0	0.002	5.6	LOS A	0.0	0.0	0.13	0.54	0.13	56.7
29	R2	1	0	1	0.0	0.002	5.8	LOS A	0.0	0.0	0.13	0.54	0.13	56.8
Approach		2	0	2	0.0	0.002	5.7	LOS A	0.0	0.0	0.13	0.54	0.13	56.7
SouthWest: Crescent Street														
30	L2	1	0	1	0.0	0.022	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
31	T1	39	0	41	0.0	0.022	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach		40	0	42	0.0	0.022	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		73	1	77	1.4	0.022	0.6	NA	0.0	0.2	0.02	0.06	0.02	59.0

Altona Rd / Crescent Street – 2032 Base Case

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2032 AM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	49	0	52	0.0	0.085	0.4	LOS A	0.4	6.8	0.10	0.14	0.10	58.3
26	R2	51	37	54	72.5	0.085	7.6	LOS A	0.4	6.8	0.28	0.39	0.28	55.0
Approach		100	37	105	37.0	0.085	4.1	NA	0.4	6.8	0.19	0.27	0.19	55.8
NorthWest: Altona Road														
27	L2	60	40	63	66.7	0.085	7.4	LOS A	0.4	6.0	0.24	0.56	0.24	52.5
29	R2	3	0	3	0.0	0.085	6.8	LOS A	0.4	6.0	0.24	0.56	0.24	56.6
Approach		63	40	66	63.5	0.085	7.4	LOS A	0.4	6.0	0.24	0.56	0.24	52.7
SouthWest: Crescent Street														
30	L2	5	0	5	0.0	0.043	5.5	LOS A	0.0	0.0	0.00	0.04	0.00	59.2
31	T1	74	0	78	0.0	0.043	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.5
Approach		79	0	83	0.0	0.043	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.5
All Vehicles		242	77	255	31.8	0.085	3.7	NA	0.4	6.8	0.14	0.27	0.14	55.2

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2032 PM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	35	0	37	0.0	0.068	0.3	LOS A	0.3	6.4	0.07	0.11	0.07	59.0
26	R2	38	34	40	89.5	0.068	7.8	LOS A	0.3	6.4	0.24	0.40	0.24	54.8
Approach		73	34	77	46.6	0.068	4.2	NA	0.3	6.4	0.16	0.26	0.16	55.8
NorthWest: Altona Road														
27	L2	32	32	34	100.0	0.060	8.1	LOS A	0.2	5.9	0.23	0.55	0.23	52.7
29	R2	2	0	2	0.0	0.060	6.4	LOS A	0.2	5.9	0.23	0.55	0.23	56.0
Approach		34	32	36	94.1	0.060	8.0	LOS A	0.2	5.9	0.23	0.55	0.23	52.9
SouthWest: Crescent Street														
30	L2	1	0	1	0.0	0.029	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
31	T1	52	0	55	0.0	0.029	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach		53	0	56	0.0	0.029	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		160	66	168	41.3	0.068	3.6	NA	0.3	6.4	0.12	0.24	0.12	55.5

Altona Rd / Crescent Street – 2032 Project Case

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2032 AM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	17	0	18	0.0	0.036	0.1	LOS A	0.2	1.2	0.04	0.11	0.04	58.4
26	R2	51	5	54	9.8	0.036	5.8	LOS A	0.2	1.2	0.19	0.52	0.19	56.3
Approach		68	5	72	7.4	0.036	4.4	NA	0.2	1.2	0.15	0.42	0.15	56.5
NorthWest: Altona Road														
27	L2	28	8	29	28.6	0.025	6.2	LOS A	0.1	0.9	0.18	0.54	0.18	55.0
29	R2	3	0	3	0.0	0.025	6.2	LOS A	0.1	0.9	0.18	0.54	0.18	56.7
Approach		31	8	33	25.8	0.025	6.2	LOS A	0.1	0.9	0.18	0.54	0.18	55.2
SouthWest: Crescent Street														
30	L2	5	0	5	0.0	0.043	5.5	LOS A	0.0	0.0	0.00	0.04	0.00	59.2
31	T1	74	0	78	0.0	0.043	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	59.5
Approach		79	0	83	0.0	0.043	0.4	NA	0.0	0.0	0.00	0.04	0.00	59.5
All Vehicles		178	13	187	7.3	0.043	2.9	NA	0.2	1.2	0.09	0.27	0.09	56.9

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2032 PM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	35	0	37	0.0	0.020	0.1	LOS A	0.0	0.3	0.05	0.08	0.05	59.0
26	R2	6	2	6	33.3	0.020	6.1	LOS A	0.0	0.3	0.06	0.10	0.06	57.7
Approach		41	2	43	4.9	0.020	0.9	NA	0.0	0.3	0.05	0.09	0.05	58.5
NorthWest: Altona Road														
27	L2	1	0	1	0.0	0.003	5.7	LOS A	0.0	0.1	0.17	0.54	0.17	56.6
29	R2	2	0	2	0.0	0.003	5.9	LOS A	0.0	0.1	0.17	0.54	0.17	56.7
Approach		3	0	3	0.0	0.003	5.8	LOS A	0.0	0.1	0.17	0.54	0.17	56.7
SouthWest: Crescent Street														
30	L2	1	0	1	0.0	0.029	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
31	T1	52	0	55	0.0	0.029	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.8
Approach		53	0	56	0.0	0.029	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.8
All Vehicles		97	2	102	2.1	0.029	0.6	NA	0.0	0.3	0.03	0.06	0.03	59.0

Altona Rd / Crescent Street – 2042 Base Case

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2042 AM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	67	0	71	0.0	0.101	0.6	LOS A	0.5	7.6	0.14	0.15	0.14	58.1
26	R2	55	38	58	69.1	0.101	7.9	LOS A	0.5	7.6	0.32	0.33	0.32	55.2
Approach		122	38	128	31.1	0.101	3.9	NA	0.5	7.6	0.22	0.23	0.22	56.0
NorthWest: Altona Road														
27	L2	70	43	74	61.4	0.098	7.5	LOS A	0.4	6.4	0.28	0.57	0.28	52.7
29	R2	4	0	4	0.0	0.098	7.2	LOS A	0.4	6.4	0.28	0.57	0.28	56.5
Approach		74	43	78	58.1	0.098	7.5	LOS A	0.4	6.4	0.28	0.57	0.28	53.0
SouthWest: Crescent Street														
30	L2	6	0	6	0.0	0.057	5.6	LOS A	0.0	0.0	0.00	0.03	0.00	59.2
31	T1	99	0	104	0.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	59.6
Approach		105	0	111	0.0	0.057	0.3	NA	0.0	0.0	0.00	0.03	0.00	59.5
All Vehicles		301	81	317	26.9	0.101	3.5	NA	0.5	7.6	0.16	0.25	0.16	55.4

MOVEMENT SUMMARY

▽ Site: 101 [1. Crescent St / Altona Rd 2042 PM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	46	0	48	0.0	0.077	0.4	LOS A	0.4	6.9	0.10	0.13	0.10	58.7
26	R2	40	34	42	85.0	0.077	8.0	LOS A	0.4	6.9	0.27	0.34	0.27	54.9
Approach		86	34	91	39.5	0.077	3.9	NA	0.4	6.9	0.18	0.23	0.18	55.9
NorthWest: Altona Road														
27	L2	32	32	34	100.0	0.062	8.5	LOS A	0.3	6.1	0.27	0.56	0.27	52.6
29	R2	2	0	2	0.0	0.062	6.6	LOS A	0.3	6.1	0.27	0.56	0.27	55.9
Approach		34	32	36	94.1	0.062	8.4	LOS A	0.3	6.1	0.27	0.56	0.27	52.8
SouthWest: Crescent Street														
30	L2	1	0	1	0.0	0.038	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
31	T1	69	0	73	0.0	0.038	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		70	0	74	0.0	0.038	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.9
All Vehicles		190	66	200	34.7	0.077	3.3	NA	0.4	6.9	0.13	0.21	0.13	55.7

Altona Rd / Crescent Street – 2042 Project Case

MOVEMENT SUMMARY

▽ **Site: 101 [1. Crescent St / Altona Rd 2042 AM Peak - Project Case (Site Folder: General)]**

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	67	0	71	0.0	0.046	0.2	LOS A	0.2	1.2	0.11	0.13	0.11	58.0
26	R2	23	6	24	26.1	0.046	6.2	LOS A	0.2	1.2	0.15	0.18	0.15	57.4
Approach		90	6	95	6.7	0.046	1.7	NA	0.2	1.2	0.12	0.15	0.12	57.7
NorthWest: Altona Road														
27	L2	38	11	40	28.9	0.035	6.3	LOS A	0.1	1.2	0.21	0.54	0.21	54.9
29	R2	4	0	4	0.0	0.035	6.5	LOS A	0.1	1.2	0.21	0.54	0.21	56.6
Approach		42	11	44	26.2	0.035	6.3	LOS A	0.1	1.2	0.21	0.54	0.21	55.1
SouthWest: Crescent Street														
30	L2	6	0	6	0.0	0.057	5.6	LOS A	0.0	0.0	0.00	0.03	0.00	59.2
31	T1	99	0	104	0.0	0.057	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	59.6
Approach		105	0	111	0.0	0.057	0.3	NA	0.0	0.0	0.00	0.03	0.00	59.5
All Vehicles		237	17	249	7.2	0.057	1.9	NA	0.2	1.2	0.08	0.17	0.08	57.3

MOVEMENT SUMMARY

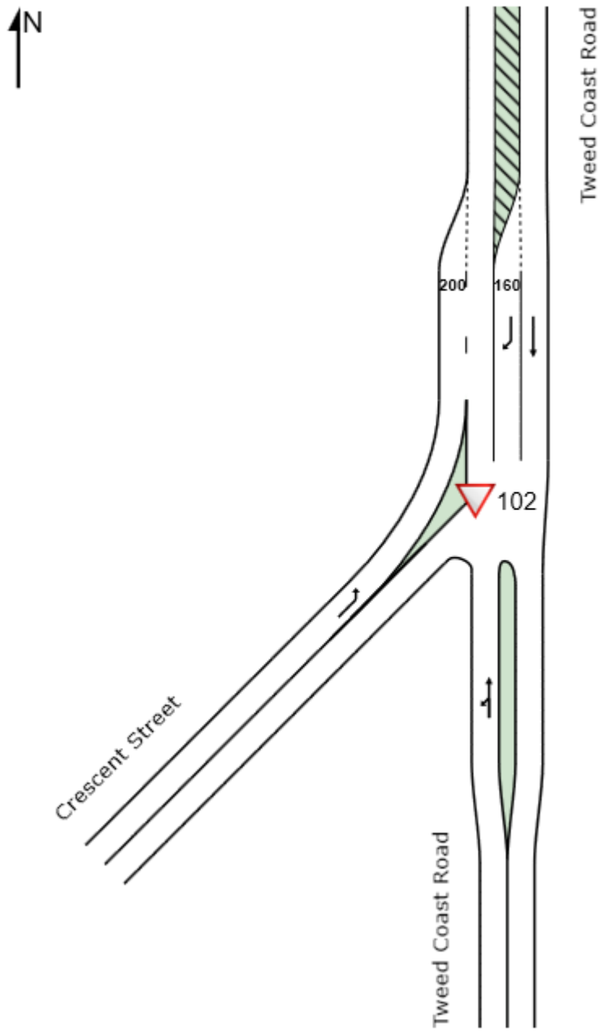
▽ **Site: 101 [1. Crescent St / Altona Rd 2042 PM Peak - Project Case (Site Folder: General)]**

New Site
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
NorthEast: Crescent Street														
25	T1	46	0	48	0.0	0.026	0.1	LOS A	0.1	0.4	0.06	0.08	0.06	58.9
26	R2	8	2	8	25.0	0.026	6.0	LOS A	0.1	0.4	0.07	0.11	0.07	57.8
Approach		54	2	57	3.7	0.026	0.9	NA	0.1	0.4	0.06	0.09	0.06	58.5
NorthWest: Altona Road														
27	L2	1	0	1	0.0	0.003	5.7	LOS A	0.0	0.1	0.20	0.54	0.20	56.6
29	R2	2	0	2	0.0	0.003	6.1	LOS A	0.0	0.1	0.20	0.54	0.20	56.7
Approach		3	0	3	0.0	0.003	5.9	LOS A	0.0	0.1	0.20	0.54	0.20	56.7
SouthWest: Crescent Street														
30	L2	1	0	1	0.0	0.038	5.5	LOS A	0.0	0.0	0.00	0.01	0.00	59.3
31	T1	69	0	73	0.0	0.038	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	59.9
Approach		70	0	74	0.0	0.038	0.1	NA	0.0	0.0	0.00	0.01	0.00	59.9
All Vehicles		127	2	134	1.6	0.038	0.6	NA	0.1	0.4	0.03	0.05	0.03	59.0

Tweed Coast Road / Crescent Street– 2022 Base Case



MOVEMENT SUMMARY

▽ Site: 102 [2. Tweed Coast Rd / Crescent St 2022AM Peak - Base Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	5	0	5	0.0	0.554	6.7	LOS A	0.0	0.0	0.00	0.00	0.00	57.9
2	T1	1006	22	1059	2.2	0.554	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.5
Approach		1011	22	1064	2.2	0.554	0.3	NA	0.0	0.0	0.00	0.00	0.00	59.5
North: Tweed Coast Road														
8	T1	695	27	732	3.9	0.388	0.4	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
9a	R1	81	35	85	43.2	1.023	192.9	LOS F	8.3	118.8	1.00	1.75	3.32	19.0
Approach		776	62	817	8.0	1.023	20.4	NA	8.3	118.8	0.10	0.18	0.35	50.0
SouthWest: Crescent Street														
30a	L1	103	39	108	37.9	0.087	9.0	LOS A	0.0	0.0	0.00	0.56	0.00	54.6
Approach		103	39	108	37.9	0.087	9.0	NA	0.0	0.0	0.00	0.56	0.00	54.6
All Vehicles		1890	123	1989	6.5	1.023	9.0	NA	8.3	118.8	0.04	0.11	0.14	55.0

MOVEMENT SUMMARY

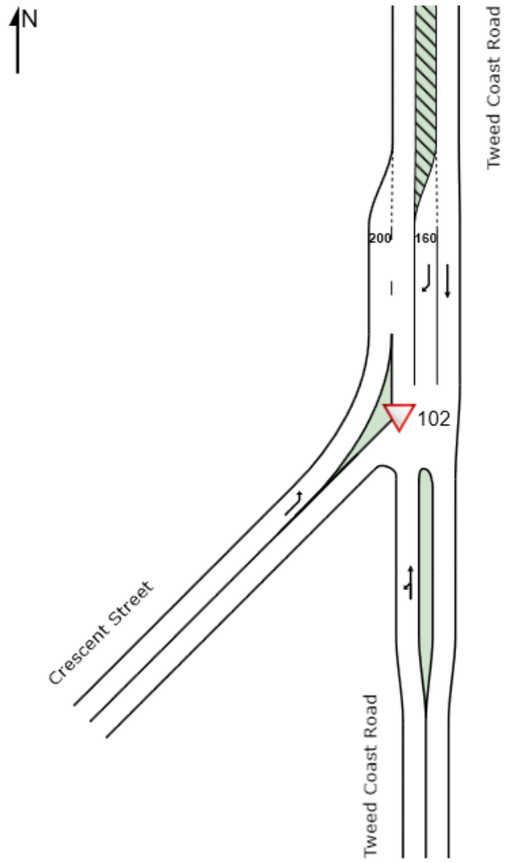
▽ Site: 102 [2. Tweed Coast Rd / Crescent St 2022PM Peak - Base Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	4	0	4	0.0	0.443	6.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.1
2	T1	792	38	834	4.8	0.443	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		796	38	838	4.8	0.443	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.6
North: Tweed Coast Road														
8	T1	881	32	927	3.6	0.489	0.5	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
9a	R1	64	35	67	54.7	0.483	44.7	LOS E	2.0	32.7	0.92	1.09	1.26	38.1
Approach		945	67	995	7.1	0.489	3.5	NA	2.0	32.7	0.06	0.07	0.09	57.7
SouthWest: Crescent Street														
30a	L1	68	32	72	47.1	0.065	7.6	LOS A	0.0	0.0	0.00	0.56	0.00	54.2
Approach		68	32	72	47.1	0.065	7.6	NA	0.0	0.0	0.00	0.56	0.00	54.2
All Vehicles		1809	137	1904	7.6	0.489	2.2	NA	2.0	32.7	0.03	0.06	0.04	58.4

Tweed Coast Road / Crescent Street – 2022 Project Case



MOVEMENT SUMMARY

Site: 102 [2. Tweed Coast Rd / Crescent St 2022AM Peak - Project Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	5	0	5	0.0	0.554	6.7	LOS A	0.0	0.0	0.00	0.00	0.00	57.9
2	T1	1006	22	1059	2.2	0.554	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.5
Approach		1011	22	1064	2.2	0.554	0.3	NA	0.0	0.0	0.00	0.00	0.00	59.5
North: Tweed Coast Road														
8	T1	695	27	732	3.9	0.387	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
9a	R1	49	3	52	6.1	0.140	14.3	LOS B	0.5	3.6	0.81	0.92	0.81	50.9
Approach		744	30	783	4.0	0.387	1.3	NA	0.5	3.6	0.05	0.06	0.05	59.2
SouthWest: Crescent Street														
30a	L1	71	7	75	9.9	0.042	8.4	LOS A	0.0	0.0	0.00	0.56	0.00	55.8
Approach		71	7	75	9.9	0.042	8.4	NA	0.0	0.0	0.00	0.56	0.00	55.8
All Vehicles		1826	59	1922	3.2	0.554	1.0	NA	0.5	3.6	0.02	0.05	0.02	59.2

MOVEMENT SUMMARY

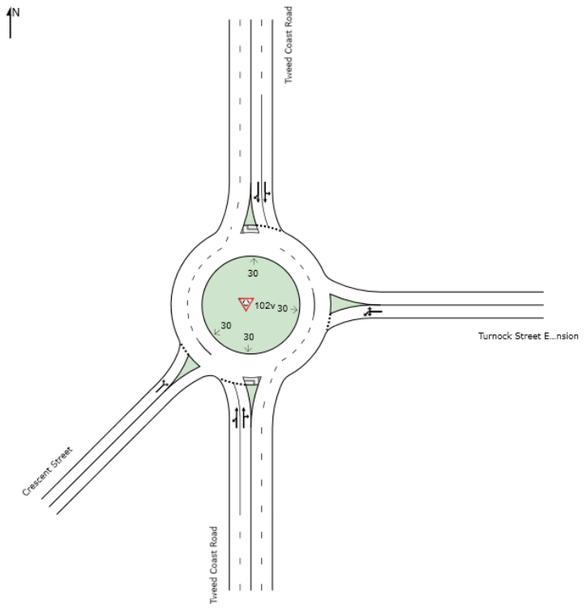
Site: 102 [2. Tweed Coast Rd / Crescent St 2022PM Peak - Project Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Existing Design
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	4	0	4	0.0	0.443	6.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.1
2	T1	792	38	834	4.8	0.443	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		796	38	838	4.8	0.443	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.6
North: Tweed Coast Road														
8	T1	881	32	927	3.6	0.487	0.5	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
9a	R1	32	3	34	9.4	0.059	10.2	LOS B	0.2	1.6	0.68	0.84	0.68	52.6
Approach		913	35	961	3.8	0.487	0.9	NA	0.2	1.6	0.02	0.03	0.02	59.4
SouthWest: Crescent Street														
30a	L1	36	0	38	0.0	0.020	6.8	LOS A	0.0	0.0	0.00	0.55	0.00	56.1
Approach		36	0	38	0.0	0.020	6.8	NA	0.0	0.0	0.00	0.55	0.00	56.1
All Vehicles		1745	73	1837	4.2	0.487	0.7	NA	0.2	1.6	0.01	0.03	0.01	59.4

Tweed Coast Road / Crescent Street – 2032 Base Case



MOVEMENT SUMMARY

Site: 102v [2. Tweed Coast Rd / Crescent St 2032AM Peak - Base Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	6	0	6	0.0	0.590	5.5	LOS A	5.6	40.0	0.69	0.54	0.69	50.4
2	T1	1338	30	1408	2.2	0.590	5.7	LOS A	5.6	40.0	0.71	0.59	0.71	56.8
3	R2	76	4	80	5.3	0.590	12.1	LOS B	5.5	39.5	0.73	0.65	0.75	54.3
Approach		1420	34	1495	2.4	0.590	6.1	LOS A	5.6	40.0	0.71	0.59	0.72	56.7
East: Turnock Street Extension														
4	L2	72	4	76	5.6	0.304	7.1	LOS A	1.3	9.7	0.68	0.87	0.68	51.1
4a	L1	1	0	1	0.0	0.304	6.6	LOS A	1.3	9.7	0.68	0.87	0.68	50.0
6	R2	126	6	133	4.8	0.304	12.9	LOS B	1.3	9.7	0.68	0.87	0.68	55.8
Approach		199	10	209	5.0	0.304	10.8	LOS B	1.3	9.7	0.68	0.87	0.68	54.5
North: Tweed Coast Road														
7	L2	78	4	82	5.1	0.403	4.1	LOS A	3.7	27.2	0.36	0.39	0.36	56.8
8	T1	924	36	973	3.9	0.403	4.1	LOS A	3.7	27.2	0.38	0.41	0.38	57.7
9a	R1	97	36	102	37.1	0.403	9.8	LOS A	3.6	30.2	0.40	0.44	0.40	54.0
Approach		1099	76	1157	6.9	0.403	4.6	LOS A	3.7	30.2	0.38	0.41	0.38	57.4
SouthWest: Crescent Street														
30a	L1	127	42	134	33.1	0.634	26.6	LOS C	3.3	39.7	0.93	1.10	1.35	47.1
32a	R1	1	0	1	0.0	0.634	24.2	LOS C	3.3	39.7	0.93	1.10	1.35	38.9
Approach		128	42	135	32.8	0.634	26.6	LOS C	3.3	39.7	0.93	1.10	1.35	47.1
All Vehicles		2846	162	2996	5.7	0.634	6.8	LOS A	5.6	40.0	0.59	0.56	0.61	56.4

MOVEMENT SUMMARY

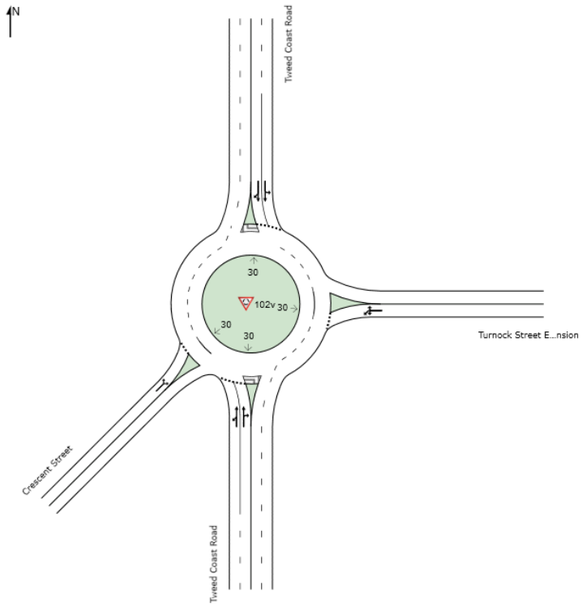
Site: 102v [2. Tweed Coast Rd / Crescent St 2032PM Peak - Base Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	5	0	5	0.0	0.481	5.3	LOS A	4.2	30.3	0.65	0.52	0.65	50.7
2	T1	1054	50	1109	4.7	0.481	5.4	LOS A	4.2	30.3	0.66	0.55	0.66	56.9
3	R2	64	3	67	4.7	0.481	11.6	LOS B	3.9	28.8	0.68	0.60	0.68	54.6
Approach		1123	53	1182	4.7	0.481	5.8	LOS A	4.2	30.3	0.66	0.56	0.66	56.8
East: Turnock Street Extension														
4	L2	118	6	124	5.1	0.460	9.3	LOS A	2.4	17.7	0.76	0.95	0.93	49.9
4a	L1	1	0	1	0.0	0.460	8.7	LOS A	2.4	17.7	0.76	0.95	0.93	48.5
6	R2	154	8	162	5.2	0.460	15.0	LOS B	2.4	17.7	0.76	0.95	0.93	54.9
Approach		273	14	287	5.1	0.460	12.5	LOS B	2.4	17.7	0.76	0.95	0.93	53.3
North: Tweed Coast Road														
7	L2	95	5	100	5.3	0.478	4.1	LOS A	4.8	34.9	0.36	0.39	0.36	56.8
8	T1	1173	42	1235	3.6	0.478	4.1	LOS A	4.8	34.9	0.38	0.40	0.38	57.8
9a	R1	75	36	79	48.0	0.478	10.1	LOS B	4.6	38.1	0.40	0.42	0.40	53.4
Approach		1343	83	1414	6.2	0.478	4.5	LOS A	4.8	38.1	0.38	0.40	0.38	57.5
SouthWest: Crescent Street														
30a	L1	79	33	83	41.8	0.426	21.9	LOS C	1.9	26.5	0.87	1.00	1.08	49.0
32a	R1	3	0	3	0.0	0.426	16.9	LOS B	1.9	26.5	0.87	1.00	1.08	41.8
Approach		82	33	86	40.2	0.426	21.8	LOS C	1.9	26.5	0.87	1.00	1.08	48.8
All Vehicles		2821	183	2969	6.5	0.481	6.3	LOS A	4.8	38.1	0.54	0.53	0.56	56.6

Tweed Coast Road / Crescent Street – 2032 Project Case



MOVEMENT SUMMARY

Site: 102v [2. Tweed Coast Rd / Crescent St 2032AM Peak - Project Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	6	0	6	0.0	0.551	4.9	LOS A	5.3	37.9	0.60	0.48	0.60	51.0
2	T1	1338	30	1408	2.2	0.551	4.9	LOS A	5.3	37.9	0.61	0.51	0.61	57.1
3	R2	76	4	80	5.3	0.551	11.1	LOS B	5.1	36.7	0.64	0.55	0.64	54.9
Approach		1420	34	1495	2.4	0.551	5.3	LOS A	5.3	37.9	0.62	0.51	0.62	57.0
East: Turnock Street Extension														
4	L2	72	4	76	5.6	0.290	6.9	LOS A	1.2	9.1	0.65	0.86	0.65	51.3
4a	L1	1	0	1	0.0	0.290	6.3	LOS A	1.2	9.1	0.65	0.86	0.65	50.3
6	R2	126	6	133	4.8	0.290	12.6	LOS B	1.2	9.1	0.65	0.86	0.65	55.9
Approach		199	10	209	5.0	0.290	10.5	LOS B	1.2	9.1	0.65	0.86	0.65	54.7
North: Tweed Coast Road														
7	L2	78	4	82	5.1	0.372	4.1	LOS A	3.3	23.6	0.34	0.39	0.34	56.9
8	T1	924	36	973	3.9	0.372	4.1	LOS A	3.3	23.6	0.35	0.41	0.35	57.8
9a	R1	65	4	68	6.2	0.372	8.7	LOS A	3.2	23.0	0.37	0.43	0.37	56.6
Approach		1067	44	1123	4.1	0.372	4.4	LOS A	3.3	23.6	0.35	0.41	0.35	57.7
SouthWest: Crescent Street														
30a	L1	95	10	100	10.5	0.253	10.2	LOS B	1.2	9.1	0.81	0.88	0.81	54.7
32a	R1	1	0	1	0.0	0.253	14.4	LOS B	1.2	9.1	0.81	0.88	0.81	50.4
Approach		96	10	101	10.4	0.253	10.2	LOS B	1.2	9.1	0.81	0.88	0.81	54.7
All Vehicles		2782	98	2928	3.5	0.551	5.5	LOS A	5.3	37.9	0.52	0.51	0.52	57.0

MOVEMENT SUMMARY

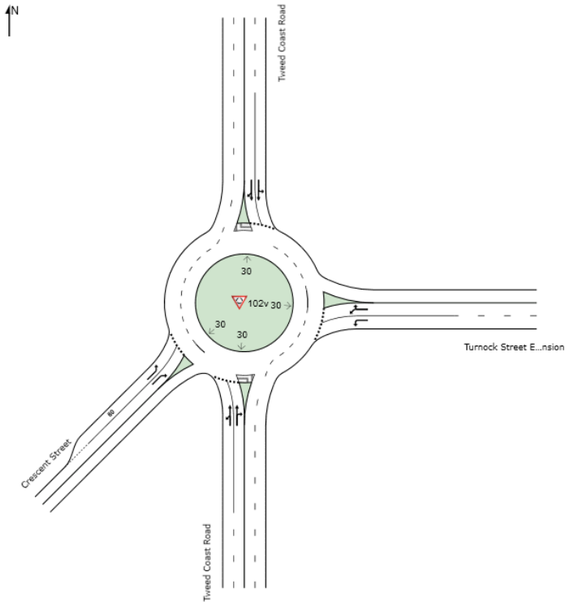
Site: 102v [2. Tweed Coast Rd / Crescent St 2032PM Peak - Project Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	5	0	5	0.0	0.449	4.7	LOS A	4.0	28.9	0.56	0.46	0.56	51.1
2	T1	1054	50	1109	4.7	0.449	4.8	LOS A	4.0	28.9	0.58	0.49	0.58	57.2
3	R2	64	3	67	4.7	0.449	10.9	LOS B	3.8	27.7	0.60	0.53	0.60	55.1
Approach		1123	53	1182	4.7	0.449	5.2	LOS A	4.0	28.9	0.58	0.49	0.58	57.1
East: Turnock Street Extension														
4	L2	118	6	124	5.1	0.438	8.7	LOS A	2.2	16.4	0.74	0.94	0.88	50.3
4a	L1	1	0	1	0.0	0.438	8.1	LOS A	2.2	16.4	0.74	0.94	0.88	49.0
6	R2	154	8	162	5.2	0.438	14.5	LOS B	2.2	16.4	0.74	0.94	0.88	55.2
Approach		273	14	287	5.1	0.438	12.0	LOS B	2.2	16.4	0.74	0.94	0.88	53.6
North: Tweed Coast Road														
7	L2	95	5	100	5.3	0.448	4.1	LOS A	4.3	30.9	0.34	0.39	0.34	56.9
8	T1	1173	42	1235	3.6	0.448	4.1	LOS A	4.3	30.9	0.35	0.40	0.35	57.9
9a	R1	43	4	45	9.3	0.448	8.7	LOS A	4.2	30.3	0.37	0.41	0.37	56.5
Approach		1311	51	1380	3.9	0.448	4.3	LOS A	4.3	30.9	0.35	0.39	0.35	57.8
SouthWest: Crescent Street														
30a	L1	47	1	49	2.1	0.104	8.2	LOS A	0.5	3.4	0.75	0.84	0.75	55.7
32a	R1	3	0	3	0.0	0.104	13.0	LOS B	0.5	3.4	0.75	0.84	0.75	52.0
Approach		50	1	53	2.0	0.104	8.5	LOS A	0.5	3.4	0.75	0.84	0.75	55.6
All Vehicles		2757	119	2902	4.3	0.449	5.5	LOS A	4.3	30.9	0.49	0.50	0.50	57.1

Tweed Coast Road / Crescent Street – 2042 Base Case



MOVEMENT SUMMARY

Site: 102v [2. Tweed Coast Rd / Crescent St 2042AM Peak - Base Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	8	0	8	0.0	0.941	24.0	LOS C	32.0	228.3	1.00	1.40	2.13	39.2
2	T1	1782	40	1876	2.2	0.941	26.1	LOS C	32.0	228.3	1.00	1.44	2.22	49.2
3	R2	153	8	161	5.2	0.941	35.6	LOS D	29.7	212.9	1.00	1.52	2.34	41.3
Approach		1943	48	2045	2.5	0.941	26.9	LOS C	32.0	228.3	1.00	1.45	2.23	48.7
East: Turnock Street Extension														
4	L2	145	8	153	5.5	0.314	8.7	LOS A	1.5	11.0	0.79	0.89	0.82	52.3
4a	L1	1	0	1	0.0	0.389	6.9	LOS A	2.2	16.1	0.82	0.96	0.89	48.2
6	R2	251	12	264	4.8	0.389	13.2	LOS B	2.2	16.1	0.82	0.96	0.89	54.7
Approach		397	20	418	5.0	0.389	11.5	LOS B	2.2	16.1	0.81	0.93	0.86	54.1
North: Tweed Coast Road														
7	L2	155	8	163	5.2	0.605	4.9	LOS A	7.1	51.8	0.65	0.48	0.65	55.9
8	T1	1231	48	1296	3.9	0.605	5.0	LOS A	7.1	51.8	0.68	0.52	0.68	56.8
9a	R1	118	37	124	31.4	0.605	11.5	LOS B	6.7	54.1	0.71	0.56	0.71	53.5
Approach		1504	93	1583	6.2	0.605	5.5	LOS A	7.1	54.1	0.68	0.52	0.68	56.5
SouthWest: Crescent Street														
30a	L1	158	45	166	28.5	0.855	56.3	LOS E	6.5	72.3	0.98	1.35	1.97	37.9
32a	R1	1	0	1	0.0	0.004	19.3	LOS B	0.0	0.2	0.90	0.74	0.90	43.6
Approach		159	45	167	28.3	0.855	56.0	LOS E	6.5	72.3	0.98	1.34	1.97	37.9
All Vehicles		4003	206	4214	5.1	0.941	18.5	LOS B	32.0	228.3	0.86	1.04	1.50	51.4

MOVEMENT SUMMARY

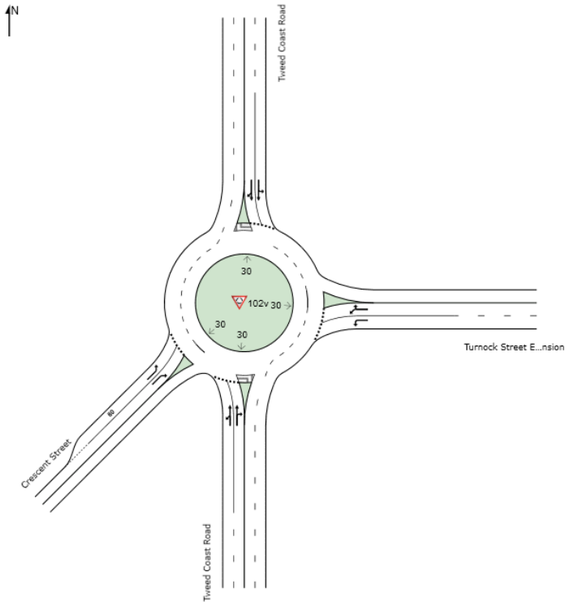
Site: 102v [2. Tweed Coast Rd / Crescent St 2042PM Peak - Base Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	6	0	6	0.0	0.793	12.2	LOS B	14.0	102.0	1.00	1.03	1.39	46.8
2	T1	1403	66	1477	4.7	0.793	13.3	LOS B	14.0	102.0	1.00	1.07	1.43	54.2
3	R2	128	6	135	4.7	0.793	20.9	LOS C	13.1	95.7	1.00	1.12	1.49	49.0
Approach		1537	72	1618	4.7	0.793	14.0	LOS B	14.0	102.0	1.00	1.07	1.44	53.9
East: Turnock Street Extension														
4	L2	236	12	248	5.1	0.642	15.5	LOS B	3.9	28.8	0.90	1.06	1.26	47.7
4a	L1	1	0	1	0.0	0.581	10.5	LOS B	4.0	29.0	0.92	1.06	1.18	45.5
6	R2	309	16	325	5.2	0.581	16.9	LOS B	4.0	29.0	0.92	1.06	1.18	53.1
Approach		546	28	575	5.1	0.642	16.3	LOS B	4.0	29.0	0.91	1.06	1.21	51.4
North: Tweed Coast Road														
7	L2	161	10	169	6.2	0.702	5.0	LOS A	9.7	70.5	0.70	0.49	0.70	55.8
8	T1	1561	56	1643	3.6	0.702	5.1	LOS A	9.7	70.5	0.73	0.52	0.73	56.7
9a	R1	89	37	94	41.6	0.702	12.4	LOS B	9.2	73.4	0.77	0.56	0.77	52.7
Approach		1811	103	1906	5.7	0.702	5.4	LOS A	9.7	73.4	0.73	0.52	0.73	56.4
SouthWest: Crescent Street														
30a	L1	75	33	79	44.0	0.316	24.5	LOS C	1.4	21.1	0.92	0.98	1.01	48.0
32a	R1	4	0	4	0.0	0.316	20.6	LOS C	1.3	17.5	0.93	1.00	1.03	36.9
Approach		79	33	83	41.8	0.316	24.3	LOS C	1.4	21.1	0.92	0.98	1.01	47.6
All Vehicles		3973	236	4182	5.9	0.793	10.6	LOS B	14.0	102.0	0.86	0.81	1.08	54.6

Tweed Coast Road / Crescent Street – 2042 Project Case



MOVEMENT SUMMARY

Site: 102v [2. Tweed Coast Rd / Crescent St 2042AM Peak - Project Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	8	0	8	0.0	0.881	13.8	LOS B	21.3	151.8	1.00	1.04	1.48	45.6
2	T1	1782	40	1876	2.2	0.881	15.2	LOS B	21.3	151.8	1.00	1.08	1.54	53.5
3	R2	153	8	161	5.2	0.881	23.3	LOS C	20.8	148.9	1.00	1.15	1.63	47.6
Approach		1943	48	2045	2.5	0.881	15.8	LOS B	21.3	151.8	1.00	1.08	1.54	53.1
East: Turnock Street Extension														
4	L2	145	8	153	5.5	0.295	8.2	LOS A	1.4	10.0	0.76	0.87	0.78	52.6
4a	L1	1	0	1	0.0	0.369	6.5	LOS A	2.0	14.7	0.79	0.92	0.84	48.3
6	R2	251	12	264	4.8	0.369	12.8	LOS B	2.0	14.7	0.79	0.92	0.84	54.8
Approach		397	20	418	5.0	0.369	11.1	LOS B	2.0	14.7	0.78	0.90	0.82	54.2
North: Tweed Coast Road														
7	L2	155	8	163	5.2	0.569	4.8	LOS A	6.4	46.5	0.63	0.48	0.63	56.0
8	T1	1231	48	1296	3.9	0.569	4.9	LOS A	6.4	46.5	0.64	0.50	0.64	56.9
9a	R1	86	5	91	5.8	0.569	9.6	LOS A	6.1	44.4	0.66	0.52	0.66	55.6
Approach		1472	61	1549	4.1	0.569	5.2	LOS A	6.4	46.5	0.64	0.50	0.64	56.8
SouthWest: Crescent Street														
30a	L1	126	13	133	10.3	0.443	17.2	LOS B	2.8	21.5	0.97	1.04	1.14	51.3
32a	R1	1	0	1	0.0	0.004	19.4	LOS B	0.0	0.2	0.90	0.74	0.90	43.5
Approach		127	13	134	10.2	0.443	17.3	LOS B	2.8	21.5	0.97	1.04	1.14	51.2
All Vehicles		3939	142	4146	3.6	0.881	11.4	LOS B	21.3	151.8	0.84	0.85	1.12	54.5

MOVEMENT SUMMARY

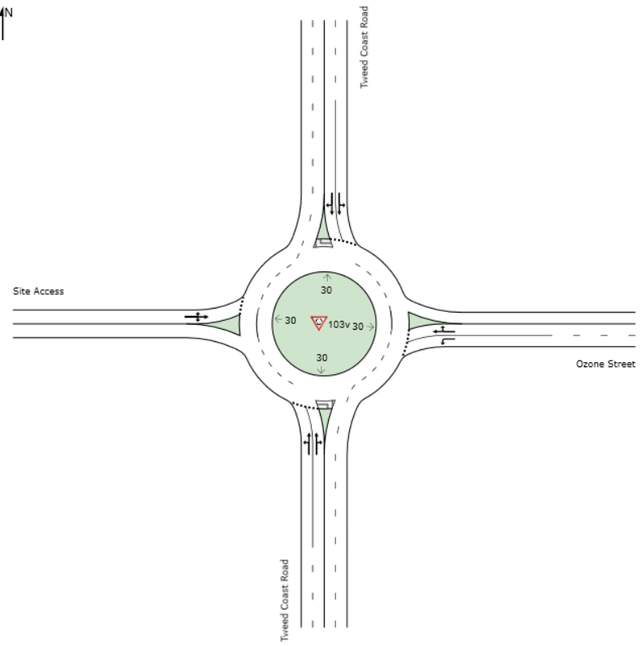
Site: 102v [2. Tweed Coast Rd / Crescent St 2042PM Peak - Project Case (Site Folder: General)]

Tweed Coast Road / Crescent Street intersection
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1b	L3	6	0	6	0.0	0.742	9.1	LOS A	11.2	81.6	0.94	0.87	1.14	48.9
2	T1	1403	66	1477	4.7	0.742	9.9	LOS A	11.2	81.6	0.95	0.91	1.18	55.6
3	R2	128	6	135	4.7	0.742	17.0	LOS B	10.8	78.9	0.97	0.97	1.25	51.7
Approach		1537	72	1618	4.7	0.742	10.5	LOS B	11.2	81.6	0.96	0.91	1.19	55.4
East: Turnock Street Extension														
4	L2	236	12	248	5.1	0.584	13.2	LOS B	3.4	25.0	0.87	1.02	1.16	49.1
4a	L1	1	0	1	0.0	0.537	9.3	LOS A	3.5	25.5	0.89	1.03	1.10	46.4
6	R2	309	16	325	5.2	0.537	15.6	LOS B	3.5	25.5	0.89	1.03	1.10	53.7
Approach		546	28	575	5.1	0.584	14.6	LOS B	3.5	25.5	0.88	1.03	1.13	52.3
North: Tweed Coast Road														
7	L2	161	10	169	6.2	0.666	4.9	LOS A	8.7	63.0	0.66	0.48	0.66	55.9
8	T1	1561	56	1643	3.6	0.666	5.0	LOS A	8.7	63.0	0.69	0.50	0.69	56.8
9a	R1	57	5	60	8.8	0.666	9.7	LOS A	8.4	60.9	0.71	0.52	0.71	55.3
Approach		1779	71	1873	4.0	0.666	5.1	LOS A	8.7	63.0	0.68	0.50	0.68	56.7
SouthWest: Crescent Street														
30a	L1	63	1	66	1.6	0.104	10.9	LOS B	0.6	4.2	0.89	0.92	0.89	54.3
32a	R1	4	0	4	0.0	0.104	17.2	LOS B	0.5	3.7	0.87	0.92	0.87	47.8
Approach		67	1	71	1.5	0.104	11.2	LOS B	0.6	4.2	0.89	0.92	0.89	54.1
All Vehicles		3929	172	4136	4.4	0.742	8.6	LOS A	11.2	81.6	0.82	0.74	0.95	55.6

Tweed Coast Road / Ozone Street Extension – 2032 Base Case



MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone St Extension 2032AM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.540	4.0	LOS A	5.9	44.6	0.38	0.38	0.38	56.9
2	T1	1469	66	1546	4.5	0.540	4.1	LOS A	5.9	44.6	0.40	0.40	0.40	57.1
3	R2	82	3	86	3.7	0.540	9.9	LOS A	5.8	43.7	0.42	0.42	0.42	57.7
Approach		1561	69	1643	4.4	0.540	4.4	LOS A	5.9	44.6	0.40	0.40	0.40	57.1
East: Ozone Street														
4	L2	25	4	26	16.0	0.058	9.6	LOS A	0.2	2.0	0.72	0.82	0.72	55.0
5	T1	10	0	11	0.0	0.086	7.0	LOS A	0.4	3.4	0.73	0.86	0.73	51.8
6	R2	40	13	42	32.5	0.086	14.1	LOS B	0.4	3.4	0.73	0.86	0.73	46.4
Approach		75	17	79	22.7	0.086	11.7	LOS B	0.4	3.4	0.73	0.85	0.73	51.1
North: Tweed Coast Road														
7	L2	75	24	79	32.0	0.484	4.7	LOS A	4.4	34.3	0.41	0.42	0.41	51.8
8	T1	1239	65	1304	5.2	0.484	4.4	LOS A	4.4	34.3	0.43	0.43	0.43	57.3
9	R2	10	0	11	0.0	0.484	10.1	LOS B	4.3	33.1	0.45	0.44	0.45	55.2
Approach		1324	89	1394	6.7	0.484	4.5	LOS A	4.4	34.3	0.43	0.43	0.43	57.1
West: Site Access														
10	L2	10	0	11	0.0	0.057	8.4	LOS A	0.3	1.8	0.73	0.84	0.73	49.2
11	T1	10	0	11	0.0	0.057	8.5	LOS A	0.3	1.8	0.73	0.84	0.73	53.0
12	R2	10	0	11	0.0	0.057	14.2	LOS B	0.3	1.8	0.73	0.84	0.73	56.0
Approach		30	0	32	0.0	0.057	10.4	LOS B	0.3	1.8	0.73	0.84	0.73	53.6
All Vehicles		2990	175	3147	5.9	0.540	4.7	LOS A	5.9	44.6	0.42	0.43	0.42	57.0

MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone St Extension 2032PM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.459	4.1	LOS A	4.5	34.4	0.41	0.40	0.41	56.7
2	T1	1195	74	1258	6.2	0.459	4.3	LOS A	4.5	34.4	0.43	0.42	0.43	56.9
3	R2	52	6	55	11.5	0.459	10.2	LOS B	4.3	33.4	0.45	0.44	0.45	57.4
Approach		1257	80	1323	6.4	0.459	4.5	LOS A	4.5	34.4	0.43	0.42	0.43	56.9
East: Ozone Street														
4	L2	57	1	60	1.8	0.135	10.5	LOS B	0.6	4.4	0.78	0.88	0.78	54.7
5	T1	10	0	11	0.0	0.133	8.3	LOS A	0.7	5.1	0.79	0.92	0.79	50.9
6	R2	69	6	73	8.7	0.133	14.4	LOS B	0.7	5.1	0.79	0.92	0.79	48.0
Approach		136	7	143	5.1	0.135	12.3	LOS B	0.7	5.1	0.78	0.90	0.78	52.1
North: Tweed Coast Road														
7	L2	69	6	73	8.7	0.562	4.2	LOS A	5.8	44.0	0.39	0.39	0.39	52.8
8	T1	1536	74	1617	4.8	0.562	4.3	LOS A	5.8	44.0	0.41	0.40	0.41	57.4
9	R2	10	0	11	0.0	0.562	9.9	LOS A	5.8	43.8	0.43	0.41	0.43	55.4
Approach		1615	80	1700	5.0	0.562	4.3	LOS A	5.8	44.0	0.41	0.40	0.41	57.3
West: Site Access														
10	L2	10	0	11	0.0	0.051	7.2	LOS A	0.2	1.5	0.68	0.79	0.68	50.0
11	T1	10	0	11	0.0	0.051	7.3	LOS A	0.2	1.5	0.68	0.79	0.68	53.7
12	R2	10	0	11	0.0	0.051	13.0	LOS B	0.2	1.5	0.68	0.79	0.68	56.5
Approach		30	0	32	0.0	0.051	9.2	LOS A	0.2	1.5	0.68	0.79	0.68	54.2
All Vehicles		3038	167	3198	5.5	0.562	4.8	LOS A	5.8	44.0	0.44	0.43	0.44	56.9

MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone Street 2032AM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.513	4.0	LOS A	5.4	38.5	0.36	0.38	0.36	56.9
2	T1	1437	34	1513	2.4	0.513	4.1	LOS A	5.4	38.5	0.38	0.39	0.38	57.3
3	R2	82	3	86	3.7	0.513	9.8	LOS A	5.3	37.9	0.40	0.42	0.40	57.8
Approach		1529	37	1609	2.4	0.513	4.4	LOS A	5.4	38.5	0.38	0.40	0.38	57.4
East: Ozone Street														
4	L2	25	4	26	16.0	0.055	9.2	LOS A	0.2	1.8	0.71	0.81	0.71	55.1
5	T1	10	0	11	0.0	0.082	6.8	LOS A	0.4	3.2	0.71	0.84	0.71	52.0
6	R2	40	13	42	32.5	0.082	13.8	LOS B	0.4	3.2	0.71	0.84	0.71	46.6
Approach		75	17	79	22.7	0.082	11.3	LOS B	0.4	3.2	0.71	0.83	0.71	51.3
North: Tweed Coast Road														
7	L2	75	24	79	32.0	0.455	4.6	LOS A	4.0	29.4	0.39	0.41	0.39	52.1
8	T1	1207	33	1271	2.7	0.455	4.3	LOS A	4.0	29.4	0.41	0.42	0.41	57.5
9	R2	10	0	11	0.0	0.455	10.0	LOS B	3.9	28.2	0.42	0.43	0.42	55.4
Approach		1292	57	1360	4.4	0.455	4.3	LOS A	4.0	29.4	0.41	0.42	0.41	57.3
West: Site Access														
10	L2	10	0	11	0.0	0.055	8.0	LOS A	0.2	1.6	0.71	0.82	0.71	49.5
11	T1	10	0	11	0.0	0.055	8.1	LOS A	0.2	1.6	0.71	0.82	0.71	53.2
12	R2	10	0	11	0.0	0.055	13.8	LOS B	0.2	1.6	0.71	0.82	0.71	56.2
Approach		30	0	32	0.0	0.055	10.0	LOS A	0.2	1.6	0.71	0.82	0.71	53.8
All Vehicles		2926	111	3080	3.8	0.513	4.6	LOS A	5.4	38.5	0.40	0.42	0.40	57.2

MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone Street 2032PM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.430	4.1	LOS A	4.1	29.2	0.39	0.40	0.39	56.8
2	T1	1163	42	1224	3.6	0.430	4.2	LOS A	4.1	29.2	0.41	0.41	0.41	57.2
3	R2	52	6	55	11.5	0.430	10.1	LOS B	3.9	28.6	0.42	0.44	0.42	57.6
Approach		1225	48	1289	3.9	0.430	4.4	LOS A	4.1	29.2	0.41	0.41	0.41	57.2
East: Ozone Street														
4	L2	57	1	60	1.8	0.126	10.0	LOS A	0.6	4.1	0.76	0.87	0.76	54.9
5	T1	10	0	11	0.0	0.127	7.9	LOS A	0.6	4.7	0.77	0.90	0.77	51.1
6	R2	69	6	73	8.7	0.127	14.0	LOS B	0.6	4.7	0.77	0.90	0.77	48.3
Approach		136	7	143	5.1	0.127	11.9	LOS B	0.6	4.7	0.77	0.89	0.77	52.3
North: Tweed Coast Road														
7	L2	69	6	73	8.7	0.535	4.2	LOS A	5.3	38.2	0.36	0.39	0.36	53.0
8	T1	1504	42	1583	2.8	0.535	4.2	LOS A	5.3	38.2	0.38	0.39	0.38	57.6
9	R2	10	0	11	0.0	0.535	9.9	LOS A	5.3	37.9	0.40	0.40	0.40	55.6
Approach		1583	48	1666	3.0	0.535	4.2	LOS A	5.3	38.2	0.38	0.39	0.38	57.4
West: Site Access														
10	L2	10	0	11	0.0	0.049	6.9	LOS A	0.2	1.4	0.66	0.77	0.66	50.2
11	T1	10	0	11	0.0	0.049	7.0	LOS A	0.2	1.4	0.66	0.77	0.66	53.9
12	R2	10	0	11	0.0	0.049	12.7	LOS B	0.2	1.4	0.66	0.77	0.66	56.6
Approach		30	0	32	0.0	0.049	8.9	LOS A	0.2	1.4	0.66	0.77	0.66	54.3
All Vehicles		2974	103	3131	3.5	0.535	4.7	LOS A	5.3	38.2	0.41	0.43	0.41	57.1

MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone Street 2042AM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.725	4.4	LOS A	11.2	83.1	0.58	0.42	0.58	56.2
2	T1	1945	78	2047	4.0	0.725	4.6	LOS A	11.2	83.1	0.61	0.44	0.61	56.4
3	R2	109	4	115	3.7	0.725	10.4	LOS B	10.9	80.7	0.65	0.47	0.65	57.0
Approach		2064	82	2173	4.0	0.725	4.9	LOS A	11.2	83.1	0.61	0.45	0.61	56.4
East: Ozone Street														
4	L2	34	6	36	17.6	0.112	12.1	LOS B	0.5	4.2	0.81	0.89	0.81	53.8
5	T1	10	0	11	0.0	0.152	8.6	LOS A	0.8	6.7	0.84	0.93	0.84	50.4
6	R2	54	18	57	33.3	0.152	16.0	LOS B	0.8	6.7	0.84	0.93	0.84	44.9
Approach		98	24	103	24.5	0.152	13.9	LOS B	0.8	6.7	0.83	0.92	0.83	49.8
North: Tweed Coast Road														
7	L2	99	32	104	32.3	0.657	5.3	LOS A	7.8	60.1	0.60	0.47	0.60	50.7
8	T1	1639	76	1725	4.6	0.657	4.9	LOS A	7.8	60.1	0.63	0.49	0.63	56.6
9	R2	10	0	11	0.0	0.657	10.6	LOS B	7.7	57.6	0.66	0.51	0.66	53.9
Approach		1748	108	1840	6.2	0.657	5.0	LOS A	7.8	60.1	0.63	0.49	0.63	56.4
West: Site Access														
10	L2	10	0	11	0.0	0.091	12.4	LOS B	0.5	3.2	0.86	0.93	0.86	46.0
11	T1	10	0	11	0.0	0.091	12.5	LOS B	0.5	3.2	0.86	0.93	0.86	50.1
12	R2	10	0	11	0.0	0.091	18.2	LOS B	0.5	3.2	0.86	0.93	0.86	54.2
Approach		30	0	32	0.0	0.091	14.4	LOS B	0.5	3.2	0.86	0.93	0.86	51.1
All Vehicles		3940	214	4147	5.4	0.725	5.2	LOS A	11.2	83.1	0.63	0.48	0.63	56.2

MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone Street 2042PM Peak - Base Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.618	4.4	LOS A	7.6	57.2	0.58	0.44	0.58	56.2
2	T1	1579	88	1662	5.6	0.618	4.7	LOS A	7.6	57.2	0.60	0.46	0.60	56.3
3	R2	70	8	74	11.4	0.618	10.7	LOS B	7.3	55.5	0.62	0.49	0.62	56.9
Approach		1659	96	1746	5.8	0.618	4.9	LOS A	7.6	57.2	0.60	0.47	0.60	56.4
East: Ozone Street														
4	L2	75	2	79	2.7	0.304	16.9	LOS B	1.6	11.2	0.89	0.96	0.95	51.9
5	T1	10	0	11	0.0	0.261	11.6	LOS B	1.5	11.5	0.93	0.97	0.93	48.6
6	R2	91	8	96	8.8	0.261	17.9	LOS B	1.5	11.5	0.93	0.97	0.93	45.3
Approach		176	10	185	5.7	0.304	17.1	LOS B	1.6	11.5	0.91	0.97	0.94	49.4
North: Tweed Coast Road														
7	L2	91	8	96	8.8	0.756	4.7	LOS A	11.8	87.6	0.61	0.45	0.61	51.4
8	T1	2034	88	2141	4.3	0.756	4.9	LOS A	11.8	87.6	0.65	0.46	0.65	56.6
9	R2	10	0	11	0.0	0.756	10.6	LOS B	11.4	84.5	0.69	0.48	0.69	53.6
Approach		2135	96	2247	4.5	0.756	4.9	LOS A	11.8	87.6	0.65	0.46	0.65	56.4
West: Site Access														
10	L2	10	0	11	0.0	0.069	9.1	LOS A	0.3	2.2	0.78	0.89	0.78	48.6
11	T1	10	0	11	0.0	0.069	9.2	LOS A	0.3	2.2	0.78	0.89	0.78	52.4
12	R2	10	0	11	0.0	0.069	14.9	LOS B	0.3	2.2	0.78	0.89	0.78	55.7
Approach		30	0	32	0.0	0.069	11.1	LOS B	0.3	2.2	0.78	0.89	0.78	53.1
All Vehicles		4000	202	4211	5.1	0.756	5.5	LOS A	11.8	87.6	0.64	0.49	0.64	56.1

MOVEMENT SUMMARY

Site: 103v [3. Tweed Coast Rd / Ozone Street 2042AM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.696	4.3	LOS A	10.0	71.8	0.54	0.42	0.54	56.4
2	T1	1913	46	2014	2.4	0.696	4.5	LOS A	10.0	71.8	0.57	0.44	0.57	56.6
3	R2	109	4	115	3.7	0.696	10.3	LOS B	9.8	70.4	0.60	0.46	0.60	57.1
Approach		2032	50	2139	2.5	0.696	4.8	LOS A	10.0	71.8	0.57	0.44	0.57	56.7
East: Ozone Street														
4	L2	34	6	36	17.6	0.104	11.5	LOS B	0.5	3.8	0.80	0.89	0.80	54.1
5	T1	10	0	11	0.0	0.142	8.2	LOS A	0.7	6.2	0.82	0.93	0.82	50.7
6	R2	54	18	57	33.3	0.142	15.6	LOS B	0.7	6.2	0.82	0.93	0.82	45.2
Approach		98	24	103	24.5	0.142	13.4	LOS B	0.7	6.2	0.81	0.91	0.81	50.1
North: Tweed Coast Road														
7	L2	99	32	104	32.3	0.625	5.2	LOS A	7.1	52.0	0.57	0.46	0.57	51.0
8	T1	1607	44	1692	2.7	0.625	4.8	LOS A	7.1	52.0	0.59	0.47	0.59	56.8
9	R2	10	0	11	0.0	0.625	10.6	LOS B	6.9	49.7	0.61	0.49	0.61	54.1
Approach		1716	76	1806	4.4	0.625	4.8	LOS A	7.1	52.0	0.59	0.47	0.59	56.6
West: Site Access														
10	L2	10	0	11	0.0	0.083	11.5	LOS B	0.4	2.8	0.84	0.92	0.84	46.7
11	T1	10	0	11	0.0	0.083	11.6	LOS B	0.4	2.8	0.84	0.92	0.84	50.7
12	R2	10	0	11	0.0	0.083	17.3	LOS B	0.4	2.8	0.84	0.92	0.84	54.6
Approach		30	0	32	0.0	0.083	13.5	LOS B	0.4	2.8	0.84	0.92	0.84	51.6
All Vehicles		3876	150	4080	3.9	0.696	5.1	LOS A	10.0	71.8	0.58	0.47	0.58	56.5

MOVEMENT SUMMARY

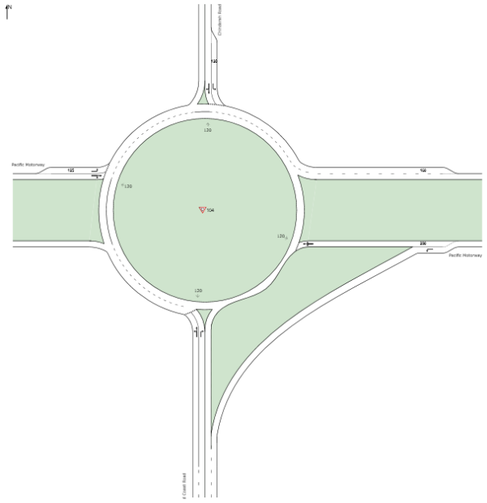
Site: 103v [3. Tweed Coast Rd / Ozone Street 2042PM Peak - Project Case (Site Folder: General)]

New Site
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	10	0	11	0.0	0.588	4.4	LOS A	6.9	49.6	0.54	0.43	0.54	56.3
2	T1	1547	56	1628	3.6	0.588	4.5	LOS A	6.9	49.6	0.56	0.45	0.56	56.6
3	R2	70	8	74	11.4	0.588	10.6	LOS B	6.7	48.4	0.59	0.48	0.59	57.1
Approach		1627	64	1713	3.9	0.588	4.8	LOS A	6.9	49.6	0.56	0.46	0.56	56.6
East: Ozone Street														
4	L2	75	2	79	2.7	0.273	15.0	LOS B	1.4	9.8	0.87	0.93	0.89	52.7
5	T1	10	0	11	0.0	0.239	10.9	LOS B	1.4	10.3	0.90	0.96	0.90	49.1
6	R2	91	8	96	8.8	0.239	17.1	LOS B	1.4	10.3	0.90	0.96	0.90	45.8
Approach		176	10	185	5.7	0.273	15.8	LOS B	1.4	10.3	0.89	0.95	0.90	50.0
North: Tweed Coast Road														
7	L2	91	8	96	8.8	0.727	4.7	LOS A	10.5	75.2	0.57	0.44	0.57	51.7
8	T1	2002	56	2107	2.8	0.727	4.7	LOS A	10.5	75.2	0.60	0.45	0.60	56.8
9	R2	10	0	11	0.0	0.727	10.5	LOS B	10.2	73.1	0.64	0.47	0.64	54.0
Approach		2103	64	2214	3.0	0.727	4.7	LOS A	10.5	75.2	0.60	0.45	0.60	56.6
West: Site Access														
10	L2	10	0	11	0.0	0.065	8.6	LOS A	0.3	2.1	0.76	0.87	0.76	49.0
11	T1	10	0	11	0.0	0.065	8.8	LOS A	0.3	2.1	0.76	0.87	0.76	52.8
12	R2	10	0	11	0.0	0.065	14.4	LOS B	0.3	2.1	0.76	0.87	0.76	55.9
Approach		30	0	32	0.0	0.065	10.6	LOS B	0.3	2.1	0.76	0.87	0.76	53.4
All Vehicles		3936	138	4143	3.5	0.727	5.3	LOS A	10.5	75.2	0.60	0.48	0.60	56.3

Tweed Coast Road / Pacific Motorway Interchange – 2022 Base Case



MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2022 AM Peak - Base Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Existing Design
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	96	9	101	9.4	0.099	3.2	LOS A	0.6	4.5	0.49	0.35	0.49	57.1
2	T1	37	1	39	2.7	0.099	3.2	LOS A	0.6	4.5	0.49	0.35	0.49	58.1
3	R2	991	50	1043	5.0	0.617	10.7	LOS B	5.8	44.8	0.68	0.67	0.68	59.4
Approach		1124	60	1183	5.3	0.617	9.8	LOS A	5.8	44.8	0.66	0.63	0.66	59.2
East: Pacific Motorway														
4	L2	887	65	934	7.3	0.347	2.4	LOS A	2.6	20.7	0.18	0.27	0.18	59.2
5	T1	174	29	183	16.7	0.347	3.2	LOS A	2.6	20.7	0.53	0.38	0.53	57.5
6	R2	84	8	88	9.5	0.347	10.0	LOS B	2.6	20.7	0.53	0.38	0.53	68.0
Approach		1145	102	1205	8.9	0.347	3.1	LOS A	2.6	20.7	0.26	0.30	0.26	59.6
North: Chinderah Road														
7	L2	56	3	59	5.4	0.143	17.1	LOS B	1.1	7.9	0.98	0.88	0.98	51.6
8	T1	73	10	77	13.7	0.297	12.6	LOS B	2.6	21.6	1.00	0.91	1.00	48.9
9	R2	70	21	74	30.0	0.297	20.1	LOS C	2.6	21.6	1.00	0.91	1.00	58.3
Approach		199	34	209	17.1	0.297	16.5	LOS B	2.6	21.6	0.99	0.90	0.99	53.1
West: Pacific Motorway														
10	L2	70	4	74	5.7	0.128	7.2	LOS A	0.8	5.6	0.83	0.80	0.83	56.0
11	T1	1	0	1	0.0	0.181	10.2	LOS B	1.3	9.7	0.87	0.84	0.87	52.3
12	R2	136	9	143	6.6	0.181	13.3	LOS B	1.3	9.7	0.87	0.84	0.87	49.1
Approach		207	13	218	6.3	0.181	11.2	LOS B	1.3	9.7	0.86	0.83	0.86	51.4
All Vehicles		2675	209	2816	7.8	0.617	7.5	LOS A	5.8	44.8	0.53	0.52	0.53	58.1

MOVEMENT SUMMARY

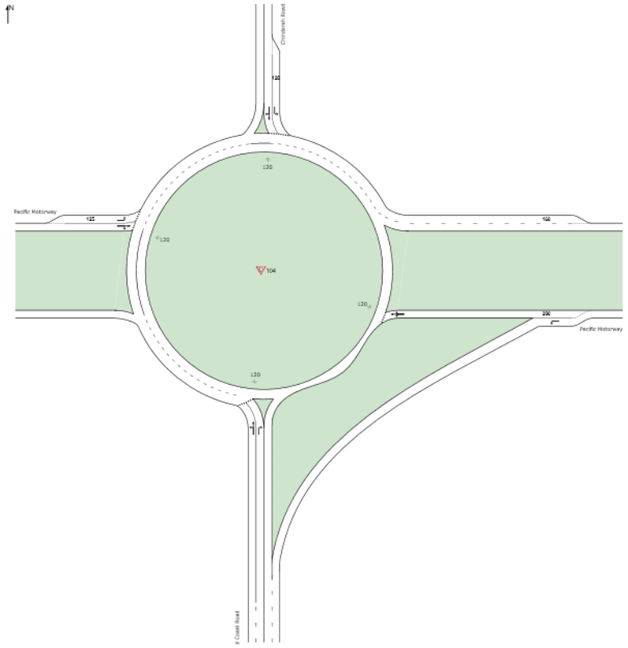
Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2022 PM Peak - Base Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Existing Design
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	109	9	115	8.3	0.103	3.1	LOS A	0.6	4.8	0.48	0.35	0.48	57.2
2	T1	27	6	28	22.2	0.103	3.4	LOS A	0.6	4.8	0.48	0.35	0.48	58.0
3	R2	821	52	864	6.3	0.515	10.5	LOS B	4.4	34.7	0.62	0.64	0.62	59.5
Approach		957	67	1007	7.0	0.515	9.4	LOS A	4.4	34.7	0.60	0.60	0.60	59.2
East: Pacific Motorway														
4	L2	1107	60	1165	5.4	0.405	2.4	LOS A	3.2	24.3	0.19	0.28	0.19	59.1
5	T1	157	18	165	11.5	0.405	3.1	LOS A	3.2	24.3	0.51	0.38	0.51	57.5
6	R2	118	4	124	3.4	0.405	9.9	LOS A	3.2	24.3	0.51	0.38	0.51	68.1
Approach		1382	82	1455	5.9	0.405	3.1	LOS A	3.2	24.3	0.25	0.30	0.25	59.7
North: Chinderah Road														
7	L2	53	1	56	1.9	0.096	11.1	LOS B	0.7	4.7	0.87	0.76	0.87	55.2
8	T1	80	6	84	7.5	0.185	8.0	LOS A	1.5	11.2	0.93	0.80	0.93	52.4
9	R2	55	2	58	3.6	0.185	14.7	LOS B	1.5	11.2	0.93	0.80	0.93	62.6
Approach		188	9	198	4.8	0.185	10.9	LOS B	1.5	11.2	0.91	0.79	0.91	56.3
West: Pacific Motorway														
10	L2	67	1	71	1.5	0.099	5.6	LOS A	0.5	3.9	0.74	0.65	0.74	56.5
11	T1	1	0	1	0.0	0.128	7.6	LOS A	0.8	6.1	0.76	0.75	0.76	52.8
12	R2	113	8	119	7.1	0.128	12.0	LOS B	0.8	6.1	0.76	0.75	0.76	49.6
Approach		181	9	191	5.0	0.128	9.6	LOS A	0.8	6.1	0.75	0.72	0.75	52.1
All Vehicles		2708	167	2851	6.2	0.515	6.3	LOS A	4.4	34.7	0.45	0.47	0.45	58.6

Tweed Coast Road / Pacific Motorway Interchange – 2022 Project Case



MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2022 AM Peak - Project Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Existing Design
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	94	7	99	7.4	0.095	3.1	LOS A	0.6	4.2	0.48	0.35	0.48	57.1
2	T1	37	1	39	2.7	0.095	3.2	LOS A	0.6	4.2	0.48	0.35	0.48	58.1
3	R2	961	20	1012	2.1	0.568	10.5	LOS B	5.2	36.9	0.64	0.65	0.64	61.0
Approach		1092	28	1149	2.6	0.568	9.6	LOS A	5.2	36.9	0.62	0.61	0.62	60.6
East: Pacific Motorway														
4	L2	857	35	902	4.1	0.324	2.3	LOS A	2.4	18.4	0.17	0.27	0.17	59.4
5	T1	174	29	183	16.7	0.324	3.2	LOS A	2.4	18.4	0.51	0.38	0.51	57.5
6	R2	84	8	88	9.5	0.324	10.0	LOS A	2.4	18.4	0.51	0.38	0.51	68.1
Approach		1115	72	1174	6.5	0.324	3.0	LOS A	2.4	18.4	0.25	0.29	0.25	59.7
North: Chinderah Road														
7	L2	56	3	59	5.4	0.123	14.2	LOS B	0.9	6.5	0.93	0.83	0.93	53.3
8	T1	73	10	77	13.7	0.255	10.4	LOS B	2.1	17.7	1.00	0.89	1.00	50.6
9	R2	70	21	74	30.0	0.255	17.9	LOS B	2.1	17.7	1.00	0.89	1.00	60.2
Approach		199	34	209	17.1	0.255	14.1	LOS B	2.1	17.7	0.98	0.87	0.98	54.8
West: Pacific Motorway														
10	L2	70	4	74	5.7	0.116	6.5	LOS A	0.7	4.9	0.78	0.75	0.78	56.2
11	T1	1	0	1	0.0	0.160	8.9	LOS A	1.1	7.9	0.82	0.79	0.82	52.5
12	R2	135	7	142	5.2	0.160	12.6	LOS B	1.1	7.9	0.82	0.79	0.82	49.4
Approach		206	11	217	5.3	0.160	10.5	LOS B	1.1	7.9	0.81	0.78	0.81	51.6
All Vehicles		2612	145	2749	5.6	0.568	7.2	LOS A	5.2	36.9	0.51	0.51	0.51	58.9

MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2022 PM Peak - Project Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Existing Design
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	107	7	113	6.5	0.099	3.0	LOS A	0.6	4.5	0.48	0.35	0.48	57.3
2	T1	27	6	28	22.2	0.099	3.4	LOS A	0.6	4.5	0.48	0.35	0.48	58.1
3	R2	791	22	833	2.8	0.466	10.3	LOS B	3.9	27.9	0.59	0.63	0.59	61.4
Approach		925	35	974	3.8	0.466	9.2	LOS A	3.9	27.9	0.57	0.59	0.57	60.9
East: Pacific Motorway														
4	L2	1076	30	1133	2.8	0.381	2.3	LOS A	3.0	21.6	0.18	0.27	0.18	59.2
5	T1	157	18	165	11.5	0.381	3.0	LOS A	3.0	21.6	0.48	0.37	0.48	57.7
6	R2	118	4	124	3.4	0.381	9.8	LOS A	3.0	21.6	0.48	0.37	0.48	68.3
Approach		1351	52	1422	3.8	0.381	3.0	LOS A	3.0	21.6	0.24	0.29	0.24	59.8
North: Chinderah Road														
7	L2	53	1	56	1.9	0.085	9.5	LOS A	0.6	4.0	0.82	0.71	0.82	56.1
8	T1	80	6	84	7.5	0.164	6.9	LOS A	1.3	9.5	0.87	0.74	0.87	53.1
9	R2	55	2	58	3.6	0.164	13.6	LOS B	1.3	9.5	0.87	0.74	0.87	63.3
Approach		188	9	198	4.8	0.164	9.6	LOS A	1.3	9.5	0.85	0.73	0.85	57.0
West: Pacific Motorway														
10	L2	67	1	71	1.5	0.091	5.1	LOS A	0.5	3.4	0.70	0.59	0.70	56.7
11	T1	1	0	1	0.0	0.112	6.7	LOS A	0.7	4.9	0.71	0.72	0.71	53.0
12	R2	111	6	117	5.4	0.112	11.5	LOS B	0.7	4.9	0.71	0.72	0.71	49.9
Approach		179	7	188	3.9	0.112	9.1	LOS A	0.7	4.9	0.70	0.67	0.70	52.4
All Vehicles		2643	103	2782	3.9	0.466	6.1	LOS A	3.9	27.9	0.43	0.45	0.43	59.4

Tweed Coast Road / Pacific Motorway Interchange – 2032 Base Case

MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2032 AM Peak - Base Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	127	11	134	8.7	0.587	4.4	LOS A	5.9	44.1	0.77	0.68	0.79	51.4
2	T1	49	1	52	2.0	0.587	4.4	LOS A	5.9	44.1	0.77	0.68	0.79	52.1
3	R2	1310	57	1379	4.4	0.587	14.7	LOS B	5.9	44.1	0.79	0.76	0.85	60.9
Approach		1486	69	1564	4.6	0.587	13.5	LOS B	5.9	44.1	0.79	0.75	0.84	59.6
East: Pacific Motorway														
4	L2	1171	77	1233	6.6	0.465	2.6	LOS A	3.9	30.5	0.21	0.29	0.21	59.0
5	T1	231	39	243	16.9	0.465	3.8	LOS A	3.9	30.5	0.65	0.45	0.65	56.8
6	R2	112	10	118	8.9	0.465	10.6	LOS B	3.9	30.5	0.65	0.45	0.65	67.0
Approach		1514	126	1594	8.3	0.465	3.4	LOS A	3.9	30.5	0.31	0.32	0.31	59.2
North: Chinderah Road														
7	L2	75	4	79	5.3	0.129	10.3	LOS B	0.7	4.9	0.80	0.64	0.80	56.1
8	T1	97	13	102	13.4	0.263	5.3	LOS A	1.6	13.0	0.84	0.69	0.84	53.1
9	R2	93	28	98	30.1	0.263	12.5	LOS B	1.6	13.0	0.84	0.69	0.84	63.0
Approach		265	45	279	17.0	0.263	9.2	LOS A	1.6	13.0	0.83	0.67	0.83	57.5
West: Pacific Motorway														
10	L2	93	6	98	6.5	0.183	6.5	LOS A	1.0	7.2	0.83	0.74	0.83	56.0
11	T1	1	0	1	0.0	0.248	10.4	LOS B	1.6	12.1	0.88	0.79	0.88	52.3
12	R2	181	11	191	6.1	0.248	12.6	LOS B	1.6	12.1	0.88	0.79	0.88	49.1
Approach		275	17	289	6.2	0.248	10.5	LOS B	1.6	12.1	0.86	0.78	0.86	51.3
All Vehicles		3540	257	3726	7.3	0.587	8.6	LOS A	5.9	44.1	0.59	0.56	0.61	58.5

MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2032 PM Peak - Base Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	114	12	120	10.5	0.489	3.9	LOS A	4.4	33.6	0.72	0.65	0.72	51.7
2	T1	36	7	38	19.4	0.489	4.2	LOS A	4.4	33.6	0.72	0.65	0.72	52.3
3	R2	1083	59	1140	5.4	0.489	12.8	LOS B	4.4	33.6	0.73	0.69	0.73	61.3
Approach		1233	78	1298	6.3	0.489	11.7	LOS B	4.4	33.6	0.73	0.69	0.73	60.0
East: Pacific Motorway														
4	L2	1463	70	1540	4.8	0.541	2.6	LOS A	4.8	36.0	0.22	0.29	0.22	58.7
5	T1	209	24	220	11.5	0.541	3.6	LOS A	4.8	36.0	0.63	0.44	0.63	56.9
6	R2	157	6	165	3.8	0.541	10.4	LOS B	4.8	36.0	0.63	0.44	0.63	67.2
Approach		1829	100	1925	5.5	0.541	3.4	LOS A	4.8	36.0	0.30	0.32	0.30	59.3
North: Chinderah Road														
7	L2	70	1	74	1.4	0.102	7.4	LOS A	0.5	3.5	0.73	0.55	0.73	56.6
8	T1	106	7	112	6.6	0.194	4.4	LOS A	1.1	8.1	0.76	0.59	0.76	53.8
9	R2	73	3	77	4.1	0.194	11.2	LOS B	1.1	8.1	0.76	0.59	0.76	64.1
Approach		249	11	262	4.4	0.194	7.2	LOS A	1.1	8.1	0.75	0.58	0.75	57.7
West: Pacific Motorway														
10	L2	90	1	95	1.1	0.149	5.6	LOS A	0.8	5.4	0.77	0.65	0.77	56.3
11	T1	1	0	1	0.0	0.176	7.4	LOS A	1.1	7.9	0.79	0.74	0.79	52.6
12	R2	149	9	157	6.0	0.176	11.7	LOS B	1.1	7.9	0.79	0.74	0.79	49.5
Approach		240	10	253	4.2	0.176	9.4	LOS A	1.1	7.9	0.78	0.71	0.78	52.0
All Vehicles		3551	199	3738	5.6	0.541	6.9	LOS A	4.8	36.0	0.52	0.49	0.52	58.8

MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2032 AM Peak - Project Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	125	9	132	7.2	0.551	4.1	LOS A	5.2	37.4	0.75	0.66	0.75	51.6
2	T1	49	1	52	2.0	0.551	4.2	LOS A	5.2	37.4	0.75	0.66	0.75	52.2
3	R2	1279	27	1346	2.1	0.551	13.9	LOS B	5.2	37.4	0.77	0.72	0.79	61.1
Approach		1453	37	1529	2.5	0.551	12.7	LOS B	5.2	37.4	0.77	0.72	0.79	59.9
East: Pacific Motorway														
4	L2	1141	47	1201	4.1	0.441	2.5	LOS A	3.7	27.7	0.20	0.29	0.20	59.1
5	T1	231	39	243	16.9	0.441	3.8	LOS A	3.7	27.7	0.63	0.44	0.63	56.9
6	R2	112	10	118	8.9	0.441	10.5	LOS B	3.7	27.7	0.63	0.44	0.63	67.1
Approach		1484	96	1562	6.5	0.441	3.3	LOS A	3.7	27.7	0.30	0.32	0.30	59.3
North: Chinderah Road														
7	L2	75	4	79	5.3	0.122	9.4	LOS A	0.6	4.6	0.78	0.62	0.78	56.3
8	T1	97	13	102	13.4	0.249	5.0	LOS A	1.4	12.0	0.82	0.66	0.82	53.3
9	R2	93	28	98	30.1	0.249	12.3	LOS B	1.4	12.0	0.82	0.66	0.82	63.1
Approach		265	45	279	17.0	0.249	8.8	LOS A	1.4	12.0	0.81	0.65	0.81	57.7
West: Pacific Motorway														
10	L2	93	6	98	6.5	0.171	6.1	LOS A	0.9	6.7	0.80	0.70	0.80	56.1
11	T1	1	0	1	0.0	0.225	9.3	LOS A	1.4	10.5	0.85	0.76	0.85	52.4
12	R2	179	9	188	5.0	0.225	12.1	LOS B	1.4	10.5	0.85	0.76	0.85	49.3
Approach		273	15	287	5.5	0.225	10.0	LOS B	1.4	10.5	0.83	0.74	0.83	51.5
All Vehicles		3475	193	3658	5.6	0.551	8.2	LOS A	5.2	37.4	0.57	0.54	0.58	58.7

MOVEMENT SUMMARY

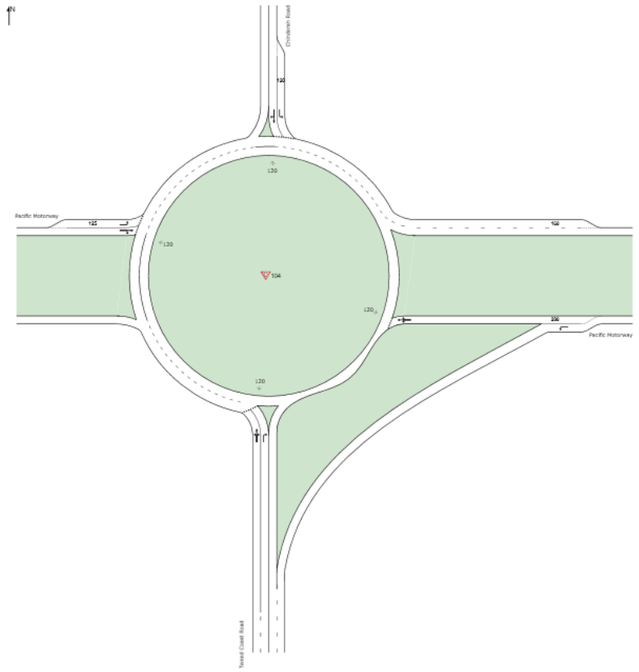
Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2032 PM Peak - Project Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	143	10	151	7.0	0.465	3.8	LOS A	4.1	30.0	0.70	0.62	0.70	52.0
2	T1	36	7	38	19.4	0.465	4.2	LOS A	4.1	30.0	0.70	0.62	0.70	52.6
3	R2	1053	29	1108	2.8	0.465	12.4	LOS B	4.1	30.0	0.72	0.68	0.72	61.6
Approach		1232	46	1297	3.7	0.465	11.2	LOS B	4.1	30.0	0.71	0.67	0.71	60.1
East: Pacific Motorway														
4	L2	1433	40	1508	2.8	0.518	2.5	LOS A	4.5	32.9	0.21	0.29	0.21	58.9
5	T1	209	24	220	11.5	0.518	3.6	LOS A	4.5	32.9	0.61	0.43	0.61	57.0
6	R2	157	6	165	3.8	0.518	10.3	LOS B	4.5	32.9	0.61	0.43	0.61	67.3
Approach		1799	70	1894	3.9	0.518	3.3	LOS A	4.5	32.9	0.29	0.32	0.29	59.4
North: Chinderah Road														
7	L2	70	1	74	1.4	0.098	7.0	LOS A	0.5	3.4	0.71	0.54	0.71	56.7
8	T1	106	7	112	6.6	0.187	4.3	LOS A	1.1	7.7	0.74	0.58	0.74	53.9
9	R2	73	3	77	4.1	0.187	11.1	LOS B	1.1	7.7	0.74	0.58	0.74	64.3
Approach		249	11	262	4.4	0.187	7.1	LOS A	1.1	7.7	0.73	0.57	0.73	57.8
West: Pacific Motorway														
10	L2	90	1	95	1.1	0.140	5.3	LOS A	0.7	5.0	0.74	0.61	0.74	56.5
11	T1	1	0	1	0.0	0.162	6.8	LOS A	0.9	6.9	0.76	0.72	0.76	52.8
12	R2	148	7	156	4.7	0.162	11.4	LOS B	0.9	6.9	0.76	0.72	0.76	49.7
Approach		239	8	252	3.3	0.162	9.1	LOS A	0.9	6.9	0.75	0.68	0.75	52.2
All Vehicles		3519	135	3704	3.8	0.518	6.7	LOS A	4.5	32.9	0.50	0.48	0.50	58.9

Tweed Coast Road / Pacific Motorway Interchange – 2042 Base Case



MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2042 AM Peak - Base Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	168	14	177	8.3	0.907	18.4	LOS B	27.0	201.2	1.00	1.34	1.99	43.9
2	T1	66	2	69	3.0	0.907	18.4	LOS B	27.0	201.2	1.00	1.34	1.99	44.4
3	R2	1733	66	1824	3.8	0.907	139.0	LOS F	27.0	201.2	1.00	1.40	2.10	49.0
Approach		1967	82	2071	4.2	0.907	124.7	LOS F	27.0	201.2	1.00	1.40	2.09	48.4
East: Pacific Motorway														
4	L2	1549	92	1631	5.9	0.640	3.2	LOS A	7.6	58.6	0.24	0.35	0.27	58.6
5	T1	308	52	324	16.9	0.640	5.9	LOS A	7.6	58.6	0.85	0.70	0.95	55.7
6	R2	149	14	157	9.4	0.640	12.6	LOS B	7.6	58.6	0.85	0.70	0.95	65.4
Approach		2006	158	2112	7.9	0.640	4.3	LOS A	7.6	58.6	0.38	0.43	0.43	58.6
North: Chinderah Road														
7	L2	99	6	104	6.1	0.240	212.3	LOS F	1.5	10.7	0.93	0.95	0.93	54.9
8	T1	129	18	136	14.0	0.536	13.1	LOS B	4.3	35.5	1.00	1.09	1.24	48.7
9	R2	123	38	129	30.9	0.536	20.1	LOS C	4.3	35.5	1.00	1.09	1.24	58.1
Approach		351	62	369	17.7	0.536	71.8	LOS F	4.3	35.5	0.98	1.05	1.15	53.9
West: Pacific Motorway														
10	L2	123	8	129	6.5	0.404	14.2	LOS B	2.6	19.3	0.97	1.02	1.09	51.0
11	T1	1	0	1	0.0	0.567	221.3	LOS F	5.2	38.6	1.00	1.11	1.31	46.9
12	R2	240	14	253	5.8	0.567	24.8	LOS C	5.2	38.6	1.00	1.11	1.31	43.3
Approach		364	22	383	6.0	0.567	21.7	LOS C	5.2	38.6	0.99	1.08	1.23	45.7
All Vehicles		4688	324	4935	6.9	0.907	61.2	LOS E	27.0	201.2	0.73	0.93	1.24	52.2

MOVEMENT SUMMARY

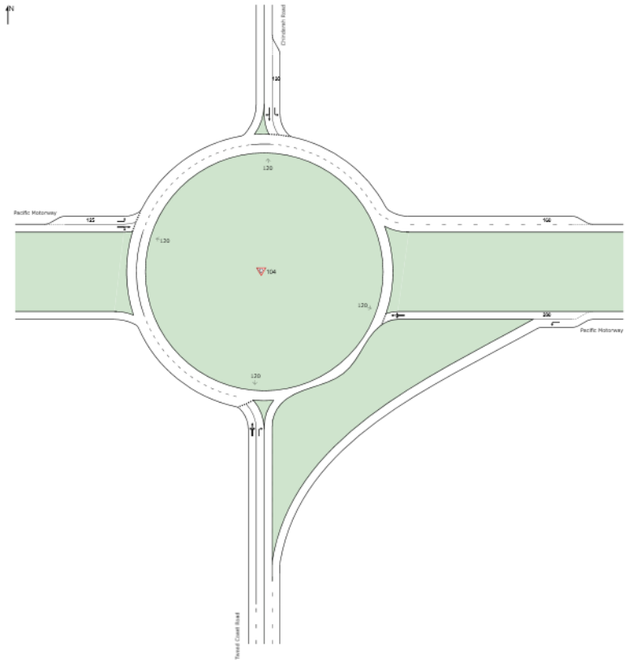
Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2042 PM Peak - Base Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	192	15	202	7.8	0.769	9.3	LOS A	13.3	100.8	1.00	1.00	1.35	49.8
2	T1	48	10	51	20.8	0.769	9.7	LOS A	13.3	100.8	1.00	1.00	1.35	50.3
3	R2	1432	68	1507	4.7	0.769	22.1	LOS C	13.3	100.8	1.00	1.06	1.41	57.4
Approach		1672	93	1760	5.6	0.769	20.3	LOS C	13.3	100.8	1.00	1.05	1.40	56.2
East: Pacific Motorway														
4	L2	1938	84	2040	4.3	0.740	3.6	LOS A	10.7	79.7	0.28	0.39	0.33	58.1
5	T1	278	32	293	11.5	0.740	6.3	LOS A	10.7	79.7	0.84	0.77	0.99	55.7
6	R2	209	8	220	3.8	0.740	13.0	LOS B	10.7	79.7	0.84	0.77	0.99	65.5
Approach		2425	124	2553	5.1	0.740	4.7	LOS A	10.7	79.7	0.39	0.47	0.46	58.4
North: Chinderah Road														
7	L2	93	2	98	2.2	0.190	15.1	LOS B	1.1	7.8	0.88	0.82	0.88	55.7
8	T1	141	10	148	7.1	0.385	7.6	LOS A	2.8	20.4	0.96	0.89	1.01	52.4
9	R2	97	4	102	4.1	0.385	14.4	LOS B	2.8	20.4	0.96	0.89	1.01	62.6
Approach		331	16	348	4.8	0.385	11.7	LOS B	2.8	20.4	0.94	0.87	0.97	56.4
West: Pacific Motorway														
10	L2	119	2	125	1.7	0.314	9.3	LOS A	1.9	13.2	0.92	0.94	0.94	54.5
11	T1	1	0	1	0.0	0.366	16.7	LOS B	2.7	20.5	1.00	0.99	1.03	51.8
12	R2	198	12	208	6.1	0.366	15.5	LOS B	2.7	20.5	1.00	0.99	1.03	48.6
Approach		318	14	335	4.4	0.366	13.2	LOS B	2.7	20.5	0.97	0.98	0.99	50.7
All Vehicles		4746	247	4996	5.2	0.769	11.3	LOS B	13.3	100.8	0.68	0.73	0.86	56.8

Tweed Coast Road / Pacific Motorway Interchange – 2042 Project Case



MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2042 AM Peak - Project Case (Site Folder: General)]

Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	166	12	175	7.2	0.863	14.0	LOS B	21.1	151.3	1.00	1.17	1.68	46.6
2	T1	66	2	69	3.0	0.863	14.1	LOS B	21.1	151.3	1.00	1.17	1.68	47.1
3	R2	1703	36	1793	2.1	0.863	101.4	LOS F	21.1	151.3	1.00	1.23	1.77	52.8
Approach		1935	50	2037	2.6	0.863	90.9	LOS F	21.1	151.3	1.00	1.23	1.76	52.0
East: Pacific Motorway														
4	L2	1518	62	1598	4.1	0.615	3.0	LOS A	6.9	51.9	0.23	0.33	0.25	58.7
5	T1	308	52	324	16.9	0.615	5.5	LOS A	6.9	51.9	0.83	0.64	0.90	55.7
6	R2	149	14	157	9.4	0.615	12.2	LOS B	6.9	51.9	0.83	0.64	0.90	65.5
Approach		1975	128	2079	6.5	0.615	4.1	LOS A	6.9	51.9	0.37	0.40	0.40	58.7
North: Chinderah Road														
7	L2	99	6	104	6.1	0.232	152.7	LOS F	1.4	10.2	0.92	0.94	0.92	55.2
8	T1	129	18	136	14.0	0.509	11.6	LOS B	3.9	32.6	1.00	1.07	1.20	49.9
9	R2	123	38	129	30.9	0.509	18.6	LOS B	3.9	32.6	1.00	1.07	1.20	59.4
Approach		351	62	369	17.7	0.509	53.8	LOS E	3.9	32.6	0.98	1.04	1.12	54.9
West: Pacific Motorway														
10	L2	123	8	129	6.5	0.380	12.6	LOS B	2.4	17.7	0.96	1.00	1.05	52.1
11	T1	1	0	1	0.0	0.519	158.8	LOS F	4.6	33.3	1.00	1.08	1.23	48.6
12	R2	238	12	251	5.0	0.519	21.4	LOS C	4.6	33.3	1.00	1.08	1.23	45.1
Approach		362	20	381	5.5	0.519	18.8	LOS B	4.6	33.3	0.99	1.05	1.17	47.4
All Vehicles		4623	260	4866	5.6	0.863	45.4	LOS D	21.1	151.3	0.73	0.85	1.09	54.2

MOVEMENT SUMMARY

Site: 104 [4. Tweed Coast Rd / Pacific Motorway Interchange 2042 PM Peak - Project Case (Site Folder: General)]

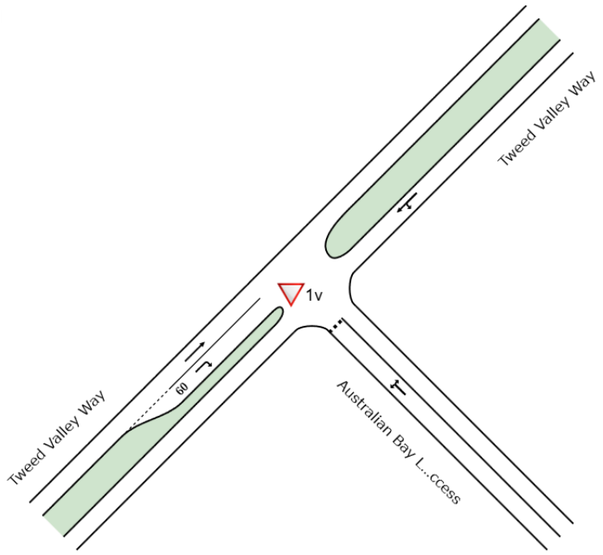
Tweed Coast Rd / Pacific Motorway Interchange
Site Category: Proposed Design 1
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Tweed Coast Road														
1	L2	190	13	200	6.8	0.725	7.9	LOS A	11.3	81.9	0.97	0.93	1.22	50.7
2	T1	48	10	51	20.8	0.725	8.4	LOS A	11.3	81.9	0.97	0.93	1.22	51.2
3	R2	1401	38	1475	2.7	0.725	19.5	LOS B	11.3	81.9	0.98	0.99	1.29	58.9
Approach		1639	61	1725	3.7	0.725	17.8	LOS B	11.3	81.9	0.98	0.98	1.28	57.6
East: Pacific Motorway														
4	L2	1907	54	2007	2.8	0.715	3.4	LOS A	9.6	70.0	0.27	0.37	0.31	58.3
5	T1	278	32	293	11.5	0.715	5.8	LOS A	9.6	70.0	0.82	0.71	0.93	55.8
6	R2	209	8	220	3.8	0.715	12.5	LOS B	9.6	70.0	0.82	0.71	0.93	65.7
Approach		2394	94	2520	3.9	0.715	4.5	LOS A	9.6	70.0	0.38	0.44	0.43	58.6
North: Chinderah Road														
7	L2	93	2	98	2.2	0.181	13.0	LOS B	1.0	7.3	0.86	0.77	0.86	55.8
8	T1	141	10	148	7.1	0.360	6.8	LOS A	2.5	18.4	0.94	0.82	0.96	52.8
9	R2	97	4	102	4.1	0.360	13.6	LOS B	2.5	18.4	0.94	0.82	0.96	63.0
Approach		331	16	348	4.8	0.360	10.5	LOS B	2.5	18.4	0.92	0.80	0.93	56.7
West: Pacific Motorway														
10	L2	119	2	125	1.7	0.291	8.3	LOS A	1.7	12.0	0.90	0.92	0.90	55.3
11	T1	1	0	1	0.0	0.333	13.9	LOS B	2.4	17.7	0.98	0.91	0.98	51.9
12	R2	197	10	207	5.1	0.333	14.4	LOS B	2.4	17.7	0.98	0.91	0.98	48.7
Approach		317	12	334	3.8	0.333	12.1	LOS B	2.4	17.7	0.95	0.92	0.95	51.1
All Vehicles		4681	183	4927	3.9	0.725	10.1	LOS B	11.3	81.9	0.67	0.69	0.80	57.5

Tweed Valley Way / ABLP Site Access – 2022 Base Case

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



MOVEMENT SUMMARY

▽ Site: 1v [5. Tweed Valley Way / ABLP Site Access 2022 AM Peak - Base Case (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Australian Bay Lobster Producers Ltd (ABLP) Access														
1	L2	3	1	3	33.3	0.017	9.9	LOS A	0.1	0.6	0.70	0.80	0.70	45.4
2	R2	2	2	2	100.0	0.017	25.4	LOS D	0.1	0.6	0.70	0.80	0.70	42.9
Approach		5	3	5	60.0	0.017	16.1	LOS C	0.1	0.6	0.70	0.80	0.70	44.4
NorthEast: Tweed Valley Way														
3	L2	3	0	3	0.0	0.337	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.2
4	T1	595	39	626	6.6	0.337	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		598	39	629	6.5	0.337	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	61	15	64	24.6	0.038	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	4	2	4	50.0	0.007	10.8	LOS B	0.0	0.3	0.61	0.69	0.61	47.8
Approach		65	17	68	26.2	0.038	0.7	NA	0.0	0.3	0.04	0.04	0.04	59.1
All Vehicles		668	59	703	8.8	0.337	0.3	NA	0.1	0.6	0.01	0.01	0.01	59.5

MOVEMENT SUMMARY

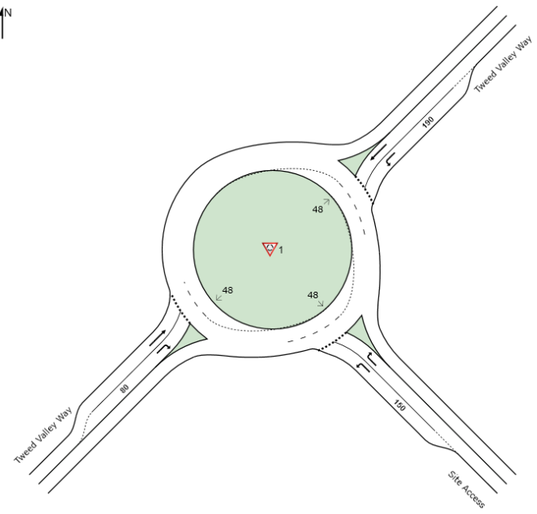
▽ Site: 1v [5. Tweed Valley Way / ABLP Site Access 2022 PM Peak - Base Case (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Australian Bay Lobster Producers Ltd (ABLP) Access														
1	L2	8	4	8	50.0	0.020	10.6	LOS B	0.1	0.7	0.61	0.75	0.61	47.5
2	R2	1	1	1	100.0	0.020	23.4	LOS C	0.1	0.7	0.61	0.75	0.61	45.2
Approach		9	5	9	55.6	0.020	12.0	LOS B	0.1	0.7	0.61	0.75	0.61	47.2
NorthEast: Tweed Valley Way														
3	L2	1	0	1	0.0	0.323	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.2
4	T1	573	37	603	6.5	0.323	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		574	37	604	6.4	0.323	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
SouthWest: Tweed Valley Way														
5	T1	50	12	53	24.0	0.031	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	1	1	1	100.0	0.002	13.6	LOS B	0.0	0.1	0.65	0.66	0.65	44.1
Approach		51	13	54	25.5	0.031	0.3	NA	0.0	0.1	0.01	0.01	0.01	59.6
All Vehicles		634	55	667	8.7	0.323	0.3	NA	0.1	0.7	0.01	0.01	0.01	59.5

Tweed Valley Way / ABLP Site Access – 2022 Project Case



MOVEMENT SUMMARY

Site: 1 [5. Tweed Valley Way / ABLP Site Access 2022 AM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	33	31	35	93.9	0.092	11.2	LOS A	0.4	8.5	0.61	0.73	0.61	50.1
6	R2	4	4	4	100.0	0.013	19.2	LOS B	0.0	0.9	0.61	0.71	0.61	46.8
Approach		37	35	39	94.6	0.092	12.0	LOS A	0.4	8.5	0.61	0.73	0.61	49.7
NorthEast: Tweed Valley Way														
7	L2	33	30	35	90.9	0.049	3.8	LOS A	0.2	4.0	0.07	0.34	0.07	55.5
8	T1	595	39	626	6.6	0.352	2.4	LOS A	1.8	13.7	0.06	0.24	0.06	60.7
Approach		628	69	661	11.0	0.352	2.5	LOS A	1.8	13.7	0.06	0.24	0.06	60.4
SouthWest: Tweed Valley Way														
2	T1	61	15	64	24.6	0.041	2.4	LOS A	0.2	1.6	0.05	0.23	0.05	60.6
3	R2	6	4	6	66.7	0.009	10.4	LOS A	0.0	0.5	0.07	0.54	0.07	53.6
Approach		67	19	71	28.4	0.041	3.2	LOS A	0.2	1.6	0.05	0.26	0.05	59.9
All Vehicles		732	123	771	16.8	0.352	3.0	LOS A	1.8	13.7	0.09	0.27	0.09	59.7

MOVEMENT SUMMARY

Site: 1 [5. Tweed Valley Way / ABLP Site Access 2022 PM Peak - Project Case (Site Folder: General)]

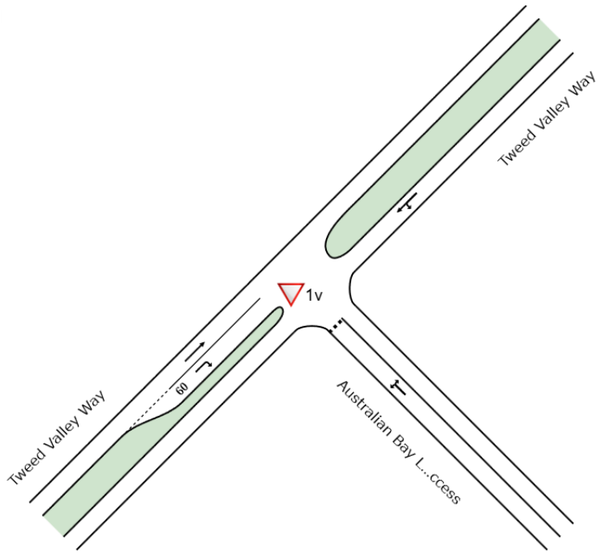
Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	38	34	40	89.5	0.094	10.1	LOS A	0.4	8.1	0.60	0.71	0.60	50.9
6	R2	4	4	4	100.0	0.013	18.8	LOS B	0.0	0.9	0.60	0.71	0.60	47.0
Approach		42	38	44	90.5	0.094	10.9	LOS A	0.4	8.1	0.60	0.71	0.60	50.5
NorthEast: Tweed Valley Way														
7	L2	31	31	33	100.0	0.046	3.8	LOS A	0.2	3.9	0.05	0.34	0.05	54.7
8	T1	573	37	603	6.5	0.336	2.4	LOS A	1.7	12.7	0.04	0.23	0.04	60.8
Approach		604	68	636	11.3	0.336	2.4	LOS A	1.7	12.7	0.04	0.24	0.04	60.5
SouthWest: Tweed Valley Way														
2	T1	50	12	53	24.0	0.033	2.4	LOS A	0.2	1.3	0.05	0.23	0.05	60.6
3	R2	3	2	3	66.7	0.004	10.5	LOS A	0.0	0.3	0.07	0.53	0.07	53.4
Approach		53	14	56	26.4	0.033	2.9	LOS A	0.2	1.3	0.05	0.25	0.05	60.1
All Vehicles		699	120	736	17.2	0.336	3.0	LOS A	1.7	12.7	0.08	0.27	0.08	59.8

Tweed Valley Way / ABLP Site Access – 2032 Base Case

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



MOVEMENT SUMMARY

Site: 1v [5. Tweed Valley Way / ABLP Site Access 2032 AM Peak - Base Case (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Australian Bay Lobster Producers Ltd (ABLP) Access														
1	L2	3	1	3	33.3	0.019	10.4	LOS B	0.1	0.7	0.73	0.83	0.73	44.6
2	R2	2	2	2	100.0	0.019	28.3	LOS D	0.1	0.7	0.73	0.83	0.73	42.2
Approach		5	3	5	60.0	0.019	17.5	LOS C	0.1	0.7	0.73	0.83	0.73	43.6
NorthEast: Tweed Valley Way														
3	L2	3	0	3	0.0	0.358	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	58.1
4	T1	632	42	665	6.6	0.358	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		635	42	668	6.6	0.358	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	64	16	67	25.0	0.040	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	4	2	4	50.0	0.008	11.4	LOS B	0.0	0.3	0.63	0.71	0.63	47.4
Approach		68	18	72	26.5	0.040	0.7	NA	0.0	0.3	0.04	0.04	0.04	59.1
All Vehicles		708	63	745	8.9	0.358	0.3	NA	0.1	0.7	0.01	0.01	0.01	59.5

MOVEMENT SUMMARY

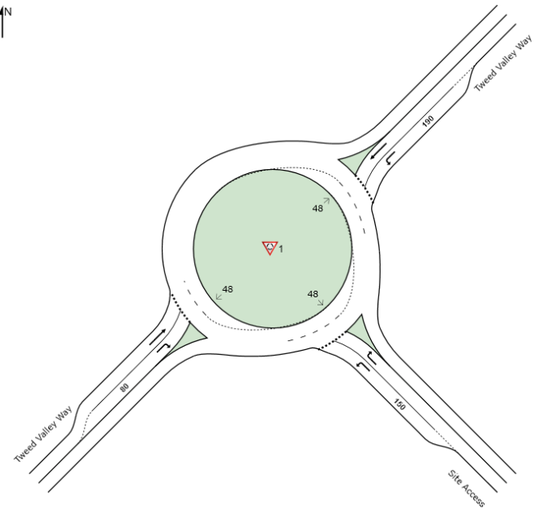
Site: 1v [5. Tweed Valley Way / ABLP Site Access 2032 PM Peak - Base Case (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Australian Bay Lobster Producers Ltd (ABLP) Access														
1	L2	9	4	9	44.4	0.029	10.8	LOS B	0.1	1.0	0.66	0.80	0.66	46.7
2	R2	2	2	2	100.0	0.029	26.0	LOS D	0.1	1.0	0.66	0.80	0.66	44.3
Approach		11	6	12	54.5	0.029	13.6	LOS B	0.1	1.0	0.66	0.80	0.66	46.2
NorthEast: Tweed Valley Way														
3	L2	1	1	1	100.0	0.343	6.8	LOS A	0.0	0.0	0.00	0.00	0.00	53.5
4	T1	608	40	640	6.6	0.343	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach		609	41	641	6.7	0.343	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
SouthWest: Tweed Valley Way														
5	T1	53	13	56	24.5	0.033	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	1	0	1	0.0	0.001	8.2	LOS A	0.0	0.0	0.56	0.59	0.56	51.1
Approach		54	13	57	24.1	0.033	0.2	NA	0.0	0.0	0.01	0.01	0.01	59.8
All Vehicles		674	60	709	8.9	0.343	0.3	NA	0.1	1.0	0.01	0.01	0.01	59.5

Tweed Valley Way / ABLP Site Access – 2032 Project Case



MOVEMENT SUMMARY

Site: 1 [5. Tweed Valley Way / ABLP Site Access 2032 AM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Av
SouthEast: Site Access													
4	L2	34	31	36	91.2	0.095	11.5	LOS A	0.4	8.7	0.63	0.74	
6	R2	4	4	4	100.0	0.014	19.7	LOS B	0.1	1.0	0.62	0.72	
Approach		38	35	40	92.1	0.095	12.3	LOS A	0.4	8.7	0.63	0.74	
NorthEast: Tweed Valley Way													
7	L2	34	30	36	88.2	0.051	3.7	LOS A	0.2	4.1	0.07	0.34	
8	T1	632	42	665	6.6	0.374	2.4	LOS A	2.0	14.9	0.06	0.24	
Approach		666	72	701	10.8	0.374	2.5	LOS A	2.0	14.9	0.06	0.24	
SouthWest: Tweed Valley Way													
2	T1	64	16	67	25.0	0.043	2.4	LOS A	0.2	1.7	0.05	0.23	
3	R2	6	4	6	66.7	0.009	10.4	LOS A	0.0	0.5	0.07	0.54	
Approach		70	20	74	28.6	0.043	3.1	LOS A	0.2	1.7	0.05	0.26	
All Vehicles		774	127	815	16.4	0.374	3.0	LOS A	2.0	14.9	0.09	0.27	

MOVEMENT SUMMARY

Site: 1 [5. Tweed Valley Way / ABLP Site Access 2032 PM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Av
SouthEast: Site Access													
4	L2	39	34	41	87.2	0.098	10.4	LOS A	0.4	8.4	0.61	0.72	
6	R2	4	4	4	100.0	0.013	19.3	LOS B	0.0	0.9	0.61	0.72	
Approach		43	38	45	88.4	0.098	11.2	LOS A	0.4	8.4	0.61	0.72	
NorthEast: Tweed Valley Way													
7	L2	31	31	33	100.0	0.046	3.8	LOS A	0.2	3.9	0.05	0.34	
8	T1	608	40	640	6.6	0.357	2.4	LOS A	1.9	13.9	0.05	0.23	
Approach		639	71	673	11.1	0.357	2.4	LOS A	1.9	13.9	0.05	0.24	
SouthWest: Tweed Valley Way													
2	T1	53	13	56	24.5	0.035	2.4	LOS A	0.2	1.4	0.05	0.23	
3	R2	3	2	3	66.7	0.004	10.5	LOS A	0.0	0.3	0.07	0.53	
Approach		56	15	59	26.8	0.035	2.9	LOS A	0.2	1.4	0.05	0.25	
All Vehicles		738	124	777	16.8	0.357	3.0	LOS A	1.9	13.9	0.08	0.27	

Tweed Valley Way / ABLP Site Access – 2042 Base Case

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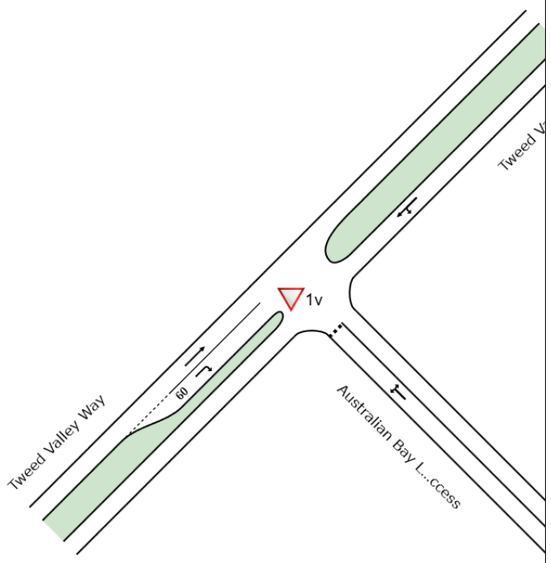


MOVEMENT SUMMARY

Site: 1v [5. Tweed Valley Way / ABLP Site Access 2042 AM Peak - Base Case (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Australian Bay Lobster Producers Ltd (ABLP) Access														
1	L2	3	1	3	33.3	0.022	10.9	LOS B	0.1	0.7	0.76	0.85	0.76	43.7
2	R2	2	2	2	100.0	0.022	31.9	LOS D	0.1	0.7	0.76	0.85	0.76	41.3
Approach		5	3	5	60.0	0.022	19.3	LOS C	0.1	0.7	0.76	0.85	0.76	42.7
NorthEast: Tweed Valley Way														
3	L2	3	0	3	0.0	0.379	5.7	LOS A	0.0	0.0	0.00	0.00	0.00	58.1
4	T1	671	44	706	6.6	0.379	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		674	44	709	6.5	0.379	0.2	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	68	17	72	25.0	0.043	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	5	2	5	40.0	0.010	11.4	LOS B	0.0	0.3	0.64	0.73	0.64	47.7
Approach		73	19	77	26.0	0.043	0.8	NA	0.0	0.3	0.04	0.05	0.04	58.9
All Vehicles		752	66	792	8.8	0.379	0.3	NA	0.1	0.7	0.01	0.01	0.01	59.5

MOVEMENT SUMMARY

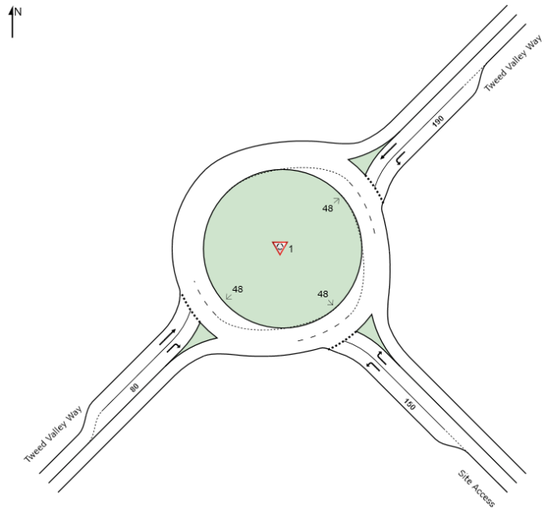
Site: 1v [5. Tweed Valley Way / ABLP Site Access 2042 PM Peak - Base Case (Site Folder: General)]

Three-way intersection with 3-lane major road (Stop control)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Australian Bay Lobster Producers Ltd (ABLP) Access														
1	L2	9	5	9	55.6	0.034	12.2	LOS B	0.1	1.2	0.70	0.84	0.70	45.4
2	R2	2	2	2	100.0	0.034	28.9	LOS D	0.1	1.2	0.70	0.84	0.70	43.4
Approach		11	7	12	63.6	0.034	15.2	LOS C	0.1	1.2	0.70	0.84	0.70	45.0
NorthEast: Tweed Valley Way														
3	L2	1	1	1	100.0	0.364	6.8	LOS A	0.0	0.0	0.00	0.00	0.00	53.5
4	T1	645	42	679	6.5	0.364	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.7
Approach		646	43	680	6.7	0.364	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.7
SouthWest: Tweed Valley Way														
5	T1	56	14	59	25.0	0.035	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
6	R2	1	0	1	0.0	0.001	8.5	LOS A	0.0	0.0	0.58	0.60	0.58	50.9
Approach		57	14	60	24.6	0.035	0.2	NA	0.0	0.0	0.01	0.01	0.01	59.8
All Vehicles		714	64	752	9.0	0.364	0.4	NA	0.1	1.2	0.01	0.01	0.01	59.4

Tweed Valley Way / ABLP Site Access – 2042 Project Case



MOVEMENT SUMMARY

Site: 1 [5. Tweed Valley Way / ABLP Site Access 2042 AM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	34	31	36	91.2	0.099	12.1	LOS A	0.4	9.1	0.64	0.76	0.64	49.5
6	R2	4	4	4	100.0	0.014	20.3	LOS B	0.1	1.0	0.63	0.73	0.63	46.2
Approach		38	35	40	92.1	0.099	12.9	LOS A	0.4	9.1	0.64	0.76	0.64	49.1
NorthEast: Tweed Valley Way														
7	L2	34	30	36	88.2	0.051	3.7	LOS A	0.2	4.1	0.07	0.34	0.07	55.6
8	T1	671	44	706	6.6	0.397	2.4	LOS A	2.2	16.3	0.06	0.24	0.06	60.7
Approach		705	74	742	10.5	0.397	2.5	LOS A	2.2	16.3	0.07	0.24	0.07	60.4
SouthWest: Tweed Valley Way														
2	T1	68	17	72	25.0	0.045	2.4	LOS A	0.2	1.9	0.05	0.23	0.05	60.6
3	R2	6	4	6	66.7	0.009	10.4	LOS A	0.0	0.5	0.07	0.54	0.07	53.6
Approach		74	21	78	28.4	0.045	3.1	LOS A	0.2	1.9	0.06	0.25	0.06	59.9
All Vehicles		817	130	860	15.9	0.397	3.0	LOS A	2.2	16.3	0.09	0.27	0.09	59.7

MOVEMENT SUMMARY

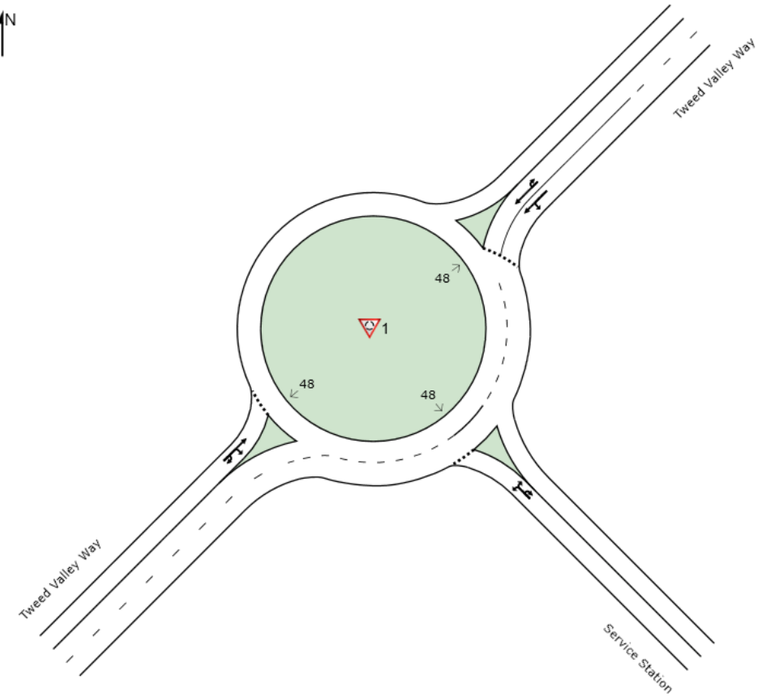
Site: 1 [5. Tweed Valley Way / ABLP Site Access 2042 PM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Site Access Roundabout
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Site Access														
4	L2	40	35	42	87.5	0.102	10.8	LOS A	0.4	8.7	0.62	0.73	0.62	50.5
6	R2	4	4	4	100.0	0.014	19.9	LOS B	0.1	1.0	0.62	0.72	0.62	46.4
Approach		44	39	46	88.6	0.102	11.6	LOS A	0.4	8.7	0.62	0.73	0.62	50.0
NorthEast: Tweed Valley Way														
7	L2	32	31	34	96.9	0.047	3.8	LOS A	0.2	4.0	0.05	0.34	0.05	55.5
8	T1	645	42	679	6.5	0.378	2.4	LOS A	2.0	15.1	0.05	0.23	0.05	60.8
Approach		677	73	713	10.8	0.378	2.4	LOS A	2.0	15.1	0.05	0.24	0.05	60.5
SouthWest: Tweed Valley Way														
2	T1	56	14	59	25.0	0.037	2.4	LOS A	0.2	1.5	0.05	0.23	0.05	60.6
3	R2	3	2	3	66.7	0.004	10.5	LOS A	0.0	0.3	0.07	0.53	0.07	53.4
Approach		59	16	62	27.1	0.037	2.9	LOS A	0.2	1.5	0.05	0.24	0.05	60.2
All Vehicles		780	128	821	16.4	0.378	3.0	LOS A	2.0	15.1	0.08	0.27	0.08	59.8

Tweed Valley Way / Service Station Roundabout – 2022 Base Case



MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2022 AM Peak - Base Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	22	4	23	18.2	0.200	4.9	LOS A	0.8	6.7	0.51	0.76	0.51	51.6
6	R2	143	40	151	28.0	0.200	12.1	LOS B	0.8	6.7	0.51	0.76	0.51	54.0
6u	U	1	0	1	0.0	0.200	13.9	LOS B	0.8	6.7	0.51	0.76	0.51	56.8
Approach		166	44	175	26.5	0.200	11.1	LOS B	0.8	6.7	0.51	0.76	0.51	53.7
NorthEast: Tweed Valley Way														
7	L2	44	6	46	13.6	0.195	3.1	LOS A	1.2	8.8	0.14	0.26	0.14	57.2
8	T1	563	39	593	6.9	0.195	2.4	LOS A	1.2	8.8	0.15	0.26	0.15	59.9
9u	U	8	1	8	12.5	0.195	12.5	LOS B	1.2	8.6	0.15	0.27	0.15	63.2
Approach		615	46	647	7.5	0.195	2.6	LOS A	1.2	8.8	0.15	0.26	0.15	59.7
SouthWest: Tweed Valley Way														
2	T1	37	11	39	29.7	0.056	2.9	LOS A	0.3	2.4	0.35	0.47	0.35	56.0
3	R2	30	1	32	3.3	0.056	10.2	LOS B	0.3	2.4	0.35	0.47	0.35	57.2
3u	U	1	0	1	0.0	0.056	12.8	LOS B	0.3	2.4	0.35	0.47	0.35	59.6
Approach		68	12	72	17.6	0.056	6.3	LOS A	0.3	2.4	0.35	0.47	0.35	56.6
All Vehicles		849	102	894	12.0	0.200	4.6	LOS A	1.2	8.8	0.23	0.38	0.23	58.2

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2022 PM Peak - Base Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	41	2	43	4.9	0.293	4.8	LOS A	1.2	9.8	0.53	0.77	0.53	51.9
6	R2	218	37	229	17.0	0.293	12.0	LOS B	1.2	9.8	0.53	0.77	0.53	54.4
6u	U	1	0	1	0.0	0.293	14.1	LOS B	1.2	9.8	0.53	0.77	0.53	56.9
Approach		260	39	274	15.0	0.293	10.8	LOS B	1.2	9.8	0.53	0.77	0.53	54.0
NorthEast: Tweed Valley Way														
7	L2	44	8	46	18.2	0.198	3.2	LOS A	1.2	9.3	0.16	0.26	0.16	57.0
8	T1	565	44	595	7.8	0.198	2.5	LOS A	1.2	9.3	0.16	0.27	0.16	59.8
9u	U	8	2	8	25.0	0.198	12.6	LOS B	1.2	9.0	0.17	0.27	0.17	62.6
Approach		617	54	649	8.8	0.198	2.7	LOS A	1.2	9.3	0.16	0.27	0.16	59.6
SouthWest: Tweed Valley Way														
2	T1	32	5	34	15.6	0.057	3.1	LOS A	0.3	2.5	0.42	0.50	0.42	55.9
3	R2	33	5	35	15.2	0.057	10.7	LOS B	0.3	2.5	0.42	0.50	0.42	56.6
3u	U	1	0	1	0.0	0.057	13.1	LOS B	0.3	2.5	0.42	0.50	0.42	59.4
Approach		66	10	69	15.2	0.057	7.0	LOS A	0.3	2.5	0.42	0.50	0.42	56.3
All Vehicles		943	103	993	10.9	0.293	5.2	LOS A	1.2	9.8	0.28	0.42	0.28	57.7

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2022 AM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	22	4	23	18.2	0.207	5.1	LOS A	0.8	7.0	0.53	0.78	0.53	51.6
6	R2	143	40	151	28.0	0.207	12.3	LOS B	0.8	7.0	0.53	0.78	0.53	53.9
6u	U	1	0	1	0.0	0.207	14.1	LOS B	0.8	7.0	0.53	0.78	0.53	56.7
Approach		166	44	175	26.5	0.207	11.4	LOS B	0.8	7.0	0.53	0.78	0.53	53.6
NorthEast: Tweed Valley Way														
7	L2	44	6	46	13.6	0.220	3.1	LOS A	1.4	10.4	0.15	0.26	0.15	57.2
8	T1	563	39	593	6.9	0.220	2.4	LOS A	1.4	10.4	0.15	0.28	0.15	59.8
9u	U	40	33	42	82.5	0.220	13.6	LOS B	1.3	12.2	0.16	0.32	0.16	59.6
Approach		647	78	681	12.1	0.220	3.2	LOS A	1.4	12.2	0.15	0.28	0.15	59.6
SouthWest: Tweed Valley Way														
2	T1	37	11	39	29.7	0.059	3.3	LOS A	0.3	2.5	0.41	0.49	0.41	55.8
3	R2	30	1	32	3.3	0.059	10.5	LOS B	0.3	2.5	0.41	0.49	0.41	57.0
3u	U	1	0	1	0.0	0.059	13.1	LOS B	0.3	2.5	0.41	0.49	0.41	59.4
Approach		68	12	72	17.6	0.059	6.6	LOS A	0.3	2.5	0.41	0.49	0.41	56.3
All Vehicles		881	134	927	15.2	0.220	5.0	LOS A	1.4	12.2	0.24	0.39	0.24	58.1

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2022 PM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	41	2	43	4.9	0.302	5.0	LOS A	1.3	10.1	0.56	0.79	0.56	51.8
6	R2	218	37	229	17.0	0.302	12.2	LOS B	1.3	10.1	0.56	0.79	0.56	54.3
6u	U	1	0	1	0.0	0.302	14.3	LOS B	1.3	10.1	0.56	0.79	0.56	56.8
Approach		260	39	274	15.0	0.302	11.1	LOS B	1.3	10.1	0.56	0.79	0.56	53.9
NorthEast: Tweed Valley Way														
7	L2	44	8	46	18.2	0.223	3.2	LOS A	1.4	10.9	0.16	0.26	0.16	57.0
8	T1	565	44	595	7.8	0.223	2.5	LOS A	1.4	10.9	0.17	0.28	0.17	59.7
9u	U	40	34	42	85.0	0.223	13.7	LOS B	1.3	12.6	0.18	0.32	0.18	59.5
Approach		649	86	683	13.3	0.223	3.2	LOS A	1.4	12.6	0.17	0.28	0.17	59.5
SouthWest: Tweed Valley Way														
2	T1	32	5	34	15.6	0.060	3.4	LOS A	0.3	2.6	0.47	0.53	0.47	55.7
3	R2	33	5	35	15.2	0.060	11.0	LOS B	0.3	2.6	0.47	0.53	0.47	56.4
3u	U	1	0	1	0.0	0.060	13.4	LOS B	0.3	2.6	0.47	0.53	0.47	59.1
Approach		66	10	69	15.2	0.060	7.4	LOS A	0.3	2.6	0.47	0.53	0.47	56.1
All Vehicles		975	135	1026	13.8	0.302	5.6	LOS A	1.4	12.6	0.29	0.44	0.29	57.6

Tweed Valley Way / Service Station Roundabout – 2032 Base Case

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2032 AM Peak - Base Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	24	4	25	16.7	0.215	5.0	LOS A	0.8	7.2	0.52	0.77	0.52	51.7
6	R2	151	43	159	28.5	0.215	12.2	LOS B	0.8	7.2	0.52	0.77	0.52	54.0
6u	U	1	0	1	0.0	0.215	14.0	LOS B	0.8	7.2	0.52	0.77	0.52	56.8
Approach		176	47	185	26.7	0.215	11.2	LOS B	0.8	7.2	0.52	0.77	0.52	53.7
NorthEast: Tweed Valley Way														
7	L2	46	6	48	13.0	0.205	3.1	LOS A	1.3	9.4	0.12	0.25	0.12	57.4
8	T1	597	42	628	7.0	0.205	2.4	LOS A	1.3	9.4	0.12	0.26	0.12	60.0
9u	U	9	1	9	11.1	0.205	12.4	LOS B	1.2	9.2	0.13	0.26	0.13	63.4
Approach		652	49	686	7.5	0.205	2.6	LOS A	1.3	9.4	0.12	0.26	0.12	59.9
SouthWest: Tweed Valley Way														
2	T1	40	12	42	30.0	0.052	2.9	LOS A	0.3	2.3	0.36	0.44	0.36	56.5
3	R2	21	1	22	4.8	0.052	10.2	LOS B	0.3	2.3	0.36	0.44	0.36	57.7
3u	U	1	0	1	0.0	0.052	12.8	LOS B	0.3	2.3	0.36	0.44	0.36	60.2
Approach		62	13	65	21.0	0.052	5.6	LOS A	0.3	2.3	0.36	0.44	0.36	57.0
All Vehicles		890	109	937	12.2	0.215	4.5	LOS A	1.3	9.4	0.22	0.37	0.22	58.3

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2032 PM Peak - Base Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	44	2	46	4.5	0.316	4.9	LOS A	1.4	10.7	0.55	0.79	0.55	51.8
6	R2	231	40	243	17.3	0.316	12.1	LOS B	1.4	10.7	0.55	0.79	0.55	54.3
6u	U	1	0	1	0.0	0.316	14.2	LOS B	1.4	10.7	0.55	0.79	0.55	56.8
Approach		276	42	291	15.2	0.316	11.0	LOS B	1.4	10.7	0.55	0.79	0.55	53.9
NorthEast: Tweed Valley Way														
7	L2	46	9	48	19.6	0.210	3.2	LOS A	1.3	10.0	0.16	0.26	0.16	57.0
8	T1	599	46	631	7.7	0.210	2.5	LOS A	1.3	10.0	0.17	0.27	0.17	59.7
9u	U	9	2	9	22.2	0.210	12.6	LOS B	1.3	9.7	0.18	0.27	0.18	62.7
Approach		654	57	688	8.7	0.210	2.7	LOS A	1.3	10.0	0.17	0.27	0.17	59.6
SouthWest: Tweed Valley Way														
2	T1	34	5	36	14.7	0.060	3.1	LOS A	0.3	2.6	0.43	0.51	0.43	55.8
3	R2	35	5	37	14.3	0.060	10.7	LOS B	0.3	2.6	0.43	0.51	0.43	56.6
3u	U	1	0	1	0.0	0.060	13.1	LOS B	0.3	2.6	0.43	0.51	0.43	59.3
Approach		70	10	74	14.3	0.060	7.1	LOS A	0.3	2.6	0.43	0.51	0.43	56.2
All Vehicles		1000	109	1053	10.9	0.316	5.3	LOS A	1.4	10.7	0.29	0.43	0.29	57.6

Tweed Valley Way / Service Station Roundabout – 2032 Project Case

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2032 AM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	24	4	25	16.7	0.222	5.2	LOS A	0.9	7.5	0.54	0.80	0.54	51.6
6	R2	151	43	159	28.5	0.222	12.5	LOS B	0.9	7.5	0.54	0.80	0.54	53.9
6u	U	1	0	1	0.0	0.222	14.2	LOS B	0.9	7.5	0.54	0.80	0.54	56.7
Approach		176	47	185	26.7	0.222	11.5	LOS B	0.9	7.5	0.54	0.80	0.54	53.6
NorthEast: Tweed Valley Way														
7	L2	46	6	48	13.0	0.229	3.1	LOS A	1.5	11.0	0.12	0.25	0.12	57.4
8	T1	597	42	628	7.0	0.229	2.4	LOS A	1.5	11.0	0.13	0.28	0.13	60.0
9u	U	41	33	43	80.5	0.229	13.5	LOS B	1.4	12.8	0.14	0.31	0.14	59.9
Approach		684	81	720	11.8	0.229	3.1	LOS A	1.5	12.8	0.13	0.28	0.13	59.8
SouthWest: Tweed Valley Way														
2	T1	40	12	42	30.0	0.055	3.3	LOS A	0.3	2.4	0.42	0.47	0.42	56.2
3	R2	21	1	22	4.8	0.055	10.6	LOS B	0.3	2.4	0.42	0.47	0.42	57.4
3u	U	1	0	1	0.0	0.055	13.1	LOS B	0.3	2.4	0.42	0.47	0.42	59.9
Approach		62	13	65	21.0	0.055	5.9	LOS A	0.3	2.4	0.42	0.47	0.42	56.7
All Vehicles		922	141	971	15.3	0.229	4.9	LOS A	1.5	12.8	0.23	0.39	0.23	58.3

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2032 PM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	44	2	46	4.5	0.327	5.1	LOS A	1.4	11.1	0.58	0.81	0.58	51.7
6	R2	231	40	243	17.3	0.327	12.4	LOS B	1.4	11.1	0.58	0.81	0.58	54.2
6u	U	1	0	1	0.0	0.327	14.4	LOS B	1.4	11.1	0.58	0.81	0.58	56.7
Approach		276	42	291	15.2	0.327	11.2	LOS B	1.4	11.1	0.58	0.81	0.58	53.8
NorthEast: Tweed Valley Way														
7	L2	46	9	48	19.6	0.236	3.2	LOS A	1.6	11.7	0.17	0.26	0.17	56.9
8	T1	599	46	631	7.7	0.236	2.5	LOS A	1.6	11.7	0.18	0.29	0.18	59.7
9u	U	41	34	43	82.9	0.236	13.7	LOS B	1.4	13.4	0.19	0.32	0.19	59.5
Approach		686	89	722	13.0	0.236	3.2	LOS A	1.6	13.4	0.18	0.29	0.18	59.5
SouthWest: Tweed Valley Way														
2	T1	34	5	36	14.7	0.064	3.5	LOS A	0.4	2.8	0.49	0.54	0.49	55.6
3	R2	35	5	37	14.3	0.064	11.1	LOS B	0.4	2.8	0.49	0.54	0.49	56.3
3u	U	1	0	1	0.0	0.064	13.5	LOS B	0.4	2.8	0.49	0.54	0.49	59.1
Approach		70	10	74	14.3	0.064	7.4	LOS A	0.4	2.8	0.49	0.54	0.49	56.0
All Vehicles		1032	141	1086	13.7	0.327	5.6	LOS A	1.6	13.4	0.31	0.44	0.31	57.6

Tweed Valley Way / Service Station Roundabout – 2042 Base Case

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2042 AM Peak - Base Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	25	5	26	20.0	0.233	5.2	LOS A	0.9	7.9	0.54	0.79	0.54	51.5
6	R2	161	46	169	28.6	0.233	12.4	LOS B	0.9	7.9	0.54	0.79	0.54	53.9
6u	U	1	0	1	0.0	0.233	14.2	LOS B	0.9	7.9	0.54	0.79	0.54	56.7
Approach		187	51	197	27.3	0.233	11.4	LOS B	0.9	7.9	0.54	0.79	0.54	53.6
NorthEast: Tweed Valley Way														
7	L2	49	7	52	14.3	0.218	3.1	LOS A	1.4	10.2	0.12	0.26	0.12	57.3
8	T1	634	44	667	6.9	0.218	2.4	LOS A	1.4	10.2	0.13	0.26	0.13	60.0
9u	U	9	1	9	11.1	0.218	12.4	LOS B	1.3	9.9	0.14	0.26	0.14	63.4
Approach		692	52	728	7.5	0.218	2.6	LOS A	1.4	10.2	0.13	0.26	0.13	59.8
SouthWest: Tweed Valley Way														
2	T1	42	13	44	31.0	0.056	3.0	LOS A	0.3	2.5	0.38	0.45	0.38	56.4
3	R2	23	1	24	4.3	0.056	10.3	LOS B	0.3	2.5	0.38	0.45	0.38	57.6
3u	U	1	0	1	0.0	0.056	12.9	LOS B	0.3	2.5	0.38	0.45	0.38	60.1
Approach		66	14	69	21.2	0.056	5.7	LOS A	0.3	2.5	0.38	0.45	0.38	56.8
All Vehicles		945	117	995	12.4	0.233	4.6	LOS A	1.4	10.2	0.23	0.38	0.23	58.2

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2042 PM Peak - Base Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	47	2	49	4.3	0.342	5.0	LOS A	1.5	11.7	0.57	0.80	0.57	51.8
6	R2	245	42	258	17.1	0.342	12.3	LOS B	1.5	11.7	0.57	0.80	0.57	54.3
6u	U	1	0	1	0.0	0.342	14.4	LOS B	1.5	11.7	0.57	0.80	0.57	56.7
Approach		293	44	308	15.0	0.342	11.1	LOS B	1.5	11.7	0.57	0.80	0.57	53.9
NorthEast: Tweed Valley Way														
7	L2	49	9	52	18.4	0.224	3.2	LOS A	1.4	10.9	0.17	0.27	0.17	56.9
8	T1	636	49	669	7.7	0.224	2.5	LOS A	1.4	10.9	0.18	0.27	0.18	59.6
9u	U	9	2	9	22.2	0.224	12.6	LOS B	1.4	10.5	0.19	0.28	0.19	62.6
Approach		694	60	731	8.6	0.224	2.7	LOS A	1.4	10.9	0.18	0.27	0.18	59.5
SouthWest: Tweed Valley Way														
2	T1	36	6	38	16.7	0.067	3.2	LOS A	0.4	3.0	0.45	0.52	0.45	55.7
3	R2	38	6	40	15.8	0.067	10.8	LOS B	0.4	3.0	0.45	0.52	0.45	56.4
3u	U	1	0	1	0.0	0.067	13.2	LOS B	0.4	3.0	0.45	0.52	0.45	59.2
Approach		75	12	79	16.0	0.067	7.2	LOS A	0.4	3.0	0.45	0.52	0.45	56.1
All Vehicles		1062	116	1118	10.9	0.342	5.3	LOS A	1.5	11.7	0.31	0.43	0.31	57.5

Tweed Valley Way / Service Station Roundabout – 2042 Project Case

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2042 AM Peak - Project Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	25	5	26	20.0	0.240	5.4	LOS A	1.0	8.2	0.56	0.81	0.56	51.5
6	R2	161	46	169	28.6	0.240	12.6	LOS B	1.0	8.2	0.56	0.81	0.56	53.8
6u	U	1	0	1	0.0	0.240	14.4	LOS B	1.0	8.2	0.56	0.81	0.56	56.6
Approach		187	51	197	27.3	0.240	11.7	LOS B	1.0	8.2	0.56	0.81	0.56	53.5
NorthEast: Tweed Valley Way														
7	L2	49	7	52	14.3	0.242	3.1	LOS A	1.6	11.8	0.13	0.25	0.13	57.3
8	T1	634	44	667	6.9	0.242	2.4	LOS A	1.6	11.8	0.14	0.28	0.14	59.9
9u	U	41	33	43	80.5	0.242	13.5	LOS B	1.5	13.6	0.15	0.31	0.15	59.9
Approach		724	84	762	11.6	0.242	3.1	LOS A	1.6	13.6	0.14	0.28	0.14	59.7
SouthWest: Tweed Valley Way														
2	T1	42	13	44	31.0	0.059	3.4	LOS A	0.3	2.6	0.43	0.48	0.43	56.1
3	R2	23	1	24	4.3	0.059	10.6	LOS B	0.3	2.6	0.43	0.48	0.43	57.3
3u	U	1	0	1	0.0	0.059	13.2	LOS B	0.3	2.6	0.43	0.48	0.43	59.8
Approach		66	14	69	21.2	0.059	6.1	LOS A	0.3	2.6	0.43	0.48	0.43	56.6
All Vehicles		977	149	1028	15.3	0.242	4.9	LOS A	1.6	13.6	0.24	0.39	0.24	58.2

MOVEMENT SUMMARY

Site: 1 [6. Tweed Valley Way / Service Station 2042 PM Peak -Project Case (Site Folder: General)]

Tweed Valley Way / Service Station

Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Service Station														
4	L2	47	2	49	4.3	0.353	5.3	LOS A	1.6	12.3	0.60	0.83	0.61	51.7
6	R2	245	42	258	17.1	0.353	12.6	LOS B	1.6	12.3	0.60	0.83	0.61	54.2
6u	U	1	0	1	0.0	0.353	14.6	LOS B	1.6	12.3	0.60	0.83	0.61	56.6
Approach		293	44	308	15.0	0.353	11.4	LOS B	1.6	12.3	0.60	0.83	0.61	53.8
NorthEast: Tweed Valley Way														
7	L2	49	9	52	18.4	0.250	3.2	LOS A	1.7	12.7	0.18	0.26	0.18	56.9
8	T1	636	49	669	7.7	0.250	2.5	LOS A	1.7	12.7	0.19	0.29	0.19	59.6
9u	U	41	34	43	82.9	0.250	13.8	LOS B	1.5	14.3	0.20	0.32	0.20	59.4
Approach		726	92	764	12.7	0.250	3.2	LOS A	1.7	14.3	0.19	0.29	0.19	59.4
SouthWest: Tweed Valley Way														
2	T1	36	6	38	16.7	0.070	3.6	LOS A	0.4	3.1	0.50	0.54	0.50	55.5
3	R2	38	6	40	15.8	0.070	11.2	LOS B	0.4	3.1	0.50	0.54	0.50	56.2
3u	U	1	0	1	0.0	0.070	13.5	LOS B	0.4	3.1	0.50	0.54	0.50	59.0
Approach		75	12	79	16.0	0.070	7.6	LOS A	0.4	3.1	0.50	0.54	0.50	55.9
All Vehicles		1094	148	1152	13.5	0.353	5.7	LOS A	1.7	14.3	0.32	0.45	0.32	57.5

Appendix C – BCR Calculations

Tweed Coast Road Maintenance Cost Saving

Year	Base Case	Project Case	NET VKT
	VKT along Tweed Coast Road Only	VKT along Tweed Coast Road Only	
Annually*	74,144	0	-74,144

Year	Annual Maintenance Costs ($)	Annual Maintenance Cost ($)	Annual Maintenance Cost Savings ($)
2022	$0	$0	$0
2023	$64,000	$51,803	$12,197
2024	$64,000	$51,803	$12,197
2025	$64,000	$51,803	$12,197
2026	$64,000	$51,803	$12,197
2027	$64,000	$51,803	$12,197
2028	$64,000	$51,803	$12,197
2029	$64,000	$51,803	$12,197
2030	$64,000	$51,803	$12,197
2031	$64,000	$51,803	$12,197
2032*	**$6,549,162**	**$5,901,674**	**$647,488**
2033	$98,237	$86,041	$12,197
2034	$98,237	$86,041	$12,197
2035	$98,237	$86,041	$12,197
2036	$98,237	$86,041	$12,197
2037	$98,237	$86,041	$12,197
2038	$98,237	$86,041	$12,197
2039	$98,237	$86,041	$12,197
2040	$98,237	$86,041	$12,197
2041	$98,237	$86,041	$12,197
2042	**$98,237**	**$86,041**	**$12,197**
2043	$98,237	$86,041	$12,197
2044	$98,237	$86,041	$12,197
2045	$98,237	$86,041	$12,197
2046	$98,237	$86,041	$12,197
2047	$98,237	$86,041	$12,197
2048	$98,237	$86,041	$12,197
2049	$98,237	$86,041	$12,197
2050	$98,237	$86,041	$12,197
2051	$98,237	$86,041	$12,197
2052	$98,237	$86,041	$12,197
Total	**$9,089,911**	**$8,088,717**	**$1,001,193**

Existing Tweed Coast Road (2-lanes) Maintenance Costs

****Tweed Coast Road upgraded to 4 Lanes from the M1 Interchange to Crescent St intersection***

Tweed Coast Road Upgrades to 4-lanes	Base Case TCR 4-lanes Upgrade Cost	Project Case TCR 4-lanes Upgrade Cost
Capital Cost to Upgrade Tweed Coast Road from 2 lanes to 4 lanes*	**$6,549,162**	**$5,901,674**
1.5% p.a. maintenance cost assumed for the proposed road geometry with TSP trucks (valued at $4.5m)	**$98,237**	

** Data extracted from the Tweed Shire Council 20-year growth Tweed Road Contribution Plan and growth to 2032*

.	Base Case TCR 2-lanes
4% p.a. maintenance cost assumed for the existing road geometry (valued at $1.6m)	**$64,000**

Vehicle Type	Unit costs (cents / vkt)	Unit costs (dollar / vkt)	Annual Maintenance Cost Savings ($)
Rigid 3 axle plus trailer	16.45	$0.16	$12,196.74

Source: TfNSW "Economic Parameter Values" *(2020) Table 48 - Unit cost of road maintenance by vehicle types*

PROJECT:		REVISION:	AUTHOR:	
Tweed Sand Plant (TSP)	**Tweed Coast Road Maintenance Cost Reduction**	**B**	**D.KLEIMEYER**	BURCHILLS ENGINEERING SOLUTIONS

Network Crash Cost Saving

Link Name	Base Case									Project Case								
	VKT per year	MVKT per year	Road Type	Road Width Description	Crash Cost ($/year)	Fatal crash rate	Injury Crash Rate	crash cost ($)		VKT per year	MVKT per year	Road Type	Road Width Description	Crash Cost ($/year)	Fatal crash rate	Injury Crash Rate	crash cost ($)	
								Rural Fatal	Rural Injury								Rural Fatal	Rural Injury
Altona Road Unsealed	26,867	0.027	Local	Rural Single	$3,598	0.009	0.1254	$7,808,768	$507,553									
Altona Road Sealed	74,613	0.075	Local	Rural Single	$9,993	0.009	0.1254	$7,808,768	$507,553									
Crescent Street	12,288	0.012	Local	Rural Single	$1,646	0.009	0.1254	$7,808,768	$507,553									
Tweed Coast Road (existing 2-lanes)	74,144	0.074	Arterial	Rural Single	$9,930	0.009	0.1254	$7,808,768	$507,553									
M1 off-ramp / on-ramp and M1	51,270	0.051	Freeway	Rural Single	$6,866	0.009	0.1254	$7,808,768	$507,553	189,173	0.189	Freeway	Rural Single	$25,335	0.009	0.1254	$7,808,768	$507,553
Tweed Valley Way										15,071	0.015	Arterial	Rural Single	$2,018	0.009	0.1254	$7,808,768	$507,553
Total	**239,182**	**0.239**			**$32,033**					**204,244**	**0.204**			**$27,354**				

Tweed Coast Road Upgrade Crash Cost

Link Name	Base Case								
	VKT per year	MVKT per year	Road Type	Road Width Description	Crash Cost ($/year)	Fatal crash rate	Injury Crash Rate	crash cost ($/mvkt)	
								Rural Fatal	Rural Injury
Tweed Coast Road (proposed 4-lanes)	74,144	0.074	Arterial	Urban Divided	**$16,061**	0.0044	0.2513	$9,242,523	$700,151

Haulage Route via Tweed Coast Road	M1 North		M1 South		Annual VKT
	To	From	To	From	
Altona Road Unsealed	516	516	516	516	26,867
Altona Road Sealed	1,433	1,433	1,433	1,433	74,613
Crescent Street	236	236	236	236	12,288
Tweed Coast Road	1,424	1,424	1,424	1,424	74,144
M1	1,026	671	3,491	3,653	51,270
Total	4,635	4,280	7,100	7,262	239,182
Trip Distribution	95%	95%	5%	5%	
Annual TSP Volumes	24,732	24,732	1,302	1,302	
VKT	114,633	105,853	9,242	9,453	

Haulage Route via Tweed Valley Way	M1 North		M1 South		Annual VKT
	To	From	To	From	
Tweed Valley Way	567	0	0	805	15,071
M1 on/off ramp two way	4,128	3,425	1,037	785	189,173
Total	4,695	3,425	1,037	1,590	204,244
Trip Distribution	95%	95%	5%	5%	
Annual TSP Volumes	24,732	24,732	1,302	1,302	
VKT	116,117	84,708	1,350	2,070	

NSW Crash Rates - Rural and Urban Carriageway (crashes per 100MVKT)

Attribute	Fatal Crash Rate	Injury Crash Rate	Fatal Crash Rate	Injury Crash Rate
	Rural by carriageway		Urban by carriageway	
Divided	0.41	10.23	0.44	25.13
Single	0.9	12.54	0.7	35.19
Cost	$7,808,768	$507,553	$9,242,523	$700,151

Source: Table 25 Average Crash Costs by Road Type

Two-way Volumes	Extraction (Tonnes)	
11,780	214,932	recorded data (2018)
27,404	500,000	forecast to approved tonnes extraction
52,068	950,000	forecast to future tonnes extraction

Hanson's TSP trucks distribution

95%	to/from north
5%	to /from south

PROJECT:	TITLE:	DATE:	REVISION:	AUTHOR:	
Tweed Sand Plant (TSP)	**Road Safety Benefits**	**20/10/2021**	**B**	**A.Szewczak**	BURCHILLS ENGINEERING SOLUTIONS

Road Safety Benefits

Year	Base Case	Project Case	Road Safety Benefits
	Crash Cost	Crash Cost	
2022	$32,033	$27,354	$4,679
2032	$38,164	$27,354	$10,810
2042	$38,164	$27,354	$10,810

Year	Annual Maintenance Costs ($)	Annual Maintenance Cost ($)	Annual Maintenance Cost Savings ($)	
2022	$0	$0	$0	
2023	$32,033	$27,354	$4,679	***Existing Tweed Coast Road (2-lanes) Crash Costs***
2024	$32,033	$27,354	$4,679	
2025	$32,033	$27,354	$4,679	
2026	$32,033	$27,354	$4,679	
2027	$32,033	$27,354	$4,679	
2028	$32,033	$27,354	$4,679	
2029	$32,033	$27,354	$4,679	
2030	$32,033	$27,354	$4,679	
2031	$32,033	$27,354	$4,679	
2032	**$38,164**	**$27,354**	**$10,810**	***Tweed Coast Road upgraded to 4 Lanes Crash Costs***
2033	$38,164	$27,354	$10,810	
2034	$38,164	$27,354	$10,810	
2035	$38,164	$27,354	$10,810	
2036	$38,164	$27,354	$10,810	
2037	$38,164	$27,354	$10,810	
2038	$38,164	$27,354	$10,810	
2039	$38,164	$27,354	$10,810	
2040	$38,164	$27,354	$10,810	
2041	$38,164	$27,354	$10,810	
2042	**$38,164**	**$27,354**	**$10,810**	
2043	$38,164	$27,354	$10,810	
2044	$38,164	$27,354	$10,810	
2045	$38,164	$27,354	$10,810	
2046	$38,164	$27,354	$10,810	
2047	$38,164	$27,354	$10,810	
2048	$38,164	$27,354	$10,810	
2049	$38,164	$27,354	$10,810	
2050	$38,164	$27,354	$10,810	
2051	$38,164	$27,354	$10,810	
2052	$38,164	$27,354	$10,810	
Total	**$1,089,729**	**$820,609**	**$269,120**	

Environmental Cost Benefits

Year	Base Case VKT	Project Case VKT	NET VKT
Annually Urban*	74,144	0	-74,144
Annually Rural	171,442	244,545	73,103

** Tweed Coast Road Only*

Year	Base Case Environmental	Project Case Environmental	Environmental Benefits ($)
2022	$0	$0	$0
2023	$109,997	$49,765	$60,232
2024	$109,997	$49,765	$60,232
2025	$109,997	$49,765	$60,232
2026	$109,997	$49,765	$60,232
2027	$109,997	$49,765	$60,232
2028	$109,997	$49,765	$60,232
2029	$109,997	$49,765	$60,232
2030	$109,997	$49,765	$60,232
2031	$109,997	$49,765	$60,232
2032	**$109,997**	**$49,765**	**$60,232**
2033	$109,997	$49,765	$60,232
2034	$109,997	$49,765	$60,232
2035	$109,997	$49,765	$60,232
2036	$109,997	$49,765	$60,232
2037	$109,997	$49,765	$60,232
2038	$109,997	$49,765	$60,232
2039	$109,997	$49,765	$60,232
2040	$109,997	$49,765	$60,232
2041	$109,997	$49,765	$60,232
2042	**$109,997**	**$49,765**	**$60,232**
2043	$109,997	$49,765	$60,232
2044	$109,997	$49,765	$60,232
2045	$109,997	$49,765	$60,232
2046	$109,997	$49,765	$60,232
2047	$109,997	$49,765	$60,232
2048	$109,997	$49,765	$60,232
2049	$109,997	$49,765	$60,232
2050	$109,997	$49,765	$60,232
2051	$109,997	$49,765	$60,232
2052	$109,997	$49,765	$60,232
Total	**$3,299,898**	**$1,492,946**	**$1,806,952**

Direction	North		South		Total
	From	To	From	To	
Distribution	95%	95%	5%	5%	N/A
Annual TSP Volumes	24,732	24,732	1,302	1,302	52,068
Base Case Distance (Urban TCR only) (km)	1.424	1.424	1.424	1.424	N/A
Base Case VKT (Urban TCR only)	35,219	35,219	1,854	1,854	74,144
Base Case Distance Rural (km)	3.334	2.979	5.799	5.961	18.073
Base Case VKT Rural	82,457	73,677	7,549	7,759	171,442
Project Case Distance Rural (km)	5.469	4.199	1.811	2.364	13.843
Project Case VKT Rural	135,260	103,850	2,357	3,077	244,545

RURAL

Cost in dollars per kilometre travelled

Externality type	Articulated Trucks - Rural (Medium)
Air pollution	$0.0065
GHG emissions	$0.1464
Noise	$0.0111
Water pollution	$0.0395
Total	**$0.2035**

Source: TfNSW "Economic Parameter Values" (2020) Table 40 - Externality unit costs for freight vehicles (cents per kilometre travelled) – rural

URBAN

Cost in dollars per kilometre travelled

Externality type	Articulated Trucks - Urban (Medium)
Air pollution	$0.6582
GHG emissions	$0.1464
Noise	$0.1097
Water pollution	$0.0987
Total	**$1.0130**

Source: TfNSW "Economic Parameter Values" (2020) Table 39 - Externality unit costs for freight vehicles (cents per kilometre travelled) – urban

Travel Time Cost along Tweed Valley Way (Project Case)

Year	Base Case		Project Case		Difference		Annual Travel Time Costs ($)
	AM and PM Peak		AM and PM Peak		AM and PM Peak		
	Annual Delay (hours) Light Vehicles	Annual Delay (hours) Heavy Vehicles	Annual Delay (hours) Light Vehicles	Annual Delay (hours) Heavy Vehicles	Annual Delay (hours) Light Vehicles	Annual Delay (hours) Heavy Vehicles	
2022	1,582	174	2,194	432	612	258	$35,371
2031	1,680	184	2,324	445	643	261	$36,537
2041	1,795	197	2,474	461	679	264	$37,907

Year	Annual Travel Time Cost ($)
2022	$0
2023	$35,500
2024	$35,630
2025	$35,760
2026	$35,889
2027	$36,019
2028	$36,148
2029	$36,278
2030	$36,407
2031	$36,537
2032	$36,537
2033	$36,674
2034	$36,811
2035	$36,948
2036	$37,085
2037	$37,222
2038	$37,359
2039	$37,496
2040	$37,633
2041	$37,770
2042	$37,907
2043	$37,222
2044	$37,359
2045	$37,496
2046	$37,633
2047	$37,770
2048	$37,633
2049	$37,496
2050	$37,359
2051	$37,222
2052	$37,085
Total	**$1,107,887**

Assumptions	
Light Vehicle TTC	$31.90
Heavy Vehicle TTC	$61.47

PROJECT:	TITLE:	DATE:	REVISION:	AUTHOR:	
Tweed Sand Plant (TSP)	**Tweed Valley Way Travel Time Costs**	**20/10/2021**	**B**	**A.SZEWCZAK**	BURCHILLS ENGINEERING SOLUTIONS

Year			Cost			Benefits					NET BENEFIT (COST)
			Travel Time Cost along Tweed Valley Way	Proposed Roundabout Maintenance Cost	Total Cost	Travel Time Saving along Tweed Coast Road	Tweed Coast Rd Maintenance Cost Reduction	Safety Benefits	Environmental Benefits	Total Benefit	
2022	Base Year	0	$0	$0	$0	$0	$0	$0	$0	$0	**$0**
2023	Year 1	1	$35,500	$48,000	$83,500	$52,368	$12,197	$4,679	$60,232	$129,476	**$45,975**
2024	Year 2	2	$35,630	$48,000	$83,630	$49,871	$12,197	$4,679	$60,232	$126,979	**$43,349**
2025	Year 3	3	$35,760	$48,000	$83,760	$47,374	$12,197	$4,679	$60,232	$124,482	**$40,722**
2026	Year 4	4	$35,889	$48,000	$83,889	$44,878	$12,197	$4,679	$60,232	$121,985	**$38,096**
2027	Year 5	5	$36,019	$48,000	$84,019	$42,381	$12,197	$4,679	$60,232	$119,488	**$35,470**
2028	Year 6	6	$36,148	$48,000	$84,148	$39,884	$12,197	$4,679	$60,232	$116,991	**$32,843**
2029	Year 7	7	$36,278	$48,000	$84,278	$37,387	$12,197	$4,679	$60,232	$114,495	**$30,217**
2030	Year 8	8	$36,407	$48,000	$84,407	$34,890	$12,197	$4,679	$60,232	$111,998	**$27,591**
2031	Year 9	9	$36,537	$48,000	$84,537	$32,393	$12,197	$4,679	$60,232	$109,501	**$24,964**
2032	Year 10	10	$36,537	$48,000	$84,537	$32,393	$647,488	$10,810	$60,232	$750,923	**$666,386**
2033	Year 11	11	$36,674	$48,000	$84,674	$59,295	$12,197	$10,810	$60,232	$142,534	**$57,860**
2034	Year 12	12	$36,811	$48,000	$84,811	$86,197	$12,197	$10,810	$60,232	$169,435	**$84,624**
2035	Year 13	13	$36,948	$48,000	$84,948	$113,099	$12,197	$10,810	$60,232	$196,337	**$111,389**
2036	Year 14	14	$37,085	$48,000	$85,085	$140,000	$12,197	$10,810	$60,232	$223,239	**$138,154**
2037	Year 15	15	$37,222	$48,000	$85,222	$166,902	$12,197	$10,810	$60,232	$250,141	**$164,919**
2038	Year 16	16	$37,359	$48,000	$85,359	$193,804	$12,197	$10,810	$60,232	$277,042	**$191,683**
2039	Year 17	17	$37,496	$48,000	$85,496	$220,706	$12,197	$10,810	$60,232	$303,944	**$218,448**
2040	Year 18	18	$37,633	$48,000	$85,633	$247,607	$12,197	$10,810	$60,232	$330,846	**$245,213**
2041	Year 19	19	$37,770	$48,000	$85,770	$274,509	$12,197	$10,810	$60,232	$357,748	**$271,977**
2042	Year 20	20	$37,907	$48,000	$85,907	$301,411	$12,197	$10,810	$60,232	$384,649	**$298,742**
2043	Year 21	21	$37,222	$48,000	$85,222	$166,902	$12,197	$10,810	$60,232	$250,141	**$164,919**
2044	Year 22	22	$37,359	$48,000	$85,359	$193,804	$12,197	$10,810	$60,232	$277,042	**$191,683**
2045	Year 23	23	$37,496	$48,000	$85,496	$220,706	$12,197	$10,810	$60,232	$303,944	**$218,448**
2046	Year 24	24	$37,633	$48,000	$85,633	$247,607	$12,197	$10,810	$60,232	$330,846	**$245,213**
2047	Year 25	25	$37,770	$48,000	$85,770	$274,509	$12,197	$10,810	$60,232	$357,748	**$271,977**
2048	Year 26	26	$37,633	$48,000	$85,633	$247,607	$12,197	$10,810	$60,232	$330,846	**$245,213**
2049	Year 27	27	$37,496	$48,000	$85,496	$220,706	$12,197	$10,810	$60,232	$303,944	**$218,448**
2050	Year 28	28	$37,359	$48,000	$85,359	$193,804	$12,197	$10,810	$60,232	$277,042	**$191,683**
2051	Year 29	29	$37,222	$48,000	$85,222	$166,902	$12,197	$10,810	$60,232	$250,141	**$164,919**
2052	Year 30	30	$37,085	$48,000	$85,085	$140,000	$12,197	$10,810	$60,232	$223,239	**$138,154**
Total			**$1,107,887**	**$1,440,000**	**$2,547,887**	**$4,289,900**	**$1,001,193**	**$269,120**	**$1,806,952**	**$7,367,165**	**$4,819,278**
Proportion of total benefits						**58%**	**14%**	**4%**	**25%**	**100%**	

Discount Rate	Discounted Cash Flows								NET BENEFIT (COST)
	Travel Time Cost along Tweed Valley Way	Proposed Roundabout Maintenance Cost	TOTAL COST	Travel Time Saving	Tweed Coast Rd Maintenance Cost Reduction	Safety Benefits	Environmental Benefits	Total Benefit	
NPV at 7%	$453,685	$595,634	**$1,049,319**	$1,269,772	$474,300	$94,197	$747,418	**$2,585,686**	**$1,536,367**
NPV at 3%	$720,706	$940,821	**$1,661,527**	$2,444,073	$711,778	$164,144	$1,180,569	**$4,500,563**	**$2,839,036**
NPV at 10%	$343,334	$452,492	**$795,826**	$834,559	$359,910	$66,596	$567,799	**$1,828,864**	**$1,033,039**

SUMMARY OF RESULTS	
Present Value Benefits @ 7%	$2,585,686
Present Value Costs @ 7%	$1,049,319
Benefit Cost Ratio 1(BCR) @ 7%	2.46
Net Present Value @ 7%	$1,536,367

Sensitivity Testing	TEST 3	TEST 4	TEST 3	TEST 4
	@ 3%	**@ 10%**	**@ 7%** PV Benefits -20% PV Cost +20%	**@ 7%** PV Benefits + 20% PV Cos t- 20%
Present Value Benefits	$4,500,563	$1,661,527	$2,068,549	$3,102,824
Present Value Costs	$1,661,527	$795,826	$1,259,183	$839,455
Net Present Value	$2,839,036	$1,033,039	$809,366	$2,263,368
Benefit Cost Ratio (BCR)	2.71	2.09	1.64	3.70

TITLE:	PROJECT:	REF NUMBER:	DATE:	REVISION:	AUTHOR:
BCR Base Case vs Project Case	**Tweed Sand Plant (TSP)**	**BE190043**	**20/10/2021**	**B**	**A.SZEWCZAK**

BURCHILLS ENGINEERING SOLUTIONS

Travel Time Savings along Tweed Coast Road (Project Case)

Year	Base Case		Project Case		Benefit		Annual Travel Time Savings ($)
	AM and PM Peak		AM and PM Peak		AM and PM Peak		
	Annual Delay (hours) Light Vehicles	Annual Delay (hours) Heavy Vehicles	Annual Delay (hours) Light Vehicles	Annual Delay (hours) Heavy Vehicles	Annual Delay (hours) Light Vehicles	Annual Delay (hours) Heavy Vehicles	
2022	3,972	333	2,640	131	1,332	201	$54,865
2031	7,893	561	7,328	327	565	234	$32,393
2041	32,471	2,205	24,839	1,262	7,632	943	$301,411

Year	Annual Travel Time Benefits ($)
2022	$0
2023	$52,368
2024	$49,871
2025	$47,374
2026	$44,878
2027	$42,381
2028	$39,884
2029	$37,387
2030	$34,890
2031	$32,393
2032	$32,393
2033	$59,295
2034	$86,197
2035	$113,099
2036	$140,000
2037	$166,902
2038	$193,804
2039	$220,706
2040	$247,607
2041	$274,509
2042	$301,411
2043	$166,902
2044	$193,804
2045	$220,706
2046	$247,607
2047	$274,509
2048	$247,607
2049	$220,706
2050	$193,804
2051	$166,902
2052	$140,000
Total	**$4,289,900**

Assumptions	
Light Vehicle TTC	$31.90
Heavy Vehicle TTC	$61.47

PROJECT:	TITLE:	DATE:	REVISION:	AUTHOR:	
Tweed Sand Plant (TSP)	**Tweed Coast Road Travel Time Savings**	**07/10/2021**	**A**	**A.Szewczak**	BURCHILLS ENGINEERING SOLUTIONS