36°45'18.2"S
144°17'23.3"E

Bendigo Tramways Expansion: 48 Hopetoun St & 75 Hargreaves St, Bendigo

Traffic and Transport Assessment

13 October 2021
Prepared for Y2 Architecture on behalf of VicTrack

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Impact

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Contents

Tables

Figures

Appendices

1 IMPACT® Snap Shot

Development Proposition		
Location	36°45'18.2"S 144°17'23.3"E	48 Hopeton Street & 75 Hargreaves Street, Bendigo
Use		Warehouse Development
Yield		2,305sq.m NLA
Car Parking		48 car spaces
Bicycle Parking		A designated area has been allocated towards bicycle parking in the form of 5 bicycle hoops (10 spaces) for Tramway patrons and staff.

Statutory Controls	
Particular Provisions	
	Clause 52.06 - Car Parking
Requirement vs Provision	36 spaces required. 48 spaces provided.
Adequacy of Provision	Based on the above, the proposed car parking provision for the warehouse development exceeds the statutory requirement and takes into consideration the current staff parking demand generated from 21 FTE who are currently relying on surrounding on-street parking spaces. This current demand can now be accommodated within the on-site car parking spaces and therefore increase the on-street parking availability within the surrounding road network.
Design	The proposed car park and accessways have been assessed and determined to have satisfied the relevant design guidelines.
	Clause 52.34 - Bicycle Facilities
Requirement vs Provision	Clause 52.34 of the Bendigo Planning Scheme does not specifically refer to bicycle parking requirements for Warehouses. As such, the Warehouse development as proposed is not required to provide bicycle spaces. However, it is acknowledged that the subject site has allocated 5 bicycle hoops (10 spaces) for Tramway patrons and staff.
Adequacy of Provision	The provision of any bicycle parking will exceed the statutory requirement and will help to encourage cycling as a mode of transport to / from the subject site. We can conclude that bicycle parking provided as part of this development satisfies the purpose of Clause 52.34, specifically: — To encourage cycling as a mode of transport and provide secure accessible and convenient bicycle parking spaces.

Clause 65.01 - Loading Arrangements

Design Considerations	The proposed loading arrangements have been assessed and determined to have satisfied the relevant design guidelines / principles contained within Clause 65.01 and AS2890.2:2018.

Traffic Considerations

Traffic Impact	The proposed warehouse development will conservatively generate between a range of 12 to 46 vehicle movements during the AM and PM peak hour. Conservatively, this level of traffic is equivalent to approximately one (1) vehicle movement every 1 minute and 20 seconds. This level of traffic is not expected to have an adverse impact on the operation of the surrounding road network.

Conclusion

- The proposed development satisfies relevant statutory requirements and where the statutory requirements are not explicitly met, the development is deemed to satisfy decision guidelines that allow for a reduction or waiver of the said requirement.
- There are no traffic and transport grounds that should prohibit the issue of a permit.

2 Introduction

2.1 Engagement

IMPACT® have been engaged by Y2 Architecture on behalf of VicTrack to undertake a Traffic and Transport Impact Assessment for the proposed Bendigo Tramways Upgrade at 48 Hopetoun Street in Bendigo.

2.2 Scope of Engagement

This Traffic and Transport Impact Assessment has been prepared to accompany a town planning submission.

In preparing this assessment we have referenced the following:

- Development plans prepared by Y2 Architecture (Drawing No. 122 P11); and
- Greater Bendigo Planning Scheme, specifically:
  - Clause 52.06 - Car Parking;
  - Clause 52.34 - Bicycle Facilities; and
  - Clause 65.01 - Loading Facilities.

3 Existing Conditions

3.1 Subject Site Location

The Bendigo Tramways comprises of two (2) separate land parcels, being the existing visitor centre and depot operating at 75 Hargreaves Street and the subject site which is currently vacant land located at 48 Hopetoun Street in Bendigo.

The overall site is irregular in shape and is bounded by Back Creek to the west, Hargreaves Street and Lansell Street to the north and to an existing train line located to the east as shown in Figure 1 and Figure 2.

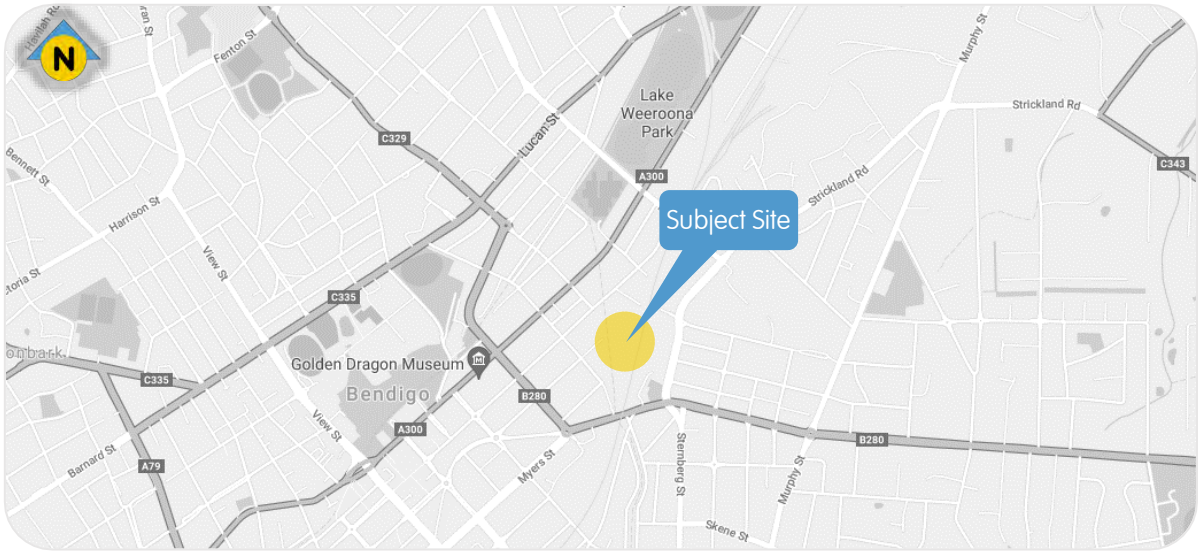


Figure 1 Location of Subject Site (Source: Google Maps)

Figure 2 Aerial of Subject Site (Source: Nearmap Aerial Dated 05 May 2021)

3.2 Planning Zone

The overall site is located within the Public Use (PUZ7) and comprises of two (2) separate land parcels as illustrated in Figure 3 and Figure 4.

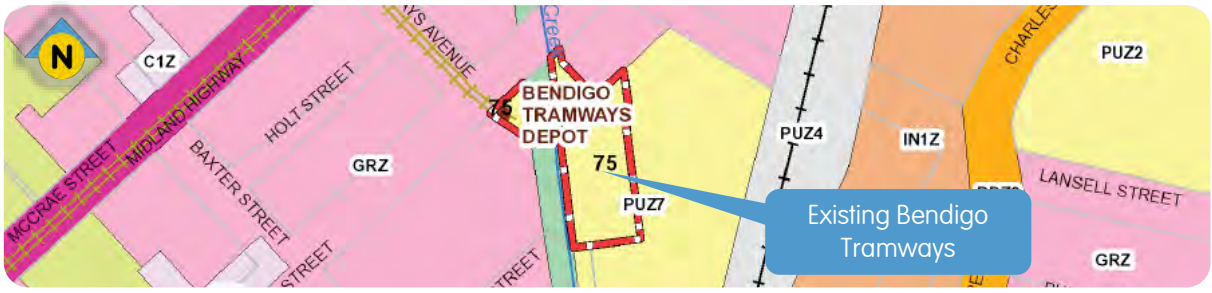


Figure 3 Land Use Planning Zone (75 Hargreaves Street)

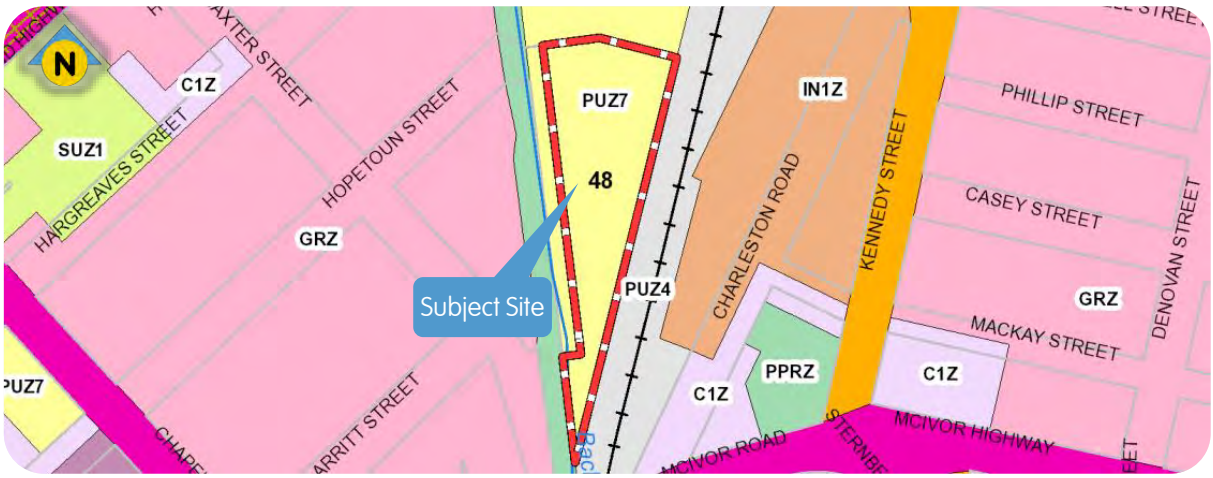


Figure 4 Land Use Planning Zone (48 Hopetoun Street)

The purpose of this zone is as described under the planning scheme is to:

- Recognise public land use for public utility and community services and facilities
- To provide for associated uses that are consistent with the intent of the public land reservation or purpose.

3.3 Road Network

3.3.1 Hopetoun Street

Classified as a local road and is aligned in an east-west direction between Mundy Street / Lyttleton Terrace to the west and terminates at a cul-dec-sac towards the east.

Hopetoun Street currently comprises of a sealed road carriageway measuring approximately 17m wide that provides for one (1) lane of traffic in both directions with unrestricted on-street angled parking on both ends of the carriageway.

No Standing parking restrictions apply at the end of the cul-dec-sac at the eastern end, adjacent to the subject site.

3.3.2 Hargreaves Street

Classified as a local road and is aligned generally in an east-west direction and is bounded to the east by Nolan Street and Chapel Street to the west.

Hargreaves Street currently comprises of a sealed road carriageway measuring approximately 15m wide that provides for one (1) lane of traffic in both directions with unrestricted on-street parking on both ends of the carriageway.

4 Development Proposition

4.1 Use and Yield

We understand that Bendigo Tramways currently operates with a visitor centre and depot (located at 75 Hargreaves Street) and will continue to operate as an existing use, with operating hours generally from Monday to Friday 8:30am to 5:30pm, and occasional after-hours requirement on weekend for operation and restoration activities.

For the remaining portion of the overall site, it is planned to develop the subject site at 48 Hopetoun Street for the purpose of a new tram storage warehouse which contemplates a total of 2,305sq.m of Net Leasable Area (NLA) and will provide for 48 car parking bays.

As part of the redevelopment of the overall site, the existing six (6) visitor bays provided for the existing visitor centre and depot at 75 Hargreaves Street will be incorporated as part of the car parking area proposed at 48 Hopetoun Street.

The proposed development plan is shown in further detail in Appendix A and illustrated in Figure 5.

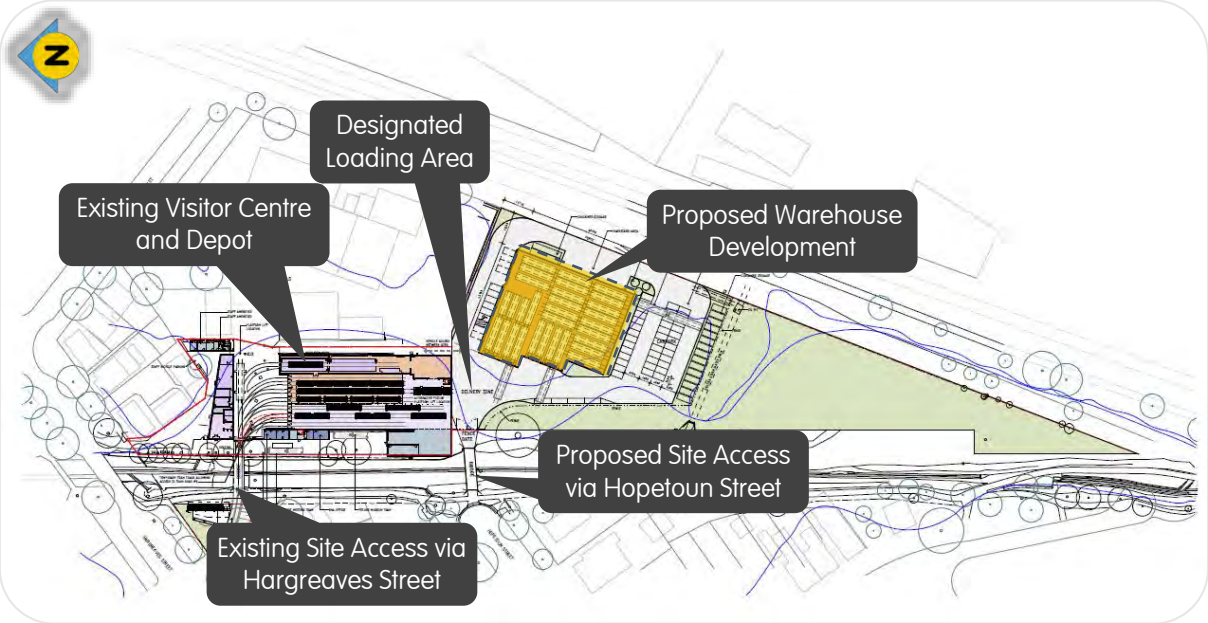


Figure 5 Proposed Development Plan

4.2 Access Arrangements

Vehicle access for the proposed warehouse development and car parking at 48 Hopetoun Street will continue to be provided via the existing bridge at the end of the cul-dec-sac along the eastern end of Hopetoun Street.

This site access point via Hopetoun Street will service both heavy and light vehicles. All delivery vehicles will enter and exit the subject site in a forward direction.

Vehicle access for the existing Visitor Centre and Depot will continue to be along Hargreaves Street.

4.3 Current and Future Staff Numbers

As a result, the proposed development will generate the following full time equivalent (FTE) staff numbers as shown in Table 1, and we understand this expected future staff numbers are based on conservative long-term estimates.

Table 1 Projected Staff Numbers

Function	Operating Times	Current FTE	Future FTE
Admin	Mon-Fri, 8:30am - 5:30pm	4	9
Operations	Mon-Sat, 8:30am - 5:30pm*	3	8
Maintenance	Mon-Fri, 8:30am - 5:30pm	4	5
Restoration	Mon-Fri, 8:30am - 5:30pm**	10	24
Total		**21**	**46**

FTE = Full-Time Equivalent
*with occasional after hours requirement
**however potential to also operate on Saturdays in the future

It is understood that staff will predominately be working at the depot (75 Hargreaves Street) whilst it is expected that up to 1-2 staff will be operating at the storage facility (48 Hopetoun Street) at any time.

4.4 Bicycle Parking

A designated area within the subject site has been allocated towards bicycle parking which will include 5 bicycle hoops (10 spaces) at 75 Hargreaves Street for Tramway patrons and for staff.

No bicycle parking has been proposed at 48 Hopetoun Street.

4.5 Site Access and Delivery

4.5.1 75 Hargreaves Street Access

Tram Delivery

It is advised that deliveries for the existing Visitor Centre & Depot will be along Hargreaves Street bridge as per the existing arrangement.

The semi-trailers will enter the site from the bridge on Hargreaves Street and will be loaded / unloaded in the rail fan area in front of the workshop.

It is understood that the frequency is expected to be ~1 tram movement per month (or 12 per annum).

These deliveries will be managed by suitably qualified external contractors with VicRoads Permits and personnel who will provide temporary traffic management measures as deemed necessary.

General Delivery

There will be minimal deliveries to 75 Hargreaves Street.

4.5.2 48 Hopetoun Street Access

Tram Delivery

For trams being delivered to or collected from the proposed storage building, semi-trailers will enter / egress Hopetoun Street at the intersection of Chapel Street and Hopetoun Street with turning movements predominately being left-in / right-out. These semi-trailers will access the site across the bridge at the end of Hopetoun Street.

It is understood that 30 trams will be delivered to the site once construction has been completed. Following this, the frequency of these movements are expected to be ~1 tram movement every 6 months (or 2 movements per annum) and as a result will require the two (2) parking spaces in front of 59 and 61 Hopetoun Street to be vacated when these deliveries occur. It is noted that Bendigo Tramways will consult with Council well in advance to make suitable arrangements.

Trams will be transported / delivered to and from the proposed site using semi-trailers of up to 25m, noting that deliveries via B-Doubles (26m) will not be required.

General Delivery & Waste Management

The subject site at 48 Hopetoun Street has been designed to accommodate truck movements for up to 12.5m Heavy Rigid Vehicle (HRV). A designated loading area is provided on-site as shown in Figure 5.

It is expected that the following services will be provided:

- Private and Council waste collection to occur weekly (to include landfill, recyclables, glass and green waste);
  - The bins provided will be in the form of the standard Council bins, providing for landfill, glass, recyclables, and organic waste;
- It is understood that site deliveries (e.g. hardware supply deliveries) will occur three (3) times a week in the form of small truck/ute vehicles.

Delivery Route

It is anticipated that the tram deliveries will be transported to the subject site via the following routes:

McIvor Highway - Hopetoun Street - Subject Site

Figure 6 shows the proposed haulage route.

Figure 6 Proposed Haulage Route

4.5.2.1 Swept Path Assessment

Access via McIvor Highway/Chapel Street & Hopetoun Street

A Swept path assessment (as shown in Appendix B) has been undertaken for the proposed route and demonstrates that 25m semi-trailers are able enter and exit the subject site in a forward direction.

The swept path assessment has also shown adequate access by 25m semi-trailers for the following movements:

- Ingress: Right-turn in from McIvor Highway/Chapel Street onto Hopetoun Street;
- Ingress: Left-turn in from McIvor Highway/Chapel Street onto Hopetoun Street;
- Egress: Left-turn out from Hopetoun Street onto McIvor Highway/Chapel Street; and
- Egress: Right-turn out from Hopetoun Street onto McIvor Highway/Chapel Street.

The assessment revealed that the egress manoeuvre from Hopetoun Street to McIvor Highway (via right-turn) will encroach onto the existing mountable island located on the northern median island. It is understood that this behaviour is currently typical (i.e. is currently occurring on-site) for this location and is further illustrated in Figure 7.

Figure 7 Parking Management Recommendation (Tram Delivery - Once a Month)

Access to the Subject Site from Hopetoun Street

The swept path assessment has shown adequate access by 25m semi-trailers for the following movements:

- Ingress: from Hopetoun Street into the Subject Site; and
- Egress: from Subject Site onto Hopetoun Street.

Ingress manoeuvres for the 25m semi-trailers into the subject site are expected to encroach onto the existing car parking bays located on the eastern end of Hopetoun Street as shown in Figure 8 and Figure 9.

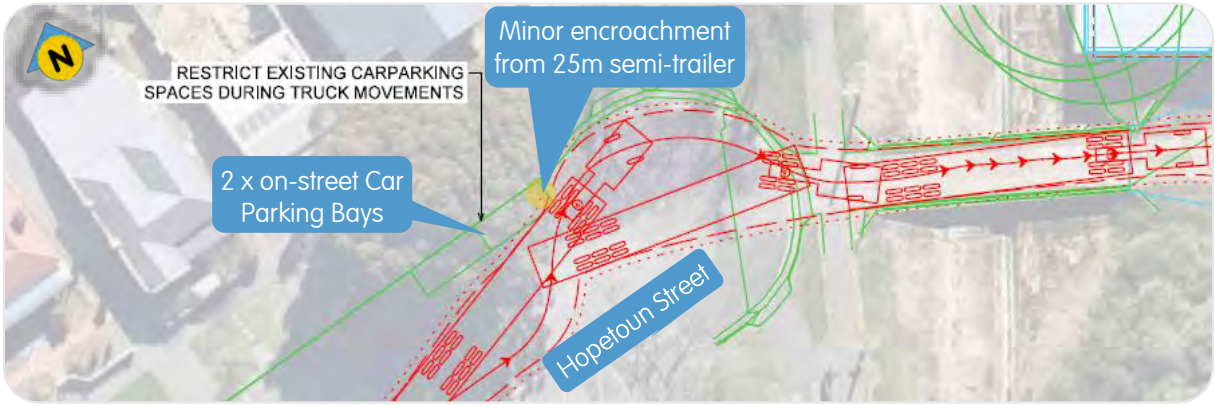


Figure 8 25m Semi-Trailer Ingress Manoeuvre

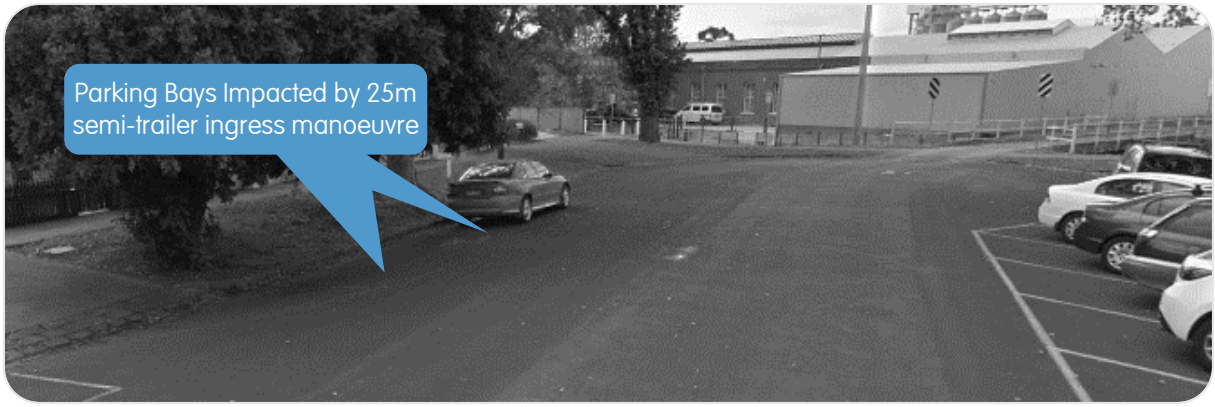


Figure 9 Street View of Hopetoun Street Eastern End

Egress manoeuvres are not expected to impact on the two (2) car parking bays located in the road reserve located at 59 and 61 Hopetoun Street as shown in Figure 10.

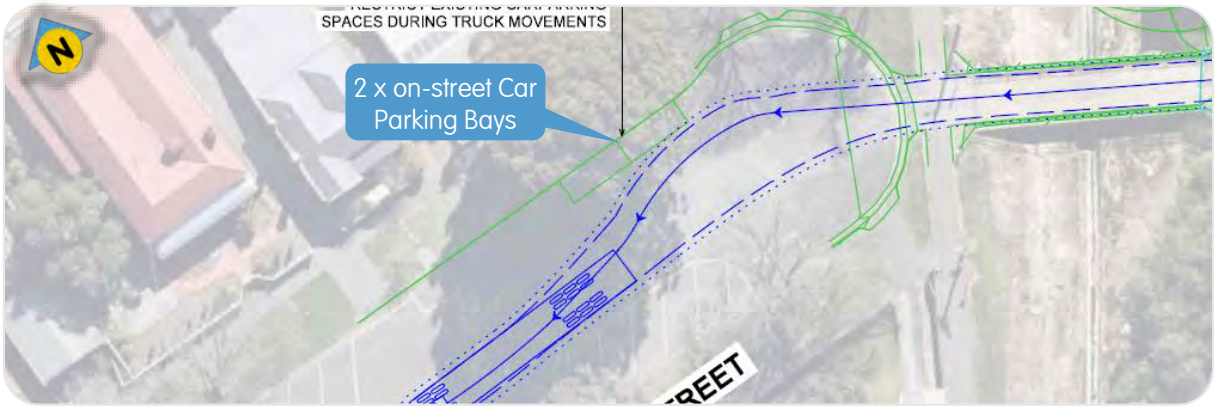


Figure 10 25m Semi-Trailer Egress Manoeuvre

In consultation with City of Greater Bendigo, it is anticipated that the tram delivery schedule will be managed by Bendigo Trams and temporary restrictions will apply to these parallel on-street car parking bays. In addition, it is anticipated that these trams will be delivered once a month and is not expected to impact on the local street parking amenity.

The project team will continue to monitor the tram deliveries and temporary parking restrictions with any changes to be undertaken as required.

Notwithstanding, Hopetoun Street is a local road and is managed by Council and is noted that any parking restrictions / loss-of-parking or impacts caused to parking bays will ultimately be decided / managed by Council.

5 Statutory Controls

The relevant traffic and transportation Statutory Controls are:

Particular Provisions

- Clause 52.06 - Car Parking
- Clause 52.34 - Bicycle Facilities
- Clause 65.01 - Loading Considerations

5.1 Clause 52.06 - Car Parking

5.1.1 Purpose

The purpose of Clause 52.06 is:

- To ensure that car parking is provided in accordance with the Municipal Planning Strategy and Planning Policy Framework.
- To ensure the provision of an appropriate number of car parking spaces having regard to the demand likely to be generated, the activities on the land and the nature of the locality.
- To support sustainable transport alternatives to the motor car.
- To promote the efficient use of car parking spaces through the consolidation of car parking facilities.
- To ensure that car parking does not adversely affect the amenity of the locality.
- To ensure that the design and location of car parking is of a high standard, creates a safe environment for users and enables easy and efficient use.

5.1.2 Provision and Design Requirements

To satisfy the above purpose, Clause 52.06 of the Bendigo Planning Scheme specifies requirements relating to the provision and design of car parking as follows:

5.1.3 Car Parking Provision Requirements - Clause 52.06-5

Table 1 to Clause 52.06-05 of the Bendigo Planning Scheme provides rates for various land uses. The proposed site is not located within the PPTN and thus Column A rates are adopted. The following rates therefore apply to the proposed Warehouse tenancies contemplated on the site.

Warehouse: **2 spaces to each premises**, plus **1.5 space per 100sq.m** of net floor area

Application of the above rates against the proposed net floor area (2,305sq.m) reveals a requirement for **36 spaces.**

5.1.4 Proposed Car Parking Provision

It is planned to provide **48 spaces** on site. The provision exceeds the statutory requirement and is therefore satisfactory.

Based on the above, the proposed car parking provision for the warehouse development exceeds the statutory requirement, and thus takes into consideration the current staff parking demand generated from 21 full time equivalent (FTE) employees who are currently relying on surrounding on-street parking spaces.

This current staff parking demand can now be accommodated within the on-site car park, and therefore increase the on-street parking availability within the surrounding local roads in the vicinity of the subject site.

The proposed warehouse facility will be occupied by Bendigo Tramways, and the primary operation and activities are for the warehousing of trams and parts.

We are advised the overall site including both the existing visitor centre/depot and the new warehouse facility will operate with a maximum of 46 Full Time Equivalent (FTE) staff.

Therefore, the proposed car parking provision, most of who, for the overall site, can accommodate the total staff parking demand, including the additional parking demand for the 25 new future employees.

5.1.5 Conclusion - Car Parking Provision

We can conclude that an adequate number of spaces are provided to cater for the projected demand.

Accordingly, the development proposition satisfies the purpose of Clause 52.06, specifically:

- To ensure the provision of an appropriate number of car parking spaces having regard to the demand likely to be generated, the activities on the land and the nature of the locality.

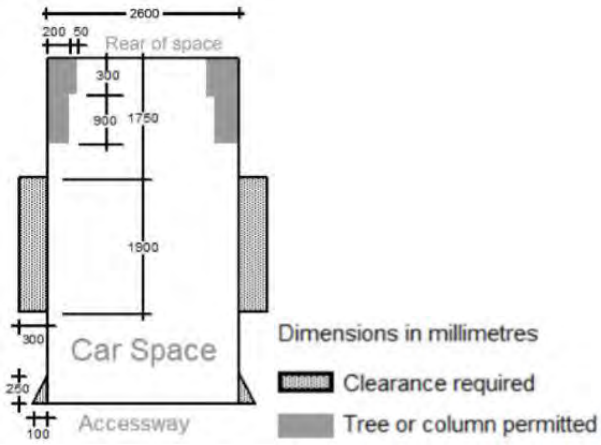
5.1.6 Design Standard for Car Parking - Clause 52.06 - 9

We have assessed the proposed car parking design and access arrangements against the requirements of Clause 52.06-9 of the Bendigo Planning Scheme. Our findings are as follows:

5.1.6.1 Design Standard 1 - Accessways

Requirements		Design Response	Status
Accessways Must:			
1	Be at least 3 metres wide.	Accessways are at least 6.4m wide.	**Comply**
2	Have an internal radius of at least 4 metres at changes of direction or intersection or be at least 4.2 metres wide.	Intersections are at least 6.4m wide at changes of direction.	**Comply**
3	Allow vehicles parked in the last space of a dead-end accessway in public car parks to exit in a forward direction with one manoeuvre.	Car Park is not a public car park.	**N/A**
4	Provide at least 2.1 metres headroom beneath overhead obstructions, calculated for a vehicle with a wheel-base of 2.8 metres.	No overhead obstructions proposed.	**N/A**
5	If the accessway serves four or more car spaces or connects to a road in a Road Zone, the accessway must be designed so that cars can exit the site in a forward direction.	Accessway is designed so that cars can exit the site in a forward direction.	**Comply**
6	Provide a passing area at the entrance at least 6.1 metres wide and 7 metres long if the accessway serves ten or more car parking spaces and is either more than 50 metres long or connects to a road in a Road Zone.	Accessway is at least 6.4m wide throughout.	**Comply**
7	Have a corner splay or area at least 50 percent clear of visual obstructions extending at least 2 metres along the frontage road from the edge of an exit lane and 2.5 metres along the exit lane from the frontage, to provide a clear view of pedestrians on the footpath of the frontage road. The area clear of visual obstructions may include an adjacent entry or exit lane where more than one lane is provided, or adjacent landscaped areas, provided the landscaping in those areas is less than 900mm in height.	It is proposed to keep structures and landscaping within the sight splay areas below 900mm in height.	**Comply**
8	If an accessway to four or more car parking spaces is from land in a Road Zone, the access to the car spaces must be at least 6 metres from the road carriageway.	Accessway is not connected to a Road in a Road Zone.	**N/A**
9	If entry to the car spaces is from a road, the width of the accessway may include the road.	Car spaces are not accessed directly from the road.	**N/A**

5.1.6.2 Design Standard 2 - Car Parking Spaces

<table>
<tr><th colspan="2">Requirements</th><th>Design Response</th><th>Status</th></tr>
<tr><td>1</td><td>Car parking spaces and accessways must have the minimum dimensions in Table 2 of Clause 52.06-9.
<table>
<tr><th>Angle of car parking spaces to access way</th><th>Accessway width</th><th>Car space width</th><th>Car space length</th></tr>
<tr><td>Parallel</td><td>3.6 m</td><td>2.3 m</td><td>6.7 m</td></tr>
<tr><td>45°</td><td>3.5 m</td><td>2.6 m</td><td>4.9 m</td></tr>
<tr><td>60°</td><td>4.9 m</td><td>2.6 m</td><td>4.9 m</td></tr>
<tr><td>90°</td><td>6.4 m</td><td>2.6 m</td><td>4.9 m</td></tr>
<tr><td></td><td>5.8 m</td><td>2.8 m</td><td>4.9 m</td></tr>
<tr><td></td><td>5.2 m</td><td>3.0 m</td><td>4.9 m</td></tr>
<tr><td></td><td>4.8 m</td><td>3.2 m</td><td>4.9 m</td></tr>
</table></td><td>Car parking spaces are designed at the following dimensions:
— 4.9m long,
— 2.6m wide,
— Accessed from an aisle 6.4m wide.</td><td>Comply</td></tr>
<tr><td>2</td><td>A wall, fence, column, tree, tree guard or any other structure that abuts a car space must not encroach into the area marked 'clearance required' on Diagram 1 other than:
A column, tree or tree guard, which may project into a space if it is within the area marked 'tree or column permitted' on Diagram 1 of the design standard
A structure, which may project into the space if it is at least 2.1 metres above the space.
 
</td><td>Appropriate clearance has been provided for car spaces in accordance with Diagram 1.</td><td>Comply</td></tr>
<tr><td>3</td><td>Car spaces in garages or carports must be at least 6 metres long and 3.5 metres wide for a single space and 5.5 metres wide for a double space measured inside the garage or carport.</td><td>No garages proposed.</td><td>N/A</td></tr>
<tr><td>4</td><td>Where parking spaces are provided in tandem (one space behind another) an additional 500mm in length must be provided between each space.</td><td>No tandem spaces proposed.</td><td>N/A</td></tr>
<tr><td>5</td><td>Where two or more car parking spaces are provided for a dwelling, at least one space must be under cover.</td><td>No dwellings proposed.</td><td>N/A</td></tr>
<tr><td>6</td><td>Disabled car parking spaces must be designed in accordance with AS 2890.6-2009 (disabled) and the Building Code of Australia. Disabled car parking spaces may encroach into an accessway width specified in Table 2 by 500mm.</td><td>Disabled car parking spaces have been designed in accordance with AS2890.6-2009.</td><td>Comply</td></tr>
</table>

5.1.7 Conclusion - Car Park Design

The proposed car park and accessways have been assessed and determined to have satisfied the relevant design guidelines.

Accordingly, the proposal satisfies the purpose of Clause 52.06, specifically:

- To ensure that the design and location of car parking is of a high standard, creates a safe environment for users and enables easy and efficient use.

5.2 Clause 52.34 - Bicycle Facilities

5.2.1 Purpose

The purpose of Clause 52.34 is to encourage cycling as a mode of transport, and provide secure, accessible and convenient bicycle parking spaces and associated shower and change facilities.

5.2.2 Provision Requirements - Clause 52.34.3

Clause 52.34-3 of the Greater Bendigo Planning Scheme does not specifically refer to bicycle parking requirements for warehouses. As such, the warehouse development as proposed is not required to provide bicycle spaces.

Based on the above, no bicycle parking provision is required for the development.

However, it is noted that the subject site has allocated 5 bicycle hoops (10 spaces) at 75 Hargreaves Street for Tramway patrons and staff.

No bicycle parking has been proposed at 48 Hopetoun Street.

5.2.3 Design Requirements

Bicycle spaces should:

- Provide a space for a bicycle of minimum dimensions of 1.7 metres in length, 1.2 metres in height and 0.7 metres in width at the handlebars.
- Be located to allow a bicycle to be ridden to within 30 metres of the bicycle parking space.
- Be located to provide convenient access from surrounding bicycle routes and main building entrances.
- Not interfere with reasonable access to doorways, loading areas, access covers, furniture, services and infrastructure.
- Not cause a hazard.
- Be adequately lit during periods of use.

5.2.4 Decision Guidelines

Before deciding on an application, in addition to the decision guidelines in Clause 65, the responsible authority must consider, as appropriate:

- Whether the proposed number, location and design of bicycle facilities meets the purpose of this clause.
- The location of the proposed land use and the distance a cyclist would need to travel to reach the land.
- The users of the land and their opportunities for bicycle travel.

- Whether showers and change rooms provided on the land for users other than cyclists are available to cyclists.
- The opportunities for sharing of bicycle facilities by multiple uses, either because of variation of bicycle parking demand over time or because of efficiencies gained from the consolidation of shared bicycle facilities.
- Australian Standard AS 2890.3 2015 Parking facilities Part 3: Bicycle parking facilities.
- Any relevant bicycle parking strategy or equivalent.

5.2.5 Proposed Bicycle Parking Provision

The development plans contemplate an open area dedicated to bicycle parking which will include 5 bicycle hoops (10 spaces) for 75 Hargreaves Street for Tramway patrons and also an area nominated for staff parking.

Further to this, the provision of any bicycle parking will exceed the statutory requirement and is therefore considered adequate.

5.2.5.1 Bicycle Parking Design

The bicycle spaces are to be provided in the form of proprietary horizontal racks designed to satisfy the relevant standards.

5.2.5.2 Conclusion - Bicycle Parking

We can conclude that bicycle parking provided as part of this development satisfies the purpose of Clause 52.34, specifically:

- To encourage cycling as a mode of transport, and provide secure, accessible and convenient bicycle parking spaces.

5.3 Loading Considerations (Clause 65.01)

5.3.1 Loading Requirements and Objectives

To address the adequacy of loading for new developments, the Bendigo Planning Scheme specifies the following:

- Clause 65.01 - The responsible authority must consider, as appropriate, the adequacy of loading and unloading facilities and any associated amenity, traffic flow and road safety impacts.

5.3.2 Adequacy of Proposed Loading Facilities

In response to the above, we note that adequate off street loading zones will be provided for the warehouse capable of accommodating articulated trucks up to 25m semi-trailers. These trucks are able to exit the site in a forward direction as shown by swept path analysis attached as Appendix B.

As such we conclude that the loading arrangements for the warehouse are considered satisfactory.

5.3.3 Conclusion - Loading Arrangements

The proposed loading arrangements have been assessed and determined to have satisfied the relevant design guidelines / principles contained within Clause 65.01 and AS2890.2:2018.

Accordingly, it is considered that the proposal:

- Provides adequate vehicle loading and unloading facilities, which will not result in associated amenity, traffic flow and road safety impacts.

6 Traffic Considerations

6.1 Traffic Generation

Traffic Generation Rate

Traffic generation for warehouse uses can vary depending on a range of factors. The RTA Guide to Traffic Generating Developments recommends traffic generation rates of 4 movements per 100sqm per day, and 0.5 movements per 100sqm per peak hour. The document doesn't however specify a particular warehouse size.

This position is informed by case study data sourced by **IMPACT**® at multi-unit and large floor area warehouse developments which revealed a peak rate of up to 0.5 movements during the commuter peak hours. Details of these studies are provided in detail in Appendix C.

The studies reveal that for both multi-unit and large floor area warehouses that peak period traffic is generated at a rate of less than 0.5 movements per 100 sq.m.

For this assessment, a rate of **0.5 movements per 100 square metres** will be adopted for both the AM and PM peaks. Application of this rate to the likely 2,305sqm warehouse development will generate approximately 12 vehicle movements during the peak periods.

6.2 First Principal Traffic Assessment

As discussed earlier, the proposed warehouse facility including the existing visitor centre/depot will operate with a maximum of 46 staff during business hours.

Therefore, the peak traffic demand is expected to occur during the morning arrival AM peak and afternoon departure PM peak.

For the purpose of the first principal traffic assessment, it has been conservatively assumed that 100% of staff will arrive and depart during the changeover period.

On this basis, the proposed development will generate 46 vehicle movements in each of the morning and afternoon peak periods.

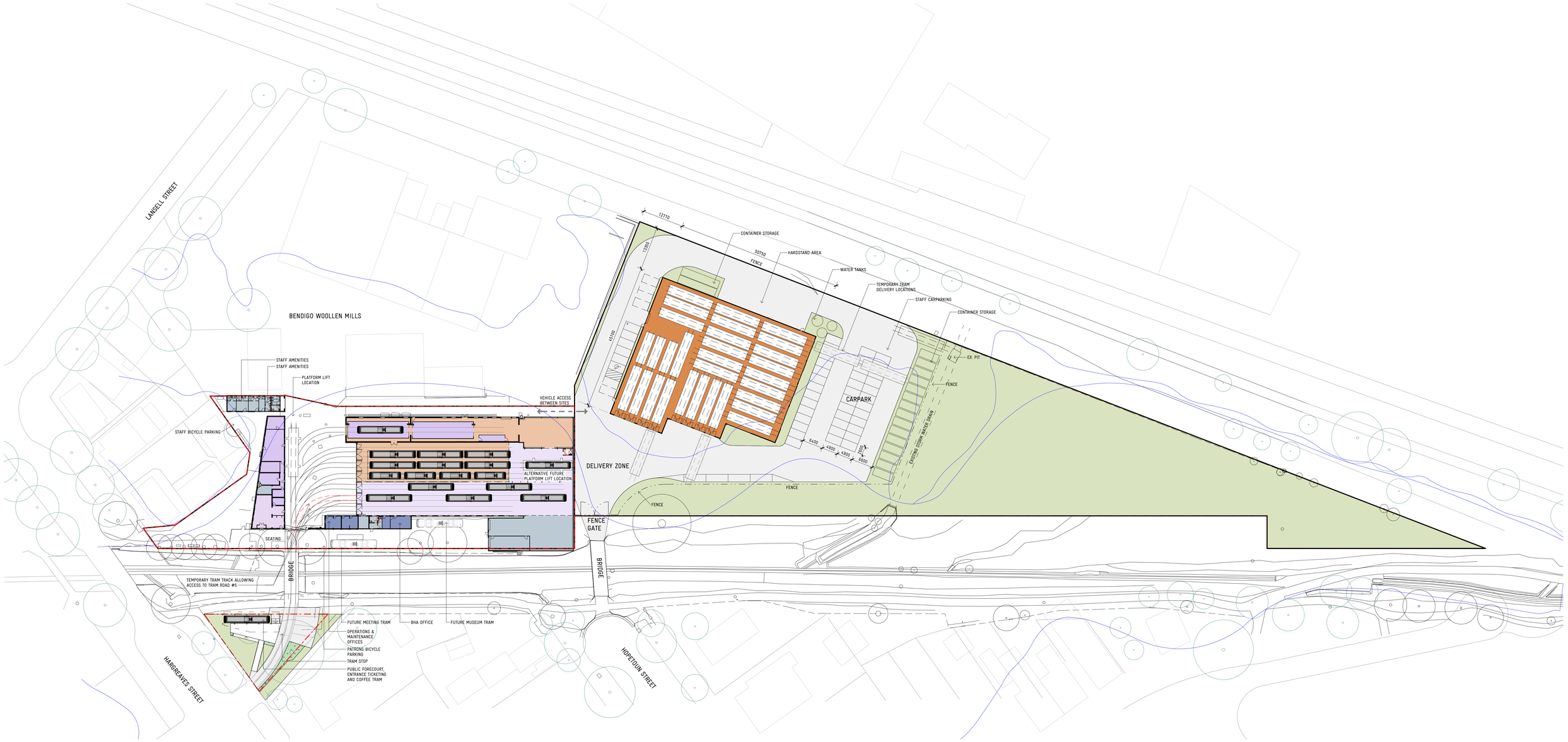
6.3 Conclusion - Traffic Impact

It is projected that the proposed warehouse development with a Net Leasable Area (NLA) of 2,305 sqm will conservatively generate between a range of 12 to 46 vehicle movements during the AM and PM peak hour. Conservatively, this level of traffic is equivalent to approximately one (1) vehicle movement every 1 minute and 20 seconds

This level of traffic is not expected to have an adverse impact on the operation of the surrounding road network.

APPENDIX A
Development Plan

Proposed Development Plan



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135
FLOOR PLAN – DEVELOPMENT REFERENCE PLAN
SCALE 1 : 500

REVISION	BY	DATE	DESCRIPTION
P7		22.07.21	P7
P8		12.08.21	P8
P9		27.08.21	P9
P10		07.09.21	WP3 Issue
P11		10.09.21	WP3 UPDATE
P12		24.09.21	WP3 Issue to QS

Print date: 4/10/2021 10:31:12 PM

ARCHITECTURE
INTERIOR DESIGN
URBAN PLANNING

Y2 ARCHITECTURE
www.y2architecture.com.au
MELBOURNE: 486 malvern road prahran victoria 3181 t 03 9510 7800 f 03 9521 1464
BENDIGO: 5/41-43 mundy street (PO Box 660) bendigo victoria 3550 t 03 5407 2130 f 03 9521 1464

Issue: PRELIMINARY
NOT FOR CONSTRUCTION

Project: BENDIGO TRAMWAYS EXPANSION
75 HARGREAVES STREET, BENDIGO

Title: DEVELOPMENT REFERENCE PLAN

0 1.0m 5.0m 10.0m

Scale: 1 : 500 @ B1
Date: MARCH 2021
Drawn: Author
Checked: Checker

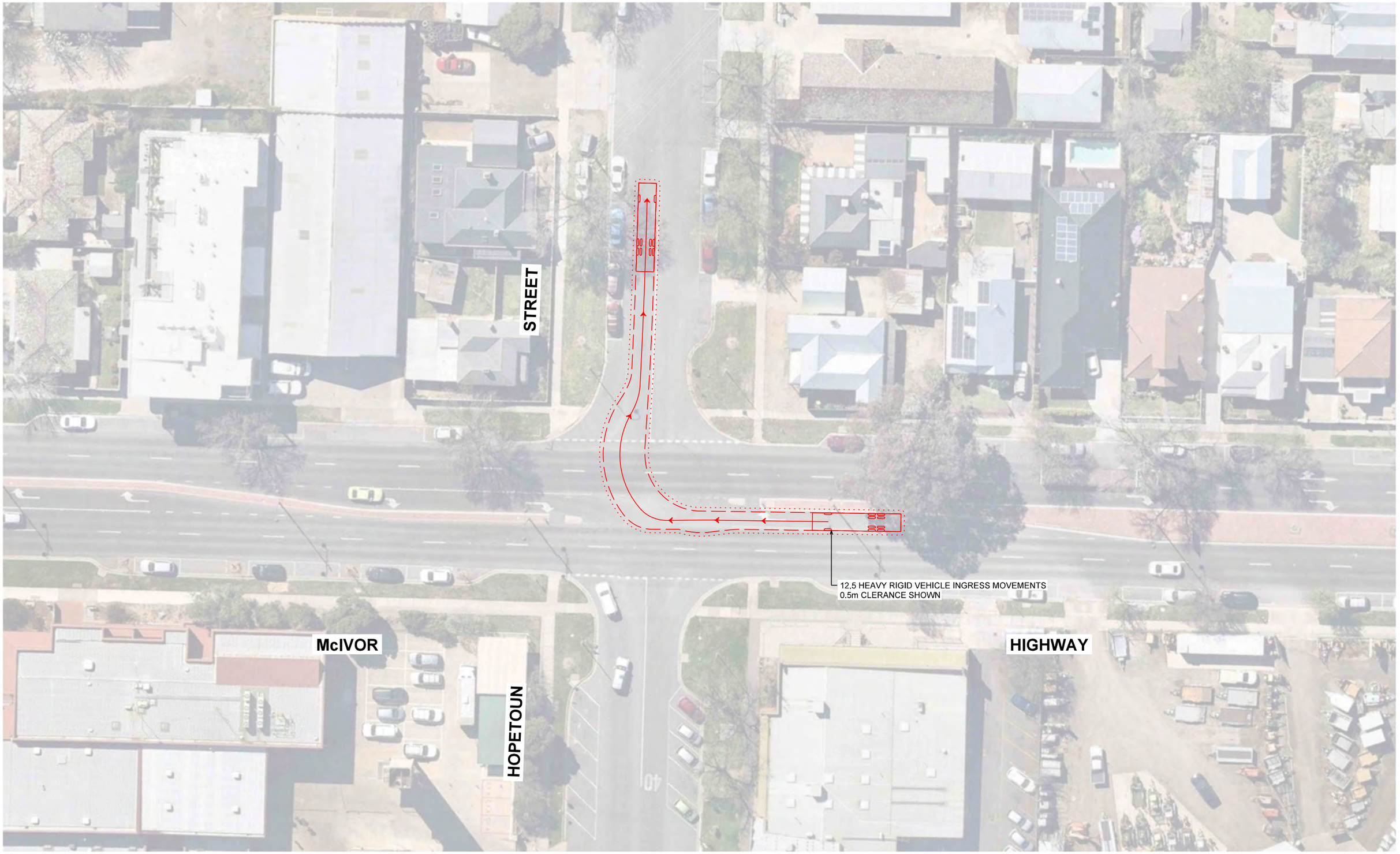
Project: 2102
File: 2102_BENDIGO TRAMWAYS_B_2019
Drawing: 122 P12

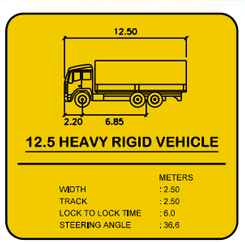
APPENDIX B
Swept Path Analysis

Proposed Site Access

Vehicle Type:

- 12.5m Heavy Rigid Vehicle
- 25m Semi-Trailer





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ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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MELWAY ONLINE REF: N/A

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Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

Drawn / Approved
JO / DH

Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
12.5m HEAVY RIGID VEHICLE MOVEMENTS

Drawing Number
IMP201120 - DG-01-01

Revision
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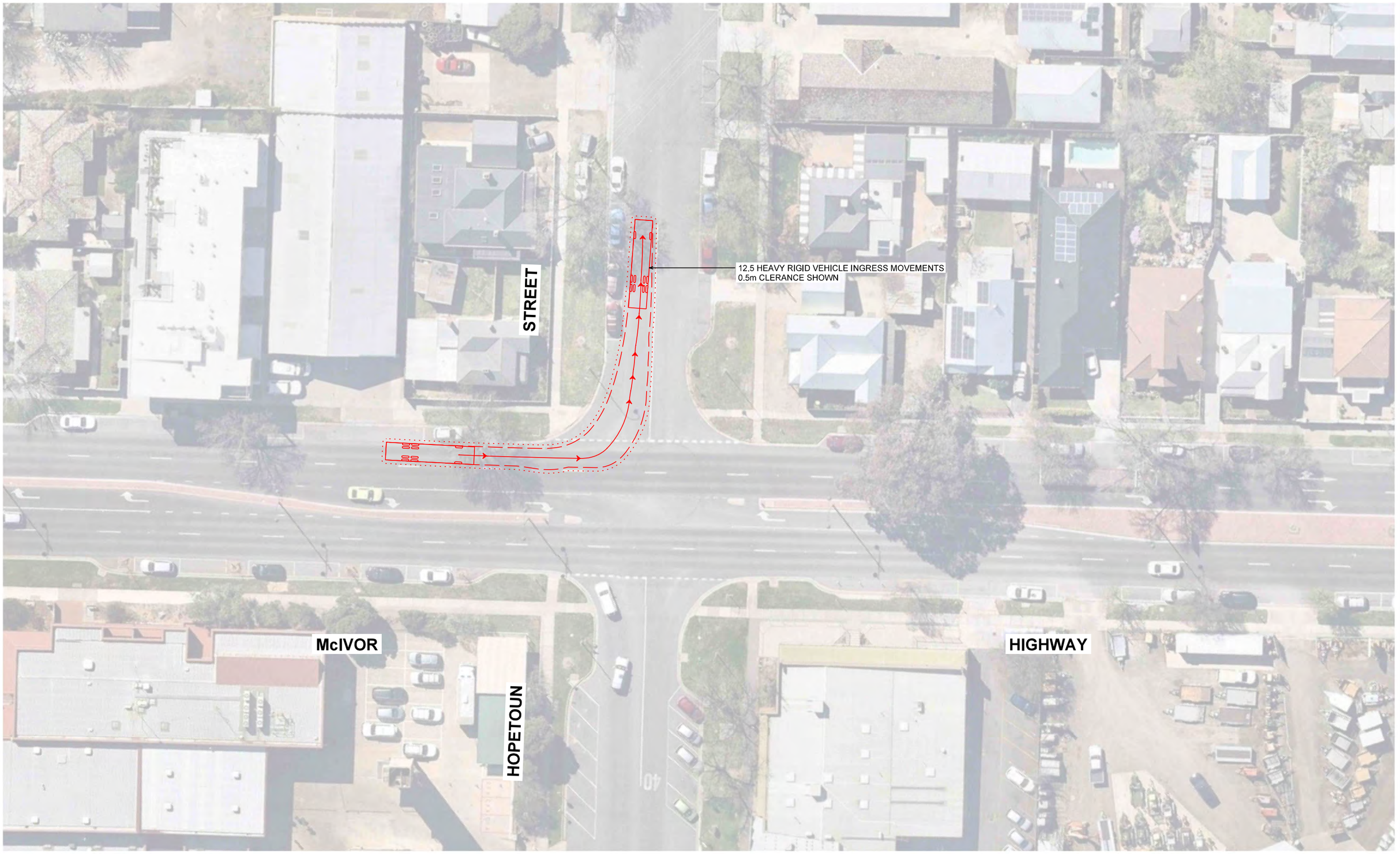
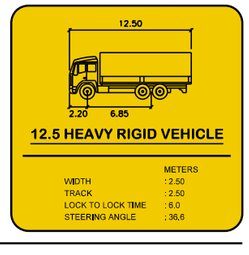
17/09/2021 2:55:49 PM





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Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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JO / DH

Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
12.5m HEAVY RIGID VEHICLE MOVEMENTS

Drawing Number
IMP201120 - DG-01-02

Revision
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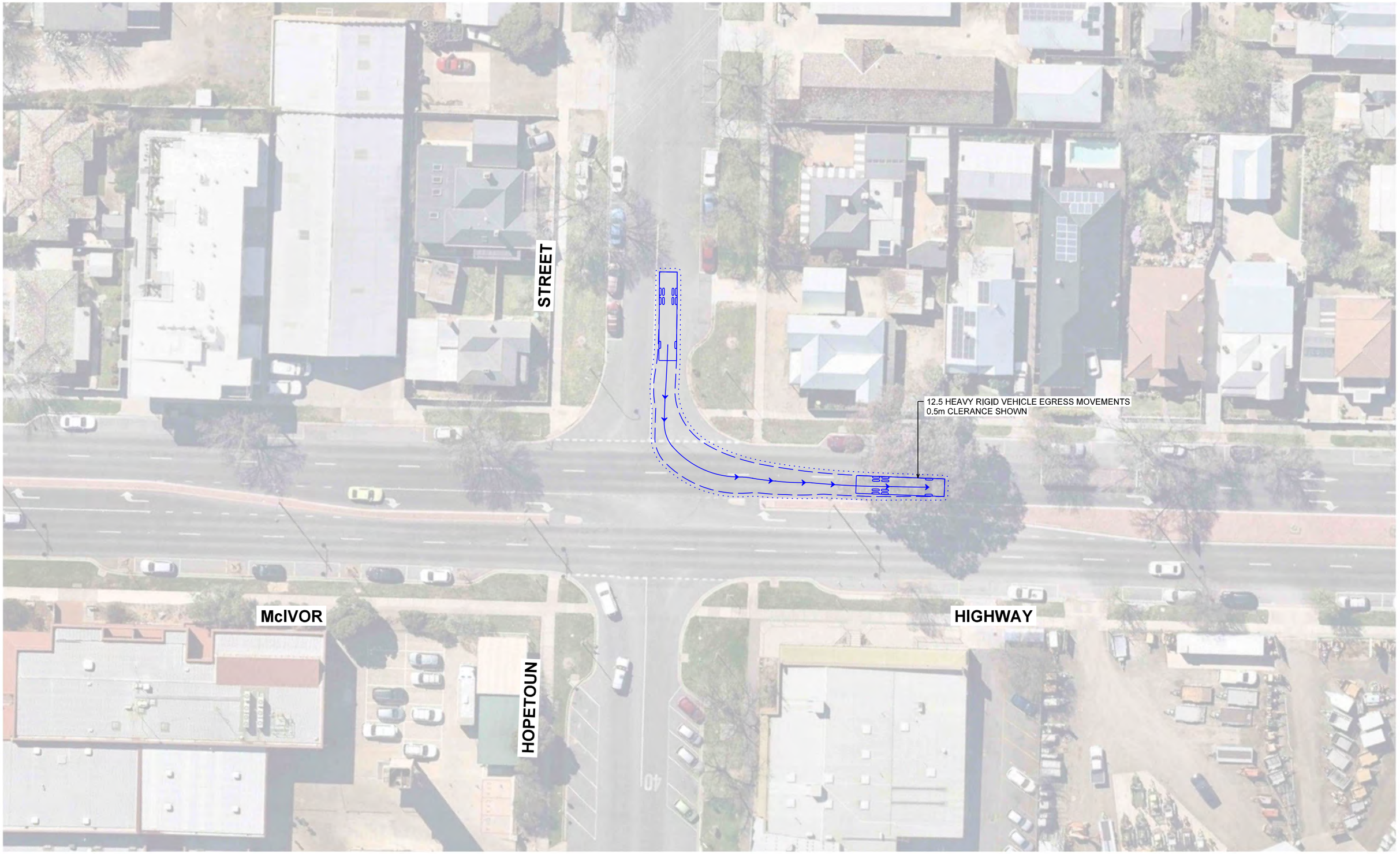

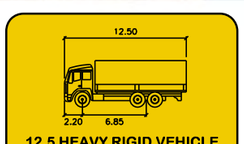

12.5 HEAVY RIGID VEHICLE

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STEERING ANGLE	: 36.6

IMPACT TRAFFIC ENGINEERING PTY LTD
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MELWAY ONLINE REF: N/A

SCALE
1:500 @ A3

Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

Drawn / Approved
JO / DH

Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
12.5m HEAVY RIGID VEHICLE MOVEMENTS

Drawing Number
IMP201120 - DG-01-03

Revision
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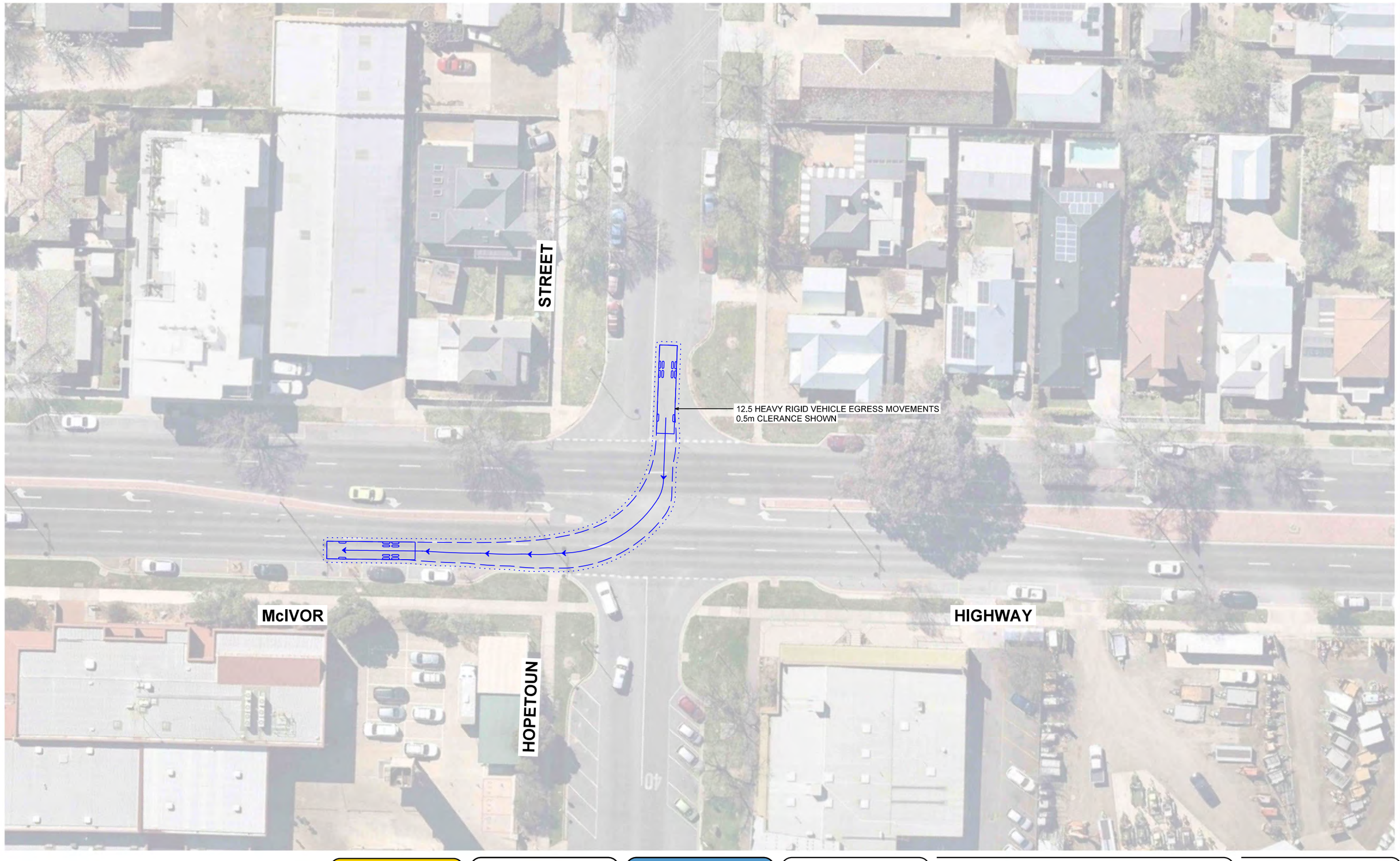

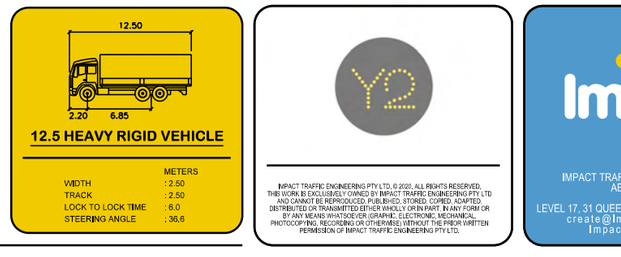

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MELWAY ONLINE REF: N/A

SCALE
1:500 @ A3

Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
12.5m HEAVY RIGID VEHICLE MOVEMENTS

Drawing Number
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Revision
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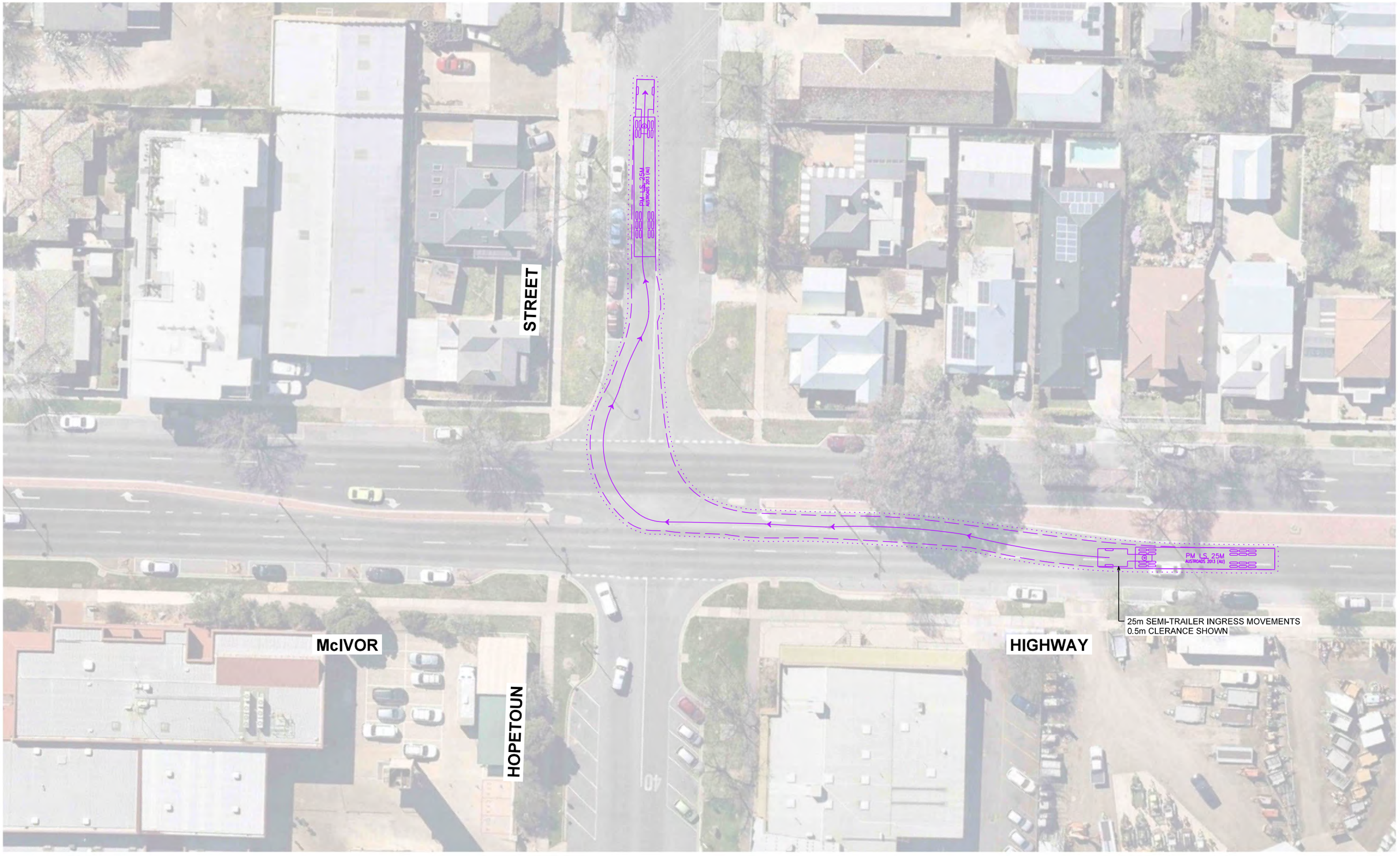

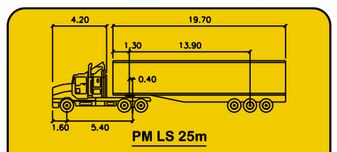

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TRAILER TRACK	: 2.50		

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MELWAY ONLINE REF: N/A

SCALE
1:500 @ A3

Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

Drawn / Approved
JO / DH

Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
25m SEMI-TRAILER MOVEMENTS

Drawing Number
IMP201120 - DG-01-05

Revision
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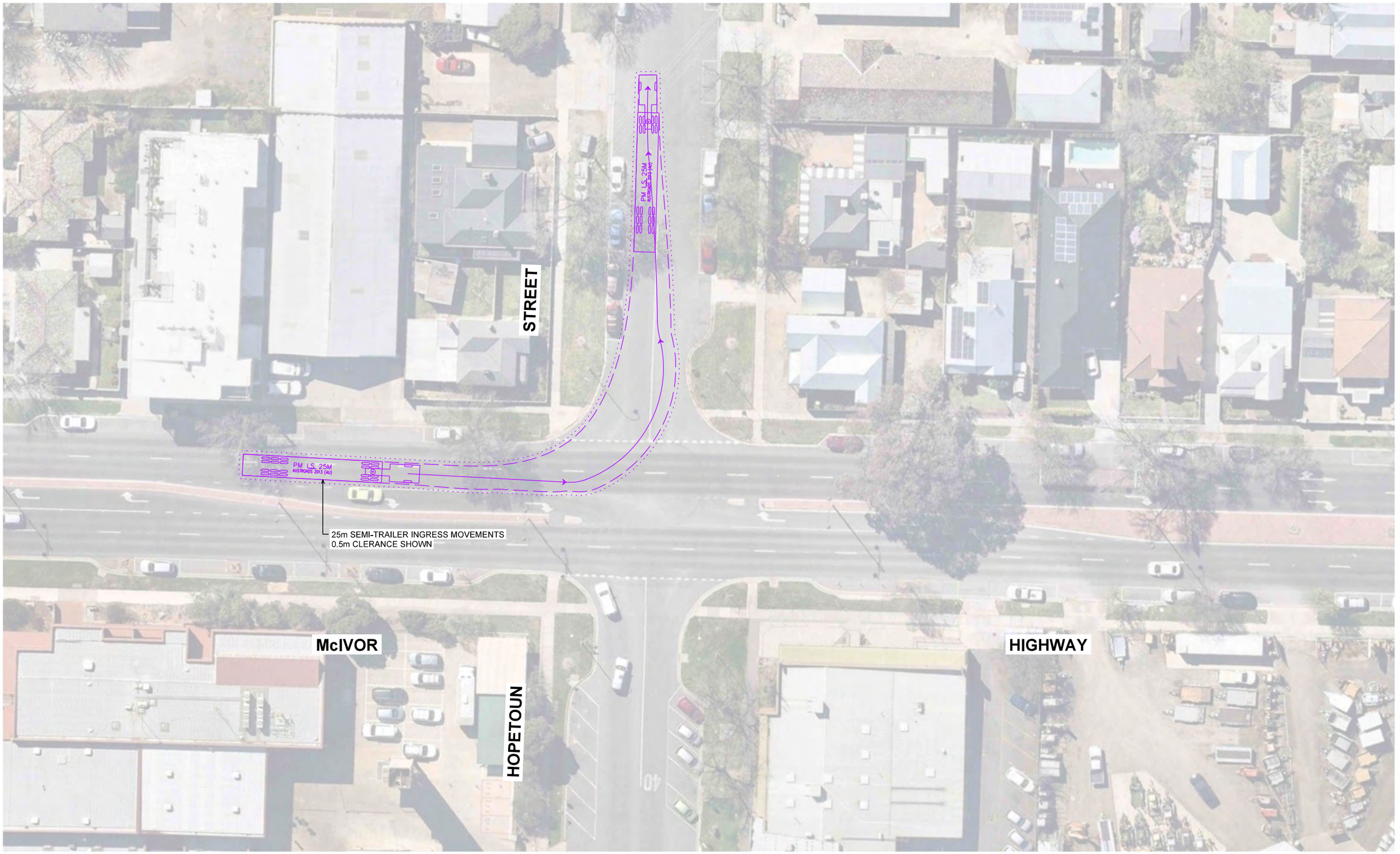

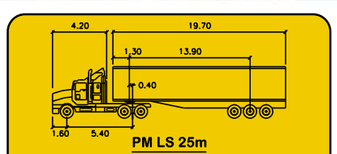

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Title
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25m SEMI-TRAILER MOVEMENTS

Drawing Number
IMP201120 - DG-01-06

Revision
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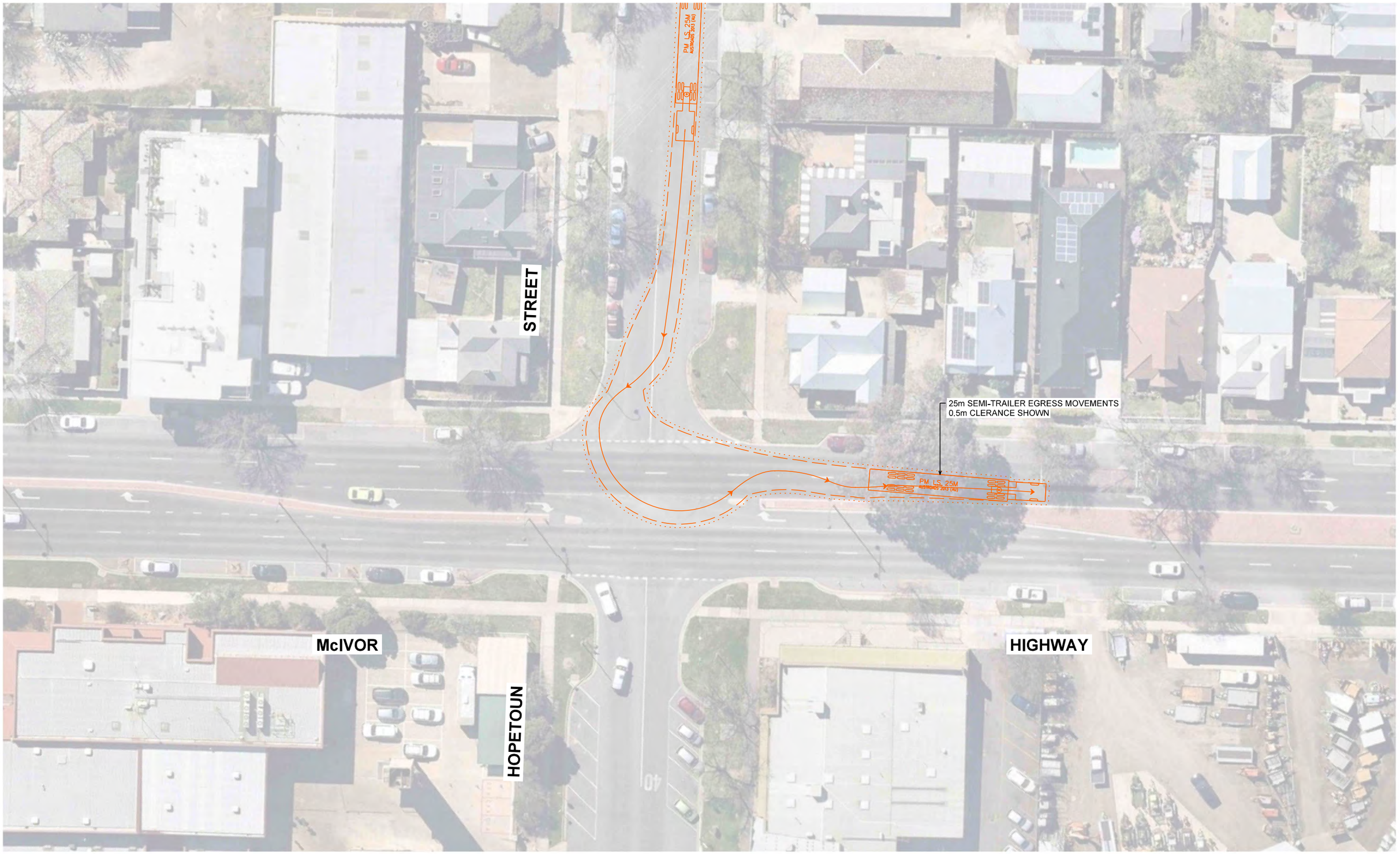

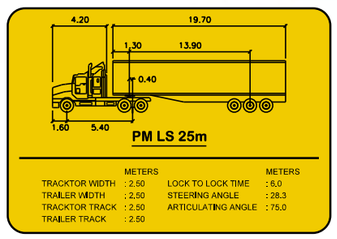

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SCALE
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Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

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Title
SWEPT PATH ANALYSIS
25m SEMI-TRAILER MOVEMENTS

Drawing Number
IMP201120 - DG-01-07

Revision
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STREET

McIVOR

HOPETOUN

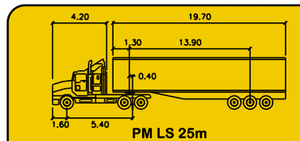
HIGHWAY

25m SEMI-TRAILER EGRESS MOVEMENTS
0.5m CLERANCE SHOWN

PM LS 25M
AUSTROADS 2013 (AU)

PM LS 25M
AUSTROADS 2013 (AU)

PM LS 25M
AUSTROADS 2013 (AU)



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ABN 76 611 424 107
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SCALE
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Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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JO / DH

Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
25m SEMI-TRAILER MOVEMENTS

Drawing Number
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Revision
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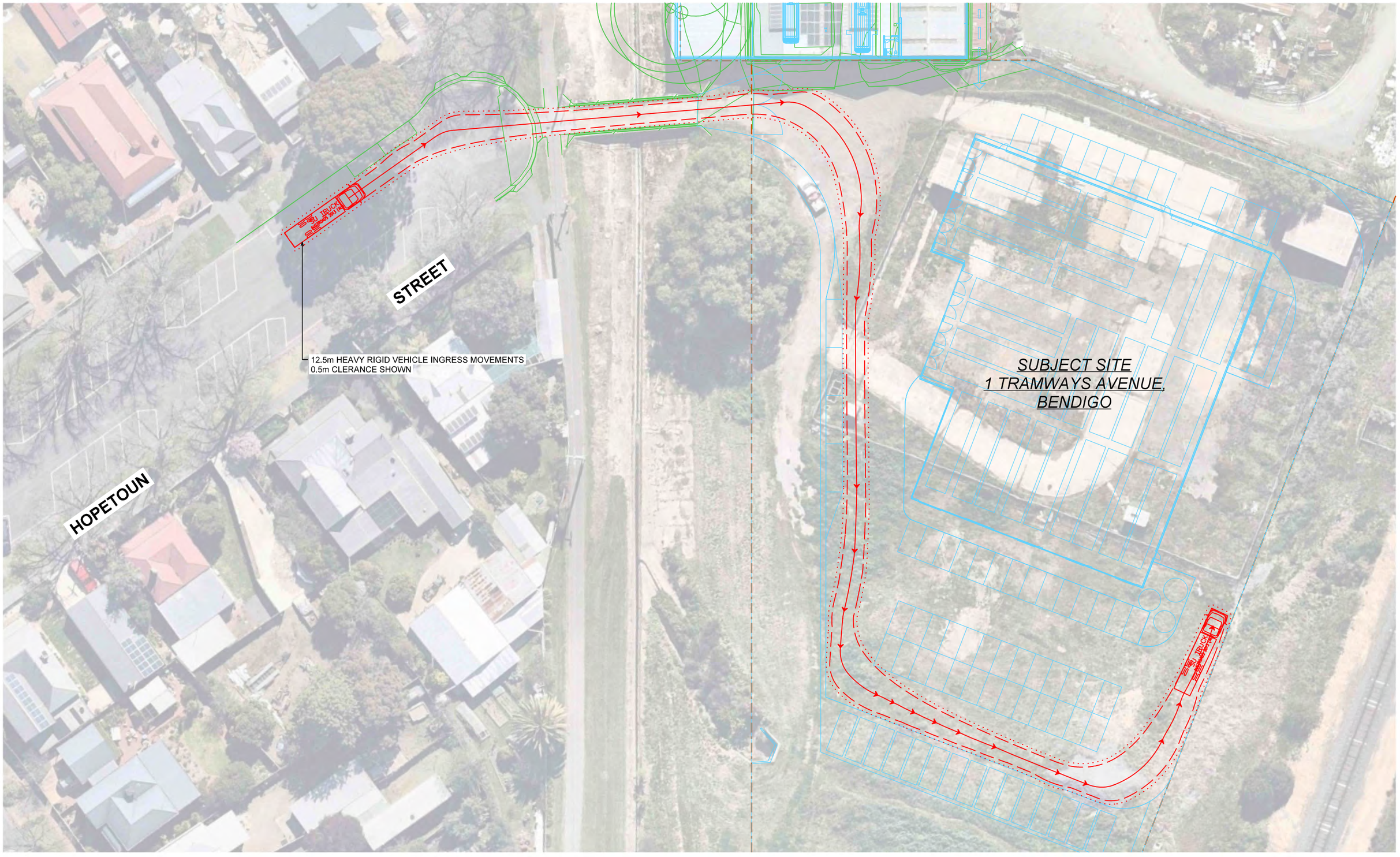

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2.20 6.85

12.5 HEAVY RIGID VEHICLE

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IMPACT TRAFFIC ENGINEERING PTY LTD
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MELWAY ONLINE REF: N/A

SCALE
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Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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Revision Description
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Title
SWEPT PATH ANALYSIS
12.5m HEAVY RIGID VEHICLE MOVEMENTS

Drawing Number
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Revision
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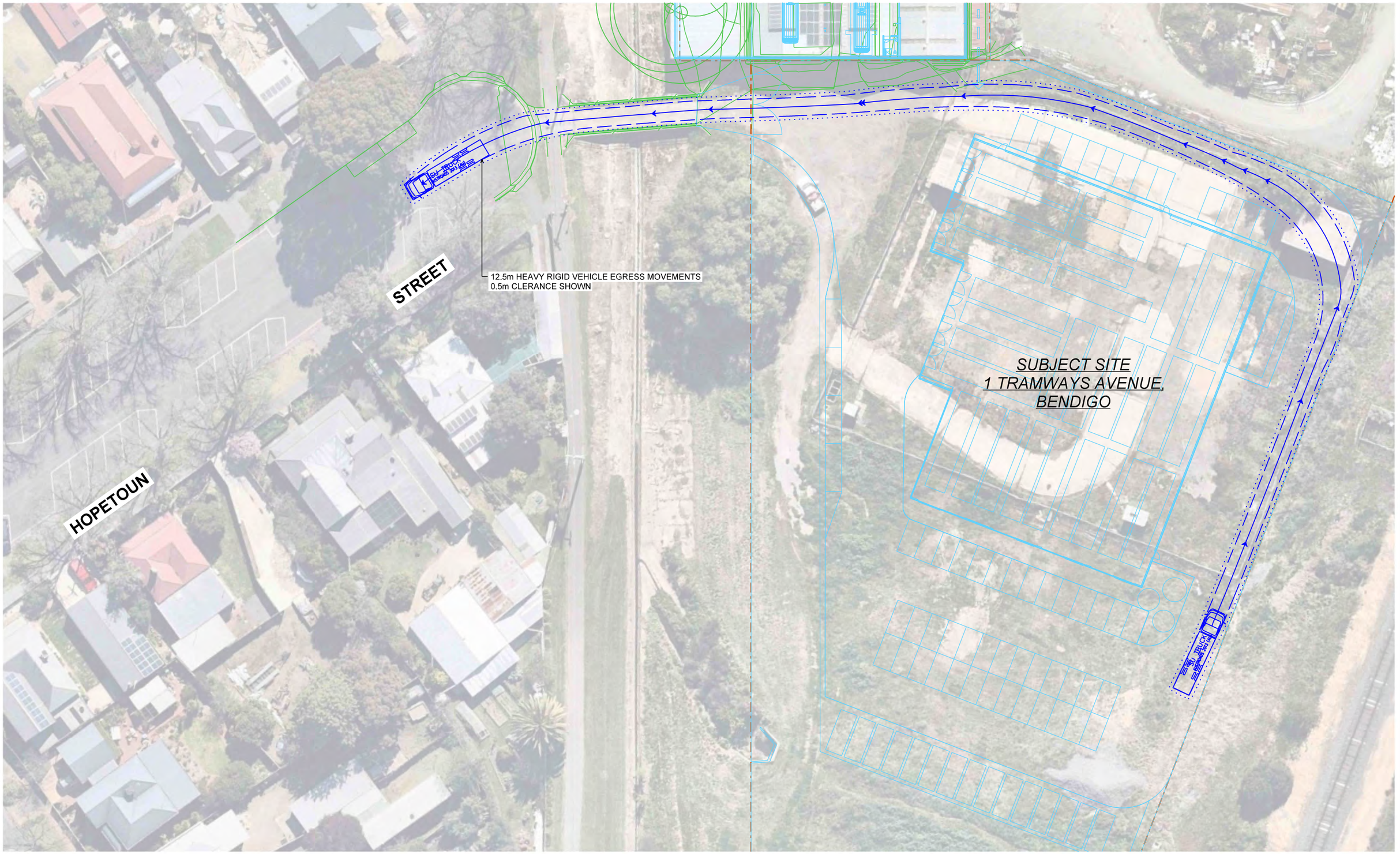

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2.20 6.85

12.5 HEAVY RIGID VEHICLE

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STEERING ANGLE	: 36.6

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SCALE
1:500 @ A3

Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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Revision Description
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Title
SWEPT PATH ANALYSIS
12.5m HEAVY RIGID VEHICLE MOVEMENTS

Drawing Number
IMP201120 - DG-01-10

Revision
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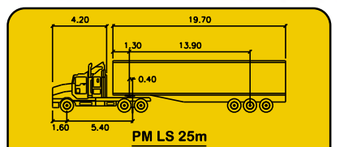
RESTRICT EXISTING CARPARKING SPACES DURING TRUCK MOVEMENTS

HOPETOUN STREET

25m SEMI-TRAILER INGRESS MOVEMENTS
0.5m CLERANCE SHOWN

SUBJECT SITE
1 TRAMWAYS AVENUE,
BENDIGO



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ABN 78 611 424 107
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MELWAY ONLINE REF: N/A

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Client
Y2 ARCHITECTS

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Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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Revision Description
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Title
SWEPT PATH ANALYSIS
25m SEMI-TRAILER MOVEMENTS

Drawing Number
IMP201120 - DG-01-11

Revision
A

17/09/2021 2:56:03 PM

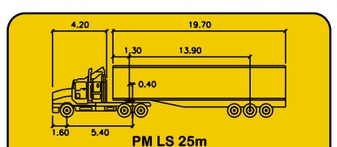
RESTRICT EXISTING CARPARKING SPACES DURING TRUCK MOVEMENTS

STREET

25m SEMI-TRAILER EGRESS MOVEMENTS
0.5m CLERANCE SHOWN

HOPETOUN

SUBJECT SITE
1 TRAMWAYS AVENUE,
BENDIGO



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ABN 78 611 424 107
LEVEL 17, 31 QUEEN STREET, MELBOURNE VIC 3000
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MELWAY ONLINE REF: N/A

SCALE
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Client
Y2 ARCHITECTS

Status
PRELIMINARY

Project
BENDIGO TRAMWAYS
1 TRAMWAYS AVENUE, BENDIGO
CITY OF GREATER BENDIGO

Date
2021-09-17

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Revision Description
ISSUED FOR INFORMATION

Title
SWEPT PATH ANALYSIS
25m SEMI-TRAILER MOVEMENTS

Drawing Number
IMP201120 - DG-01-10

Revision
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APPENDIX C
Case Study Data

Warehouse Case Studies

Multi-Unit Warehouse Development

IMPACT® commissioned BVY Traffic Survey Pty Ltd to undertake traffic movements surveys at 81 - 82 Paramount Boulevard. This site is developed as a multi-unit warehouse development (including retail show rooms) with an approximate floor area of 7,000sqm.

The surveys were undertaken on Tuesday 21st March 2017: 6am - 6pm and Thursday 23rd March 2017 6am - 6pm.

Video recorders installed at the site access points recorded all traffic movements into and out of the car park areas. The case study site is illustrated in Figure 11.

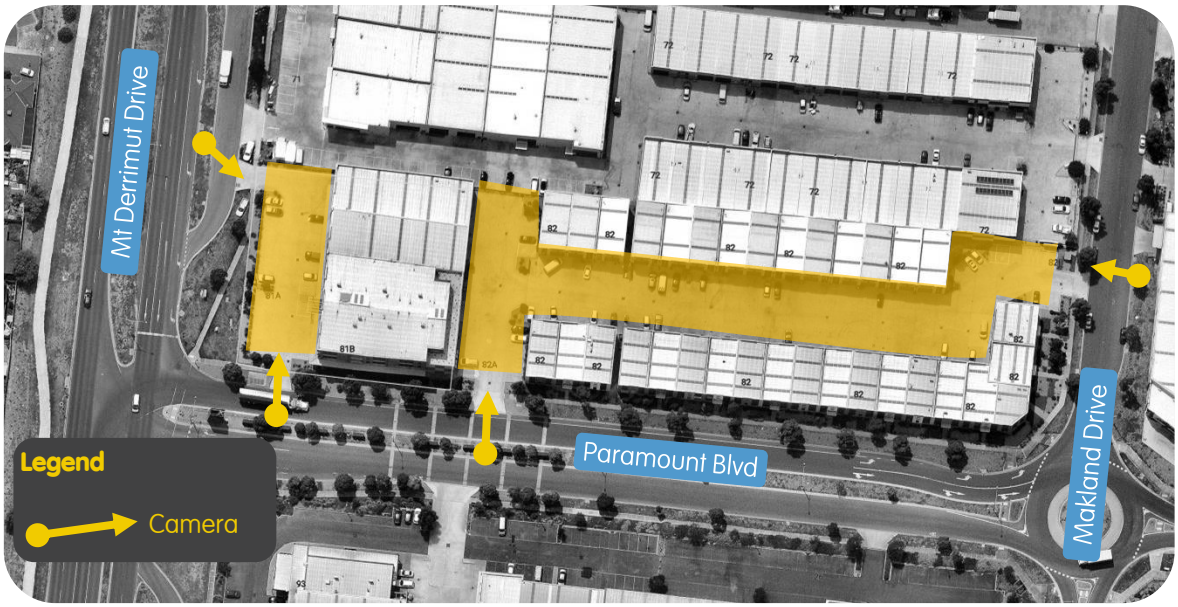


Figure 11 Derrimut Case Study Site

Results

The results of the case study revealed are at the road network peak i.e. 8:00am - 9:00am and between 4:00pm - 5:00pm, that the existing multi-unit development was generating traffic at the following rates:

AM Peak	Tuesday 21st March 2017	0.27 movements per 100 sq.m
	Thursday 23rd March 2017	0.41 movements per 100 sq.m
PM Peak	Tuesday 21st March 2017	0.43 movements per 100 sq.m
	Thursday 23rd March 2017	0.41 movements per 100 sq.m

Large Floor Area Warehouse Development

IMPACT® commissioned traffic movement studies at 448 Boundary Road, Derrimut. This site is developed as a single unit warehouse development with an approximate floor area of 20,508 sq.m. The studies were undertaken in the period between Tuesday 6th February 2018 - Friday 9th February 2018.

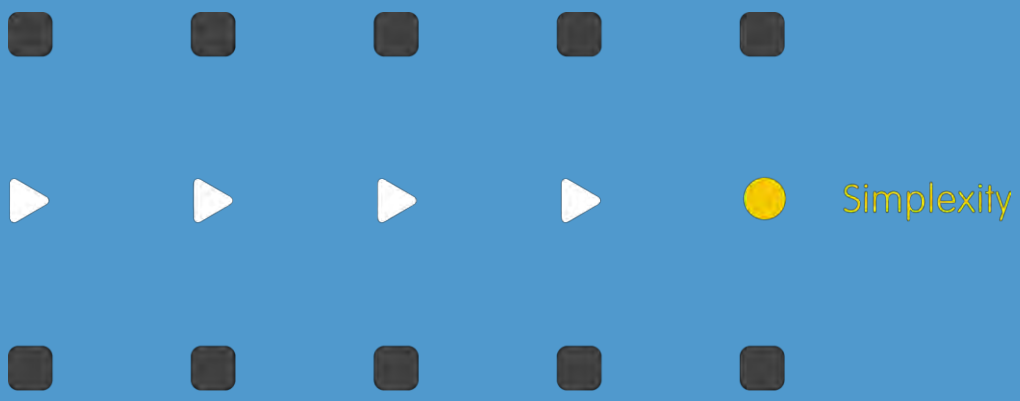
Pneumatic tube counters installed at the site access points as illustrated in Figure 12. The Pneumatic tube counters recorded all traffic movements into and out of the subject site.

Figure 12 Methodology - Parking Accumulation

Results

The results of the case study revealed are at the road network peak i.e. 8:00am - 9:00am and between 4:00pm - 5:00pm, that the existing multi-unit development was generating traffic at the following rates:

AM Peak	Tuesday 6th February 2018	0.32 movements per 100 sq.m
	Wednesday 7th February 2018	0.36 movements per 100 sq.m
	Thursday 8th February 2018	0.37 movements per 100 sq.m
	Friday 9th February 2018	0.31 movements per 100 sq.m
PM Peak	Tuesday 6th February 2018	0.34 movements per 100 sq.m
	Wednesday 7th February 2018	0.39 movements per 100 sq.m
	Thursday 8th February 2018	0.47 movements per 100 sq.m
	Friday 9th February 2018	0.40 movements per 100 sq.m


Simplexity