Shepparton North-East Growth Corridor Development

Addendum to

Traffic Impact Assessment Report

Client:

Greater Shepparton City Council

Project 170769

Addendum Report B, Rev 2: 13/07/2018

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1 PREAMBLE

1.1 Background

In 2014 Trafficworks Pty Ltd was engaged by Greater Shepparton City Council to prepare a comprehensive Traffic Impact Assessment Report (TIAR) for the Shepparton North-East Growth Corridor (refer final report dated 15/09/2014).

Further development of the growth corridor proposals since completion of the above report has included referral and review of the proposed structure plan for the precinct to the Victorian Planning Authority (VPA) and the exhibition of Amendment C118 that provides the framework to develop the land in accordance with the Shepparton North East Precinct Structure Plan (NEPSP).

The Shepparton North-East Growth Corridor covers an area of approximately 170ha that is bounded by Verney Road to the west, Ford Road to the north and the Shepparton Alternative Route (locally known as Grahamvale Road) to the east.

Verney Road along the precinct's western boundary is included in a Road Zone (Category 2) in the Greater Shepparton Planning Scheme and is managed by Council. Verney Road is designated as a trunk collector road in the local road network. Council has recently upgraded Verney Road to comprise a three-lane divided cross section (one lane in each direction separated by a central painted median providing sheltered right-turn lanes at all significant intersections) and incorporating on-road bicycle lanes. It is currently subject to a 60km/h speed limit along the precinct frontage, with a time-based 40km/h school zone along the frontage of Shepparton Christian College. As well as the on-road cycle lanes, an off-road shared path has been constructed to the west of the reservation from Elm Terrace in the south to Ford Road in the north.

Council is in the process of upgrading the Balaclava Road / Hawdon Street / New Dookie Road / Verney Road intersection from a roundabout to a signalised intersection. Works on this project are planned to be undertaken over the 2018/19 and 2019/20 financial years.

Ford Road that forms part of the northern boundary to the PSP is included in the Road Zone (Category 2). This is also designated as a trunk collector road in the local road network and it is managed by Council. It currently has a two-lane two-way cross-section within a 20m road reservation width. Ford Road operates under a 60km/h speed limit.

Council, in collaboration with VicRoads, is investigating the possibility of upgrading Ford Road (between the Goulburn Valley Highway and Grahamvale Road), and its extension east of the highway along Wanganui Road, to serve as a direct connection and critical link between Stage 1 of the Goulburn Valley Freeway Bypass of Shepparton and the Shepparton Alternative Route. Council, in association with VicRoads, prepared the *Draft Wanganui Road and Ford Road, Shepparton: Feasibility Study Design Report 2018*. The Report explores the options and constraints to upgrading Ford and Wanganui Roads to serve as an east-west connecting link. At the Ordinary Council Meeting held on 20 February 2018, Council resolved to endorse the Draft Report and to release it for public comment for a period of eight weeks, commencing on 26 February 2018 and concluding on 23 April 2018.

Greater Shepparton City Council and the VPA have engaged Trafficworks to prepare an Addendum Report to the 2014 TIAR for the North East Growth Corridor that investigates the following aspects of the PSP:

a. Intersections

   i. The impact of deletion or change to left-in/left-out operation for the intersection at Access B onto Ford Road

   ii. The impact of deletion or change to left-in/left-out operation for the intersection at Access C onto Grahamvale Road

   iii. The impact on the road network of the above changes at both intersections

   iv. The best solution for access to the NEPSP, including whether the traffic signals proposed for Access A can be deleted and the traffic signals for Access D can be replaced with a roundabout

   v. Comment on the intersection layout for Access A (lane arrangement for east approach) and Access D (realignment of east approach into No 145 – parcel 13).

b. Connector Road Widenings

   i. Determine the minimum access road standards at Accesses A, C and D if abutting land holdings were developed in isolation

   ii. Assess the ultimate cross sections and lengths for these access roads to determine the differential to be funded from the DCP.

c. Cross Sections

   i. Review the post-exhibition cross sections.

d. Functional Drawings

   i. Prepare concept plans for all proposed road lengths

   ii. Prepare functional plans for the minimum and ultimate standards under item b).

e. Costings

   i. Comment on probable costs for each intersection.

   ii. Comment on probable costs for connector road options in item b).

1.2 Executive Summary

The principal conclusions drawn from the investigations undertaken as part of this addendum to the 2014 TIAR are that:

- Internal traffic diversions resulting from closure of Access B can be accommodated within the network and the proposed intersection treatment at Access A.
- Partial (left-in/left-out) control at Access B is expected to result in adverse safety outcomes and is not recommended.

- Reassignment of traffic from a closure of Access C is expected to result in serious congestion, delays and queuing issues at Access D, with downstream negative network implications further south along Verney Road. The planning wisdom of denying an easterly access into the precinct is also questioned and closure of Access C is not supported.
- Partial (left-in/left-out) control at Access C is also expected to result in adverse safety outcomes and is not recommended. However, the replacement of Accesses B and C with a combined access, by way of an additional leg to the proposed roundabout at the intersection of Ford Road and Grahamvale Road, is an option that should be further investigated.
- The amended post-exhibition road profiles result in closer alignment of cross-sections with those recommended in the IDM. However, consideration should be given to further adjustments to include an off-road shared path in the cross-section for Road-04 and retaining the IDM cross-section (with two lanes in each direction) for Road-02 if closure of Access C proceeds.

1.3 References

Reports and technical references used in the preparation of this report include the following:

- *Shepparton North East, Precinct Structure Plan,* prepared by the Victorian Planning Authority and dated February 2018
- *Shepparton North East, Development Contributions Plan,* prepared by the Victorian Planning Authority and dated February 2018
- *Greater Shepparton Planning Scheme Amendment C118, Explanatory Report*
- *Ford and Wanganui Roads Investigation Study* on Greater Shepparton City Council website
- *Wanganui Road/Ford Road, Shepparton – Road and Intersection Upgrade Functional Design, Road Safety Audit Report,* conducted by RSA and dated 27/11/2017
- *Ford and Wanganui Road Masterplan,* prepared by McGregor + Coxall, Sheets LD-SK-P01 to P04
- *Shepparton North East Growth Corridor Development, Traffic Impact Assessment Report,* prepared by Trafficworks Pty Ltd dated 15 September 2014
- *Shepparton North East Growth Corridor Development, Traffic Impact Assessment Report Addendum A,* prepared by Trafficworks Pty Ltd dated 11 January 2017
- Local Government Infrastructure Design Association's *Infrastructure Design Manual*, Version 5.10, released 11 Jan 2018
- *Shepparton North East Growth Corridor, Structure Plan, Traffic Engineering Assessment,* by TraffixGroup Pty Ltd dated 7 March 2011.

2 BASIS FOR ASSESSMENTS

2.1 Land parcels

In order to draw meaningful comparisons with the 2014 TIAR, the land splits as described in the Ownership Plan prepared by Reeds Consulting (refer Figure 1) have been used in the manipulation of the traffic generation model in Attachment D to this report. Cross references between land parcels in Plan 3 of the PSP (on page 10 of the PSP) and the ownership areas as defined in the Reeds plan and the traffic generation model are detailed in Table 1.

Figure 1: Ownership Plan (Source: Reeds Consulting "Ownership Plan Version A"). Plan includes access point notation.

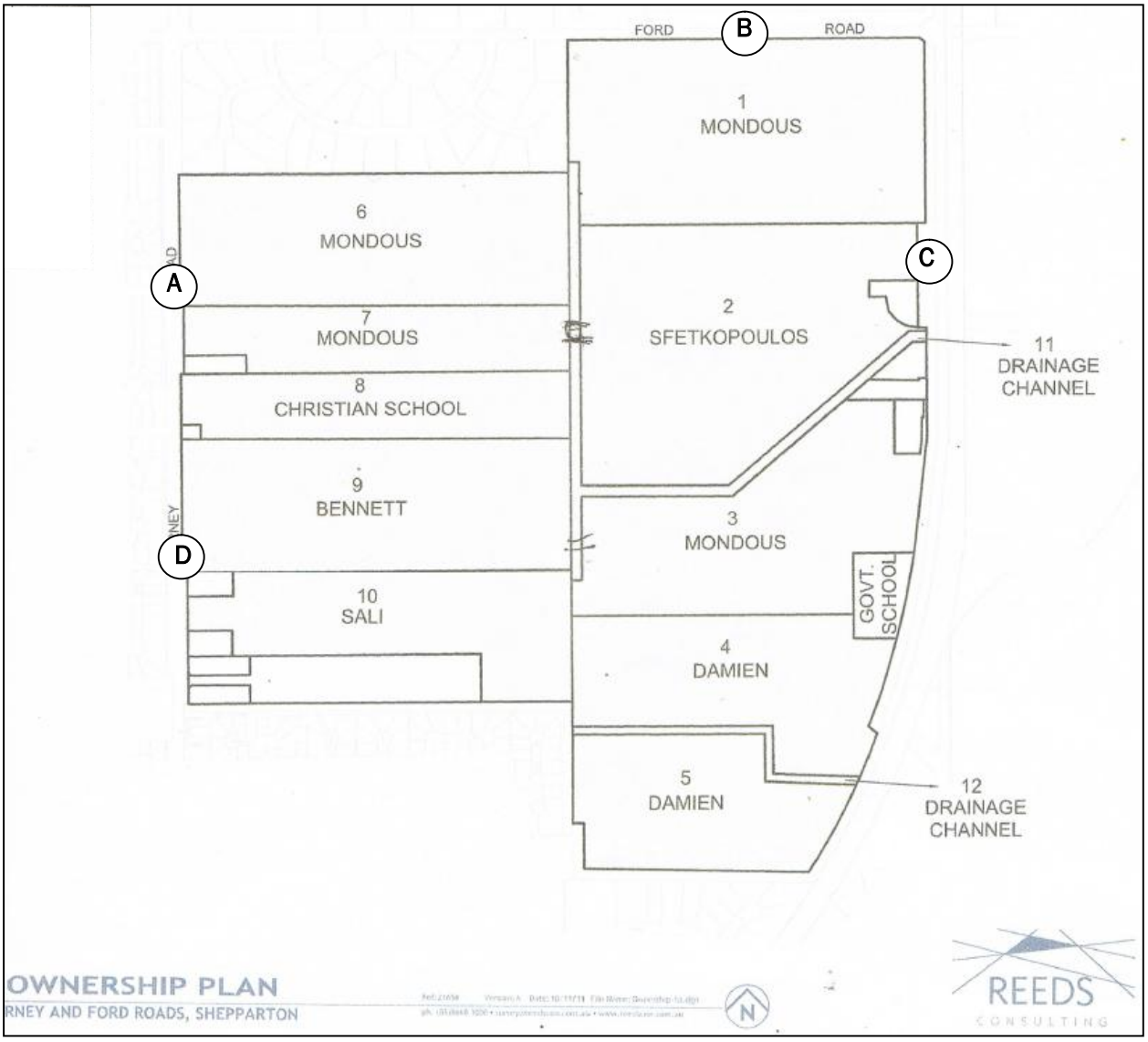


Table 1: Cross references between land parcels in the PSP and Reeds Ownership Plan

PSP Parcel Number	Ownership Area Number
1	6 (Mondous)
2	11 (Drainage channel)
3	1 (Mondous)
4	7 (Mondous)
6	2 (Sfetkopoulos)
12	8 (Christian School)
13	9 (Bennett)
14	3 (Mondous)
15	Grahamvale School
16	Not identified
17	10 (Sali)
25 & 26	4 & 5 (Damien)

2.2 Traffic generation and distribution

For consistency with the previous TIA reports, the following parameters have been adopted in this report for establishing traffic generation from within the precinct:

- Lot yield = 10 dwellings/hectare applied to gross areas. This is consistent with the PSP but introduces a 10% reduction on the previous TIAR estimates based on 11 dwellings/hectare
- Generation rate = 8 trips/dwelling/day, with 10% occurring in the AM and PM peaks
- Traffic generation by the neighbourhood centre has assumed that 90% will be generated within the precinct and 10% externally
- The 2014 assessment was conducted on the basis of an 80% exiting/20% entering directional split in the AM peak and a 70% entering/30% exiting directional split in the PM peak for residential traffic
- The distribution of residential traffic outlined in the 2011 TraffixGroup report and used as a basis for traffic distribution in the 2014 TIAR, as depicted in Figure 2.

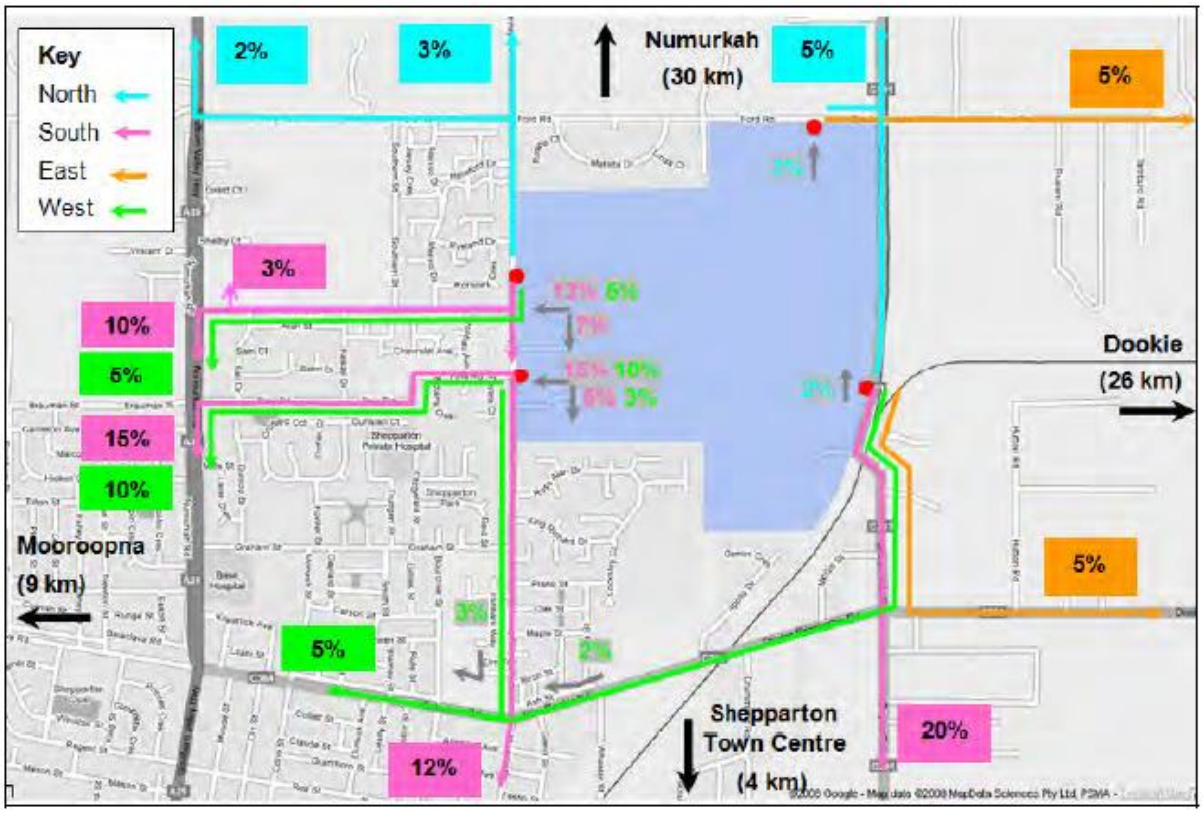
In order to estimate changes in traffic patterns upon the closure of Accesses B and C, the following reassignments have been undertaken in the traffic model:

- From Access B: 8% (3% to north + 5% to east) reassigned to Access A all directed north
- From Access C: 2% reassigned to Access A and directed north

  25% (20% south +5% east) reassigned to Access D and directed south

  2% reassigned to Access D and directed west (along Pine Road)

Figure 2: Adopted traffic distribution (Source: Figure 8 from TraffixGroup report dated 7/3/2011)



2.3 SIDRA Assessments

Assessments of intersection operation at Accesses A, B, C and D for the 2014 TIAR concluded that the following controls be implemented:

- Access A: Operation was considered satisfactory under Give Way control with Type CHR and Type AUL turn lanes provided in Verney Road. It is noted that this assessment only considered the impact of the PSP and did not include Ryeland Drive traffic. Council's preference was for signalisation.
- Access B: Give Way control was considered satisfactory onto Ford Road with Type AUL left turn lane from the east.
- Access C: The heavy demand for west to/from south turn movements made Give Way control unsuitable, a roundabout marginal (requiring two lane operation) but operation expected to be satisfactory under traffic signal control.
- Access D: Total traffic volumes made Give Way control unsuitable. The analysis confirmed satisfactory operation under the signalised intersection proposed by Council. A roundabout option was not assessed, given the constraints imposed on the footprint for such a treatment by adjacent existing development.

An explanation of the intersection operating characteristics is shown in Table 2. Note that good or better operating conditions relates to an intersection operation below the practical capacity.

Table 2: Definitions of intersection operation characteristics

Degree of Saturation (DOS)			Operation
Sign control	Roundabout	Traffic Signals	
Less than 0.60	Less than 0.60	Less than 0.60	Excellent operating conditions, minimal delays
0.60 – 0.70	0.60 – 0.70	0.60 – 0.70	Very good operating conditions, minimal delays
0.70 – 0.80	0.70 – 0.85	0.70 – 0.90	Good operating conditions, delays and queuing increasing
0.80 – 0.90	0.85 – 0.95	0.9 – 0.95	Acceptable operating conditions, delays and queues growing. Any interruption to flow such as minor incidents causes increasing delays
0.90 – 1.00	0.95 – 1.00	0.95 – 1.00	Poor operating conditions, flows starting to break down and queues and delays increase rapidly.
Above 1.00	Above 1.00	Above 1.00	Very poor operating conditions with queues and delays increasing rapidly. Once queues develop it takes a significant time for queues to dissipate resulting in long delays to traffic movements.

3 ASSESSMENTS

3.1 Access options

i) Access B onto Ford Road

Closure of this intersection would result in the reassignment of all traffic from Access B to Access A. With reference to the traffic distribution plan in Figure 2, this would comprise 5% of internally generated traffic to/from destinations to the east and 3% of internally generated traffic to/from the north. As such, all this traffic at Access A would depart to and enter from the north.

Under the redistribution caused by closures of Accesses B and C, a total of 40% of internally generated traffic will use Access A. The 8% (5% + 3%) component of internal traffic redirected from Access B will represent 1/5 (8/40) of total traffic at Access A. Under the impact of this added traffic and with the addition of Ryeland Drive traffic to this intersection, the SIDRA assessment has indicated that this intersection will operate satisfactorily under Give Way control with a Degree of Saturation (DoS) of 0.834, average delays of 42 seconds and 95% queue lengths of 46m in the east approach during the AM peak (refer Figure B1 in Attachment B). Operation during the PM peak is also expected to be satisfactory under Give Way control (refer Figure B2 in Attachment B) and operation of the intersection under signalised control is excellent in both AM and PM peak periods.

Conversion of Access B to left-in/left-out only movements is expected to result in no change in travel patterns from those in the PSP. As movements are expected to be almost exclusively to/from the east the mooted restriction will:

- Have no impact on traffic entering the PSP from the east
- Result in exiting traffic exiting onto Ford Road in a westerly direction and conducting a U turn at the earliest opportunity – at nearby driveways or within the Matilda Drive intersection. These U turn manoeuvres are considered hazardous and present a strong case against implementation of partial control at this access.

The impact of the partial control at Access B is not explored further.

In summary, traffic redistribution resulting from closure of Access B can be accommodated without change at Access A. Partial closure of Access B is not recommended for safety reasons.

ii) Access C onto Grahamvale Road

Closure of this intersection would result in the reassignment of all traffic from Access C to Accesses A and D. With reference to the traffic distribution plan in Figure 2, this would comprise 2% of internally generated traffic reassigned to Access A to/from destinations to the north, and a total of 27% of internally generated traffic reassigned to Access D, distributed 2% to/from the west and 25% to/from the south.

This represents an almost 50% increase in traffic at Access D. SIDRA analysis indicates that the intersection will operate well above practical capacity during the AM and PM peaks, exhibiting serious congestion, delays of several minutes and queues hundreds of metres long in the north,

east and south approaches. The intersection will require significant modification to obtain acceptable operating conditions (refer Figures B3 and B4 in Attachment B).

Conversion of Access C to left-in/left-out only movements is expected to favour the entry movement from the south that represents 27% of the 29% of internally generated traffic at this access. However, control over the heavy demand for southbound departure movements could not be safely accommodated without a roundabout at the Ford Road/Grahamvale Road intersection in the first instance.

Even if it is assumed that a roundabout is provided at Ford Road/Grahamvale Road, it is expected that it will require the construction of a median for the full distance between Access C and this roundabout to prevent hazardous U turn movements being executed by departing southbound vehicles. Partial (left-in/left-out) control at Access C is not recommended.

In summary, closure of Access C will result in substantial increases in traffic at Access D to the extent that the proposed signals at this intersection will operate beyond practical capacity at peak times. Partial control at Access C will require the completion of the proposed roundabout at the Ford Road/Grahamvale Road intersection and the likely need to install a median between this roundabout and Access C for it to operate safely.

iii) Network impacts

As noted above, the anticipated traffic redistribution resulting from closure of Accesses B and C can be accommodated at Access A with Give Way control or under the signals control proposed at this intersection. The small increase in traffic volumes in Verney Road to the north and through the Ford Road intersection is also expected to be catered for without difficulty, whether this intersection is ultimately configured as a roundabout or signals.

However, the 50% increase in traffic at Access D is expected to cause significant congestion, queuing and delays at the intersection.

In addition, the downstream impact of this additional traffic on the Verney Road leg of the New Dookie Road/Balaclava Road/Hawdon Street intersection to the south of Access D is significant and is expected to seriously reduce the design life of the new signals proposed for this intersection.

iv) Alternative access configurations

Access A: This intersection is expected to operate satisfactorily under Give Way control. However, as noted earlier in this report, Greater Shepparton City Council has expressed a preference for signalisation of this intersection. Development of the community hub at the northeast corner of the intersection is expected to attract considerable pedestrian traffic along Ryeland Drive from the residential areas to the west of Verney Road. In addition, pedestrian traffic generated by the Christian School to the south of Access A (PSP parcel 12) has required the recent installation of a flagged school crossing across Verney Road at the school frontage. It is expected that continued growth of this school will require the upgrading of the crossing facility in the near future and the installation of traffic signals at Access A would also service this need. Signalisation of Access A is considered desirable for operational as well as safety reasons.

It is noted that, with signalisation, the sight line issues raised during the exhibition period, in relation to the multiple stand-up lanes in the east approach, no longer play a part in the safe operation of the intersection.

Access D: Development of layout options at the cross-intersection with Verney Road and Pine Road at Access D is constrained by the existing development at No 125 Verney Road (PSP parcel 16). This was nominated as a control during the development of the 2014 TIAR, which results in an off-set between the east and west legs. The offset can be accommodated in the layout for signalisation of the intersection (refer DCP page 47) but would not permit the development of a suitable and functional roundabout layout without incursion into No 125.

Accesses B & C: Closure of Access B and, in particular, Access C makes it difficult for Access D and Verney Road to accommodate the resultant additional reassigned traffic demand. From an overall accessibility perspective it is also considered undesirable for all access to the precinct to be westerly oriented, with no connection to the abutting road network to the east.

In response to these issues, the option of a connection to the proposed roundabout at the intersection of Ford Road with Grahamvale Road has been mooted, by way of an additional leg to replace both Accesses B and C. A concept layout for a modified roundabout has been investigated by VicRoads and appears to offer a viable alternative to replace the two separate access points. It is noted that such a change of access would also involve significant modifications to the internal road layout for the northeast quadrant of the PSP.

In summary Closure of Access C is expected to significantly reduce the design life of the proposed signalisation of the intersection of Verney Road with New Dookie Road/Balaclava Road, and is considered an undesirable constraint on easterly access to the precinct. It is recommended that the option of providing access to the roundabout at Ford Road/Grahamvale Road be further investigated.

3.2 Connector road profiles

Road-01: This road is located along the boundaries of PSP parcels 1 and 4 (Mondous lots 6 and 7 on the Reeds plan). If it is assumed both parcels are fully developed and yield a total of 268 lots (26.8ha @ 10 lots/ha) plus the commercial hub, traffic generation can be expected to reach 2,300vpd at Access A (including 10% contribution from the shops to/from external destinations). The IDM indicates this to be just below the threshold of the traffic range for a Connector Street, requiring only an Access Street profile (refer copy of IDM Table 2 in Attachment C). It is noted that inclusion of the currently vacant land at the rear of the Christian College property – the eastern portion of parcel 12 (or lot 8) - would increase traffic generation at Access A to 2,700vpd or above the maximum for an Access Street.

Traffic will progressively decrease along this road to the east and, although it will need to accommodate the 90% traffic contribution from the shops that is internally generated, it is considered that an Access Street designation can be applied to the full length of Road-01 through parcels 1 and 4 if undertaken as stand-alone developments. With the eastern portion of parcel 12 included, the western end should be upgraded to Connector Level 1, reducing to Access Street at the eastern boundary of the open space adjacent to the community hub for the remaining distance to the east.

Ultimate traffic volumes at Access A, with Accesses B and C closed and based on a yield of 10 lots/ha, indicate traffic volumes just above the 6,000vpd threshold for a Trunk Collector Road and a need to implement this road profile for the first 25% of its length through parcels 1 and 4 (i.e. from Verney Road to east of the community hub). From this point a Connector Street Level 1 profile would need to be maintained along Road-01 to its intersection with Road-03/Road-04.

Road-02: This road connects with Verney Road at the boundaries of PSP parcels 13, 16 and 17 (Bennett lot 9 and Sali lot 10, with parcel 16 not identified on the Reeds plan). If it is assumed parcels 13 and 17 are fully developed and yield a total of 305 lots (30.5ha @ 10 lots/ha), traffic generation can be expected to reach 3,050vpd at Access D. The IDM indicates this to be well within the traffic range requiring a Connector Street Level 1. Assuming traffic will exhibit a linear decrease along this road to the east, volumes will drop below the Level 1 Connector Street threshold at about one fifth of the distance through parcel 13 and its designation can be reduced to Access Street at approximately 150m from Verney Road if parcels 13 and 17 are undertaken as stand-alone developments.

Ultimate traffic volumes with Access C closed indicate traffic levels in the order of 12,500vpd, which exceed Trunk Collector Road designation. These high traffic volumes progressively reduce along Road-02, to fall within the range for a Trunk Collector at approximately 50m east of Verney Road, and would be expected to continue within the range of Trunk Collector for the remaining length of this road.

Road-03: This road is shown in the PSP to enter parcel 6 (Sfetkopoulos lot 2 on the Reeds plan) from Grahamvale Road immediately north of parcel 7. If it is assumed parcel 6 is fully developed and yields a total of 250 lots (25.04ha @ 10 lots/ha), traffic generation can be expected to reach 2,500vpd at Access C. The IDM indicates this to be at the threshold between Access Street and Connector Street Level 1. As traffic will progressively decrease along this road, it is considered reasonable for its full length to be designated as Access Street if parcel 6 is undertaken as a stand-alone development.

Ultimate traffic levels along Road-03, assuming retention of Access C onto Grahamvale Road and a yield of 10 lots/ha (representing a 10% reduction on the 2014 estimates based on 11 lots/ha), are estimated to be in the order of 5,300vpd and require upgrading of this road to Connector Road Level 1 from Grahamvale Road to its junction with Road-01 and Road-04.

Figure 3A: Road profiles for stand-alone developments

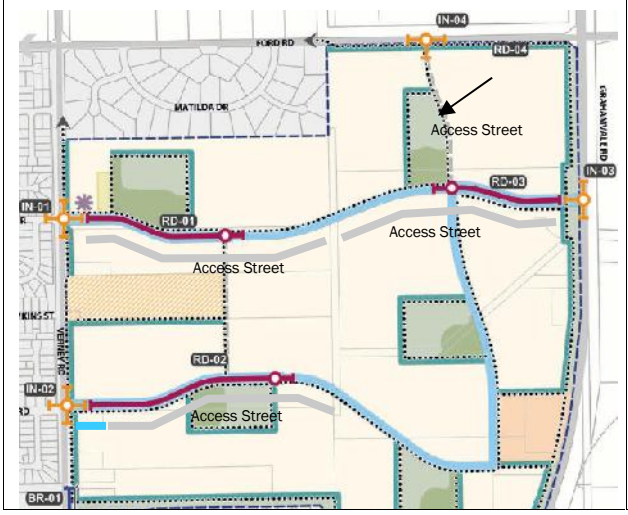
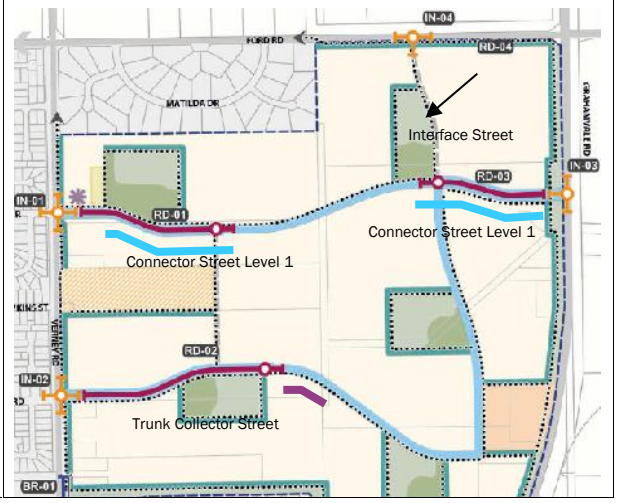


Figure 3B: Road profiles at full development



3.3 Cross sections

Section 4.2 (Appendix B) to the PSP provides a series of street cross-sections, generally in accordance with Table 2 of the Infrastructure Design Manuel (IDM) reproduced in Figure C1 of Attachment C. These cross-sections were modified following exhibition with the updates provided in Attachment E to this report.

The updated cross-sections for Local Access Street (16.0m), Park and Retardation Basin Interface Street (16.0m) and Reserve and School Interface Street with shared path (17.0m) all provide a 7.3m carriageway width (consistent with Access Street in the IDM) and varying verge width configurations. Implementation of the strategy in Plan 5 of the PSP would result in the selection of the appropriate cross-sections that include shared path facilities along key cycling routes.

The Key Local Access Street (18.0m) has been superseded by specific Interface Streets (18.0m) for the Ford Road and Verney Road frontages. These also contain 7.3m wide carriageways and varying verge width configurations. However, Road-04 (between Road-01/Road-03 and Ford Road, which previously had Key Local Access Street status) will need to be designated Interface Street (17.0m) to incorporate an off-road shared path.

The modified cross-section for Connector Street Level 1 (24.0m) is consistent with the IDM Connector Street Level 1, and now provides an 11.6m wide carriageway with shared paths along both sides of the road. This cross-section is supported where applied to the appropriate traffic volume range.

The modified cross-section for Connector Street Level 2 (30.0m) or Trunk Collector has reduced the cross-section nominated in the IDM by limiting traffic to a single lane in each direction. This cross-section is expected to result in congestion where required to operate under the higher traffic volumes expected along Road-02 with closure of Access C. However, if Access C is retained, traffic volumes along Road-02 would reduce to an extent that the proposed modified cross-section for Connector Street Level 2 (30.0m) is expected to operate satisfactorily.

In summary, consideration should be given to amending the post-exhibition road profiles to include an off-road shared path in the cross-section for Road-04 and retaining the IDM cross-section (with two lanes in each direction) for Road-02 if Access C is closed.

3.4 Functional design

The functional layout plans in Section 6.2.1 of the DCP should be updated to provide the following profiles for the key connector roads through the PSP, as outlined in Figures 3A and 3B:

Road-01: Beyond the limits of the Trunk Collector Road for the first 100m from the signals at Verney Road to east of the community hub, Section 3.2 above indicates an ultimate requirement for a Connector Level 1 (24m) profile for this road to its junction with Road-03/Road-04. This configuration is outlined in the functional plan on page 37 of the DCP, but with the width reduced to 24.0m (refer to Figure A1 of Attachment A) and is supported.

If parcels 1 and 4 are undertaken as a standalone development then the full length of this road can be maintained as an Access Street (refer to Figure A2 of Attachment A).

Road-02: Ultimate traffic volumes indicate a need for the full length of this road to be configured as a Trunk Collector Road as detailed in the functional plan on page 42 of the DCP but with the width reduced to 30.0m (refer to Figure A3 of Attachment A). It is noted that, if Access C is closed, the western 50m of the road is expected to experience traffic volumes in excess of the range for a Trunk Collector as set out in the IDM. It is considered that the IDM cross-section (34.0m) should be the minimum standard adopted for this road if closure of Access C proceeds to better accommodate mid-block traffic volumes. However, significant capacity issues would still exist at the intersection of Road-02 with Verney Road.

If parcels 13 and 17 are undertaken as a standalone development then this road can be maintained as an Access Street, with the first 150m east of Verney Road configured as a Connector Road Level 1 (refer to Figure A4 of Attachment A).

Road-03: Ultimate traffic volumes indicate a need for the full length of this road to be configured as a Connector Road Level 1 as detailed in the functional plan on page 39 of the DCP but with the width reduced to 24.0m (refer to Figure A5 of Attachment A).

If parcel 6 is undertaken as a standalone development then the full length of this road can be maintained as an Access Street (refer to Figure A6 of Attachment A).

Road-04: In addition to the above, traffic volumes in Road-04, at both stand-alone and integrated stages, indicate a need for its full length to be configured as an Interface Street (Section 4 - 18m) so as to provide a shared path along this designated cycling route.

3.5 Costings

3.5.1 Road Lengths

Order-of-cost estimates have been prepared for Road-01, Road-02 and Road-03, based on the modified cross-sections discussed above and using the unit rates from Section 6.2.1 of the DCP. Individual cost estimates for each road option, i.e. stand-alone development (Interim 1), integrated development as assessed in this report (Interim 2) are shown in Attachment F.

In addition, cost estimates have been reviewed to reflect the post-exhibition amended PSP cross-sections for each road (refer Attachment E). These are noted as Connector Street Level 1, 24m (Ultimate 1) and Trunk Collector, 30m (Ultimate 2) in each case. Revised estimates for these options are also shown in Attachment F.

The costs associated with all four options for each road are summarised in Table 3.

It should be noted that, in order to provide valid comparisons with costings shown in the DCP, the lengths of each road treatment considered in these cost estimates are close approximations of the road lengths described in Plan 5 of the PSP and do not necessarily extend for the full length of the subject parcels.

Table 3: Cost estimates for road length options

Road Length	Treatment description	Total cost
Road-01 Interim 1	Access Street (16m) full length	$ 924,449
Road-01 Interim 2	Connector Street L1 (24m) with 100m Trunk Collector terminal	$1,130,165
Road-01 Ultimate 1	Connector Street L1 (24m as per PSP) no roundabout	$1,105,902
Road-01 Ultimate 2	Trunk Collector full length (30m as per PSP) & roundabout	$1,691,129
Road-02 Interim 1	Access Street (16m) with 150m Connector Level 1 terminal	$1,320,959
Road-02 Interim 2	Trunk Collector full length (30m)	$1,896,026
Road-02 Ultimate 1	Connector Street L1 (24m as per PSP) no roundabout	$1,700,245
Road-02 Ultimate 2	Trunk Collector (30m as per PSP) full length & roundabout	$1,930,724
Road-03 Interim 1	Access Street (16m) full length	$ 924,449
Road-03 Interim 2	Connector Street L1 (24m) full length	$1,108,564
Road-03 Ultimate 1	Connector Street L1 (24m as per PSP) no roundabout	$1,105,902
Road-03 Ultimate 2	Trunk Collector full length (30m as per PSP) & roundabout	$1,691,129

3.5.2 Intersections

There has been no substantial change to the proposed intersection treatments as described in the DCP. The cost estimate for the signalisation of the intersection of Verney Road with Road-02 and Pine Road was reviewed as representing the most complex of the proposed external connections. The estimate of $1,124,336 provided in the DCP was confirmed as being realistic, albeit slightly conservative. On the basis of this review, the remaining intersection cost estimates in the DCP are supported.

3.6 Additional matters

Submissions made during the exhibition process included discussion on the following four matters, on which Greater Shepparton City have requested Trafficworks to provide comment.

1) Change of control at Access A from traffic signals to a small roundabout. As noted in Section 3.1(iv), although this intersection is expected to operate satisfactorily under Give Way control, to provide a safe crossing of Verney Road for the anticipated pedestrian movements between the community hub at the northeast corner of this intersection and residential areas to the west, and to cater for an impending need to upgrade the flagged the school crossing to the south of the intersection, Greater Shepparton City's preference for the signalisation of this intersection is supported.

   Conversion of control to a roundabout will not assist in addressing either of the above pedestrian needs.

2) Realignment of the connection of Road-02 to form a conventional cross intersection with Pine Road and Verney Road (Access D). As noted in Section 3.1(iv), the alignment shown in the PSP is necessary to avoid impact on the existing residence at No 125 Verney Road. A square intersection layout would require the acquisition of No 125 and converting part

of this land into road. The installation of a roundabout would involve an even greater incursion into No 125.

An option to realign Road-02 to the south of the open space (OS-02) and adjacent retardation basin (RB-02) is expected to have no operational impacts on traffic, either along Road-02 or at the Verney Road intersection, but it would have the benefit of the location of Road-02 being shared between Parcels 13 and 17. Such a realignment would result in slightly better coverage of the bus catchment in the southeast quadrant of the PSP from the consequent relocated bus stop. However, it would require a shift of the key local access street between Road-01 and Road-02 to maintain north-south connectivity clear of the reserve.

3) Sight lines from Road-01 at Access A. The configuration of the multiple east approach lanes to offer optimum visibility along Verney Road for drivers exiting Road-01 is a matter that would need to be addressed in detailed design if a simple Give Way controlled intersection were to be installed. As noted in Section 3.1(iv), with a preference for signalisation of this site, the sight line issue does not play a part in the safe operation of a signalised intersection.

6 CONCLUSIONS AND RECOMMENDATIONS

The principal conclusions drawn from the investigations undertaken as part of this addendum to the 2014 TIAR are that:

- Internal traffic diversions resulting from closure of Access B can be accommodated within the network and the proposed intersection treatment at Access A.
- Partial (left-in/left-out) control at Access B is expected to result in adverse safety outcomes and is not recommended.
- Reassignment of traffic from a closure of Access C is expected to result in serious congestion, delays and queuing issues at Access D, with downstream negative network implications further south along Verney Road. The planning wisdom of denying an easterly access into the precinct is also questioned, and closure of Access C is not supported.
- Partial (left-in/left-out) control at Access C is also expected to result in adverse safety outcomes and is not recommended. However, the replacement of Accesses B and C with a combined access, by way of an additional leg to the proposed roundabout at the intersection of Ford Road and Grahamvale Road, is an option that should be further investigated.
- The amended post-exhibition road profiles result in closer alignment of cross-sections with the IDM. However, consideration should be given to further adjustments to include an off-road shared path in the cross-section for Road-04 and retaining the IDM cross-section (with two lanes in each direction) for Road-02 if closure of Access C proceeds.

ATTACHMENT A –INTERNAL ROAD CROSS-SECTIONS

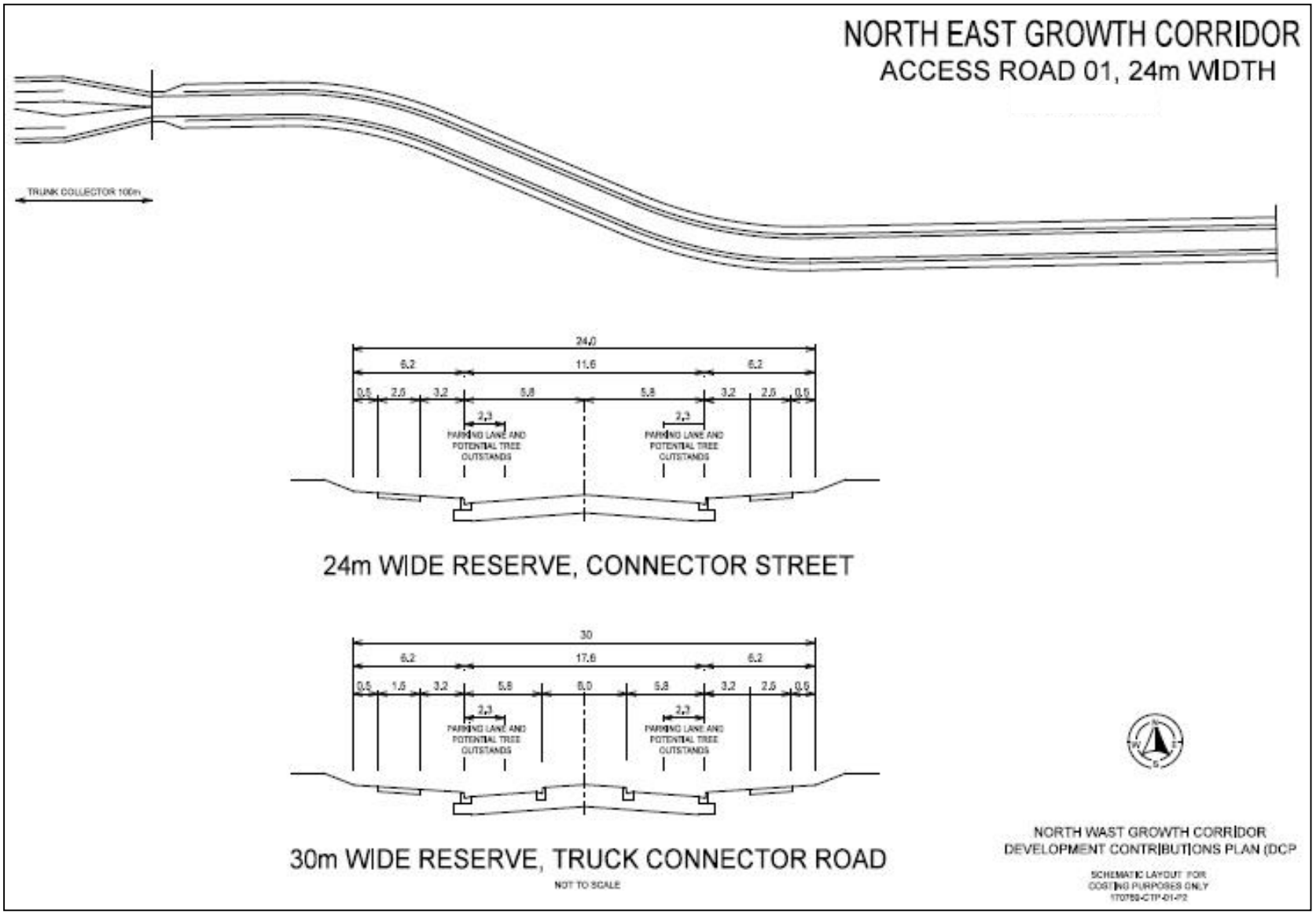


Figure A1: Typical Road Profile for Road-01 – Connector Street Level 1 with Trunk Collector terminal

Figure A2: Typical Road Profile for Road-01– Access Street to serve only Parcels 1 & 4

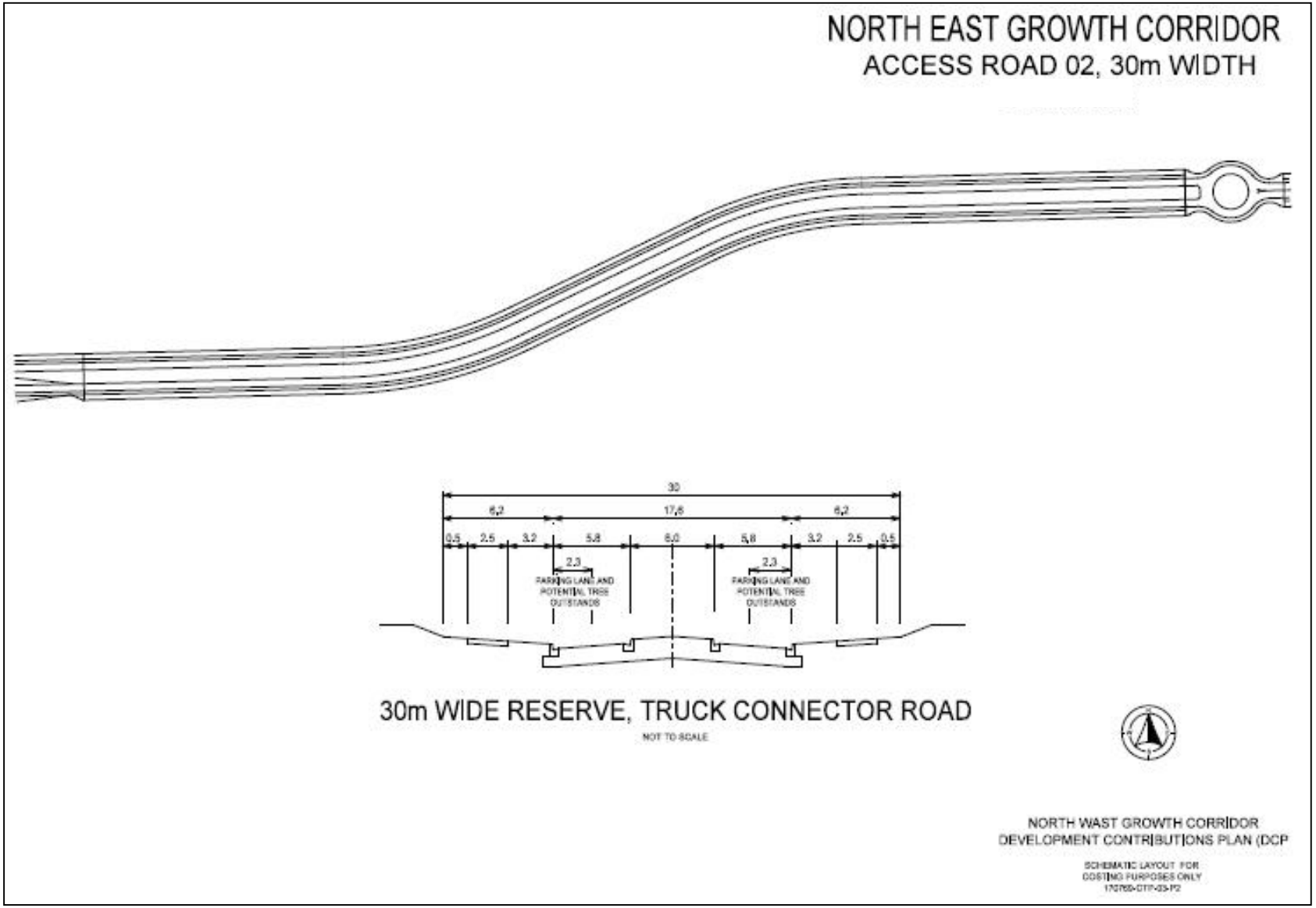


Figure A3: Typical Road Profile for Road-02– Trunk Collector full length from Verney Road to roundabout

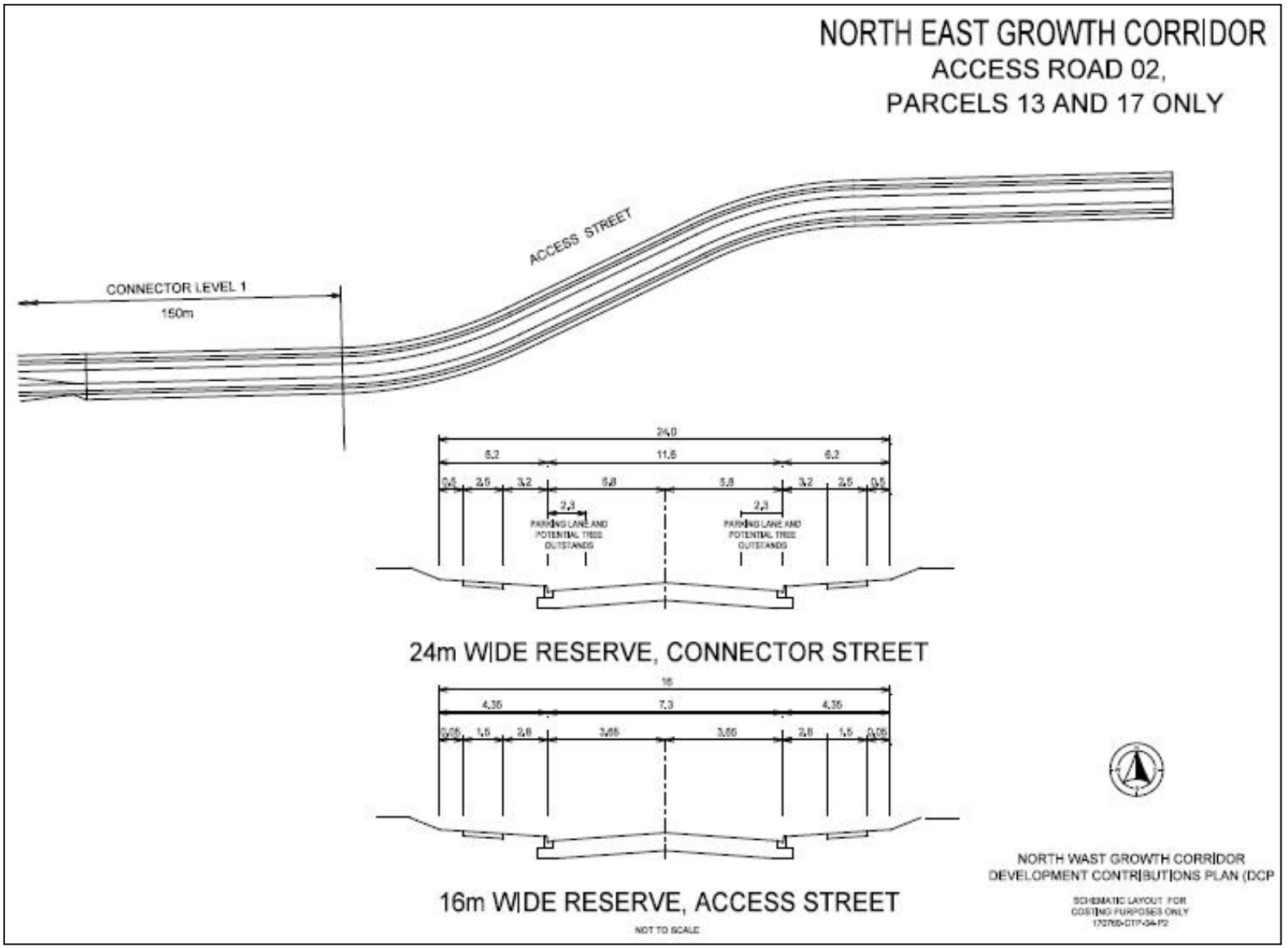


Figure A4: Typical Road Profile for Road-01 – Access Street to serve only Parcels 13 & 17

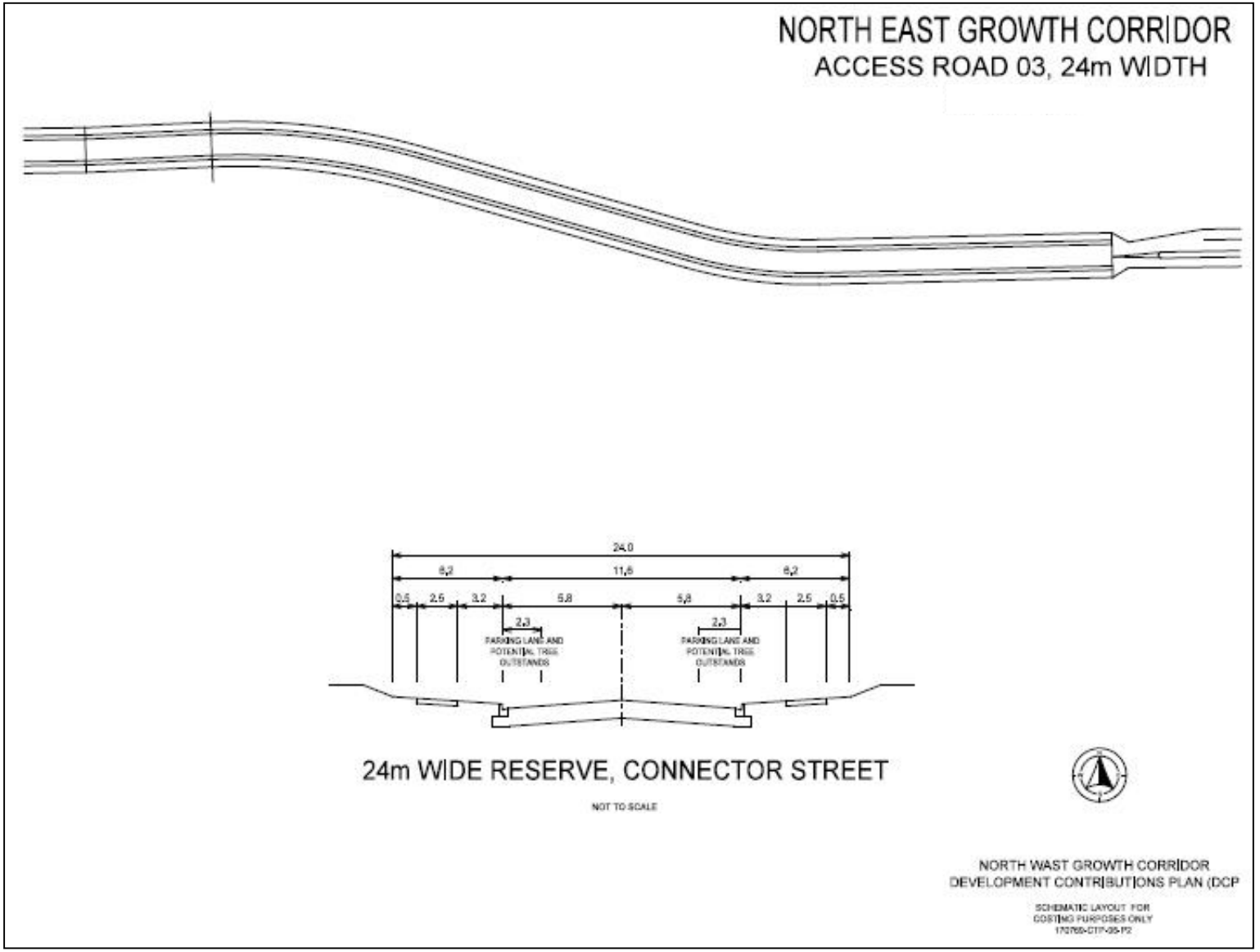


Figure A5: Typical Ultimate Road Profile for Road-03 – Connector Street Level 1 for full length

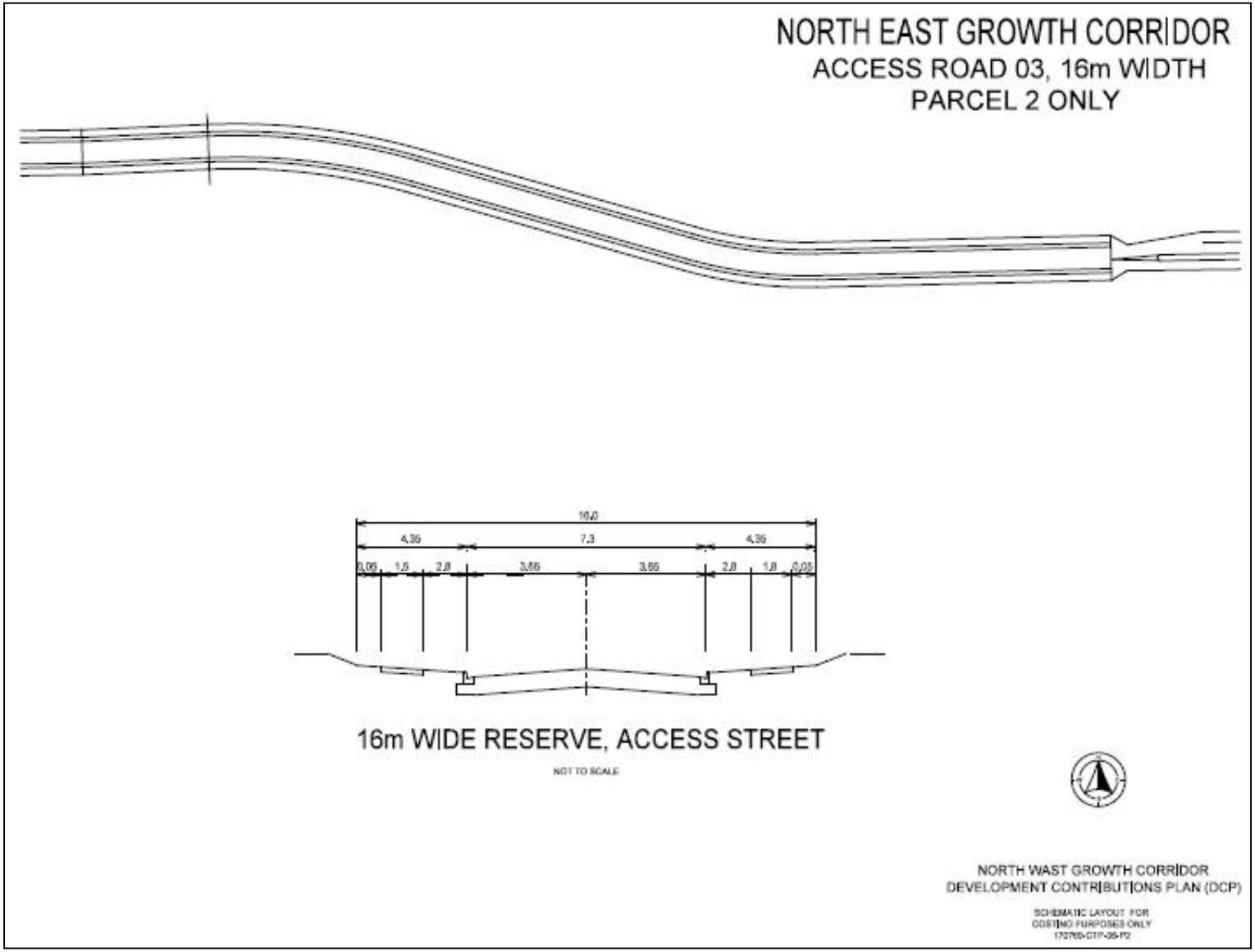


Figure A6: Typical Road Profile for Road-03 – Access Street to serve only Parcel 2

ATTACHMENT B – SIDRA SUMMARIES

Figure B1: LANE SUMMARY

Site: 101v [Verney Road / Ryeland Drive / Access A - AM peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Verney Road													
Lane 1	8	1.0	1844	0.005	100	6.4	LOS A	0.0	0.0	Short	55	0.0	NA
Lane 2	213	3.0	1897	0.112	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	80	1.0	976	0.082	100	8.0	LOS A	0.3	2.3	Short	45	0.0	NA
Approach	301	2.4		0.112		2.3	NA	0.3	2.3				
East: Access A													
Lane 1	318	1.0	956	0.333	100	6.6	LOS A	1.5	10.8	Short	60	0.0	NA
Lane 2	192	1.0	230	0.834	100	42.6	LOS E	6.5	45.9	Full	500	0.0	0.0
Approach	509	1.0		0.834		20.2	LOS C	6.5	45.9				
North: Verney Road													
Lane 1	47	1.0	1844	0.026	100	6.4	LOS A	0.0	0.0	Short	55	0.0	NA
Lane 2	320	3.0	1913	0.167	100	0.0	LOS A	0.0	0.0	Full	450	0.0	0.0
Lane 3	1	1.0	1149	0.001	100	6.9	LOS A	0.0	0.0	Short	30	0.0	NA
Approach	368	2.7		0.167		0.9	NA	0.0	0.0				
West: Ryeland Drive													
Lane 1	37	1.0	97	0.379	100	49.0	LOS E	1.2	8.8	Full	280	0.0	0.0
Approach	37	1.0		0.379		49.0	LOS E	1.2	8.8				
Intersection	1216	1.9		0.834		10.8	NA	6.5	45.9				

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

Figure B2: LANE SUMMARY

Site: 101v [Verney Road / Ryeland Drive / Access A - PM peak]

New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Verney Road													
Lane 1	28	1.0	1844	0.015	100	6.4	LOS A	0.0	0.0	Short	55	0.0	NA
Lane 2	315	3.0	1897	0.166	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	278	1.0	864	0.322	100	9.4	LOS A	1.6	11.3	Short	45	0.0	NA
Approach	621	2.0		0.322		4.5	NA	1.6	11.3				
East: Access A													
Lane 1	119	1.0	966	0.123	100	6.1	LOS A	0.5	3.2	Short	60	0.0	NA
Lane 2	73	1.0	120	0.608	100	50.8	LOS F	2.5	17.3	Full	500	0.0	0.0
Approach	192	1.0		0.608		23.0	LOS C	2.5	17.3				
North: Verney Road													
Lane 1	167	1.0	1844	0.091	100	6.4	LOS A	0.0	0.0	Short	55	0.0	NA
Lane 2	311	3.0	1913	0.162	100	0.0	LOS A	0.0	0.0	Full	450	0.0	0.0
Lane 3	3	1.0	1002	0.003	100	7.5	LOS A	0.0	0.1	Short	30	0.0	NA
Approach	481	2.3		0.162		2.3	NA	0.0	0.1				
West: Ryeland Drive													
Lane 1	15	1.0	102	0.145	100	37.9	LOS E	0.4	3.0	Full	280	0.0	0.0
Approach	15	1.0		0.145		37.9	LOS E	0.4	3.0				
Intersection	1308	2.0		0.608		6.8	NA	2.5	17.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Lane LOS values are based on average delay per lane.

Minor Road Approach LOS values are based on average delay for all lanes.

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 lanes.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Figure B3: LANE SUMMARY

Site: 101 [Verney Road / Ryeland Drive / Access A - AM peak]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Verney Road													
Lane 1	8	1.0	415	0.020	100	32.4	LOS C	0.3	1.8	Short	55	0.0	NA
Lane 2	213	3.0	478	0.445	100	27.8	LOS C	7.1	51.3	Full	500	0.0	0.0
Lane 3	80	1.0	161	0.496	100	46.6	LOS D	3.2	22.6	Short	45	0.0	NA
Approach	301	2.4		0.496		32.9	LOS C	7.1	51.3				
East: Access A													
Lane 1	318	1.0	576	0.552	100	25.0	LOS C	9.5	66.9	Short	60	0.0	NA
Lane 2	1	1.0	484	0.002	100	23.8	LOS C	0.0	0.2	Full	500	0.0	0.0
Lane 3	191	1.0	461	0.413	100	32.2	LOS C	6.4	44.9	Short	35	0.0	NA
Approach	509	1.0		0.552		27.7	LOS C	9.5	66.9				
North: Verney Road													
Lane 1	47	1.0	415	0.114	100	33.3	LOS C	1.5	10.5	Short	55	0.0	NA
Lane 2	320	3.0	477 [1]	0.671	100	30.2	LOS C	11.6	83.5	Full	450	0.0	0.0
Lane 3	1	1.0	161	0.007	100	42.8	LOS D	0.0	0.3	Short	30	0.0	NA
Approach	368	2.7		0.671		30.6	LOS C	11.6	83.5				
West: Ryeland Drive													
Lane 1	37	1.0	208	0.177	100	39.5	LOS D	1.2	8.4	Full	280	0.0	0.0
Approach	37	1.0		0.177		39.5	LOS D	1.2	8.4				
Intersection	1216	1.9		0.671		30.2	LOS C	11.6	83.5				

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

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Figure B4: LANE SUMMARY

Site: 101 [Verney Road / Ryeland Drive / Access A - PM peak]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Verney Road													
Lane 1	28	1.0	691	0.041	100	23.3	LOS C	0.7	4.9	Short	55	0.0	NA
Lane 2	315	3.0	765	0.411	100	18.6	LOS B	8.9	63.6	Full	500	0.0	0.0
Lane 3	278	1.0	415	0.670	100	38.3	LOS D	10.3	73.0	Short	45	0.0	NA
Approach	621	2.0		0.670		27.6	LOS C	10.3	73.0				
East: Access A													
Lane 1	119	1.0	576	0.206	100	23.5	LOS C	3.3	23.1	Short	60	0.0	NA
Lane 2	1	1.0	218	0.005	100	34.2	LOS C	0.0	0.3	Full	500	0.0	0.0
Lane 3	72	1.0	207	0.345	100	41.8	LOS D	2.7	19.2	Short	35	0.0	NA
Approach	192	1.0		0.345		30.4	LOS C	3.3	23.1				
North: Verney Road													
Lane 1	167	1.0	415	0.403	100	35.5	LOS D	5.7	40.3	Short	55	0.0	NA
Lane 2	311	3.0	475 [1]	0.654	100	29.8	LOS C	11.2	80.1	Full	450	0.0	0.0
Lane 3	3	1.0	138	0.023	100	44.5	LOS D	0.1	0.8	Short	30	0.0	NA
Approach	481	2.3		0.654		31.9	LOS C	11.2	80.1				
West: Ryeland Drive													
Lane 1	15	1.0	208	0.071	100	28.2	LOS C	0.4	2.8	Full	280	0.0	0.0
Approach	15	1.0		0.071		28.2	LOS C	0.4	2.8				
Intersection	1308	2.0		0.670		29.6	LOS C	11.2	80.1				

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

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Figure B5: LANE SUMMARY

Site: 101 [Verney Road / Pine Street / Access D - AM peak]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Verney Road													
Lane 1	141	1.0	400	0.353	100	49.6	LOS D	7.1	49.8	Short	45	0.0	NA
Lane 2	319	3.0	393 [1]	0.812	100	49.9	LOS D	18.4	132.3	Full	500	0.0	0.0
Lane 3	147	1.0	215	0.685	100	64.1	LOS E	8.7	61.5	Short	65	0.0	NA
Approach	607	2.1		0.812		53.3	LOS D	18.4	132.3				
East: Access D													
Lane 1	589	1.0	683 [1]	0.863	100	39.2	LOS D	30.6	215.9	Short	75	0.0	NA
Lane 2	482	1.0	469 [1]	1.028	100	114.5	LOS F	46.6	328.8	Full	500	0.0	0.0
Lane 3	1	1.0	630	0.002	100	31.7	LOS C	0.0	0.3	Short	75	0.0	NA
Approach	1073	1.0		1.028		73.0	LOS E	46.6	328.8				
North: Verney Road													
Lane 1	1	1.0	400	0.003	100	45.1	LOS D	0.0	0.3	Short	30	0.0	NA
Lane 2	467	3.0	452 [1]	1.033	100	116.1	LOS F	43.9	315.4	Full	500	0.0	0.0
Lane 3	16	1.0	215	0.073	100	57.7	LOS E	0.8	5.9	Short	40	0.0	NA
Approach	484	2.9		1.033		114.1	LOS F	43.9	315.4				
West: Pine Street													
Lane 1	162	1.0	189	0.859	100	75.3	LOS E	10.4	73.3	Full	145	0.0	0.0
Approach	162	1.0		0.859		75.3	LOS E	10.4	73.3				
Intersection	2326	1.7		1.033		76.6	LOS E	46.6	328.8				

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

[1] Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Figure B6: LANE SUMMARY

Site: 101 [Verney Road / Pine Street / Access D - PM peak]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site Practical Cycle Time)

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Verney Road													
Lane 1	197	1.0	353	0.557	100	54.4	LOS D	10.6	74.8	Short	45	0.0	NA
Lane 2	488	3.0	340 [1]	1.438	100	448.7	LOS F	93.8	673.6	Full	500	0.0	39.4 [8]
Lane 3	516	1.0	349 [1]	1.479	100	491.5	LOS F	103.2	728.4	Short	65	0.0	NA
Approach	1201	1.8		1.479		402.5	LOS F	103.2	728.4				
East: Access D													
Lane 1	221	1.0	553	0.400	100	38.6	LOS D	10.0	70.8	Short	75	0.0	NA
Lane 2	181	1.0	194	0.935	100	76.6	LOS E	12.8	90.3	Full	500	0.0	0.0
Lane 3	1	1.0	184	0.006	100	56.9	LOS E	0.1	0.4	Short	75	0.0	NA
Approach	403	1.0		0.935		55.7	LOS E	12.8	90.3				
North: Verney Road													
Lane 1	1	1.0	353	0.003	100	47.8	LOS D	0.0	0.3	Short	30	0.0	NA
Lane 2	400	3.0	405 [1]	0.988	100	91.5	LOS F	32.8	235.5	Full	500	0.0	0.0
Lane 3	16	1.0	415	0.038	100	44.9	LOS D	0.7	5.1	Short	40	0.0	NA
Approach	417	2.9		0.988		89.7	LOS F	32.8	235.5				
West: Pine Street													
Lane 1	702	1.0	486	1.443	100	445.0	LOS F	127.5	900.1	Full	145	0.0	100.0
Approach	702	1.0		1.443		445.0	LOS F	127.5	900.1				
Intersection	2723	1.7		1.479		314.2	LOS F	127.5	900.1				

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

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.

ATTACHMENT C – IDM URBAN ROAD STANDARDS

Figure C1: Table 2 from Council's Infrastructure Design Manual

INFRASTRUCTURE DESIGN MANUAL

TABLE 2 - URBAN ROAD / STREET CHARACTERISTICS

Street Type	Indicative Maximum Traffic Volume	Carriageway Width	Minimum Reserve Width See Note 5 & 6	Minimum Verge Width	Parking Provision within Carriageway	Pedestrian / Cycle Provision within Road Reserve	Kerbing
Access Lane (second road frontage)	300 veh/day	5.5m	As determined by turning movements		Yes one side	No footpath	Nil if concrete road with central drain or SM2 or modified SM2 See note 3
Access Place	300 veh/day max. (maximum length 100m)	6.0m	14.0m	3.5m See Note 2	Yes (one side)	Footpath both sides No separate cycle provision	B2,SM2 or modified SM2 See note 3
Access Street	1000 veh/day max	7.5m	16.0m	3.5m See Note 2	Yes (both sides)	Footpath both sides No separate cycle provision	B2, SM2 or modified SM2 See note 3
Collector/Connector Street Level 1	3000 veh/day max	11.0m	24.0m	6.0m	Yes (both sides)	Shared path both sides	Barrier B2 Kerb outstands or splitters required at intersections and pedestrian crossing points
Collector/Connector Street Level 2 (alternatively called trunk collector)	6000 veh/day max	2 x 7.0m + 5.0m median	34.0m	6.0m	Yes (both sides)	Footpath both sides Shared path both sides	Barrier B2
Residential Court Bowl	n/a	10.0m radius	28.0m	3.5m See Note 2	n/a	Footpath both sides No separate cycle provision	SM2 or modified SM2 See note 3
Commercial Street	n/a	22.0m	32.0m	5.0m	Yes (both sides)	Footpath both sides Cycle provision where directed	Barrier B2
Industrial Street	n/a	12.5m See Note 1 below	25.0m	6.0m See Note 4	Yes (both sides)	Yes	Barrier B2
Industrial Court Bowl	n/a	15.0m radius	37.0m	3.5m	n/a	n/a	Barrier B2

ATTACHMENT D – TRAFFIC ESTIMATES

Figure D1: 2014 Traffic Generation Estimates (based on 80%/20% split in AM) and a yield of 11 lots/ha

Precinct	Area (ha)	Lots @ 11/ha	Peak Traffic @ 0.8vph/lot (vph)	Distribution Split	Distribution Access Point Direction	Distribution Access Point vph	Prescinct Totals (vph)	Orientation AM IN (20%)	Orientation AM OUT (80%)	Orientation PM IN (70%)	Orientation PM OUT (30%)
Stage 1: only precincts 6 & 7 and community hub developed with all traffic via access A											
6	18.16	200	160	100%	A (west)	160					
7	8.626	95	76	100%	A (west)	76					
Comm. Hub	1350m²		169	10%	A (west)	17	253	51	202	177	76
		295	404								
Stage 2: precincts 6, 7 & 1 and community hub developed with traffic split between access A & B											
6	18.16	200	160	92%	A (west)	147					
7	8.626	95	76	92%	A (west)	70					
Comm. Hub	1350m²		169	10%	A (west)	17					
1	23.04	253	203	92%	A (west)	187	420	84	336	294	126
6	18.16	200	160	8%	B (north)	13					
7	8.626	95	76	8%	B (north)	6					
1	23.04	253	203	8%	B (north)	16	35	7	28	25	11
		548	438	100%			455				
Stage 3: precincts 6, 7, 1, 2, 3, 4 & 5 developed and school included, traffic split between access A, B & C											
6	18.16	200	160	63%	A (west)	101					
7	8.626	95	76	63%	A (west)	48					
Comm. Hub	1350m²		169	10%	A (west)	17					
1	23.04	253	203	63%	A (west)	128					
2	25.04	275	220	63%	A (west)	139					
3	17.01	187	150	63%	A (west)	94					
4	13.67	150	120	63%	A (west)	76					
5	11.11	122	98	63%	A (west)	62	664	133	531	465	199
6	18.16	200	160	8%	B (north)	13					
7	8.626	95	76	8%	B (north)	6					
1	23.04	253	203	8%	B (north)	16					
2	25.04	275	220	8%	B (north)	18					
3	17.01	187	150	8%	B (north)	12					
4	13.67	150	120	8%	B (north)	10					
5	11.11	122	98	8%	B (north)	8	82	16	66	57	25
6	18.16	200	160	29%	C (east)	46					
7	8.626	95	76	29%	C (east)	22					
1	23.04	253	203	29%	C (east)	59					
2	25.04	275	220	29%	C (east)	64					
Grahamvale School	600 students + 35 staff		635	37%	C (east)	235					
3	17.01	187	150	29%	C (east)	43					
4	13.67	150	120	29%	C (east)	35					
5	11.11	122	98	29%	C (east)	28	533	201	332	302	230
		1283	1242	100%			1278				
Stage 4: all precincts, hub and school fully developed with traffic split between access A, B, C & D											
6	18.16	200	160	30%	A (west)	48					
7	8.626	95	76	30%	A (west)	23					
Comm. Hub	1350m²		169	10%	A (west)	17					
1	23.04	253	203	30%	A (west)	61					
2	25.04	275	220	30%	A (west)	66					
3	17.01	187	150	30%	A (west)	45					
4	13.67	150	120	30%	A (west)	36					
5	11.11	122	98	30%	A (west)	29					
9	18.23	201	160	30%	A (west)	48					
10	12.22	134	108	30%	A (west)	32	405	81	324	284	122
6	18.16	200	160	8%	B (north)	13					
7	8.626	95	76	8%	B (north)	6					
1	23.04	253	203	8%	B (north)	16					
2	25.04	275	220	8%	B (north)	18					
3	17.01	187	150	8%	B (north)	12					
4	13.67	150	120	8%	B (north)	10					
5	11.11	122	98	8%	B (north)	8					
9	18.23	201	160	8%	B (north)	13					
10	12.22	134	108	8%	B (north)	9	104	21	83	72	31
6	18.16	200	160	29%	C (east)	46					
7	8.626	95	76	29%	C (east)	22					
1	23.04	253	203	29%	C (east)	59					
2	25.04	275	220	29%	C (east)	64					
Grahamvale School	600 students + 35 staff		635	32%	C (east)	203					
3	17.01	187	150	29%	C (east)	43					
4	13.67	150	120	29%	C (east)	35					
5	11.11	122	98	29%	C (east)	28					
9	18.23	201	160	29%	C (east)	47					
10	12.22	134	108	29%	C (east)	31	579	171	364	327	209
6	18.16	200	160	33%	D (west)	53					
7	8.626	95	76	33%	D (west)	25					
1	23.04	253	203	33%	D (west)	67					
2	25.04	275	220	33%	D (west)	73					
Grahamvale School	600 students + 35 staff		635	5%	D (west)	32					
3	17.01	187	150	33%	D (west)	49					
4	13.67	150	120	33%	D (west)	40					
5	11.11	122	98	33%	D (west)	32					
9	18.23	201	160	33%	D (west)	53					
10	12.22	134	108	33%	D (west)	35	459	131	372	329	174
		1618	1510	100%			1546				

AM orientation split

IN 20% OUT 80%

Stage 1 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	253	2526	Collector Level 1

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	5/25	OUT	5/25
Access A	294	49 N	336	56 N
		245 S		280 S
Hawkins	from	177 W	to	202 W
		69 S		78 S

Peak Through Traffic

Verney Road (2008 x 1.2)

AM	PM
202 NB	299 NB
304 SB	245 SB
505 Σ	544 Σ

Indicative Turn Treatment

At Access A

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
56	280	245	299	600	CHR & AUL(S)

At Hawkins Street

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
0	177	304	202	505	CHR

Stage 2 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	420	4203	Trunk Collector
Access B	35	351	Access Street

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	5/25	OUT	5/25
Access A	465	77 N	531	88 N
		387 S		442 S
Hawkins	from	279 W	to	319 W
		108 S		124 S

Peak Through Traffic

Verney Road (2008 x 1.2)

AM	PM
202 NB	299 NB
304 SB	245 SB
505 Σ	544 Σ

Indicative Turn Treatment

At Access A

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
88	442	245	299	632	CHR & AUL(S)

At Hawkins Street

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
0	279	304	202	505	CHR

Stage 3 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	664	6636	Trunk Collector
Access B	82	821	Access Street
Access C	533	5327	Trunk Collector

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	2/27	OUT	2/27
Access C	201	14 N	332	23 N
AM		187 S		309 S
	302	21 N	230	16 N
PM		282 S		214 S

Peak Through Traffic

Grahamvale Road (2003 x 1.2)

AM	PM
226 NB	271 NB
269 SB	242 SB
494 Σ	514 Σ

Indicative Turn Treatment

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
187	14	242	271	700	CHR & AUL

Stage 4 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	405	4052	Trunk Collector
Access B	104	1036	Collector Level 1
Access C	579	5786	Trunk Collector
Access D	459	4589	Trunk Collector
		15464	

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
Access B	IN	100%	OUT	100%
AM	21	21 E	83	83 E
PM	72	72 E	31	31 E

Peak Through Traffic

Ford Road (2010 x 1.16)

AM	PM
242 EB	147 EB
172 WB	187 WB
414 Σ	334 Σ

Indicative Turn Treatment

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
21		147	187	187	AUL(S)

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	2/27	OUT	2/27
Access C	171	12 N	364	25 N
AM		159 S		339 S
	327	23 N	209	14 N
PM		304 S		194 S

Peak Through Traffic

Grahamvale Road (2003 x 1.2)

AM	PM
226 NB	271 NB
269 SB	242 SB
494 Σ	514 Σ

Indicative Turn Treatment

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
159	12	242	271	673	CHR & AUL

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	8/25	OUT	8/25
Access D	131	32 S	372	90 S
AM		99 W		282 W
		0 N		0 N
PM	329	80 S	174	42 S
		250 W		132 W
		0 N		0 N

Peak Through Traffic

Verney Road (2008 x 1.2)

AM	PM
202 NB	299 NB
304 SB	245 SB
505 Σ	544 Σ

Indicative Turn Treatment

Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
0	90	299	245	544	CHR

Figure D2: 2018 Traffic Generation Estimates (based on closure of Accesses B and C) and a yield of 10 lots/ha

Precinct	Area (ha)	Lots @ 10/ha	Peak Traffic @ 0.8vph/lot (vph)	Distribution Split	Access Point Direction	Access Point vph	Prescinct Totals (vph)	Orientation AM IN (20%)	AM OUT (80%)	PM IN (70%)	PM OUT (30%)
Stage 1: only precincts 6, 7, part 8 and community hub developed with all traffic via access A											
6	18.16	182	145	100%	A (west)	145					
7	8.626	86	69	100%	A (west)	69					
8	5.00	50	40	100%	A (west)	40					
Comm. Hub	1350m²		169	10%	A (west)	17	271	54	217	190	81
		318	423								
Stage 2: precincts 6, 7, 8, 1 and community hub developed with all traffic via access A											
6	18.16	182	145	100%	A (west)	145					
7	8.626	86	69	100%	A (west)	69					
8	5.00	50	40	100%	A (west)	40					
Comm. Hub	1350m²		169	10%	A (west)	17					
1	23.04	230	184	100%	A (west)	184	455	91	364	319	137
6	18.16	182	145	0%	B (north)	0					
7	8.626	86	69	0%	B (north)	0					
8	5.00	50	40	0%	B (north)	0					
1	23.04	230	184	0%	B (north)	0	0	0	0	0	0
		548	439	100%			455				
Stage 3: precincts 6, 7, 8, 1, 2, 3, 4 & 5 developed, all traffic via access A but school to Grahamvale Rd											
6	18.16	182	145	100%	A (west)	145					
7	8.626	86	69	100%	A (west)	69					
8	5.00	50	40	100%	A (west)	40					
Comm. Hub	1350m²		169	10%	A (west)	17					
1	23.04	230	184	100%	A (west)	184					
2	25.04	250	200	100%	A (west)	200					
3	17.01	170	136	100%	A (west)	136					
4	13.67	137	109	100%	A (west)	109					
5	11.11	111	89	100%	A (west)	89	990	198	792	693	297
6	18.16	182	145	0%	B (north)	0					
7	8.626	86	69	0%	B (north)	0					
8	5.00	50	40	0%	B (north)	0					
1	23.04	230	184	0%	B (north)	0					
2	25.04	250	200	0%	B (north)	0					
3	17.01	170	136	0%	B (north)	0					
4	13.67	137	109	0%	B (north)	0					
5	11.11	111	89	0%	B (north)	0	0	0	0	0	0
6	18.16	182	145	0%	C (east)	0					
7	8.626	86	69	0%	C (east)	0					
8	5.00	50	40	0%	C (east)	0					
1	23.04	230	184	0%	C (east)	0					
2	25.04	250	200	0%	C (east)	0					
Grahamvale School	600 students + 35 staff		635	100%	C (east)	635					
3	17.01	170	136	0%	C (east)	0					
4	13.67	137	109	0%	C (east)	0					
5	11.11	111	89	0%	C (east)	0	635	381	254	254	381
		1217	1189	100%			1625				
Stage 4: all precincts, hub and school fully developed with traffic split between access A & D											
6	18.16	182	145	100%	A (west)	145					
7	8.626	86	69	100%	A (west)	69					
8	5.00	50	40	100%	A (west)	40					
Comm. Hub	1350m²		169	10%	A (west)	17					
1	23.04	230	184	50%	A (west)	92					
2	25.04	250	200	100%	A (west)	200					
3	17.01	170	136	30%	A (west)	41					
4	13.67	137	109	0%	A (west)	0					
5	11.11	111	89	0%	A (west)	0					
9	18.23	182	146	0%	A (west)	0					
10	12.22	122	98	0%	A (west)	0	604	121	484	423	181
6	18.16	182	145	0%	B (north)	0					
7	8.626	86	69	0%	B (north)	0					
8	5.00	50	40	0%	B (north)	0					
1	23.04	230	184	0%	B (north)	0					
2	25.04	250	200	0%	B (north)	0					
3	17.01	170	136	0%	B (north)	0					
4	13.67	137	109	0%	B (north)	0					
5	11.11	111	89	0%	B (north)	0					
9	18.23	182	146	0%	B (north)	0					
10	12.22	122	98	0%	B (north)	0	0	0	0	0	0
6	18.16	182	145	0%	C (east)	0					
7	8.626	86	69	0%	C (east)	0					
8	5.00	50	40	0%	C (east)	0					
1	23.04	230	184	0%	C (east)	0					
2	25.04	250	200	0%	C (east)	0					
Grahamvale School	600 students + 35 staff		635	0%	C (east)	0					
3	17.01	170	136	0%	C (east)	0					
4	13.67	137	109	0%	C (east)	0					
5	11.11	111	89	0%	C (east)	0					
9	18.23	182	146	0%	C (east)	0					
10	12.22	122	98	0%	C (east)	0	0	0	0	0	0
6	18.16	182	145	0%	D (west)	0					
7	8.626	86	69	0%	D (west)	0					
8	5.00	50	40	0%	D (west)	0					
1	23.04	230	184	0%	D (west)	0					
2	25.04	250	200	50%	D (west)	100					
Grahamvale School	600 students + 35 staff		635	100%	D (west)	635					
3	17.01	170	136	70%	D (west)	95					
4	13.67	137	109	100%	D (west)	109					
5	11.11	111	89	100%	D (west)	89					
9	18.23	182	146	100%	D (west)	146					
10	12.22	122	98	100%	D (west)	98	1272	254	1018	891	382
		1521	1433				1877				

Access B & C closed

Orientation splits

AM / PM	IN	20% / 70%	OUT	80% / 30%

Stage 1 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	271	2712	Collector Level 1

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	5/25	OUT	5/25
Access A	319	53 N	364	61 N
		266 S		304 S
Hawkins	from	191 W	to	219 W
		74 S		85 S

Stage 2 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	455	4555	Collector Level 1
Access B	0	0	No access

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	13/25	OUT	13/25
Access A	693	237 N	792	271 N
		456 S		521 S
Hawkins	from	328 W	to	375 W
		128 S		146 S

Stage 3 Internal Traffic Volumes

	vph	vpd	Road Class
Access A	990	9901	Trunk Collector
Access B	0	0	No access
Access C	635		School Access only

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
School Access	IN	2/27	OUT	2/27
AM	381	26 N	254	18 N
		355 S		236 S
PM	254	18 N	381	26 N
		236 S		355 S

Stage 4 Internal (2 way) Traffic Volumes

	vph	vpd	Road Class
Access A	604	6045	Trunk Collector
Access B	0	0	No access
Access C	0	0	No access
Access D	1272	12467	Exceeds Trunk Collector
		18511	

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
	IN	100%	OUT	100%
Access B				
AM	0	0 E	0	0 E
PM	0	0 E	0	0 E

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
Access C	IN	2/27	OUT	2/27
AM	0	0 N	0	0 N
		0 S		0 S
PM	0	0 N	0	0 N
		0 S		0 S

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
Access D	IN	27W/33S	OUT	27W/33S
AM	254	140 S	1018	560 S
		115 W		458 W
		0 N		0 N
PM	891	490 S	382	210 S
		401 W		172 W
		0 N		0 N

Peak Turn Movements at each Access

	Dir	Split	Dir	Split
Access A	IN	25S/15N	OUT	25S/15N
AM	121	45 N	484	181 N
		0 W		0 W
		76 S		302 S
PM	423	159 N	181	68 N
		0 W		0 W
		264 S		113 S

Peak Through Traffic

Verney Road (2008 x 1.2)

	AM		PM	
	202	NB	299	NB
	304	SB	245	SB
	505	Σ	544	Σ

Indicative Turn Treatment

At Access A

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
AM						
PM	53	266	299	245	597	signals or roundabout

At Hawkins Street

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
PM	0	219	245	299	544	signals or rbt

Peak Through Traffic

Verney Road (2008 x 1.2)

	AM		PM	
	202	NB	299	NB
	304	SB	245	SB
	505	Σ	544	Σ

Indicative Turn Treatment

At Access A

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
AM						
PM	271	521	245	299	815	signals or rbt

At Hawkins Street

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
PM	0	328	304	202	505	signals or rbt

Peak Through Traffic

Grahamvale Road (2003 x 1.2)

	AM		PM	
	226	NB	271	NB
	269	SB	242	SB
	494	Σ	514	Σ

Indicative Turn Treatment

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
AM	355	26	242	271	868	signals or rbt

Peak Through Traffic

Ford Road (2010 x 1.16)

	AM		PM	
	242	EB	147	EB
	172	WB	187	WB
	414	Σ	334	Σ

Indicative Turn Treatment

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
AM						
PM	0	0	147	187	187	Nil

Peak Through Traffic

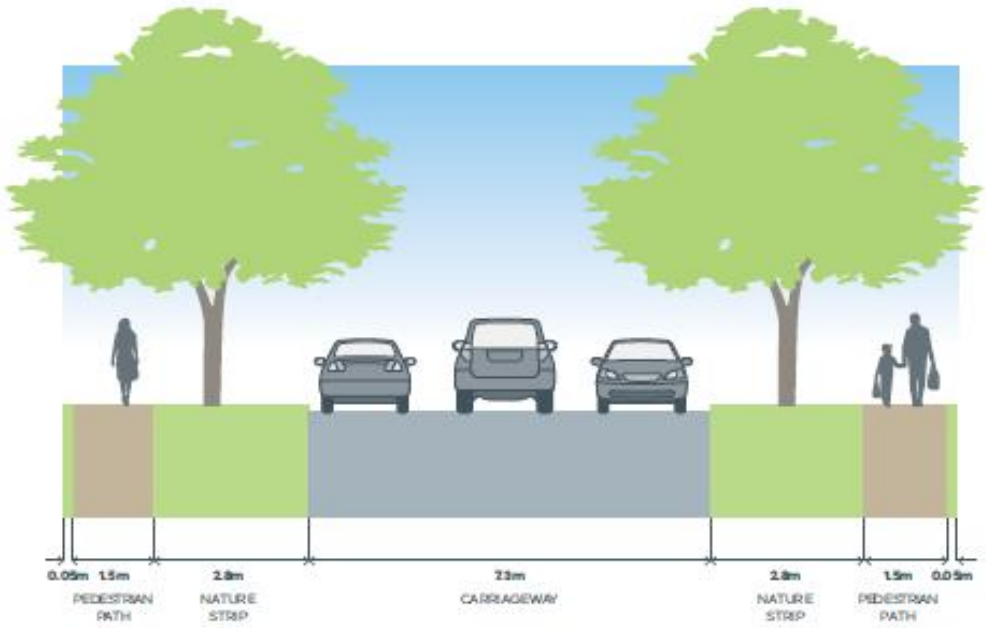
Grahamvale Road (2003 x 1.2)

	AM		PM	
	226	NB	271	NB
	269	SB	242	SB
	494	Σ	514	Σ

Indicative Turn Treatment

	Q_L	Q_R	Q_{T1}	Q_{T2}	Q_M	Treatment
AM	0	0	269	226	494	Nil
PM	0	0	242	271	514	Nil

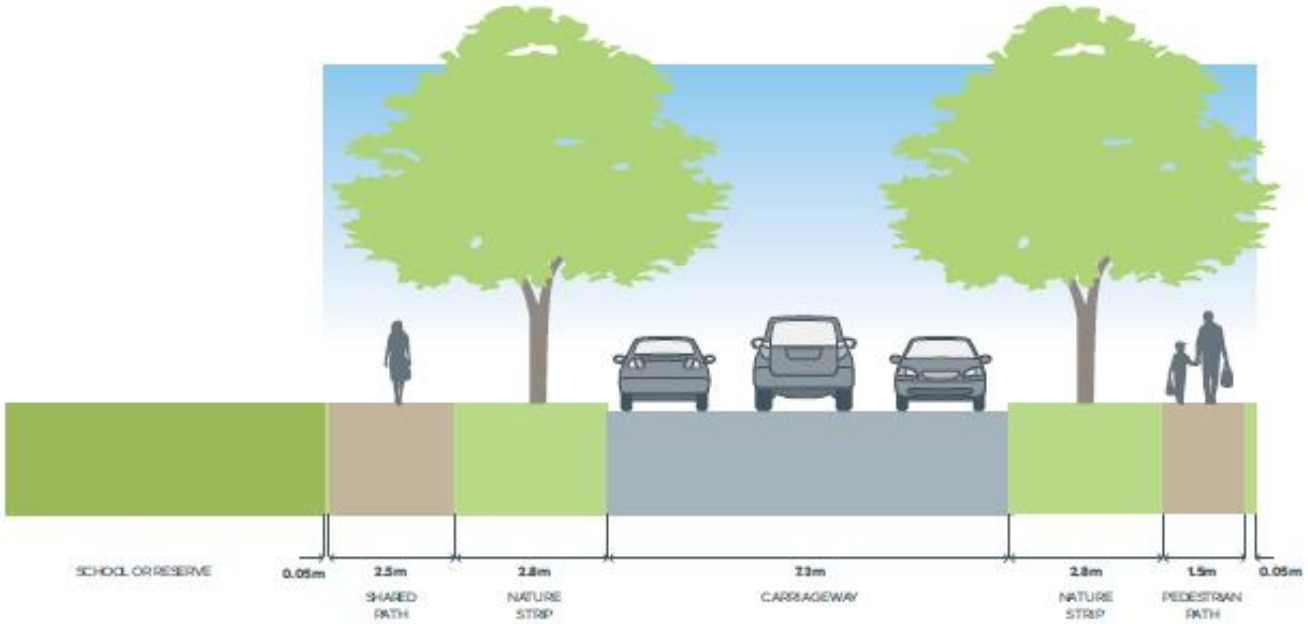
ATTACHMENT E – POST-EXHIBITION CROSS-SECTIONS



NOTES:

- Minimum street tree mature height 12 metres
- All kerbs are to be SM modified (refer to the Infrastructure Design Manual)

Section 1
Access Street (16.0m)

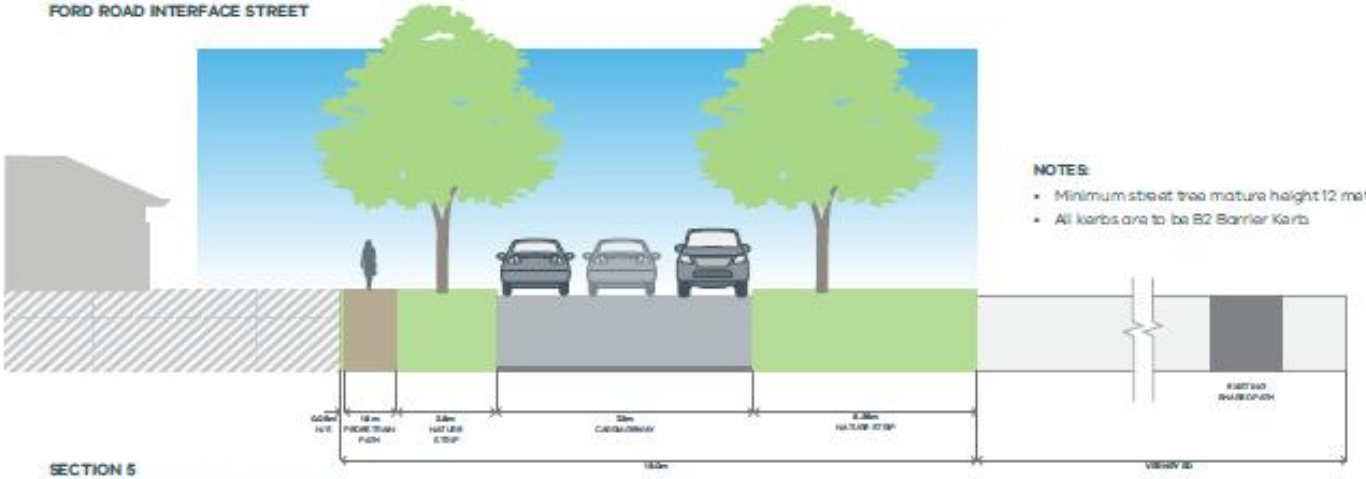


NOTES:

- Minimum street tree mature height 12 metres
- All kerbs are to be B2 Barrier Kerb (fronting school or reserve SM Modified elsewhere)

Section 3
Reserve and School interface street (17.0m)

SECTION 4
FORD ROAD INTERFACE STREET

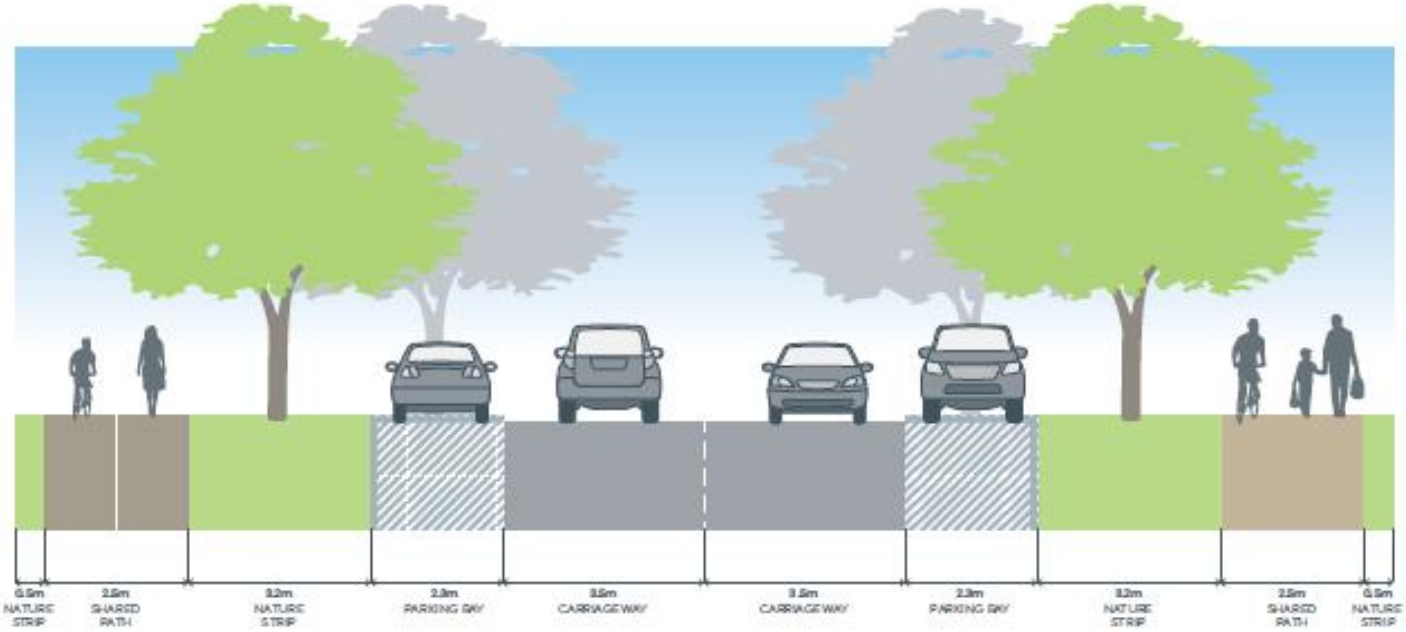


SECTION 5
VERNEY ROAD INTERFACE STREET

NOTES:

- Minimum street tree mature height 12 metres
- All kerbs are to be B2 Barrier Kerb

Interface Streets

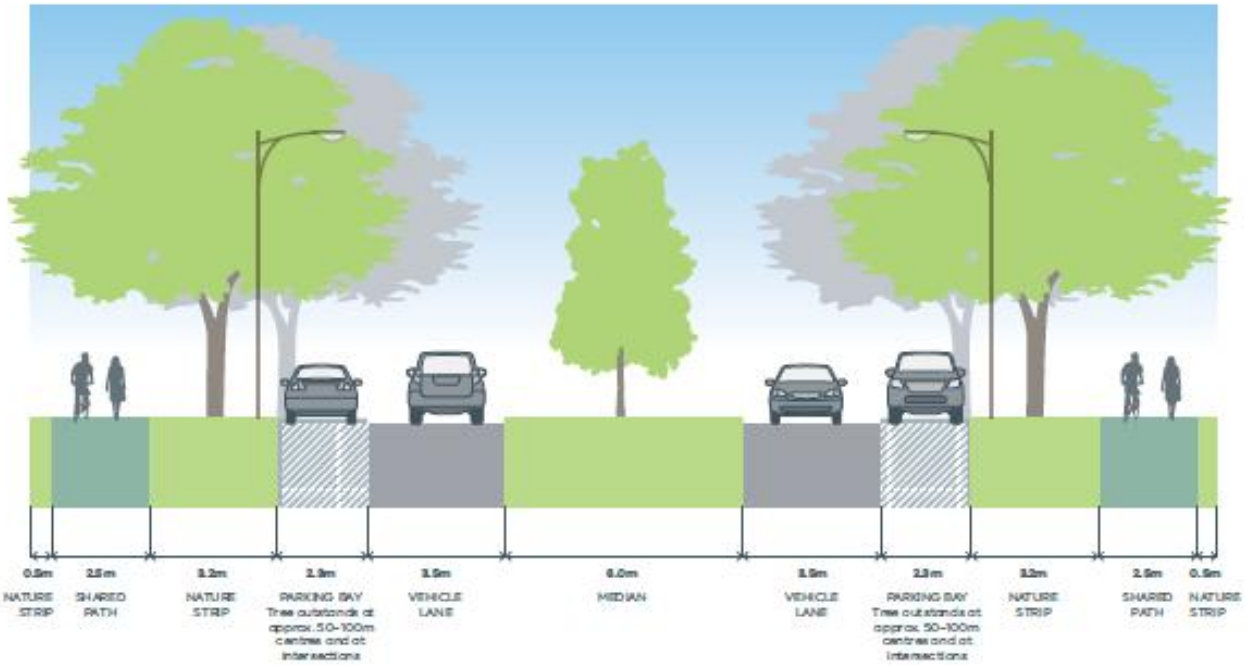


NOTES:

- Minimum street tree mature height 15 metres.
- All kerbs are to be B2 Barrier Kerb as per the Infrastructure Design Manual.
- Where roads abut school drop-off zones and thoroughfares, grassed nature strip should be replaced with pavement. Canopy tree planting must be incorporated into any additional pavement.
- Verge widths may be reduced where roads abut open space with the consent of the responsible authority.

Section 6
Connector Street Level 1 (24.0m)

Victorian Planning Authority



NOTES:

- Minimum street tree mature height 15 metres.
- All kerbs are to be B2 Barrier Kerb as per the Infrastructure Design Manual.
- Where roads abut school drop-off zones and thoroughfares, grassed nature strip should be replaced with pavement. Canopy tree planting must be incorporated into any additional pavement.
- Verge widths may be reduced where roads abut open space with the consent of the responsible authority.

Section 7
Connector Street Level 2 (30.0m)

ATTACHMENT F – ROAD LENGTH COST ESTIMATES

Figure F1: Stand-alone development cross-section (Interim 1) for Road-01

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-01 Access Street (16.0m) x 400m long				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	1920	m^3	30	57,600	16m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	2920	m^2	65	189,800	7.3m x 400m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	48	38,400	400m x 2 sides
3.2	Pedestrian Paths	1200	m^2	70	84,000	400m x 1.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	22	Lm	152	3,344	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	800	Lm	17.5	14,000	400m x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		15,000	6m x 400m @ $6/$m^2$
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	659,144	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		21,422	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		32,957	
10.4	Environmental Management	0.5	%		3,296	
10.5	Survey/Design	5	%		32,957	
10.6	Supervisio & Project Management	9	%		59,323	
10.7	Site Establishment	2.5	%		16,479	
10.8	Contingency	15	%		98,872	
	SUB-TOTAL DELIVERY			$	265,305	
11	**TOTAL ESTIMATED COST**			$	924,449	

Figure F2: Integrated development cross-section (Interim 2) for Road-01

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-01 Connector Street (24.0m) + Trunk terminal				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	3000	m³	30	90,000	24m wide x 0.3m x 400m + 5%
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4650	m²	65	302,250	11.6m x 400m (urban pavement)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1000	Lm	48	48,000	400m x 2 sides + 200m (median)
3.2	Pedestrian Paths	2000	m²	35	70,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	36	Lm	152	5,472	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	1000	Lm	17.5	17,500	400m x 2 sides + 200m (median)
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	36	No	150	5,400	25m spacing x 2 sides + median
6.2	Landscaping		Item		15,000	6m x 400m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	805,822	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		26,189	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		40,291	
10.4	Environmental Management	0.5	%		4,029	
10.5	Survey/Design	5	%		40,291	
10.6	Supervisio & Project Management	9	%		72,524	
10.7	Site Establishment	2.5	%		20,146	
10.8	Contingency	15	%		120,873	
	SUB-TOTAL DELIVERY			$	324,343	
11	**TOTAL ESTIMATED COST**			$	1,130,165	

Figure F3: Connector Level 1 cross-section as per PSP (Ultimate 1) for Road-01

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-01 Connector Street (24.0m as per PSP)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	2880	m^3	30	86,400	24m wide x 0.3m x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4650	m^2	65	302,250	11.6m x 400m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	48	38,400	400m x 2 sides
3.2	Pedestrian Paths	2000	m^2	35	70,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	36	Lm	152	5,472	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	800	Lm	17.5	14,000	400m x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		15,000	6m x 400m @ $6/$m^2$
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	788,522	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		25,627	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		39,426	
10.4	Environmental Management	0.5	%		3,943	
10.5	Survey/Design	5	%		39,426	
10.6	Supervisio & Project Management	9	%		70,967	
10.7	Site Establishment	2.5	%		19,713	
10.8	Contingency	15	%		118,278	
	SUB-TOTAL DELIVERY			$	317,380	
11	**TOTAL ESTIMATED COST**			$	1,105,902	

Figure F4: Trunk Collector cross-section + roundabout as per PSP (Ultimate 2) for Road-01

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-01 Trunk Collector (30.0m as per PSP)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	3600	m³	30	108,000	30m wide x 0.3m x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	9280	m²	65	603,200	11.6m x 2 x 400m (urban)
2.2	Pavement Other	340	m²	65	22,100	roundabout pavement
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1600	Lm	48	76,800	400m x 2 sides x 2 c'ways
3.2	Kerb & Channel	40	Lm	66	2,640	roundabout kerb + subsoil drain
3.3	Pedestrian Paths	2000	m²	35	70,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	53	Lm	152	8,056	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	1600	Lm	17.5	28,000	400m x 2 sides x 2 c'ways
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		30,000	6m + 6m median x 400m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	1,205,796	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		39,188	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		60,290	
10.4	Environmental Management	0.5	%		6,029	
10.5	Survey/Design	5	%		60,290	
10.6	Supervisio & Project Management	9	%		108,522	
10.7	Site Establishment	2.5	%		30,145	
10.8	Contingency	15	%		180,869	
	SUB-TOTAL DELIVERY			$	485,333	
11	**TOTAL ESTIMATED COST**			$	1,691,129	

Figure F5: Stand-alone development cross-section (Interim 1) for Road-02

	ROAD/INTERSECTION - COST ESTIMATE FOR:			ROAD-02 Access Street (16.0m) + Connector terminal		
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	3170	m³	30	95,100	16m wide x 0.3m x 600m + 10%
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4820	m²	65	313,300	7.3m x 600m + 10% (urban)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1200	Lm	48	57,600	600m x 2 sides
3.2	Pedestrian Paths	1800	m²	70	126,000	600m x 1.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	30	Lm	152	4,560	4 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	175	52,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	2200	17,600	2 @ 150m spacing
4.3	Drainage - subsoil drainage	1200	Lm	17.5	21,000	600m x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	48	No	150	7,200	25m spacing x 2 sides
6.2	Landscaping		Item		22,000	6m x 600m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	941,860	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		30,610	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		47,093	
10.4	Environmental Management	0.5	%		4,709	
10.5	Survey/Design	5	%		47,093	
10.6	Supervisio & Project Management	9	%		84,767	
10.7	Site Establishment	2.5	%		23,547	
10.8	Contingency	15	%		141,279	
	SUB-TOTAL DELIVERY			$	379,099	
11	**TOTAL ESTIMATED COST**			$	1,320,959	

Figure F6: Integrated development cross-section (Interim 2) for Road-02

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-02 Trunk Collector (30.0m)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	5400	m³	30	162,000	30m wide x 0.3m deep x 600m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	6960	m²	65	452,400	2 x 5.8m x 600m (urban)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	2400	Lm	48	115,200	600m x 2 sides x 2 c'ways
3.2	Pedestrian Paths	3000	m²	70	210,000	600m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	70	Lm	152	10,640	4 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	175	52,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	2200	17,600	2 @ 150m spacing
4.3	Drainage - subsoil drainage	2400	Lm	17.5	42,000	600 x 2 sides x 2 c'ways
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	72	No	150	10,800	25m spacing x 2 sides + median
6.2	Landscaping		Item		48,250	2 x 3.7m + 6.0m x 600m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		12,000	
8.2	Regulatory signs		Item		3,000	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	1,351,890	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		43,936	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		67,595	
10.4	Environmental Management	0.5	%		6,759	
10.5	Survey/Design	5	%		67,595	
10.6	Supervisio & Project Management	9	%		121,670	
10.7	Site Establishment	2.5	%		33,797	
10.8	Contingency	15	%		202,784	
	SUB-TOTAL DELIVERY			$	544,136	
11	**TOTAL ESTIMATED COST**			$	1,896,026	

Figure F7: Connector Level 1 cross-section as per PSP (Ultimate 1) for Road-02

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-02 Connector Level 1 (24.0m) as per PSP				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	4320	m^3	30	129,600	24m wide x 0.3m deep x 600m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	6960	m^2	65	452,400	11.6m x 600m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1200	Lm	48	57,600	600m x 2 sides
3.2	Pedestrian Paths	3000	m^2	70	210,000	600m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	48	Lm	152	7,296	4 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	175	52,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	2200	17,600	2 @ 150m spacing
4.3	Drainage - subsoil drainage	1200	Lm	17.5	21,000	600 x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	48	No	150	7,200	25m spacing x 2 sides
6.2	Landscaping		Item		26,600	2 x 3.7m x 600m @ $6/$m^2$
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		12,000	
8.2	Regulatory signs		Item		3,000	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	1,212,296	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		39,400	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		60,615	
10.4	Environmental Management	0.5	%		6,061	
10.5	Survey/Design	5	%		60,615	
10.6	Supervisio & Project Management	9	%		109,107	
10.7	Site Establishment	2.5	%		30,307	
10.8	Contingency	15	%		181,844	
	SUB-TOTAL DELIVERY			$	487,949	
11	**TOTAL ESTIMATED COST**			$	1,700,245	

Figure F8: Trunk Collector cross-section + roundabout as per PSP (Ultimate 2) for Road-02

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-02 Trunk Collector (30.0m) as per PSP				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	5400	m^3	30	162,000	30m wide x 0.3m deep x 600m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	6960	m^2	65	452,400	2 x 5.8m x 600m (urban)
2.2	Pavement Other	340	m^2	65	22,100	roundabout pavement
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	2400	Lm	48	115,200	600m x 2 sides x 2 c'ways
3.2	Kerb & Channel	40	Lm	66	2,640	roundabout kerb + subsoil drain
3.3	Pedestrian Paths	3000	m^2	70	210,000	600m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	70	Lm	152	10,640	4 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	175	52,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	2200	17,600	2 @ 150m spacing
4.3	Drainage - subsoil drainage	2400	Lm	17.5	42,000	600 x 2 sides x 2 c'ways
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	72	No	150	10,800	25m spacing x 2 sides + median
6.2	Landscaping		Item		48,250	2 x 3.7m + 6.0m x 600m @ $6/$m^2$
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		12,000	
8.2	Regulatory signs		Item		3,000	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	1,376,630	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		44,740	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		68,832	
10.4	Environmental Management	0.5	%		6,883	
10.5	Survey/Design	5	%		68,832	
10.6	Supervisio & Project Management	9	%		123,897	
10.7	Site Establishment	2.5	%		34,416	
10.8	Contingency	15	%		206,495	
	SUB-TOTAL DELIVERY			$	554,094	
11	**TOTAL ESTIMATED COST**			$	1,930,724	

Figure F9: Stand-alone development cross-section (Interim 1) for Road-03

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-03 Access Street (16.0m)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	1920	m³	30	57,600	16m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	2920	m²	65	189,800	7.3m x 400m (urban pavement)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	48	38,400	400m x 2 sides
3.2	Pedestrian Paths	1200	m²	70	84,000	400m x 1.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	22	Lm	152	3,344	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	800	Lm	17.5	14,000	400 x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		15,000	6m x 400m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	659,144	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		21,422	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		32,957	
10.4	Environmental Management	0.5	%		3,296	
10.5	Survey/Design	5	%		32,957	
10.6	Supervisio & Project Management	9	%		59,323	
10.7	Site Establishment	2.5	%		16,479	
10.8	Contingency	15	%		98,872	
	SUB-TOTAL DELIVERY			$	265,305	
11	**TOTAL ESTIMATED COST**			$	924,449	

Figure F10: Integrated development cross-section (Interim 2) for Road-03

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-03 Connector Street (24.0m)				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	2880	m³	30	86,400	24m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4640	m²	65	301,600	11.6m x 400m (urban pavement)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	48	38,400	400m x 2 sides
3.2	Pedestrian Paths	2000	m²	35	70,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	35	Lm	152	5,320	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	800	Lm	17.5	14,000	400 x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		17,700	7.4m x 400m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	790,420	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		25,689	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		39,521	
10.4	Environmental Management	0.5	%		3,952	
10.5	Survey/Design	5	%		39,521	
10.6	Supervisio & Project Management	9	%		71,138	
10.7	Site Establishment	2.5	%		19,761	
10.8	Contingency	15	%		118,563	
	SUB-TOTAL DELIVERY			$	318,144	
11	**TOTAL ESTIMATED COST**			$	1,108,564	

Figure F11: Connector Level 1 cross-section as per PSP (Ultimate 1) for Road-03

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-03 Connector Street (24.0m) as per PSP				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	2880	m^3	30	86,400	24m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4650	m^2	65	302,250	11.6m x 400m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	48	38,400	400m x 2 sides
3.2	Pedestrian Paths	2000	m^2	35	70,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	36	Lm	152	5,472	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	800	Lm	17.5	14,000	400 x 2 sides
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		15,000	6.0m x 400m @ $6/$m^2$
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	788,522	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		25,627	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		39,426	
10.4	Environmental Management	0.5	%		3,943	
10.5	Survey/Design	5	%		39,426	
10.6	Supervisio & Project Management	9	%		70,967	
10.7	Site Establishment	2.5	%		19,713	
10.8	Contingency	15	%		118,278	
	SUB-TOTAL DELIVERY			$	317,380	
11	**TOTAL ESTIMATED COST**			$	1,105,902	

Figure F12: Trunk Collector cross-section + roundabout as per PSP (Ultimate 2) for Road-03

	ROAD/INTERSECTION - COST ESTIMATE FOR:	ROAD-03 Trunk Collector (30.0m) as per PSP				
Item	**Description**	**Quantity**	**Unit**	**Rate $**	**Amount**	**Comments**
	WORKS					
1	**SITEWORKS AND EARTHWORKS**					
1.1	Site preparation		Item			
1.2	Earthworks	3600	m³	30	108,000	30m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	9280	m²	65	603,200	11.6m x 2 x 400m (urban)
2.2	Pavement Other	340	m²	65	22,100	roundabout pavement
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1600	Lm	48	76,800	400m x 2 sides x 2 c'ways
3.2	Kerb & Channel	40	Lm	66	2,640	roundabout kerb + subsoil drain
3.3	Pedestrian Paths	2000	m²	35	70,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	53	Lm	152	8,056	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	175	35,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	2200	13,200	2 @ 150m spacing
4.3	Drainage - subsoil drainage	1600	Lm	17.5	28,000	400 x 2 sides x 2 c'ways
4.4	Drainage - miscellaneous		Item			
5	**TRAFFIC**					
5.1	Traffic signals		Item			
5.2	Traffic safety		Item			
6	**LANDSCAPE**					
6.1	Trees	32	No	150	4,800	25m spacing x 2 sides
6.2	Landscaping		Item		30,000	6m + 6m median x 400m @ $6/m²
7	**STREET LIGHTING**					
7.1	Street lighting		Item		150,000	
8	**MISCELLANEOUS**					
8.1	Line marking		Item		8,000	
8.2	Regulatory signs		Item		1,500	
8.3	Work maintenance - up to 1 year		Item		1,000	
8.4	Landscape maintenance - 1yr/2 summers		Item		1,500	
8.5	Traffic signals - 10 year maintenance fee		Item			
9	**OTHER**					
9.1	List		Item			
	SUB-TOTAL WORKS			$	1,205,796	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		39,188	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		60,290	
10.4	Environmental Management	0.5	%		6,029	
10.5	Survey/Design	5	%		60,290	
10.6	Supervisio & Project Management	9	%		108,522	
10.7	Site Establishment	2.5	%		30,145	
10.8	Contingency	15	%		180,869	
	SUB-TOTAL DELIVERY			$	485,333	
11	**TOTAL ESTIMATED COST**			$	1,691,129	