Thomastown BESS - Traffic Impact Assessment

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Revision History

Revision Nº	Prepared By	Description	Date
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Document Acceptance

Action		Name	Signed	Date
Prepared by		Charles Fowler		17/06/2022
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on behalf of	Beca Limited	Beca Limited		

Executive Summary

This report presents the likely traffic and parking impact associated with the development of vacant land at 15 High Street, Thomastown (subject site) for the construction of a Battery Energy Storage System (BESS). The report supports the Town Planning Permit Application for the subject site.

The impact of the development has been considered over both the construction phase and the maintenance and operation phase. During both of these phases, access will be provided via an existing double width crossing from Pelmet Crescent. The construction phase is anticipated to last approximately 15 months. During the maintenance and operation phase, the site will generally be managed remotely, with occasional maintenance and operations activities occurring at the site.

The existing Mahoneys Road access for the Thomastown Terminal Station (TTS) will be used to support access by light and heavy vehicles during construction of the BESS facility. Additional traffic movements to the TTS site will be minimal.

The assessment of access is provided in **Section 4.2** and indicates that the access routes and on-site turning provisions are suitable to enable access by all vehicles associated with the development of the site, including fire service appliances.

The assessment against the Whittlesea Planning Scheme is provided in **Section 4.1** and indicates that a car parking layout plan will be required to be submitted as part of the Planning Approval, noting that the areas designated for car parking during the Construction phase and Maintenance and Operation phase will be designed. The areas set aside for on-site parking under both phases will be sufficient to accommodate a minimum of 30 spaces for the construction phase, and a minimum of 5 spaces for the maintenance and operation phase. The design of the existing accessway generally meets the requirements of the planning scheme, whilst the car parking spaces will be provided to meet the demands of the site and designed in accordance with Clause 52.06-9 of the Whittlesea Planning Scheme.

The assessment of traffic impact is provided in **Section 5** and indicates that in the worst-case scenario, traffic generated by the development proposal during the maintenance and operation phase will not materially impact the operation of the intersection of Edgars Road/Horne Street. Construction phase traffic will exacerbate existing deficiencies on the Horne Street approach, however in the context of the existing operation of this intersection, this will be managed through the development and implementation of an approved CTMP or TMP by the contractor.

Overall, the transportation effects of this proposal are acceptable during the construction phase and are expected to be negligible moving forward under the maintenance and operation phases, therefore there are no transportation reasons which preclude approval of this development on traffic and parking grounds.

1 Introduction

AusNet Transmission Group Pty Ltd (AusNet) is proposing the development of vacant land at 15 High Street, Thomastown (subject site) for the construction of a Battery Energy Storage System (BESS). The subject site is located to the northwest of the existing Thomastown Terminal Station.

Beca has been engaged by AusNet to consider the likely traffic and parking impacts associated with the development and use of the subject site for a BESS facility, and to prepare a Transport Impact Assessment (TIA) for submission as part of the Town Planning Permit Application.

2 Location and Transport Context

2.1 Site Location

The subject site on which the BESS facility is to be located is currently vacant and sits within a larger site that has previously been subdivided into two separate land parcels. These are known as Lot 1 (TP865439), which is the primary subject site, and Lot 2 (PS401440) on which the existing Thomastown Terminal Station (TTS) is located and connecting infrastructure will be constructed. The larger site that comprises Lot 1 and Lot 2 is bisected by the Edgars Creek. Lot 1 and Lot 2 provide separate points of vehicular access to the local and / or arterial road network, noting that there is no vehicular access that links these two sites together, nor is this to be proposed as part of this application.

Access to the subject site is provided via a double width concrete driveway crossing to 27 Pelmet Crescent (Lot 22 LP219848), at the northern boundary of the site. This access facilitates ingress and egress movements. At present a large steel gate at the Pelmet Crescent boundary frontage closes the site to the public. The existing driveway aligns with the easternmost, north-south alignment of Pelmet Crescent.

The subject site is currently vacant and is surrounded by industrial land uses to the north, south and west, with the Edgars Creek along its eastern boundary.

Figure 2-1 presents the location of the subject site and the existing TTS.

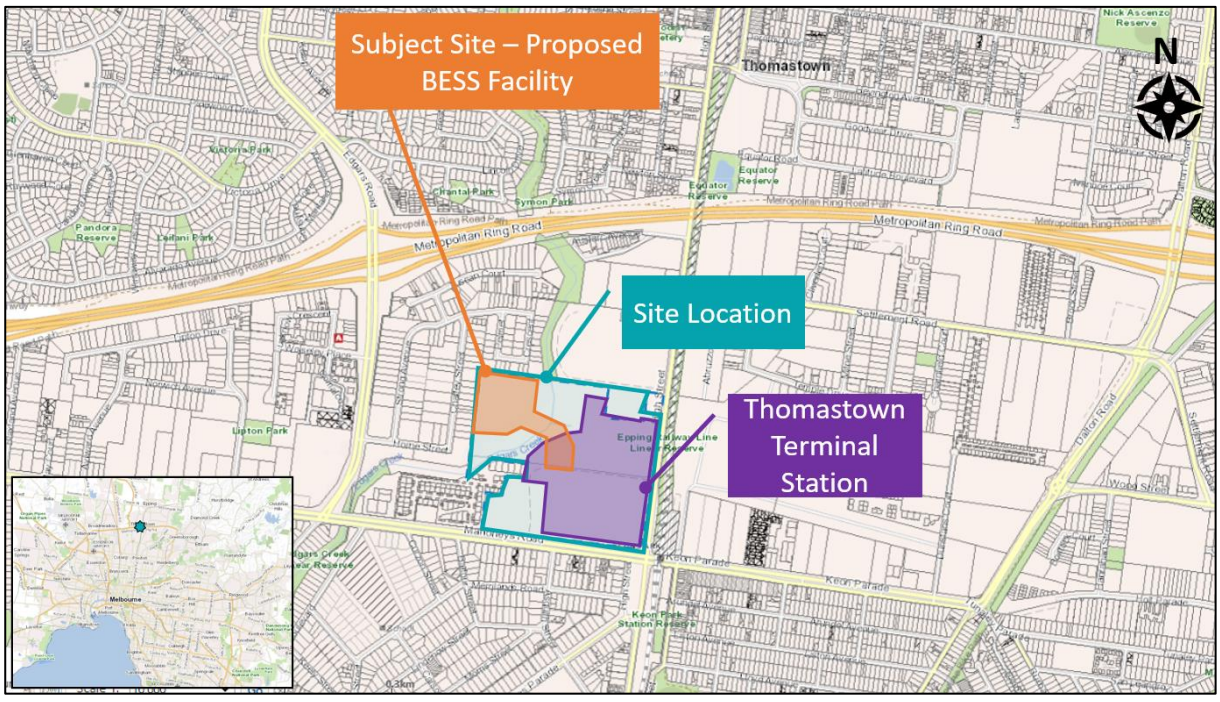

Figure 2-1: BESS Site (Subject Site) Location (Indicative Only) (source: VicPlan)

2.2 Planning Zones

As shown in Figure 2-2 , the BESS Site (Subject Site) is located within an Industrial 1 zone.

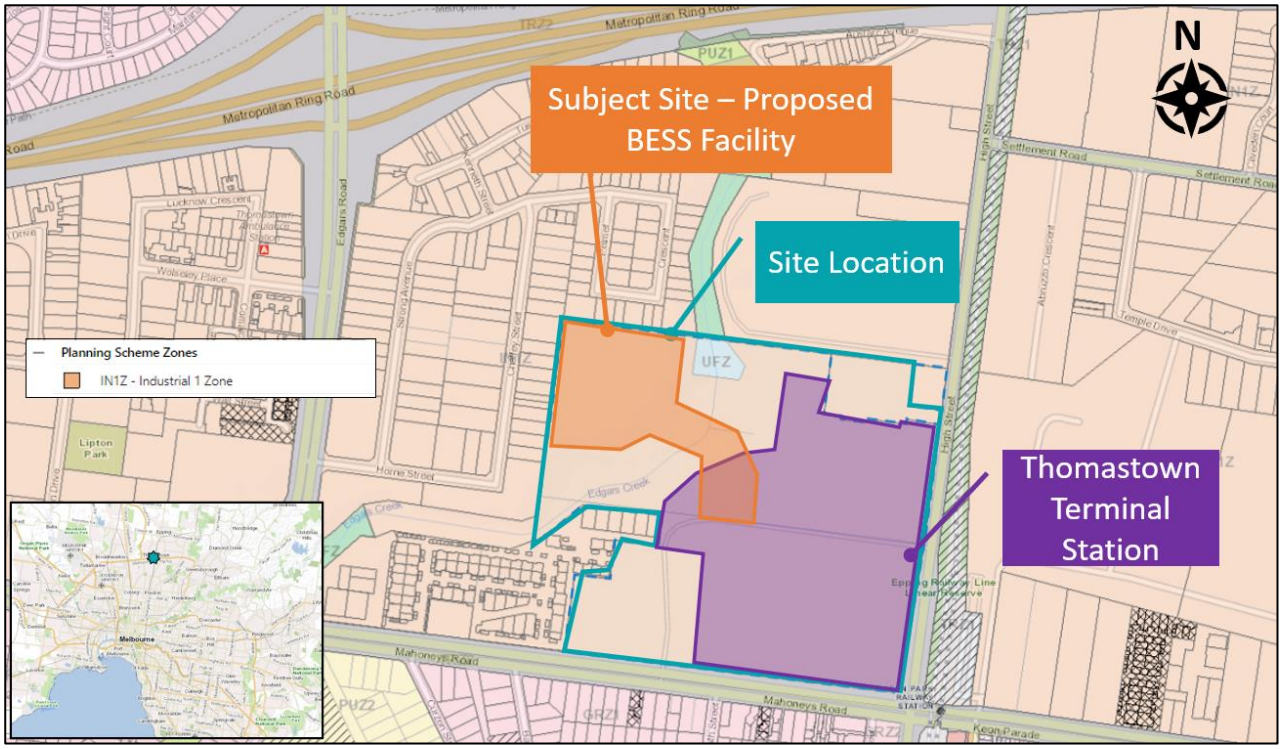

Figure 2-2: Planning Zone Map showing the BESS Site (Subject Site) (Indicative Only) (source: VicPlan)

2.3 Transport Network

2.3.1 Public Transport and Active Modes

The public transport and active mode network is shown in Figure 2-3. The key features of the sustainable transport network are:

i. Bicycle Network:
   - On road Cycle Lanes on Keon Parade and on Edgars Road (in part)

ii. Public Transport
   - Keon Park Railway Station, which is on the South Morang line and located to the south-east of the subject site. The railway station is located approximately 16km from the Melbourne CBD. Notably, this station is to be relocated to the south side of Keon Parade as part of the Keon Parade level crossing removal project. It is understood that early works are underway at present with construction ramping up in 2023 with a completion date set for 2025.

iii. Bus services on High Street and Mahoneys Road, namely:
   - Mahoneys Road –902 Smart Bus Service between Chelsea and Airport West
   - High St – 555 bus service between Epping–Northland via Lalor, Thomastown, Reservoir
   - Bus Stops are located on Mahoneys Road close to the Keon Park Railway Station, further west and proximate to the intersection of Edgars Road and Mahoneys Road, as well as on High St opposite the Keon Park Railway Station.

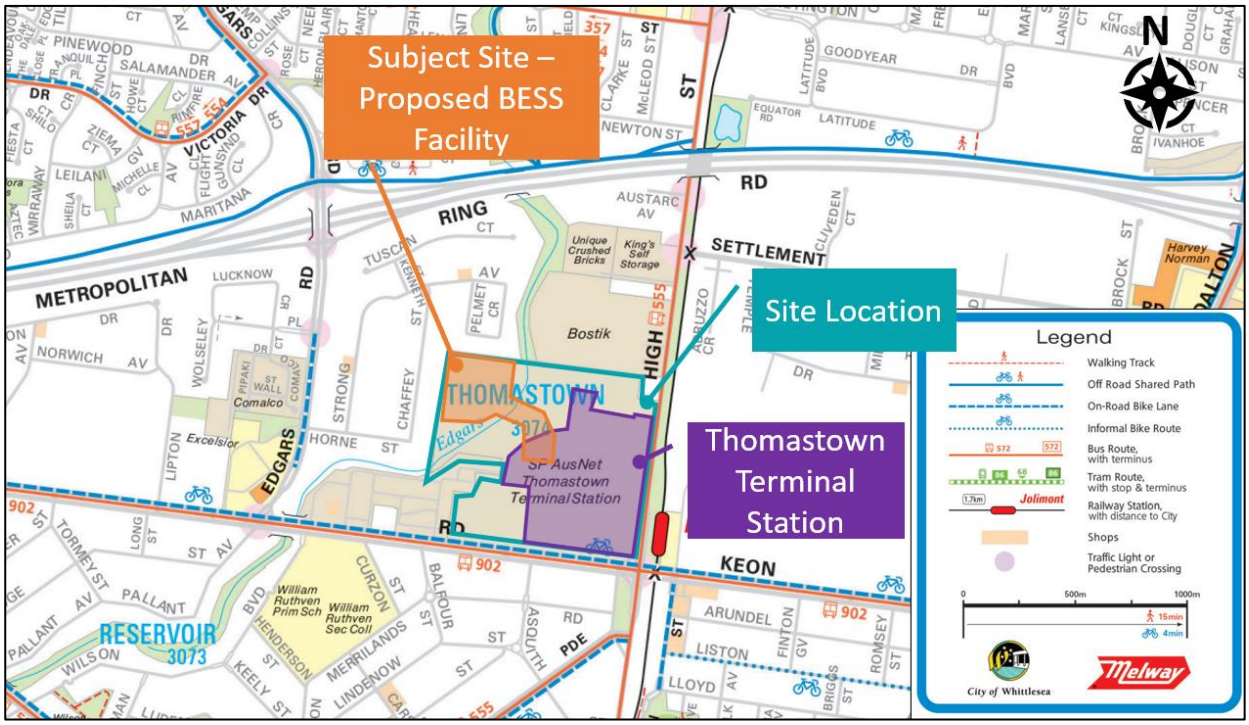

Figure 2-3: BESS Site (Subject Site) in the context of the Public Transport Map (Indicative Only) (source: Whittlesea Travel smart Map)

VicPlan mapping indicates the following future strategic sustainable transport features in the area:

- A primary C1 strategic cycling network is identified along the east side of High Street, to the west side of the railway line. It is understood that this is in design development at present and will be finalised as the Keon Park level crossing removal works are progressed.

Based on the above, the subject site is provided with good public transport and active mode accessibility.

2.4 Road Network

The Road Network is shown in Figure 2-4. The key features are summarised in Table 2-1 below.

Table 2-1: Road Network Characteristics

Road	Classification	Declared Arterial or Freeway	Principal Freight Network (PFN)
Source of Data	Melway Online	VicPlan maps	VicPlan maps
M80 – Metropolitan Ring Road	Freeway	Declared Freeway	PFN Road
Edgars Road	Primary State Arterial	Declared Arterial	No
High Street	Primary State Arterial	Declared Arterial	PFN Road
Mahoneys Road	Primary State Arterial	Declared Arterial	PFN Road
Horne Street	Local Traffic Street	No	No
Strong Avenue	Local Traffic Street	No	No
Chaffey Street	Local Traffic Street	No	No
Pelmet Crescent	Local Traffic Street	No	No

Based on the VicPlan maps, no future road planning is proposed in the immediate vicinity of the site.

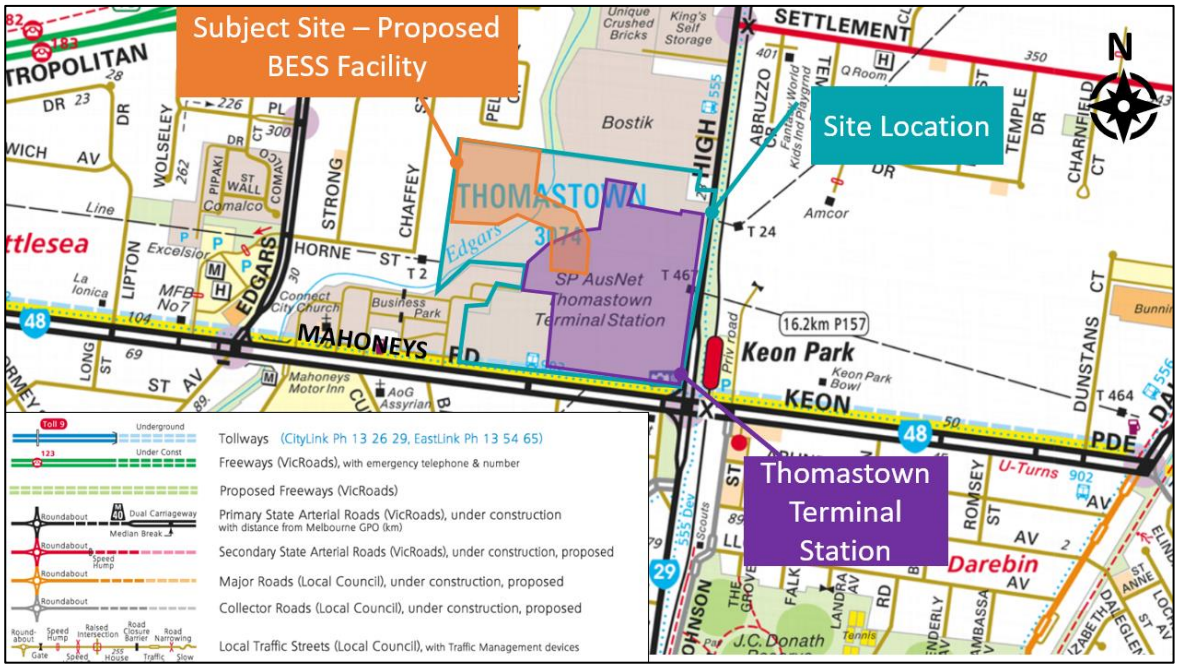

Figure 2-4: BESS Site (Subject Site) in the context of the Road Network (Indicative Only) (source: Melway Online)

2.4.1 Edgars Road

Edgars Road is an arterial road, generally aligned in a north-south direction, and runs between Mahoneys Road (southern extent) in Thomastown and Oherns Road (northern extent) in Epping. In the vicinity of the subject site, Edgars Road comprises a divided carriageway with two lanes in each direction, separated by a 6m wide central median. Footpaths are provided on both sides of Edgars Road and a short on road bicycle lane is provided southbound on Edgars Road, just north of the intersection with Horne Street. Edgars Road has a 70 km/hr posted speed limit and carries in the order of 33,000 vehicles per day.

Fully directional turns are available at the intersection of Edgars Road / Horne Street, with an indented right hand turn lane providing for right turn access into Horne Street from the Edgars Road south approach, and an exclusive left turn lane on the Edgars Road north approach.

2.4.2 Horne Street

Horne Street is a local road aligned in an east-west direction. Horne Street provides direct access to industrial uses along its length. Horne Street is a two-way road which comprises a 10.6m wide carriageway with a single lane of traffic in each direction. Kerbside parking is available at locations along both the north and south sides. Further east of the intersection with Strong Avenue, Horne Street narrows to an 8.6m two-way width with some kerbside parking permitted on the north and south sides of the road. A footpath is provided on the north side of Horne Street. Horne Street carries in the order of 3100 vehicles per day.

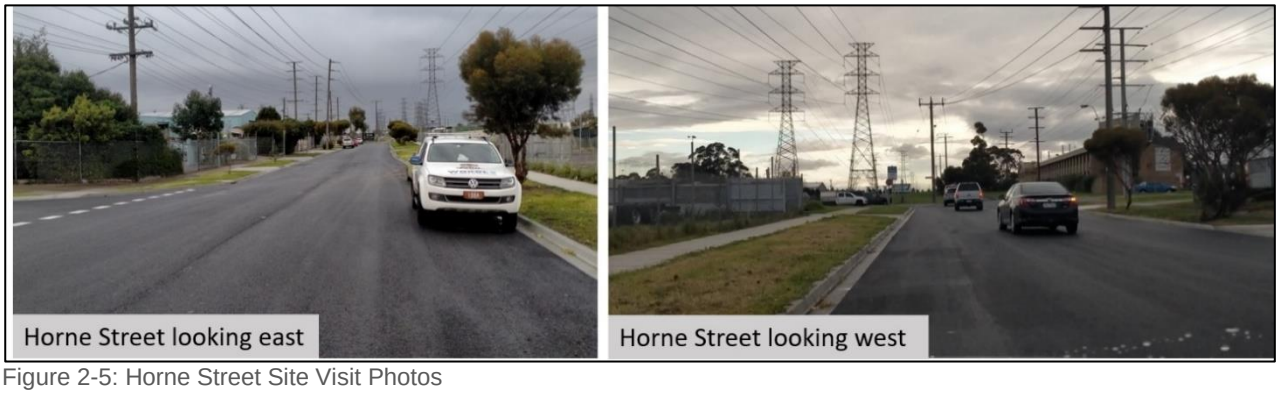

Figure 2-5: Horne Street Site Visit Photos

2.4.3 Chaffey Street

Chaffey Street is a local road aligned in a north – south direction and provides access between Horne Street and Strong Avenue. Chaffey Street comprises a single lane of traffic in each direction and has a pavement width of approximately 8.6m. Kerbside parking is permitted on the west side of Chaffey Street only. Chaffey Street caries in the order of 1,200 vehicles per day. The default speed limit of 50km/h applies to Horne Street and Chaffey Street.

Figure 2-6: Chaffey Street Site Visit Photos

2.4.4 Strong Avenue

Strong Avenue is a local road that runs between Horne Street and Pelmet Crescent. Strong Avenue is generally aligned in a north-south direction from Horne Street, but it also gently bends to an east – west alignment at its northern end. Strong Avenue comprises a single lane of traffic in each direction and has a pavement width of approximately 8.6m. Kerbside parking is unrestricted on the east side of Strong Avenue (north – south section) with the west side subject to No Stopping restrictions between the hours of 7am and 5.00pm, Monday to Friday. For the east- west section of Strong Avenue, kerbside parking on both sides is restricted to No Stopping between 8.00am and 5.00pm Monday to Friday and 8.00am to 1.00pm Saturday.

Concrete footpaths are provided on both sides of Strong Avenue. Strong Avenue carries in the order of 2,000 vehicles per day.

The default speed limit of 50km/h applies to Strong Avenue.

Figure 2-7: Site Visit Photos

2.4.5 Pelmet Crescent

Pelmet Crescent is a local road that loops around from the eastern end of Strong Avenue. Pelmet Crescent is a two-way road with a pavement width of approximately 11.2m, with unrestricted kerbside parking on both sides of the road. A concrete footpath is provided on both sides of Pelmet Crescent.

The default speed limit of 50km/h applies to Strong Avenue.

Figure 2-8: Site Visit Photos

2.5 Traffic Volumes

Beca engaged Trans Traffic Surveys to undertake traffic volume and turning movement counts on key roads and intersections within proximity of the subject site. These surveys were undertaken on Tuesday 13 May 2022 over a 13-hour period.

A summary of the surveys is provided in Table 2-2 and Figure 2-9 below

Table 2-2: Traffic Survey Summary

Reference	Count Type	Location	AM Peak	PM Peak
1	Intersection Turning	Edgars Rd/ Horne St	8:00 AM – 9:00 AM	3:30 PM – 4:30 PM
2	Access Turning	Mahoneys Road/Substation Access	7:45 AM – 8:45 AM	3:45 PM – 4:45 PM
3	Tube count	Strong Avenue	N/A	N/A
4	Tube count	Chaffey Street	N/A	N/A

A graphic showing the count locations is shown in Figure 2-9.

Figure 2-9: Traffic Count Locations in the context of the BESS Site (Subject Site) (Indicative Only) and the wider site.

2.5.1 Edgars Road/Horne Street

The AM and PM peak hours at the intersection of Edgars Road and Horne Street occurred between 8:00AM and 9:00AM, and 3:30PM and 4:30PM, respectively, as determined from the traffic surveys undertaken. During this period, the turning movements presented in Figure 2-10 below were observed. The counts show the total vehicles at the intersection, split by light vehicles (cars) and heavy vehicles (trucks).

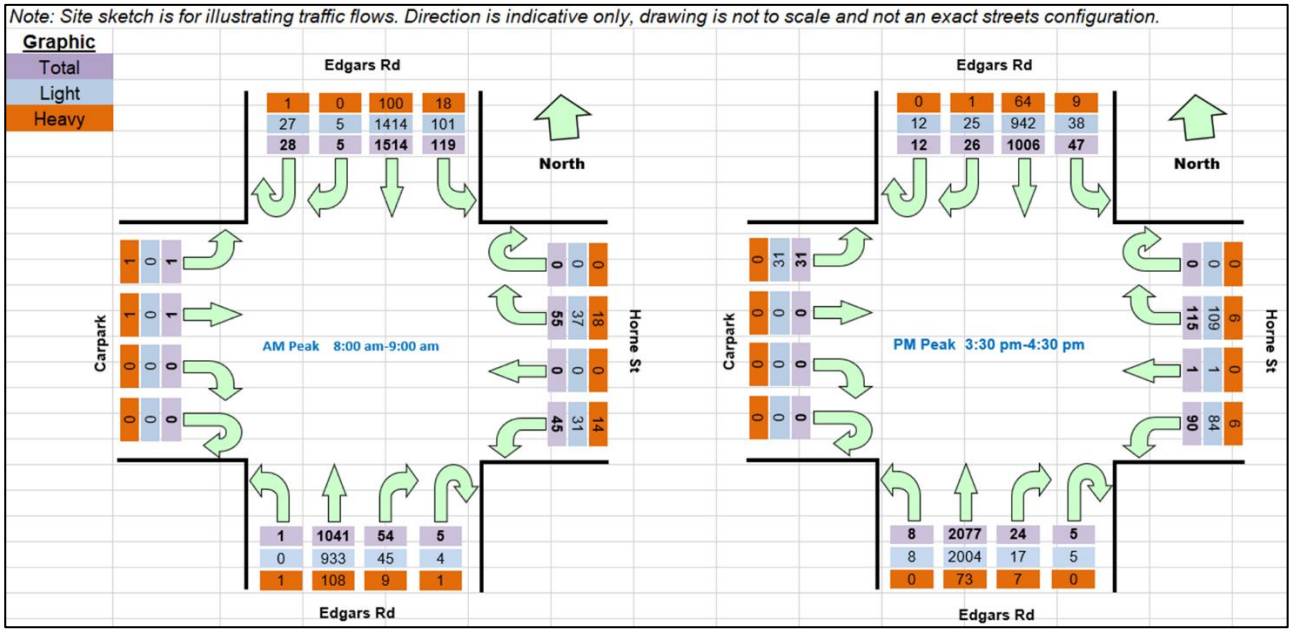

Figure 2-10: Turning Counts - Edgars Road/Horne Street

2.5.2 Mahoneys Road/Thomastown Terminal Station Access

The AM and PM peak hours at the Thomastown Terminal Station (TTS) access occurred between 7.45AM and 8.45AM, and 3:45PM and 4:45PM, respectively, as determined from the traffic surveys undertaken. During this period, the turning movements presented in Figure 2-11 below were observed. The counts show the total vehicles entering and exiting the access during the identified road network AM and PM peak periods, split by light vehicles (cars) and heavy vehicles (trucks).

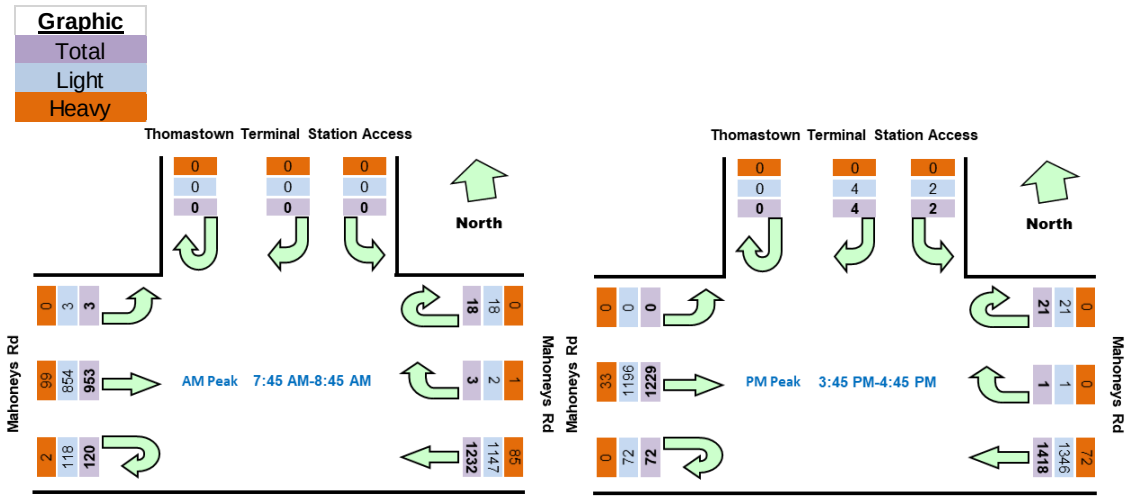

Figure 2-11: Turning Counts – Mahoneys Road/TTS Access

As can be seen from the above counts, the TTS access experiences low utilisation by both light and heavy vehicles.

2.5.3 Strong Avenue and Chaffey Street Tube Counts

The daily movements at Strong Avenue and Chaffey Street are shown in Figure 2-12 below. The movements show that approximately 60-65% of traffic uses Strong Avenue. The traffic on these roads is tidal, with inbound movements in the AM period and outbound movements in the PM period.

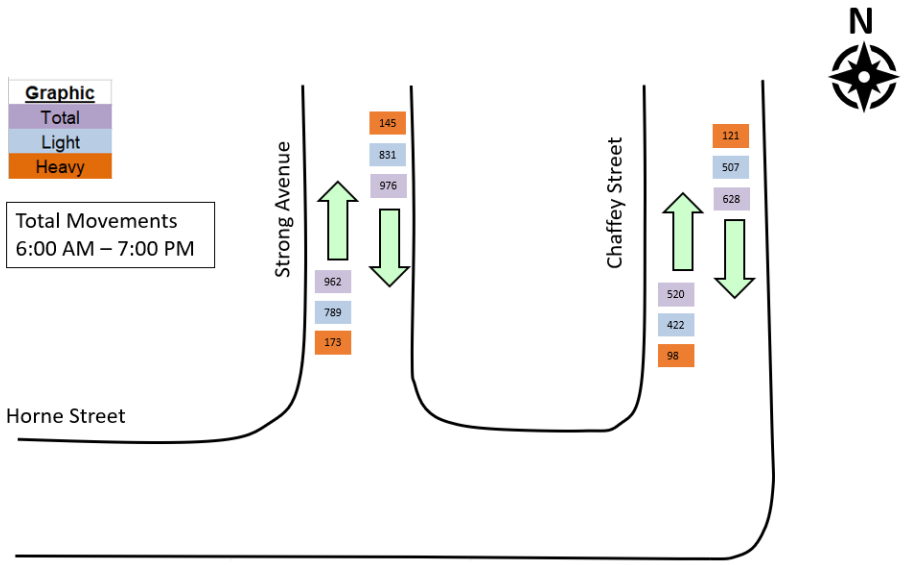

Figure 2-12: Tube Counts Strong Avenue and Chaffey Street

2.6 Road Safety

The Department of Transport's Open Dataset, ***Road Crashes for five Years - Victoria*** was used to understand the crash history in the vicinity of the subject site. The Open Dataset was sourced from the Victoria Government's open data portal and is a dataset of all reported fatal and injury crashes on Victorian roads during the latest five-year reporting period. The data set includes crash data from July 2015 – June 2020.

The crash data indicates that in the above five-year period, there have been no crashes on Horne Street, Strong Avenue, Chaffey Street or Pelmet Crescent. There has been a total of 2 road crashes that have occurred on Edgars Road, at the intersection of Horne St and Edgars Road (50m radius of intersection). These were both other injury crashes and occurred in 2018 and 2019. A summary of the crashes by crash type and severity is shown in Table 2-3 and Figure 2-13 below.

Table 2-3: Crash Summary at the intersection of Horne Street and Edgars Road

Crash Type	Fatal	Serious	Other Injury	Total
Other adjacent (intersections only)	-	-	1	**1**
Right near (intersections only)	-	-	1	**1**
Total	**-**	**-**	**1**	**2**

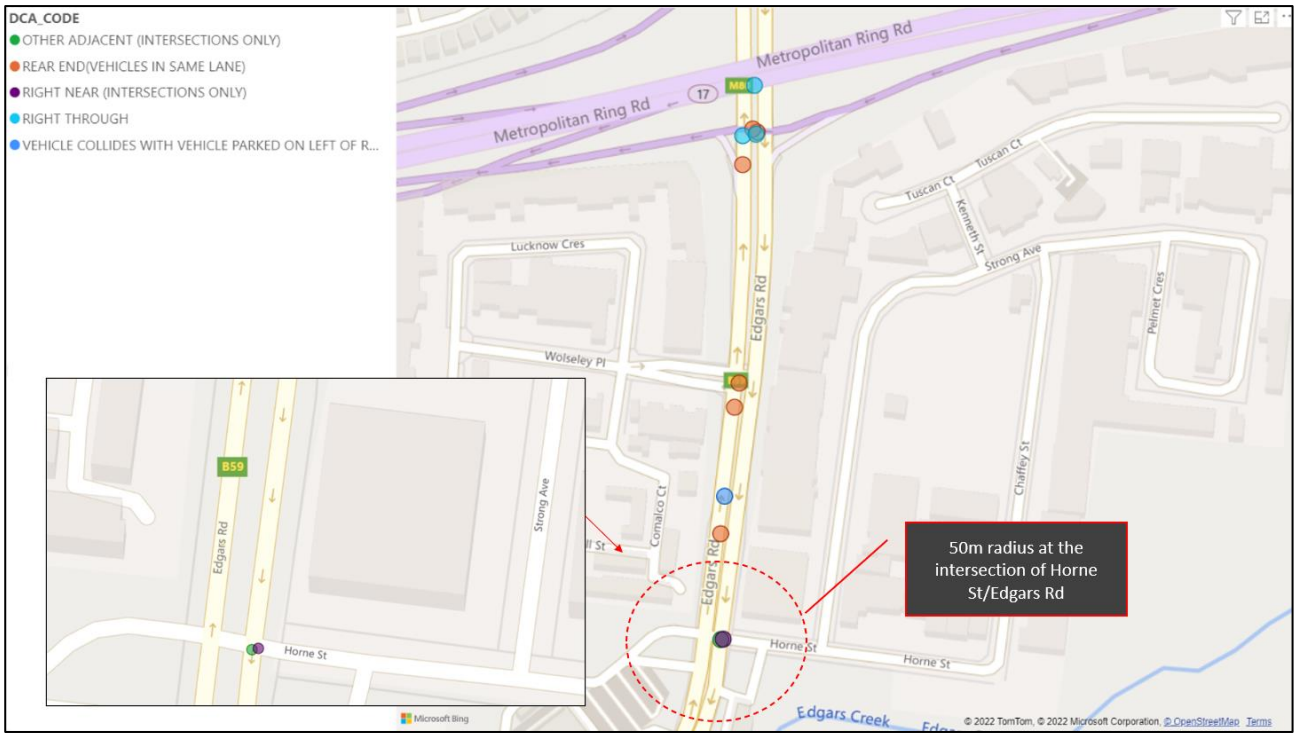

Figure 2-13: Five-year crash statistics based on crash type

At the intersection of Edgars Road/Horne Street, there has been a right rear an adjacent intersection crash. A fatal crash occurred north of the intersection and involved a vehicle colliding with a parked vehicle, as can be seen in Figure 2-12.

Overall, the crash history at the intersection is limited and consists of other injury crashes, therefore no meaningful trend can be drawn from this. On site observations indicated vehicles on Edgars Road were cooperative with respect to allowing turning vehicles to enter the road from and into Horne Street. This, coupled with the nearby signalised intersections creating gaps in northbound and southbound traffic on Edgars Road, together with traffic conditions during the peak AM and PM commuter periods limiting speed on the Edgars Road, suggests that there is no significant crash risk at this intersection.

2.7 Site Visit Observations

A site visit was undertaken on Monday 6 June between the hours of 2:30 PM and 4:00 PM. The following key observations were made during this visit:

i. Pelmet Crescent:

- Underutilisation of on-street parking on both sides of Pelmet Crescent
- Truck and trailer units accessing Pelmet Crescent, including the Boral yard east of the site access
- Truck and trailer units were reversing into the Boral yard from Pelmet Crescent, per Figure 2-13
- Trucks were observed to be comfortably utilising the local network around the subject site.

ii. Strong Avenue and Chaffey Street:

- More traffic activity, including heavy vehicle (truck) traffic
- On street parking is well utilised, more so than that observed on Pelmet Crescent.

iii. Intersection of Edgars Road / Horne Street:

- Cars and some smaller trucks are using the median to stage their turns when turning from Horne Street to travel northbound on Edgars Road.

Figure 2-14: A Boral truck reversing in front of the site access

3 Development Proposal

3.1 Description of Proposal

3.1.1 BESS Facility

It is proposed to establish a BESS facility on vacant AusNet land to the northwest of the existing Thomastown Terminal Station (TTS). There will also be some connecting infrastructure within the existing TTS yard. Access to the site is available from Pelmet Crescent. The construction of the BESS facility is to provide strength and reliability to the Victorian Transmission Network. Moreover, the development involves the construction of hardstands, access, security fences and the installation of the batteries on bunded pads.

The development is anticipated to include:

- A series of battery units, inverters, cooling systems, transformers, protection devices and connecting infrastructure (maximum 300MW / 600MWh storage capacity).
- A utility maintenance building.
- 6.0m wide internal roads to provide access to the BESS, and site circulation for vehicles, and a 10m perimeter track on the outside of the existing fenced facility.
- Above ground and underground direct current (DC) cabling, trenching typically not below 1m in depth and 1m wide.
- Medium voltage aboveground and underground alternating current (AC) and communications cable, trenching typically not below 1m in depth and 1m wide.
- High voltage aboveground infrastructure and underground alternating current (AC) cables including communication cables, trenching typically not below 1.5m in depth and 1.5m wide.
- Installation of perimeter security fencing to a depth of approximately 600mm.
- Associated infrastructure, e.g. drainage, lighting etc.

To enable access to the BESS site during construction, as well as when the facility is operational, a vehicle access road will be established into the site from the existing double width driveway from Pelmet Crescent. Further detail of the access arrangements is provided in Section 4.2 of this report.

An onsite laydown and parking area is proposed on the east side of the internal access road. This will provide on-site parking during both the construction and operational phases of the project. This area will reduce in size as the site is constructed and operation of the BESS facility commences, as the site will require less space for parking and manoeuvring of construction vehicles during this time.

The concept site layout is shown in Figure 3-1.

3.1.2 Thomastown Terminal Station

During the construction period, contractors will also be required to access the Thomastown Terminal Station site to facilitate the installation of hardware to connect the BESS facility to the terminal station. It is anticipated that the additional traffic movements to the terminal station site will be minimal. An existing two-way access is provided on Mahoneys Road to the Terminal Station site. There is also a secondary access on the west side of High Street.

As stated above movements to the Thomastown Terminal Station are expected to be minimal and mainly via Mahoneys Road. As presented in Section 2.5.2 of this report, this access experiences very low traffic movements during the peak AM and PM commuter periods. This activity is associated with the operation and maintenance of the TTS, noting:

- Approximately 35 formally marked and formed car parking spaces are provided on this site, which currently experience very low utilisation.
- The existing access currently allows for entry and exit movements by light and heavy vehicles. This is expected to marginally increase when the ancillary connection works occur for the BESS facility.
- An appropriate traffic management plan (TMP) will be arranged by the awarded contractor, and approvals sought for these, to facilitate the movement of larger heavy vehicles that may be required to access the site to deliver associated hardware.

Figure 3-1: Site Layout (Source:AusNet).

3.2 Construction Phase (BESS Facility)

3.2.1 Description

Construction of the BESS facility is anticipated to occur over approximately a 15-month period, with the specific activities and timeframes summarised in Table 3-1 below.

Table 3-1: Construction Period

Stage	Timeframe	Approx. Duration (months)
Site Civil Works	Month 1 – Month 4	**4**
Primary Works	Month 5 – Month 10	**6**
Electrical and Commissioning	Month 11 – Month 15	**5**
	Total	**15**

3.2.2 Staff

During the construction phase, the following numbers of staff / contractors are anticipated to be operating from the BESS site, as provided by AusNet.

Table 3-2: Maximum Construction Staff

Site	Staff
BESS	Maximum of 30

3.2.3 Vehicle Types

AusNet has confirmed the following vehicles are anticipated to be accessing the BESS site during the construction phase, as shown in Table 3-3 below. All construction vehicle traffic will enter and exit the subject site using the existing Pelmet Crescent access.

Table 3-3: Construction Traffic Vehicles

Construction/Load Type	Critical Vehicle Type
Site Establishment	19m semi-trailer
Civil Plant and Equipment	19m semi-trailer or 26m b-double truck
BESS equipment	19m semi-trailer
Electrical Equipment	19m semi-trailer
Special Vehicles	Cranes
Transformers (MV)	19m semi-trailer
Car and Light Vehicles	Passenger Vehicle

3.2.4 Car Parking and Site Circulation

A site laydown and car parking area are identified for the northeast section of the subject site. On-site car parking will be provided to meet the anticipated construction phase staff and contractor requirements during this time, there is sufficient space to fit a minimum of 30 car parking spaces. This area will be configured to meet with the minimum dimensional requirements set out in Clause 52.06-9 of the Whittlesea Planning Scheme. This area will be used for car parking and material storage, as well as manoeuvring of trucks on site as required.

A circulation road is provided around the BESS facility to enable access for maintenance and emergency vehicles. The site access roads are provided at a width of 6.0m generally and wider at isolated corners to enable manoeuvring of larger vehicles as required.

3.2.5 Site Access

Vehicles carrying plant, equipment and materials are expected to access the site from Pelmet Crescent via the Metropolitan Western Ring Road (M80), using the 4-way diamond interchange at the Edgar Road/M80 junction. The expected access route to the site will be:

From Port of Melbourne:

Via M80:

- Webb Dock Drive – Cook Street – Vegemite Way - M2 (City Link Toll Road) – Metropolitan Ring Rd/Western Ring Road/M80 – Edgars Road – Horne Street – Strong Avenue – Pelmet Crescent

Via Mahoneys Road:

- Webb Dock Drive – Cook Street – Vegemite Way - M2 (City Link Toll Road) – Metropolitan Ring Rd/Western Ring Road/M80 – Sydney Road – Mahoneys Road – Edgars Road – Horne Street – Strong Avenue – Pelmet Crescent

Following appointment of a construction team, specific access routes will be confirmed and adopted for the construction phase and detailed in an appropriate site-specific Construction Traffic Management Plan (CTMP) and/or Traffic Management Plan (TMP).

3.3 Construction Phase (Thomastown Terminal Station)

The Mahoneys Road access to the Thomastown Terminal Station, as well as potentially the High Street access, will be used for access to this site to facilitate ancillary works for the connection of the BESS to the TTS noting:

- The existing access points currently allow for entry and exit movements by light and heavy vehicles. This is expected to marginally increase when the ancillary connection works occur for the BESS facility.
- An appropriate traffic management plan (TMP) will be arranged by the awarded contractor, and approvals sought for these, to facilitate the movement of larger heavy vehicles that may be required to access the site to deliver associated hardware.

3.4 Operation and Maintenance Phase (BESS Facility)

3.4.1 Description

Once construction is completed, and the subject site in operation and maintenance phase, the BESS facility is expected to be remotely managed and operated, and generally not staffed. However, infrequent monitoring, maintenance and inspection activities can be expected throughout operation.

3.4.2 Staff

During the operation and maintenance phase, the following staff numbers may be operating from the site from time-to-time when inspection, maintenance and monitoring activities are taking place.

Table 3-4: Operational Staff

Site	Staff
BESS Facility	Maximum of 5

3.4.3 Vehicle Types

AusNet has confirmed the following vehicle types for day-to-day operation and occasional maintenance.

Table 3-5: Operational Vehicle Types

Construction/Load Type	Critical Vehicle Type
Maintenance Truck	12.5m Large Rigid Vehicle
Battery Replacement	19m Semi-Trailer
Car and Light Vehicles	Passenger Vehicle

3.4.4 Car Parking and Site Circulation

A total of 5 car parking spaces will be retained in the laydown area following completion of the construction phase. A circulation road is provided around the BESS facility to enable access for maintenance and emergency vehicles. The site access roads are provided at a minimum width of 6.0m.

3.4.5 Site Access and Circulation

During maintenance and operation, all vehicles will access the site from Pelmet Crescent via Strong Avenue and Horne Street.

4 Car Parking and Access Assessment

4.1 Car Parking

4.1.1 Statutory Requirement

Statutory requirements for parking are outlined in Clause 52.06-5 of the Whittlesea Planning Scheme.

The Planning Scheme does not include a requirement associated with a BESS facility (utility installation land use). In this respect, Clause 52.06-6 of the Planning Scheme indicates:

Where a use of land is not specified in Table 1 or where a car parking requirement is not specified for the use in another provision of the planning scheme or in a schedule to the Parking Overlay, before a new use commences or the floor area or site area of an existing use is increased, car parking spaces must be provided to the satisfaction of the responsible authority.

Section 4.1.2 of this report includes an assessment of the anticipated parking demand against the proposed parking provision.

4.1.2 Parking Demand Assessment (BESS Facility)

A total of 30 parking spaces are proposed to be provided during the construction of the facility. This on-site parking area will be to accommodate 5 car parking spaces once the BESS facility is in operational.

During construction, up to 30 staff are anticipated to be working on site. During maintenance and operation phase, up to 5 staff may be operating from the site at any one time.

Based on the fact that the total number of car parking spaces provided at any phase is equal to the total number of staff associated with the use i.e. 30 spaces during construction and 5 car parking spaces during the maintenance and operation phase, the proposed parking provision in both cases is considered appropriate to meet the use of the site. Allowing for 30 spaces reflects the worst-case scenario that all construction staff attend site at the same time, all drive to the site individually, and assuming that no-one ride shares or uses public transport or other active travel modes to travel to the site.

The layout of car parking spaces will be confirmed during the detailed design phase of the project.

4.1.3 Parking Demand Assessment (Thomastown Terminal Station)

Approximately 35 formally marked and formed car parking spaces are provided on this site, which currently experience very low utilisation. Given that the works at the TTS will primarily be associated with installation, electrical works and commissioning for the BESS facility, the existing car parking supply on site is expected to be sufficient to accommodate any minor (temporary) increase to car parking demand during this time.

Following the completion of construction activities associated with the BESS facility, the TTS site will operate as per existing conditions.

4.1.4 Parking Layout

Car parking spaces are proposed within the northeast section of the site. Car parking spaces will be constructed in accordance with the dimensions required under Clause 52.06-9 of the Whittlesea Planning Scheme (i.e. a minimum 2.6m wide x 4.9m long accessed from a 6.4m wide aisle).

4.2 Access

As outlined in Section 3.2.5 and Section 3.4.5 vehicles are anticipated to access the via M80 or Mahoneys Road, Edgars Road and the industrial roads leading to Pelmet Crescent. These roads (with the exception of Pelmet Crescent) are approved declared roads on the VicRoads B-double network.

Pelmet Crescent is a road providing access to industrial uses at the end of a B-double route. The roads on the access routes are therefore designed to accommodate the heavy vehicle design vehicles associated with this use. All vehicles are anticipated to access the subject site from Pelmet Crescent.

In addition to the below access assessment, it is noted that any required traffic management treatments and/or mitigation works are to be identified and addressed by way of an approved CTMP or TMP by the contractor who is to be eventually awarded the construction works.

4.2.1 Pelmet Crescent Access (Turning)

4.2.1.1 Swept Path Assessment

To assess the access conditions for vehicles entering and exiting the subject site to and from Pelmet Crescent, a swept path assessment has been completed. As noted in Section 3.2.3 the critical design vehicles accessing the site are 19m semi-trailers (during construction and occasional access during operation and maintenance phase) and 26m B-doubles (during construction phase only).

i. 26 m B-double truck:

- Figure 4-1 illustrates ingress manoeuvre
- Figure 4-2 illustrates egress manoeuvre

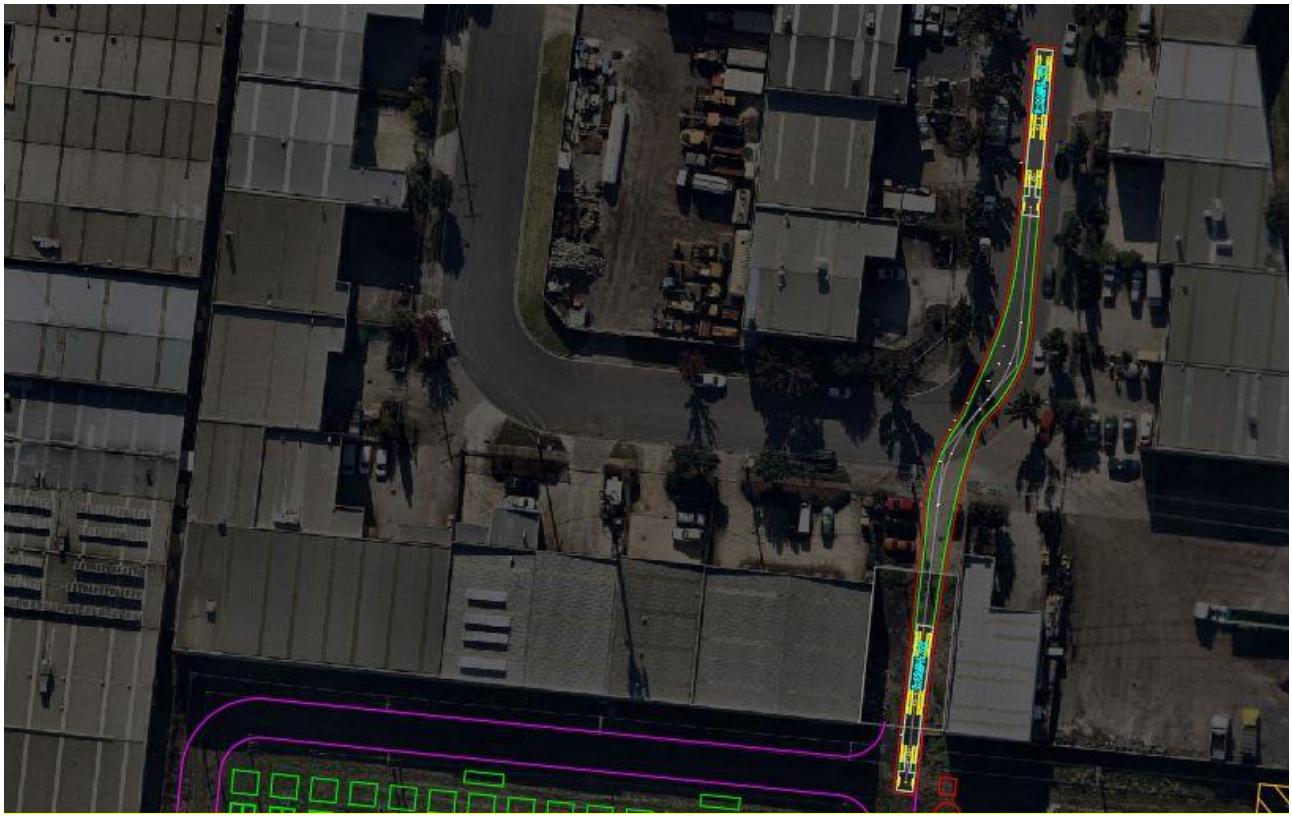

Figure 4-1: B-double entering

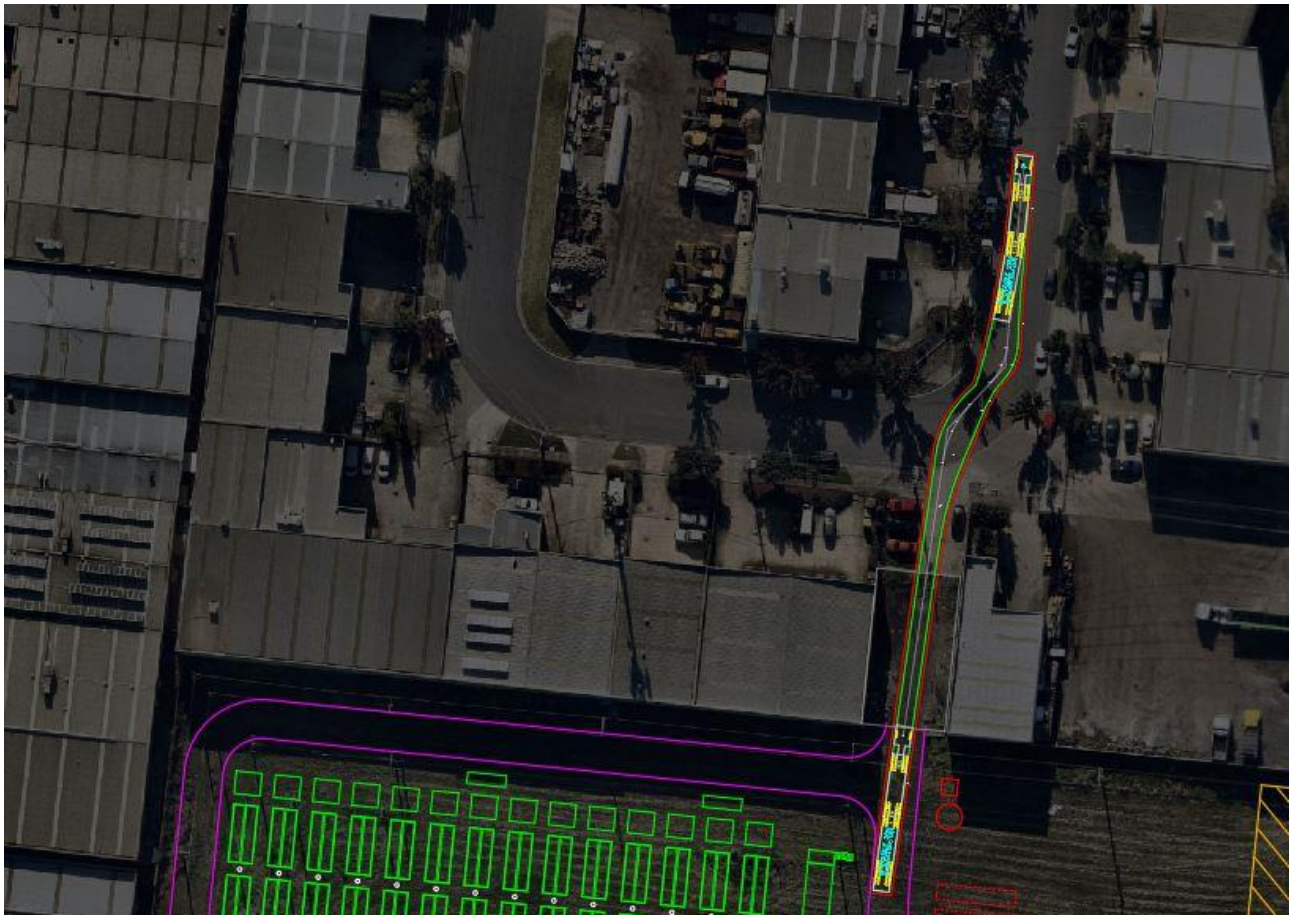

Figure 4-2: B-double exiting

The swept paths indicate a B-double can safely enter and exit the site. It is noted that simultaneous movements are unachievable at the access for both B-doubles and 19m semi-trailers. The chance of an entering and exiting vehicle meeting at the access at the same time is unlikely. Notwithstanding, given that the B-double will only be accessing the site during the construction phase, it is expected that the site construction traffic management plan (CTMP) and/or traffic management plan (TMP) implemented by the contractor will marshal and control site entry and exit and will therefore manage traffic movements should this occur.

Further there is sufficient space on Pelmet Crescent adjacent to the access on the eastern side to enable an entering vehicle to 'prop' and allow the vehicle to exit the site. This is considered a suitable, arrangement given the form and function of Pelmet Crescent as a low volume road. As mentioned, the above should be confirmed and addressed appropriately by way of an approved CTMP or TMP to be completed by the construction contractor post issue of the planning permit.

During the site visit, several heavy vehicles were observed on Strong Avenue, Chaffey Street and Pelmet Crescent. This included a truck and trailer navigating the bend at the top of Pelmet Crescent and on Pelmet Crescent adjacent to the site.

4.2.1.2 Height Clearance

It is noted that vertical clearance to powerlines and other overhead obstructions will be required for all trucks accessing the site. The VicRoads B-double network map shows all roads on the vehicle route (with the exception of Pelmet Crescent) are approved declared roads on the B-double map, with no height clearance restrictions along the route.

It is recommended that available height clearances at the access and on site are confirmed, including the existing overhead power lines that run overhead at the site access (for construction vehicles, transformer delivery and Fire Rescue Victoria (FRV) requirements).

4.2.2 BESS Site Internal Access

4.2.2.1 Laydown Areas - On-site turning Swept Paths

On site turning of a B-double truck has been modelled to inform the design of the site laydown and car parking areas to enable for turning on site, such that this vehicle can enter and exit in a forward direction. Similarly, the circulation of an Austroads 12.5 metre rigid truck, and a 19m semi-trailer has been modelled to inform the design of the internal circulating road. As noted, the typical maintenance and emergency vehicle likely to be visiting the site during the operation and maintenance phase is a vehicle of similar dimensions to the Austroads 12.5m single unit truck. Access by a 19m semi-trailer during the operation and maintenance phase will be infrequent and only likely where a battery or other large piece of equipment requires replacement.

The following swept paths are shown below:

i. 26m B-double truck
   - Figure 4-3 illustrates indicative turning requirements.

ii. 12.5m single unit truck
   - Figure 4-4 illustrates circulation around the internal road.

iii. 19m-semi-trailer
   - Figure 4-5 illustrates circulation around the internal road.

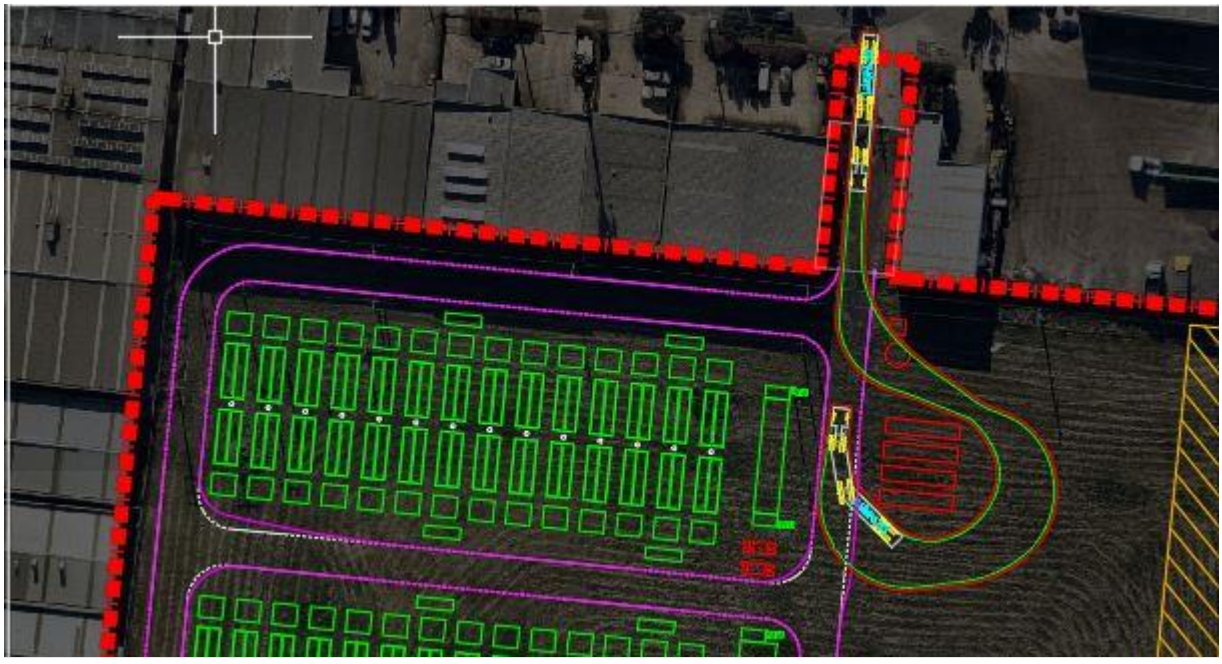

Figure 4-3: B-double turning requirements

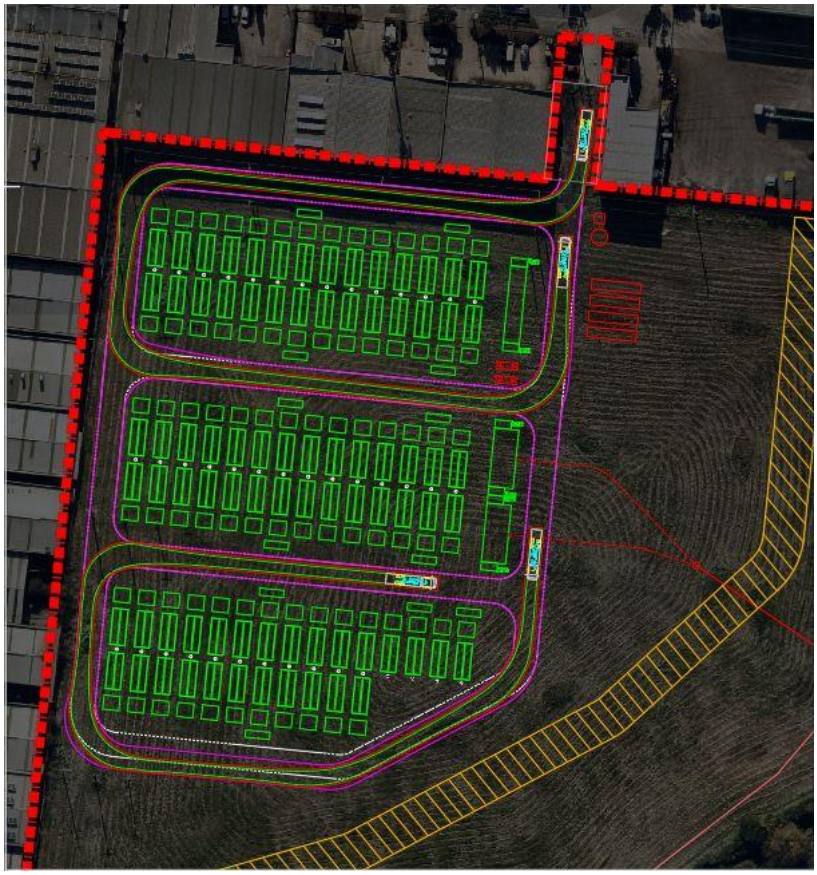

Figure 4-4: 12.5m Single Unit Truck Circulation

Figure 4-5: 19m semi-trailer circulation

4.2.2.2 Fire Rescue Victoria (FRV) Requirements

The FRV vehicle access requirements of the site are outlined within Guideline 27 of the FRV's planning guidelines. This guideline is currently under review with the Fire Safety Advisory Group, so it is not available for specific reference at the time of preparation of this report.

Guideline 13 outlines FRV's position on specific building and dangerous goods related issues. Although the facility isn't a building as such, these guidelines have been used to inform the adequacy of emergency vehicle access to the BESS facility.

To this end, with respect to emergency vehicle access requirements, Guideline 13 indicates:

The BCA generally requires that all large, isolated buildings be provided with a means of emergency vehicle access for the purpose of facilitating the activities of the attending fire brigade. The criteria used to satisfy the emergency vehicle access requirements of the NCC are contained within Clauses C2.3 and C2.4. These clauses generally prescribe the requirements outlined in Table 4-1 *below:*

Table 4-1: FRV Requirements

FRV Requirements	Comment
Emergency vehicle access be provided to surround the entire perimeter of the large, isolated building (refer to Figures 1 & 2)	Not an isolated building however a 6.0m wide access road is provided around the perimeter of the BESS facility.
The road must be capable of providing emergency vehicle access and passage from a public road	A formal access crossover and driveway is provided from Pelmet Crescent.
The road must have a minimum unobstructed width of 6 metres, with no part of its furthest boundary more than 18 metres from the building and in no part of the 6 metre width be built upon or used for any purpose other than vehicular or pedestrian movement (refer to Figure 2)	The internal road and access meets these requirements.
The road must provide reasonable pedestrian access to the building	Road provides for pedestrian access
The road must have a load bearing capacity and unobstructed height to permit the operation and passage of firefighting appliances	Road will be designed to accommodate heavy vehicles as required
Some public roads maybe used to partially satisfy the emergency vehicle access requirements of a large, isolated building	Not applicable

4.2.3 Other Considerations

4.2.3.1 Other Access Points

The Mahoneys Road and High Street access points to the Thomastown Terminal Station may be used at different times through the duration of the works to enable overhead connection of the BESS facility to the terminal station. These access points provide existing vehicle access to the Terminal Station site and are capable of accommodating vehicles involved in these activities.

5 Transport Impact Assessment

5.1 Trip Generation

5.1.1 Construction Phase Traffic

Based on information provided by AusNet, the BESS facility is anticipated to generate the following average daily traffic trips during the construction period.

i. 33 light vehicles trips (in, and out) per day i.e. construction worker private vehicles; and

ii. 11 heavy vehicle trips (in, and out) per day

With respect to the TTS site, we have not assessed the traffic impact due to the low number of vehicles accessing this site during the construction phase and noting that the TTS site will operate as per existing following completion of the BESS facility works.

For the BESS facility, it is noted the peak traffic movements associated with light vehicles are mainly concerned with staff coming to site, while the heavy vehicle movements are associated with a range of activities across the construction period, with the bulk earthworks period accounting for the majority of truck trips. The peak trips associated with light vehicles and heavy vehicles occur at different times through the construction period, given that the number of staff are highest during the Primary Works and vehicle movements highest during early site Civil Works. It is further noted that it is likely that the majority of light vehicle movements will be spread over a greater time period than being contained to within the AM or PM peak period. Notwithstanding, we have assumed that these movements occur during the identified AM and PM peak commuter periods for the purpose of our assessment, hence representing a worst-case scenario (conservative on the high side)

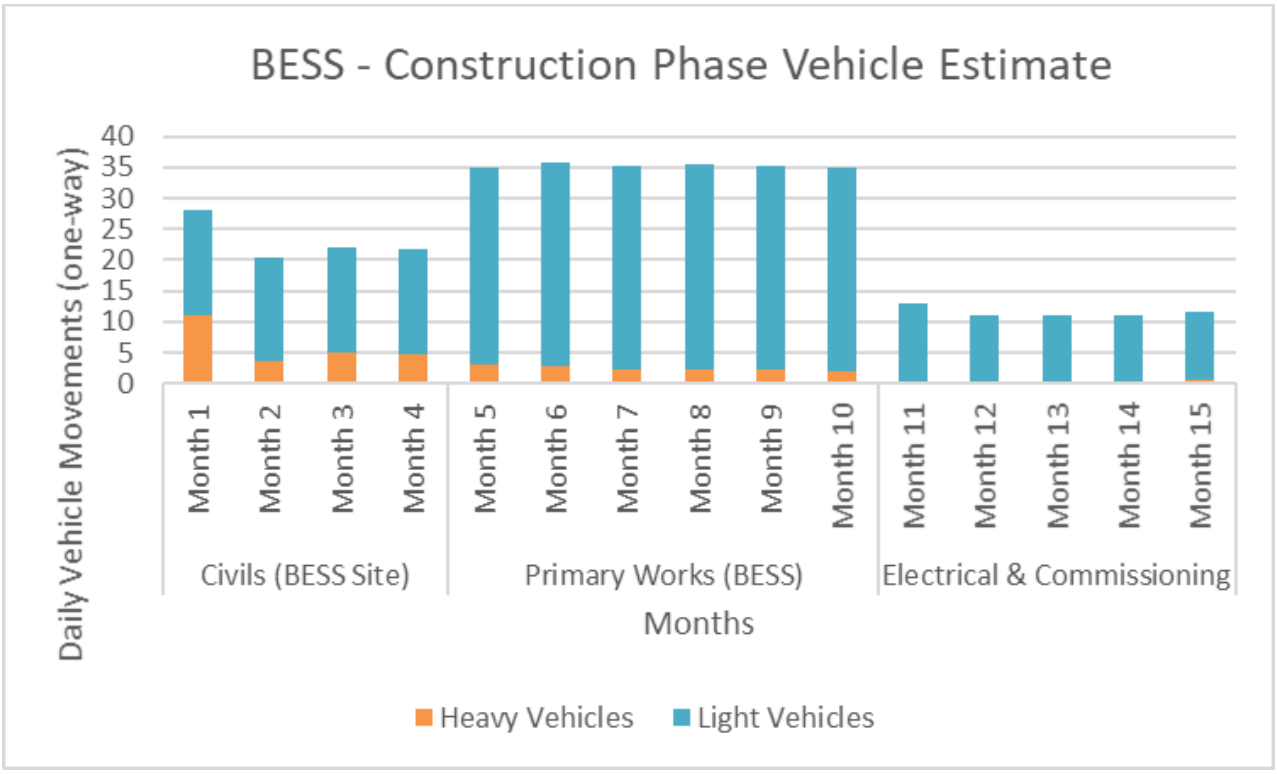

Figure 5-1: Thomastown BESS - Construction Vehicle Estimate

Based on the above, a peak of 66 light vehicle movements and 22 heavy vehicle movements are anticipated to occur during Primary Works, and in Month 1 respectively. Peak daily movements to site will occur during Month 6, when up to 36 daily trips or 72 movements are anticipated over the course of the day.

5.1.2 Operation and Maintenance Phase Traffic

As noted in Section 3.4 of this report, when in operation and maintenance phase, the facility is expected to be remotely managed and operated, and generally not staffed. However, infrequent monitoring and inspection activities can be expected throughout operation, where up to 5 staff might be on site at any one time. This could result in up to 1 trip (2 movements) for each staff member accessing the site:

5.1.3 Total Site Traffic Generation

Based on the above, the construction period is the critical phase in terms of traffic movements to and from the site. However, this period will occur over a 15-month period, and the peak movements during this period can be said to not represent the typical construction period movements. It is noted that the volume of traffic during operation (5 vehicles) is significantly lower than the peak construction phase traffic. Five vehicles represent the worst-case scenario for what the site is likely to generate during the operation and maintenance phase.

An assessment of the impact of the construction phase and operation and maintenance phase traffic on the road network has been completed in the below section with reference to the existing operation of the intersection of Edgars Road and Horne Street.

The assessment undertaken considers a worst-case scenario for both the construction phase, as well as the operation and maintenance phase, and the likely impact on the intersection of Edgars Road and Horne Street in the unlikely scenario where this occurs.

5.2 Traffic Impact Assessment

The performance measures adopted to assess the performance of the external network are:

i. **Degree of Saturation (DoS):** is the ratio of arrival (demand) flow rate to capacity during a given flow period. A value of above 0.90 indicates the intersection is reaching capacity, a value of above 0.90 for a critical movement is common for a significant number of suburban intersections.

ii. **Average delay:** The delay in seconds that can be expected for all vehicles undertaking a particular movement

iii. **95th Percentile Queue Length:** The maximum queue length in metres that can be expected in 95% of observed queue lengths in the peak hour

On the above basis, an assessment of the construction phase and the operation and maintenance phase traffic movements is included in the following section. SIDRA intersection modelling was used to compare the existing traffic conditions with the anticipated traffic during the construction period at the intersection of Edgars Road and Horne Street.

The following assumptions were made in modelling the intersection:

i. Generally, default SIDRA values have been used, however calibration has been completed to:

- Adopt the calculated Peak Flow Factor for Horne St and Edgar Rd approaches
- Apply extra bunching to reflect the effect of the upstream and downstream signalised intersections.

The SIDRA model was calibrated against queues and behaviours observed on site during the PM peak to confirm accuracy of the existing scenario modelling. It is noted that during the site visit, some cooperation was observed between vehicles on Edgars Road and those turning, whereby queuing vehicles on Edgars Road would let turning drivers through on occasion. The ‘Keep Clear’ line marking on the Edgars Road southbound carriageway, opposite Horne Street, further improves the capacity for right turns into and from Horne Street. As this can’t be reflected in the model, the model is likely to predict greater delays for right turning movements than what is occurring on site.

The form of the intersection under the existing and future (existing with the additional construction phase traffic) is shown Figure 5-2 below. It is noted that the model was created to reflect the Edgars Road central median arrangement at the intersection, whereby vehicles exiting from Horne Street complete right turns in a staged movement, using the central median.

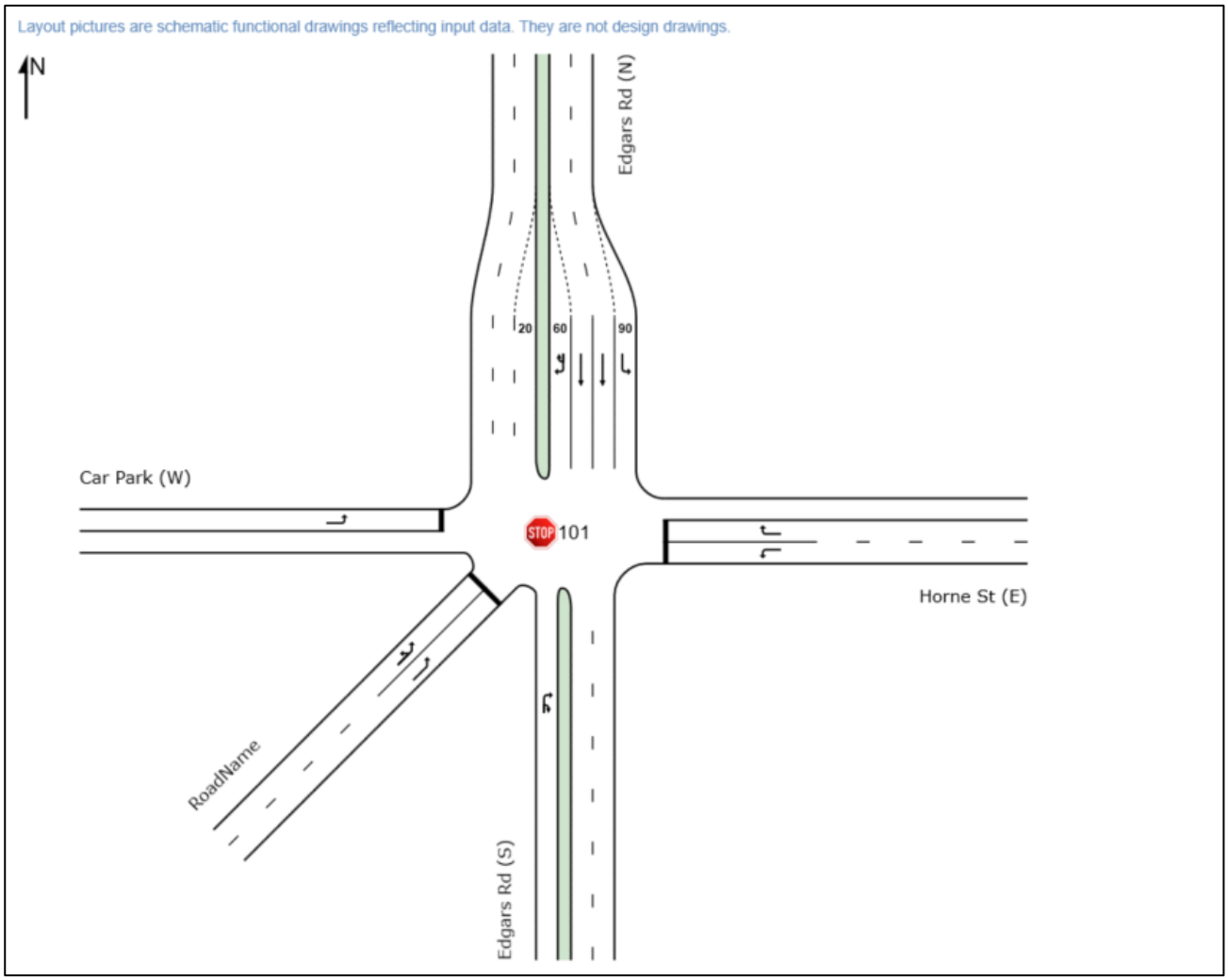

Figure 5-2: SIDRA intersection layout

The Sidra results are described in the following sections.

5.2.1 Construction Phase

5.2.1.1 Edgars Road / Horne Street

The peak period turning movements shown in Section 2.5.1 were used to analyse the effect of the construction traffic on the intersection, and comparison of the existing operation with the addition of construction period traffic at the intersection.

The following assumptions were made in modelling the intersection:

i. No growth on the network or at the intersection due to the construction period scheduled to start almost immediately and the operation and maintenance phase occurring soon after.

ii. No allowance for growth associated with future developments in the area.

iii. The peak **construction traffic** scenario assumed the peak light vehicle (LV) and heavy vehicle (HV) traffic movements across the construction period occur together i.e. where Month 1 HV movements and Month 6 LV movements occur concurrently. This is an extremely conservative approach and represents an unlikely scenario as it does not reflect the typical traffic during the construction phase.

iv. The daily trips have been converted to peak hour trips as follows:

- 20% of the peak total daily HV trips occur in the peak hour – 4 movements

- All the one-way peak daily light vehicle movements occur in the peak hour – 33 movements

The SIDRA results indicate:

i. At the Edgars Road approaches:

- Construction traffic will not impact the performance of the Edgars Road approaches during the PM peak.
- During the AM peak, no changes to existing queues or delays for through movements and left turn movements on Edgars Road are anticipated.
- On Edgars Road there is anticipated to be increased delays and queues for right turning traffic from the Edgars Road south approach into Horne Street in the AM peak.

ii. At the Horne St Approach:

- Horne Street approach is already operating at capacity during the AM peak, with right turners from Horne Street into Edgars Road northbound experiencing significant delays (close to 5 minutes).
- The analysis indicates construction traffic will increase existing delays at the Horne Street approach during both the AM and PM peak.

The critical approach results during construction phase are shown in Table 5-1.

Table 5-1: SIDRA Critical Intersection Outputs - Construction

	DoS		Avg Delay (s)		Max 95th Percentile Queues (m)	
	Existing	Construction	Existing	Construction	Existing	Construction
AM Peak						
Horne St (E)						
Left turn	0.11	0.11	16	16	4	4
Right turn[1]	1.12	1.18	280	321	83	97
Edgars Road (S)						
Right turn	0.68	0.84	75	99	19	27
PM Peak						
Horne St (E)						
Left turn	0.16	0.19	11	11	5	6
Right turn	0.84	0.97	74	114	40	71

[1] Observations on site indicated cooperation between drivers on Horne St and Edgars Road and therefore the delays for turning movements indicated in the model may be overstated.

The results indicate that during the **construction phase**, the worst case (unlikely) scenario:

i. Edgars Road south approach (right turn) - Average delays may increase by 24 seconds and 95th percentile queues by 8m in the AM peak

ii. Horne Street east approach (right turn) - Average delays may increase by 41 seconds and 95th percentile queues by 14m in the AM peak.

iii. Horne Street east approach (right turn) - Average delays may increase by 40 seconds and 95th percentile queues by 31m in the PM peak.

On Edgars Road, the impact is considered acceptable with vehicle queues remaining contained within the existing right hand turn lane, with delays increasing by in the order of 24 seconds. With respect to Horne Street, the SIDRA modelling indicates the construction phase traffic will add to these queues and delays in both the AM and PM peak periods, however, it is recommended that the contractor awarded the construction of the BESS facility develops and implements a CTMP and / or a TMP that looks to set down specific mitigations. Moreover, as noted, the outputs present an unlikely worst-case scenario given that the concurrent HV and LV movements will not occur at the one time and LV movements are likely to occur outside of, or spread across, the peak AM and PM peak periods.

With respect to the development and implementation of a CTMP and / or TMP, the specific details and mitigations will be confirmed and addressed appropriately by the contractor awarded the construction of the BESS facility. On this basis, the intersection may include additional signage, management of entry and exit movements into and from Edgars Road.

In consideration of the above, and the fact this scenario represents the absolute worst case that is unlikely to occur during the construction phase (temporary nature only), the construction traffic impact is considered acceptable.

5.2.2 Maintenance and Operation Phase

5.2.2.1 Edgars Road/Horne Street

The surveyed AM and PM peak period turning movements shown in Section 2.5.1 were used to analyse the effect of the critical development generated traffic on the road network. SIDRA intersection modelling was used to compare the existing traffic conditions at the intersection with the additional, anticipated traffic generated during the maintenance and operation phase at the intersection.

The following assumptions have been made in modelling the intersection:

i. The peak **maintenance and operation phase** traffic associated with the development assumes:
   - All the one-way daily light vehicle movements occur in the peak hour – 5 movements.
   - Trip distribution in accordance with the existing distribution at the intersection.
   - Generally, default SIDRA values have been used, however calibration has been completed to reflect site observations.

The SIDRA results for the intersection, comparing the existing operation with the addition of traffic movements generated by the BESS facility during this phase, indicates that during the maintenance and operation phase, traffic generated by the BESS facility will not materially impact the performance of any intersection approaches in either peak period with insignificant increases to delays and queues.

The critical intersection results during the maintenance and operation phase are shown in Table 5-2.

Table 5-2: Critical Intersection Outputs – Maintenance and Operation

	DoS		Avg Delay (s)		Max 95th Percentile Queues (m)	
	Existing	Maintenance & Operation	Existing	Maintenance & Operation	Existing	Maintenance & Operation
AM Peak						
Horne St (E)						
Left turn	0.11	0.11	16	16	4	4
Right turn[2]	1.12	1.13	280	285	83	85
Edgars Road (S)						
Right turn	0.68	0.70	75	76	19	19
PM Peak						
Horne St (E)						
Left turn	0.16	0.16	11	11	5	5
Right turn	0.84	0.86	74	78	40	43

Based on the above, during **maintenance and operation phase** in the worst case:

i. Horne Street east approach right turn into Edgars Road northbound - Average delays may increase by 5 seconds and 95th percentile queues by 2m in the AM peak (noting this approach has an existing DoS of 1.12)

ii. Edgars Road south approach right turn into Horne Street - Average delays may increase by 1 second in the AM peak.

iii. Horne Street east approach right turn into Edgars Road northbound- Average delays may increase by 4 seconds and 95th percentile queues by 3m in the PM peak.

Based on the above, the development maintenance and operation traffic is not anticipated to materially impact on the performance of the intersection in the context of the existing operation.

[2] Observations on site indicated cooperation between drivers on Horne St and Edgars Road and therefore the delays for turning movements indicated in the model may be overstated.

6 Summary and Conclusions

Considering the analysis presented above, it is concluded that:

i. A BESS facility is proposed to be constructed northwest of the existing Thomastown Terminal Station site.

ii. During the construction period and operation periods, access will be provided via an existing double width crossing from Pelmet Crescent.

iii. During the construction phase, which is anticipated to last approximately15 months, a maximum of 30 staff are expected to operate from the site and at least 30 car parks are proposed for the use.

iv. During the operation phase, the site will generally be managed remotely, with occasional maintenance and operations activities occurring at the site, with a maximum of five staff working on the site and at least five car parks.

v. The assessment with respect to **access** indicate:

- The access routes to the site are suitable to enable access to the site by a B-double truck (the critical vehicle accessing the site during the construction phase).
- On-site turning space will be provided in the laydown and parking area to accommodate a B-double turning around on site, enabling forward entry and exit for all vehicle on site.
- An internal access road of a minimum 6.0m width is provided through the site and at the perimeter of the batteries, the road is designed suitably for circulation of maintenance vehicles and firefighting appliances.

vi. The vehicle access point to the site is:

- Suitable for a B-double truck and Semi-trailer to enter and exit the site in a forward direction. There is the potential for the access to be managed in the case of two vehicles arriving simultaneously, in which case, suitable room adjacent to the access exists for arriving vehicles to give way to exiting traffic. Furthermore, the site is likely to be controlled / marshalled during the construction phase, so in the unlikely event that this occurs, then an appropriate form of traffic management will be undertaken.
- Minimum height clearance available at the access should be confirmed to be above 4.6m.

vii. Assessment against the **Whittlesea Planning Scheme** indicates:

- The design of the existing accessway generally meets the requirements of the planning scheme.
- The car parking spaces will be designed in accordance with Clause 52.06-9 of the Planning Scheme and will be provided to meet the demands of the site for each of the construction and operational phases of the activity.
- Gradients, urban design, safety and landscaping requirements will be adhered to through the detailed design stage of the facility.

viii. The assessment of effects with respect to **traffic impact** indicates:

- Month 1 is critical for heavy vehicle traffic, month 6 is critical for light vehicle traffic and overall traffic associated with construction.
- A peak of 66 light vehicle movements and 22 heavy vehicle movements are expected to and from the site during primary works (including month 6) and month 1 respectively.

ix. The Edgars Road/Horne Street intersection currently has operating deficiencies, specifically at the Horne Street east approach during the peak periods, reporting a DoS above 0.9.

x. In the worst-case scenario, traffic generated by the development proposal during the maintenance and operation phase will not materially impact the operation of the intersection.

xi. During construction, under a worst-case scenario (which is unlikely to occur due to the proposed construction program):

- Through traffic on Edgars Road will be unaffected.
- The delay for right turn movements from the Edgars Road south approach into Horne Street during the AM period will increase, but overall will have minimal impact on the operation of the intersection.
- Construction phase traffic will exacerbate existing deficiencies on the Horne Street approach, however in the context of the existing operation, this will be managed through the development and implementation of an approved CTMP or TMP by the contractor.

xii. During the construction of the BESS facility, the Thomastown Terminal Station site is likely to only experience a minimal increase in traffic accessing the site from the existing access points given that the proposed works primarily involve electrical works and commissioning. Post construction of the BESS facility, the TTS site will operate as per existing conditions.

xiii. Overall, the transportation effects of this proposal are acceptable during the construction phase and are expected to be negligible moving forward under the operational phase, therefore there are no transportation reasons which preclude approval of this development.

A

Appendix A – SIDRA Outputs

MOVEMENT SUMMARY

Site: 101 [Edgars Road-Horne St Existing - AM Peak - Staged (Site Folder: General)]

New Site
Site Category: (None)
Stop (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: Edgars Rd (S)														
3	R2	54	9	56	16.7	0.681	74.5	LOS F	2.3	18.5	0.97	1.00	1.41	18.2
3u	U	5	1	5	20.0	0.681	75.4	LOS F	2.3	18.5	0.97	1.00	1.41	6.4
Approach		59	10	61	16.9	0.681	74.5	NA	2.3	18.5	0.97	1.00	1.41	17.4
East: Horne St (E)														
4	L2	45	14	48	31.1	0.107	15.8	LOS C	0.4	3.6	0.66	1.02	0.66	36.3
6	R2	55	18	64	32.7	1.123	279.7	LOS F	9.3	83.1	1.00	1.77	3.68	10.3
Approach		100	32	112	32.0	1.123	166.8	LOS F	9.3	83.1	0.86	1.45	2.39	13.1
North: Edgars Rd (N)														
7	L2	119	18	120	15.1	0.072	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.5
8	T1	1514	100	1529	6.6	0.409	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
9	R2	5	0	5	0.0	0.145	13.1	LOS B	0.4	3.0	0.84	0.95	0.84	46.7
9u	U	28	1	28	3.6	0.145	26.7	LOS D	0.4	3.0	0.84	0.95	0.84	46.0
Approach		1666	119	1683	7.1	0.409	1.1	NA	0.4	3.0	0.02	0.06	0.02	66.6
West: Car Park (W)														
10	L2	1	1	1	100.0	0.004	18.5	LOS C	0.0	0.2	0.66	0.92	0.66	30.9
Approach		1	1	1	100.0	0.004	18.5	LOS C	0.0	0.2	0.66	0.92	0.66	30.9
SouthWest: RoadName														
30b	L3	1	1	1	100.0	0.302	13.5	LOS B	0.0	0.0	0.00	1.18	0.00	39.2
30a	L1	1041	108	1073	10.4	0.302	9.8	LOS A	0.0	0.0	0.00	1.18	0.00	55.5
Approach		1042	109	1074	10.5	0.302	9.8	LOS A	0.0	0.0	0.00	1.18	0.00	55.5
All Vehicles		2868	271	2931	9.5	1.123	12.1	NA	9.3	83.1	0.06	0.55	0.13	51.0

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

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MOVEMENT SUMMARY

Site: 101 [Edgars Road-Horne St Future Operation- AM Peak - Staged (Site Folder: General)]

New Site
Site Category: (None)
Stop (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: Edgars Rd (S)														
3	R2	56	9	58	16.1	0.703	76.4	LOS F	2.4	19.3	0.98	1.01	1.45	17.9
3u	U	5	1	5	20.0	0.703	77.3	LOS F	2.4	19.3	0.98	1.01	1.45	6.3
Approach		61	10	63	16.4	0.703	76.4	NA	2.4	19.3	0.98	1.01	1.45	17.1
East: Horne St (E)														
4	L2	45	14	48	31.1	0.107	15.8	LOS C	0.4	3.6	0.66	1.02	0.66	36.3
6	R2	55	18	64	32.7	1.131	285.4	LOS F	9.5	85.0	1.00	1.79	3.73	10.1
Approach		100	32	112	32.0	1.131	170.0	LOS F	9.5	85.0	0.86	1.46	2.42	12.9
North: Edgars Rd (N)														
7	L2	122	18	123	14.8	0.073	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.6
8	T1	1514	100	1529	6.6	0.409	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
9	R2	5	0	5	0.0	0.145	13.1	LOS B	0.4	3.0	0.84	0.95	0.84	46.7
9u	U	28	1	28	3.6	0.145	26.7	LOS D	0.4	3.0	0.84	0.95	0.84	46.0
Approach		1669	119	1686	7.1	0.409	1.1	NA	0.4	3.0	0.02	0.06	0.02	66.6
West: Car Park (W)														
10	L2	1	1	1	100.0	0.004	18.5	LOS C	0.0	0.2	0.66	0.92	0.66	30.9
Approach		1	1	1	100.0	0.004	18.5	LOS C	0.0	0.2	0.66	0.92	0.66	30.9
SouthWest: RoadName														
30b	L3	1	1	1	100.0	0.302	13.5	LOS B	0.0	0.0	0.00	1.18	0.00	39.2
30a	L1	1041	108	1073	10.4	0.302	9.8	LOS A	0.0	0.0	0.00	1.18	0.00	55.5
Approach		1042	109	1074	10.5	0.302	9.8	LOS A	0.0	0.0	0.00	1.18	0.00	55.5
All Vehicles		2873	271	2936	9.5	1.131	12.3	NA	9.5	85.0	0.06	0.55	0.13	50.8

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

Organisation: BECA LIMITED | Licence: PLUS / Enterprise | Processed: Friday, 10 June 2022 5:38:50 pm
Project: C:\Users\CF6\OneDrive - Beca\TT BESS\TT BESS.sip9

MOVEMENT SUMMARY

Site: 101 [Edgars Road-Horne St Future Construction - AM Peak - Staged (Site Folder: General)]

New Site
Site Category: (None)
Stop (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: Edgars Rd (S)														
3	R2	65	10	67	15.4	0.837	99.4	LOS F	3.4	26.6	0.99	1.10	1.83	14.9
3u	U	5	1	5	20.0	0.837	100.4	LOS F	3.4	26.6	0.99	1.10	1.83	5.0
Approach		70	11	72	15.7	0.837	99.5	NA	3.4	26.6	0.99	1.10	1.83	14.4
East: Horne St (E)														
4	L2	45	14	48	31.1	0.107	15.8	LOS C	0.4	3.6	0.66	1.02	0.66	36.3
6	R2	55	18	64	32.7	1.179	321.2	LOS F	10.8	96.5	1.00	1.87	4.02	9.1
Approach		100	32	112	32.0	1.179	190.5	LOS F	10.8	96.5	0.86	1.50	2.58	11.8
North: Edgars Rd (N)														
7	L2	145	21	146	14.5	0.087	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.6
8	T1	1514	100	1529	6.6	0.409	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
9	R2	5	0	5	0.0	0.145	13.1	LOS B	0.4	3.0	0.84	0.95	0.84	46.7
9u	U	28	1	28	3.6	0.145	26.7	LOS D	0.4	3.0	0.84	0.95	0.84	46.0
Approach		1692	122	1709	7.2	0.409	1.2	NA	0.4	3.0	0.02	0.07	0.02	66.3
West: Car Park (W)														
10	L2	1	1	1	100.0	0.004	18.5	LOS C	0.0	0.2	0.66	0.92	0.66	30.9
Approach		1	1	1	100.0	0.004	18.5	LOS C	0.0	0.2	0.66	0.92	0.66	30.9
SouthWest: RoadName														
30b	L3	1	1	1	100.0	0.302	13.5	LOS B	0.0	0.0	0.00	1.18	0.00	39.2
30a	L1	1041	108	1073	10.4	0.302	9.8	LOS A	0.0	0.0	0.00	1.18	0.00	55.5
Approach		1042	109	1074	10.5	0.302	9.8	LOS A	0.0	0.0	0.00	1.18	0.00	55.5
All Vehicles		2905	275	2968	9.6	1.179	13.8	NA	10.8	96.5	0.07	0.55	0.15	49.4

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

MOVEMENT SUMMARY

Site: 101 [Edgars Road-Horne St Existing - PM Peak - Staged (Site Folder: General)]

New Site
Site Category: (None)
Stop (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: Edgars Rd (S)														
3	R2	24	7	24	29.2	0.153	22.7	LOS C	0.4	3.5	0.82	0.93	0.82	32.7
3u	U	5	0	5	0.0	0.153	21.1	LOS C	0.4	3.5	0.82	0.93	0.82	16.4
Approach		29	7	29	24.1	0.153	22.4	NA	0.4	3.5	0.82	0.93	0.82	31.1
East: Horne St (E)														
4	L2	90	6	122	6.7	0.157	11.0	LOS B	0.7	5.0	0.56	0.94	0.56	39.3
6	R2	115	6	131	5.2	0.836	74.1	LOS F	5.4	39.5	0.97	1.42	2.38	27.3
Approach		205	12	252	5.9	0.836	43.7	LOS E	5.4	39.5	0.77	1.19	1.50	30.5
North: Edgars Rd (N)														
7	L2	47	9	51	19.1	0.031	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	54.5
8	T1	1006	64	1082	6.4	0.289	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
9	R2	26	1	28	3.8	0.461	84.8	LOS F	1.8	12.6	0.99	0.70	1.14	26.0
9u	U	12	0	13	0.0	0.461	89.7	LOS F	1.8	12.6	0.99	0.70	1.14	26.2
Approach		1091	74	1173	6.8	0.461	3.4	NA	1.8	12.6	0.03	0.05	0.04	62.5
West: Car Park (W)														
10	L2	31	0	33	0.0	0.153	21.6	LOS C	0.5	3.3	0.85	1.00	0.85	33.2
Approach		31	0	33	0.0	0.153	21.6	LOS C	0.5	3.3	0.85	1.00	0.85	33.2
SouthWest: RoadName														
30b	L3	8	0	8	0.0	0.565	9.7	LOS A	0.0	0.0	0.00	1.15	0.00	39.3
30a	L1	2077	73	2098	3.5	0.565	9.5	LOS A	0.0	0.0	0.00	1.15	0.00	57.2
Approach		2085	73	2106	3.5	0.565	9.5	LOS A	0.0	0.0	0.00	1.15	0.00	57.1
All Vehicles		3441	166	3593	4.9	0.836	10.1	NA	5.4	39.5	0.08	0.79	0.13	54.5

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

Organisation: BECA LIMITED | Licence: PLUS / Enterprise | Processed: Friday, 10 June 2022 5:38:53 pm
Project: C:\Users\CF6\OneDrive - Beca\TT BESS\TT BESS.sip9

MOVEMENT SUMMARY

Site: 101 [Edgars Road-Horne St Future Operation - PM Peak - Staged (Site Folder: General)]

New Site
Site Category: (None)
Stop (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: Edgars Rd (S)														
3	R2	24	7	24	29.2	0.153	22.7	LOS C	0.4	3.5	0.82	0.93	0.82	32.7
3u	U	5	0	5	0.0	0.153	21.1	LOS C	0.4	3.5	0.82	0.93	0.82	16.4
Approach		29	7	29	24.1	0.153	22.4	NA	0.4	3.5	0.82	0.93	0.82	31.1
East: Horne St (E)														
4	L2	92	6	124	6.5	0.160	11.0	LOS B	0.7	5.1	0.56	0.94	0.56	39.3
6	R2	118	6	134	5.1	0.856	77.9	LOS F	5.8	42.6	0.97	1.46	2.53	26.6
Approach		210	12	258	5.8	0.856	45.7	LOS E	5.8	42.6	0.77	1.21	1.58	29.9
North: Edgars Rd (N)														
7	L2	47	9	51	19.1	0.031	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	54.5
8	T1	1006	64	1082	6.4	0.289	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
9	R2	26	1	28	3.8	0.461	84.8	LOS F	1.8	12.6	0.99	0.70	1.14	26.0
9u	U	12	0	13	0.0	0.461	89.7	LOS F	1.8	12.6	0.99	0.70	1.14	26.2
Approach		1091	74	1173	6.8	0.461	3.4	NA	1.8	12.6	0.03	0.05	0.04	62.5
West: Car Park (W)														
10	L2	31	0	33	0.0	0.153	21.6	LOS C	0.5	3.3	0.85	1.00	0.85	33.2
Approach		31	0	33	0.0	0.153	21.6	LOS C	0.5	3.3	0.85	1.00	0.85	33.2
SouthWest: RoadName														
30b	L3	8	0	8	0.0	0.565	9.7	LOS A	0.0	0.0	0.00	1.15	0.00	39.3
30a	L1	2077	73	2098	3.5	0.565	9.5	LOS A	0.0	0.0	0.00	1.15	0.00	57.2
Approach		2085	73	2106	3.5	0.565	9.5	LOS A	0.0	0.0	0.00	1.15	0.00	57.1
All Vehicles		3446	166	3600	4.9	0.856	10.3	NA	5.8	42.6	0.08	0.79	0.14	54.3

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

MOVEMENT SUMMARY

Site: 101 [Edgars Road-Horne St Future Construction - PM Peak - Staged (Site Folder: General)]

New Site
Site Category: (None)
Stop (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: Edgars Rd (S)														
3	R2	24	7	24	29.2	0.153	22.7	LOS C	0.4	3.5	0.82	0.93	0.82	32.7
3u	U	5	0	5	0.0	0.153	21.1	LOS C	0.4	3.5	0.82	0.93	0.82	16.4
Approach		29	7	29	24.1	0.153	22.4	NA	0.4	3.5	0.82	0.93	0.82	31.1
East: Horne St (E)														
4	L2	110	8	149	7.3	0.192	11.2	LOS B	0.8	6.3	0.57	0.95	0.57	39.2
6	R2	132	8	150	6.1	0.970	113.5	LOS F	9.7	71.2	0.99	1.81	3.71	21.1
Approach		242	16	299	6.7	0.970	62.5	LOS F	9.7	71.2	0.78	1.38	2.15	25.4
North: Edgars Rd (N)														
7	L2	47	9	51	19.1	0.031	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	54.5
8	T1	1006	64	1082	6.4	0.289	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
9	R2	26	1	28	3.8	0.461	84.8	LOS F	1.8	12.6	0.99	0.70	1.14	26.0
9u	U	12	0	13	0.0	0.461	89.9	LOS F	1.8	12.6	0.99	0.70	1.14	26.2
Approach		1091	74	1173	6.8	0.461	3.4	NA	1.8	12.6	0.03	0.05	0.04	62.5
West: Car Park (W)														
10	L2	31	0	33	0.0	0.153	21.6	LOS C	0.5	3.3	0.85	1.00	0.85	33.2
Approach		31	0	33	0.0	0.153	21.6	LOS C	0.5	3.3	0.85	1.00	0.85	33.2
SouthWest: RoadName														
30b	L3	8	0	8	0.0	0.565	9.7	LOS A	0.0	0.0	0.00	1.15	0.00	39.3
30a	L1	2077	73	2098	3.5	0.565	9.5	LOS A	0.0	0.0	0.00	1.15	0.00	57.2
Approach		2085	73	2106	3.5	0.565	9.5	LOS A	0.0	0.0	0.00	1.15	0.00	57.1
All Vehicles		3478	170	3640	5.0	0.970	12.1	NA	9.7	71.2	0.09	0.81	0.20	52.5

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