Planning Scheme Amendment C118

Shepparton North East PSP/DCP

Expert Witness Statement

STATEMENT TO PLANNING PANELS VICTORIA

by John Bob Citroën, TRAFFIC ENGINEER

20 August 2018

Trafficworks Project No. 170769

Instructions: Mr Michael MacDonagh & Ms Emily Killin

On behalf of Greater Shepparton City Council and VPA

Statement Prepared: 13/08/2018

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1 QUALIFICATIONS

My name is John Bob Citroën and I practise as a Senior Associate Traffic Engineer with Trafficworks Pty Ltd, First Floor, 132 Upper Heidelberg Road, Ivanhoe 3079.

My educational qualifications and membership of professional associations are as follows:

- Diploma of Engineering (Civil), Swinburne University;
- Graduate Diploma in Road Safety, University of New England;
- Member, Institution of Engineers, Australia.

I have over 48 years' experience in road construction and traffic engineering, 33 years with VicRoads and 15 years in private practice, initially with John Piper Traffic, then CPG Australia (CPG). In April 2011, I left CPG and joined Trafficworks Pty Ltd.

My areas of expertise include traffic and transport planning, road safety auditing of projects, traffic impact and parking assessments for a variety of land developments and general traffic engineering and road safety issues.

A copy of relevant information to support this Expert Evidence is provided at Attachment A to this report.

My declaration in regard to this statement is provided in Section 4.

2 BACKGROUND

2.1 Introduction

Trafficworks Pty Ltd was initially engaged by Greater Shepparton City Council (the Council) in 2014 to review a number of previous traffic studies[1] and undertake a comprehensive traffic assessment for the Shepparton North East Growth Corridor. This resulted in preparation of the Traffic Impact Assessment Report (TIAR) dated 15/09/2014, which I authored.

A review of the growth corridor proposals indicated that proposed residential land in the southeast corner of the precinct had the potential to be adversely impacted by existing industries in the adjacent industrial estate. Alternative rezoning of this impacted land was considered and Trafficworks was engaged to assess traffic impacts resulting from such a change in zoning. This resulted in my preparation of Addendum Report (A) dated 11/01/2017 to inform consideration of rezoning options. This rezoning did not proceed and Addendum Report A had no further relevance to the formulation of Amendment C118.

Subsequently, the Victorian Planning Authority (VPA) and the Council prepared Amendment C118 to the Greater Shepparton Planning Scheme to implement the Shepparton North East Precinct Structure Plan (PSP) and the Development Contributions Plan (DCP) to facilitate development of the land within the precinct. Exhibition of this Amendment in early 2018 elicited 17 submissions.

Trafficworks was again engaged to prepare an addendum report to the original TIAR to address a number of the traffic-related matters raised in the submissions. I prepared the Addendum Report B, dated 13/07/2018, which informed the revision of Amendment C118 that was published on 16/07/2018. Addendum Report B was also published as part of documentation accompanying the revised Amendment C118, which elicited a further 10 submissions by the closing date at end July.

I have since been requested by the Council and VPA to prepare an expert witness statement, and present this statement at Planning Panels Victoria set for 20 and 21 August 2018, broadly in relation to:

- the merits of the proposed transport and movement network in the updated PSP
- the costing of the transport projects included in the DCP.

I was instructed that my expert witness statement was to include, amongst other things, my opinions on:

[1] Reports included: *Shepparton North East Growth Corridor Development, Traffic Impact Assessment,* draft report by Nordic Pty Ltd, dated 21 November 2008

Shepparton North East Growth Corridor, Appendix F, Traffic Impact Assessment, draft by AECOM Australia Pty Ltd dated 17 December 2009

Shepparton North East Growth Corridor, Structure Plan, Traffic Engineering Assessment, by TraffixGroup Pty Ltd dated 7 March 2011.

a) whether the PSP adequately implements the recommendations referred to in my 2018 Addendum Report and, to the extent it is still relevant, the 2014 TIAR

b) the transport related issues raised in the submissions (these are summarised in Section 2.2)

c) the accuracy of costings for the collector road upgrades

d) whether I support deletion of proposed IN-03 (Access C) to Grahamvale Road if access to the precinct is provided via a proposed roundabout at the intersection of Ford Road and Grahamvale Road (as suggested by VicRoads) and, related to this, my opinion about:

    i. the impact on the transport network if intersection IN-03 is deleted and access to the precinct is provided via a roundabout at Ford and Grahamvale Roads

    ii. what consequential modifications to the internal transport network would be required if IN-03 is deleted and access to the precinct is provided via a roundabout at Ford and Grahamvale Roads. This is to include consequential modifications to the length, alignment and cost of RD-03

    iii. the infrastructure and land required to ensure access to the precinct can be realised at the intersection of Ford and Grahamvale Roads.

Extracts from Plan 3 – Land Use Budget and Plan 5 – Transport and Movement from the amended PSP have been reproduced in Figures 1 and 2 over the page for reference with respect to parcel numbering and for road and intersection identification.

Figure 1: Extract from PSP Plan 3 showing parcel numbering

Figure 2: Extract from PSP Plan 5 showing road and intersection numbering

2.2 Submissions

Of the initial 17 submissions, four contained concerns with respect to traffic and road infrastructure issues. These were addressed in my Addendum Report. The additional submissions following the publication of revised proposals in July 2018 acknowledged that the majority of the initial issues had been addressed. However, there remained four new submissions that still contained matters relating to traffic and road infrastructure. These issues can be summarised as follows:

1. The impact of providing access to the precinct via a proposed roundabout at the intersection of Ford Road and Grahamvale Road (as proposed by VicRoads) on residential lot yield achievable within the precinct
2. Whether the revised costs of new traffic infrastructure in the 2018 Addendum Report are based on construction costs in metropolitan Melbourne rather than regional Victoria
3. Whether the distribution of the proposed transport network is fair and equitable, with particular concern expressed over the location of RD-02 in Parcel 13

4. Why the 2018 Addendum Report identifies the traffic generation parameters as based on 10 lots per gross hectare, compared with 10 lots per net developable hectare as per the PSP
5. Whether traffic volumes have been over estimated and, related to this, whether the proposed cross-sections need to be adjusted accordingly
6. Whether RD-02 needs to be 30m wide and 600m long
7. Whether Attachment C in the 2018 Addendum Report is based on an outdated version of the IDM and, if so, the implications of this
8. Whether the costings for RD-01, RD-02 and RD-03 in the 2018 Addendum Report are correct, particularly having regard to the inclusion of costs for:
    a. Dual carriageways in RD-01 and RD-03
    b. RD-01 and RD-02 that are also included as intersection projects.

This statement does not duplicate the previous findings but should be read in conjunction with the 2014 TIAR and the 2018 Addendum Report. In Section 3 of this statement I have provided a brief overview of the previous two reports, responded to the above matters raised in submissions and have provided additional commentary on some of the findings in the earlier reports.

2.3 References

References used in the preparation of this statement include the following:

- *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, Addendum to Traffic Impact Assessment Report,* Addendum Report B, prepared by Trafficworks Pty Ltd, dated 13 July 2018
- *Shepparton North East, Precinct Structure Plan,* prepared by the Victorian Planning Authority and dated July 2018
- *Shepparton North East, Development Contributions Plan,* prepared by the Victorian Planning Authority and dated July 2018
- Local Government Infrastructure Design Association's *Infrastructure Design Manual*, Version 5.10, released 11 Jan 2018

3 THE REPORTS

3.1 2014 TIAR

The aim of the 2014 TIAR I authored, was to update findings in various previous documents and to present a consolidated status report on traffic impacts for the North-East Growth Corridor. In preparing this report, I also provided ongoing design advice to Greater Shepparton City Council that informed development of aspects of the Precinct Structure Plan (PSP), particularly with respect to the internal street network and external road connections.

The TIAR describe the road network bounding the precinct that comprises:

- Verney Road to the west - a sub-arterial managed by Council; recently upgraded, with signalisation of its intersection with Balaclava Road/New Dookie Road/Hawdon Street, to the south of the precinct, to commence in the current financial year
- Grahamvale Road to the east – forming part of the Shepparton Alternative Route (SAR); a State Arterial Road (C391) managed by VicRoads
- Ford Road – currently a local road but proposed to be declared a State Arterial Road and ceded to VicRoads control for upgrading to provide the arterial east-west link between the Shepparton Bypass to the west and the SAR to the east,

The report incorporated the outcomes of the above collaborative design approach, with key findings presented in the areas of:

- Control and configuration of external road connections
- Internal road configuration consistent with the IDM
- Reorientation of access to Grahamvale Primary School
- Provision for bus routes through the precinct
- Staging issues related to Grahamvale Road access.

It should be noted that the assessments for this report were based on traffic generation estimates that assumed a lot yield of 11 lots/ha and that street profiles were based on Version 4.2 of the IDM (dated November 2013) that had lower traffic threshold volumes for each of the road types than those contained in the current IDM Version 5.10.

3.2 2018 Addendum TIAR

Greater Shepparton City Council and the VPA engaged Trafficworks to prepare an Addendum Report to the 2014 TIAR for the North East Growth Corridor. This Addendum Report was authored by me and was specifically requested to investigate 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 (original IN-04 but since abandoned) onto Ford Road

ii. The impact of deletion or change to left-in/left-out operation for the intersection at Access C (IN-03) 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 (IN-01) can be deleted and the traffic signals for Access D (IN-02) can be replaced with a roundabout

v. Comment on the intersection layout for Access A (IN-01) (lane arrangements for the east approach) and Access D (IN-02) (realignment of the east approach into No 125 – parcel 16).

b. Connector Road Widenings

i. Determine the minimum access road standards at Accesses A, C and D (IN-01,IN- 03 & IN-02) 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).

The resulting Addendum Report dated 13 July 2018 informed the review of the PSP and resulted in preparation of the amended Plan 5 reproduced in Figure 2. The report was made available for public scrutiny on 16 July 2018. Specific issues raised in submissions following the July exhibition, as summarised in Section 2.2, are discussed below.

3.3 Discussion of traffic issues in submissions

3.3.1 Impact of a roundabout connection at Ford Road/Grahamvale Road

The impact of providing access to the precinct via a proposed roundabout at the intersection of Ford Road and Grahamvale Road (as proposed by VicRoads) on residential lot yield achievable within the precinct.

Details of the option for an alternative connection to Grahamvale Road via a proposed roundabout treatment at its intersection with Ford Road were not available for assessment as part of the 2018 Addendum Report. The roundabout concept plan since provided by VicRoads (reproduced in Attachment C) shows this to be a viable option to consider.

VicRoads has advised that the acquisition footprint of the suggested treatment is estimated to occupy approximately 1.4ha at the northeast corner of Parcel 3, where the treatment options are constrained by the railway line to the east and a major channel to the west. VicRoads has further

advised that the addition of an extra leg to this roundabout, to serve as access into the precinct, can be accommodated within the original footprint and would require no additional land acquisition.

As an alternative to the alignment of the new connection shown in Figure 2, an extension of the north-south connector road along a straight or easterly deviated alignment would require a reduced length of angled connecting alignment to link with the roundabout, thereby minimising inefficiencies inherent in the layout of lots along an angled road (see also discussion in Section 3.4.1).

3.3.2 Basis of cost estimates

Whether the revised costs of new traffic infrastructure in the 2018 Addendum Report are based on construction costs in metropolitan Melbourne rather than regional Victoria.

For comparison purposes, the cost estimates in the Addendum Report used the rates from the exhibited DCP. These have since been cross-checked with the most recent (2017) typical contract rates provided by Greater Shepparton City Council for pavement, kerb & channel, footpath and drainage installation tasks and have adopted the lower rate for earthworks as suggested in one of the submissions (refer adjusted estimates in Attachment B). Comparison of the estimated costs for various roads as provided in the Addendum Report and as re-estimated using Council rates is provided in Table 1.

As can be seen from Table 1, the majority of the adjustments resulted in an increase in the estimated cost in the range 2% to 9%, with two estimates reducing by 1%. The suggestion that inflated rates have been used for estimating the roadwork components of the DCP, as claimed in several of the submissions, cannot be substantiated.

Table 1: Comparison of cost estimates for road and traffic infrastructure

Road length and Stage	Cost as per Addendum Report	Cost adjusted to Council rates
RD-01 Stand-alone (interim 1)	$ 924,449	$ 942,943
RD-01 Integrated (interim 2)	$1,130,165	$1,215,647
RD-01 Connector 1 (ultimate 1)	$1,105,902	$1,247,369
RD-01 Trunk Collector (ultimate 2)	$1,691,129	$1,677,495
RD-02 Stand-alone (Interim 1)	$1,320,959	$1,325,734
RD-02 Integrated (interim 2)	$1,896,026	$1,980,190
RD-02 Connector 1 (ultimate 1)	$1,700,245	$1,716,828
RD-02 Trunk Collector (ultimate 2)	$1,930,724	$2,069,220
RD-03 Stand-alone (Interim 1)	$ 924,449	$ 942,943
RD-03 Integrated (interim 2)	$1,108,564	$1,217,686
RD-03 Connector 1 (ultimate 1)	$1,105,902	$1,214,761
RD-03 Trunk Collector (ultimate 2)	$1,691,129	$1,674,129

Note that the costs for RD-03 relate to the original alignment connecting to IN-03 at Grahamvale Road

3.3.3 Location of RD-02

Whether the distribution of the proposed transport network is fair and equitable, with particular concern expressed over the location of RD-02 in Parcel 13.

It is agreed that the location of RD-02 entirely within parcel 13 does not seem equitable. Section 3.6 item 2) in the Addendum Report indicated that

> *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*.

I have no reason to depart from this position and I recommend that RD-02 in the PSP be realigned to the south of open space OS-02 and the adjacent retardation basin RB-02 and that the key local access street be shifted in an easterly direction to maintain north-south connectivity between RD-01 and RD-02 clear of the reserves.

3.3.4 Traffic generation rate

> *Why the 2018 Addendum Report identifies the traffic generation parameters as based on 10 lots per gross hectare, compared with 10 lots per net developable hectare as per the PSP.*

Traffic generation estimates and directional assignments in the 2014 TIAR were based on the total (gross) areas of the major parcels (as identified in the Reeds Consulting ownership plan) and a lot yield of 11 lots per hectare. As such, these calculations only took into account PSP Parcels 1, 3, 4, 6, 11, 12, 13, 14, 17, 25 and 26.

Given the limited time available for the preparation of the supplementary assessments for the Addendum Report, the original spreadsheet was used and modified to adopt the lower lot yield of 10 lots per hectare and with altered traffic distributions to assess the various access closure options. This resulted in traffic generation estimates being based on a total area of 156.15ha, being the sum of the gross parcel areas identified above. This compares with a total (net) developable area of 144.83ha (obtained from Table 4.1 in Appendix A of the PSP). I agree that traffic generation estimates based on net developable area would have provided more accurate results. However, the impacts of such higher traffic generation rates (of less than 8%) were inconsequential in the selection of street profiles in this case. This outcome is discussed in detail in Section 3.3.5.

3.3.5 Traffic volumes and road cross-sections

> *Whether traffic volumes have been over estimated and, related to this, whether the proposed cross-sections need to be adjusted accordingly.*

Section 3.2 of the Addendum Report used Table 2 of the IDM version 5.10 to assess road profiles against estimated traffic volumes at full development of various stages of the precinct.

RD-01

For the case where this road serves a stand-alone development for Parcels 1 and 4, the Addendum Report notes that traffic volumes peak at 2,300vpd at the western end indicating an Access Street profile. With the inclusion of Parcel 12 this is expected to require upgrading of the section abutting the community hub to a Connector Street Level 1.

Ultimate development of the remainder of the precinct is expected to result in peak traffic volumes that exceed the Connector Street Level 1 upper threshold of 6,000vpd at the approach to Verney

Road and the report recommends that a Trunk Collector Street cross-section be applied abutting the community hub, with the remaining length conforming to the profile of a Connector Street Level 1.

If the traffic generation estimates were inflated by a factor of up to say 10% (refer paragraph 3.3.4) the above recommended street designations would not alter for the stand-alone case. However, at full development, deletion of the Trunk Collector cross-section along the community hub frontage could be considered. Given the complex vehicle manoeuvres at the hub entries and approaching the signalised intersection at Verney Road, it is considered desirable for these conflicting traffic movements to be controlled through a short section of divided carriageway with separate turn lanes. I recommend retention of the Trunk Collector profile along the frontage of the community hub.

RD-02

For the case where this road serves a stand-alone development for Parcels 13, 16 and 17, the Addendum Report notes that traffic volumes peak at over 3,000vpd at the western end indicating a Connector Street Level 1 profile at the western end. Assuming a linear decrease in traffic volumes towards the east, the report suggests the cross-section could be reduced to Access Street at approximately 150m from Verney Road.

The Addendum Report indicates that ultimate development of the remainder of the precinct, with Access C (IN-03) closed, is expected to result in traffic volumes exceeding the Trunk Collector Street lower threshold and the report recommends that a Trunk Collector Street status be applied for the full length of RD-02 to cater for such an access restriction along the precinct's eastern boundary.

Review of the 2014 TIAR shows that ultimate traffic volumes on RD-02, whilst retaining an access to Grahamvale Road (via either IN-03 or the proposed roundabout) is expected to peak at less than 6,000vpd. Under the relevant criteria of IDM Version 4.2 applicable at that time, the 2014 TIAR recommended Trunk Collector status for the road. The current IDM Version 5.10 requires the lower level Collector Street Level 1 for this route and this is now recommended (refer further discussion in Section 3.3.6).

Again, if the traffic generation estimates were inflated by a factor of up to 10% the above recommended street designations would not alter and there is no reason to change the above findings based on traffic generation estimates.

RD-03

The Addendum Report recommendations for this road are for it to be an Access Street if Parcel 6 were developed in its own right, and Connector Street Level 1 under ultimate layout conditions. A reduction in traffic generation estimates by up to 10% would result in the same assessment and there is no reason to change the findings of the Addendum Report.

3.3.6 Dimensions of RD-02

Whether RD-02 needs to be 30m wide and 600m long.

As noted above, without an access to Grahamvale Road, RD-02 is expected to experience traffic volumes in the range 6,000-12,000vpd for its full length through Parcels 13 and 17, a distance of some 730m. This places it within the Trunk Collector Street category located within the 30m reservation width nominated in the PSP, rather than the 34m reservation specified in the IDM.

However, with access to Grahamvale Road maintained, either at IN-03 or at the proposed roundabout, traffic levels on RD-02 are expected to fall below 6,000vpd, for which a Connector Street Level 1 is now appropriate. Traffic volumes will decrease progressively east from the Verney Road intersection but are not expected to fall below 2,500vpd within the limits of Parcels 13 & 17 and the Connector Street Level 1 profile should be maintained for the full length of RD-02.

This clarification on the cross-section options for RD-02, i.e. reduction from Trunk Collector to Connector Level 1 where access to Grahamvale Road is maintained, will need to be incorporated in the review of costings in the DCP.

3.3.7 IDM reference

Whether Attachment C in the 2018 Addendum Report is based on an outdated version of the IDM and, if so, the implications of this.

Assessments of road profiles in the Addendum Report are based on the Infrastructure Design Manual (IDM) Version 5.10 released 11 January 2018. Attachment C to the report inadvertently retained a reproduction of Table 2 from the earlier Version 4.2 of the IDM. However, references to cross sectional issues throughout the report used the criteria outlined in Table 2 of the current edition (reproduced in Attachment D to this statement).

3.3.8 Costs of RD-01, RD-02 and RD-03

Whether the costings for RD-01, RD-02 and RD-03 in the 2018 Addendum Report are correct, particularly having regard to the inclusion of costs for:

a. *Dual carriageways in RD-01 and RD-03*
b. *DR-01 and RD-02 that are also included as intersection projects*.

The costs for RD-01, RD-02 and RD-03 have been reviewed (refer summary in Table 1 and recalculations of the original estimates using Council rates in Attachment B). These include allowance for dual carriageways at the following locations:

- RD-01: Trunk Collector terminal at ultimate Stage
- RD-02: Trunk Collector at ultimate stage if no access to Grahamvale Road is provided

The cost estimates for these sections of road show little variation between the values in the Addendum Report and those recalculated using Council rates. They are considered reasonable estimates and I see no reason to change those relating to RD-01 and RD-02 on the basis of the rates used in the calculations.

The potential realignment of RD-03 to connect with the Ford Road/Grahamvale Road roundabout will require revision of costs relating to the change in length of RD-03. In addition, retention of access to Grahamvale Road (either at IN-03 or via the proposed roundabout) will involve adoption of the lesser standard Connector Street Level 1 status for RD-02 (see Section 3.3.6). Revised costings would need to be developed in the DCP to implement these changes.

3.4 Additional matters

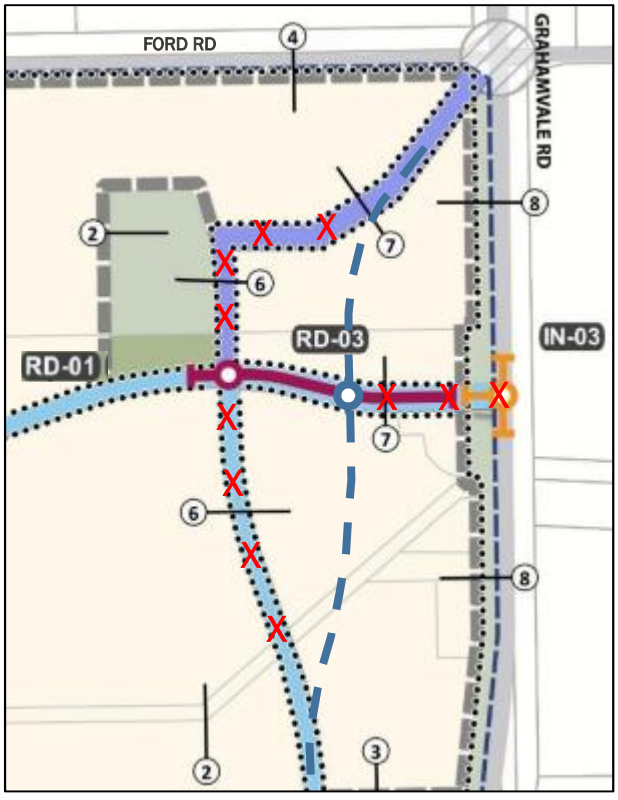
3.4.1 Access to the Ford Road/Grahamvale Road Roundabout

If the new access proposal suggested by VicRoads is accepted, it is likely to result in the following changes to the internal road network and external connections for the eastern part of the precinct:

- Closure of IN-03 (Access C) and removal of the signalised intersection at Grahamvale Road
- Realignment of RD-03 as a key external connector route to the east via the roundabout at Ford Road/Grahamvale Road
- Possible creation of an eastern frontage road to collect individual access movements generated by the multiple separate parcels along the Grahamvale Road frontage
- Reduction of the cross-section for RD-02 from trunk Collector to Connector Street Level 1.

I have assumed that traffic volumes along the realigned RD-03 will be comparable to those estimated for the original RD-03 alignment and that the same cross-section criteria will apply, i.e. Connector Street Level 1. An alternative alignment option for this road (shown as a blue dashed line in Figure 3) would minimise inefficiencies in lot layout design through Parcel 3, compared with the alignment shown in the current PSP (shown as purple with red cross-hatching in Figure 3).

Figure 3: Alternative road realignment for RD-03 as access to Grahamvale Road at Ford Road



The length of the new RD-03 connection to the proposed roundabout at Ford Road/Grahamvale Road is estimated to be approximately 380m, i.e. 50m longer than the original route length in the

order of 330m direct to Grahamvale Road at IN-03. The suggested alternative realignment would also require an easterly extension of RD-01 in the order of 120m as a Connector Street Level 1 to connect to the new alignment of RD-03.

However, a simpler channel crossing at its northern end and the deletion of the traffic signals at IN-03 are expected to accrue cost savings that will more than compensate for the extra road length of RD-03. This will need to be confirmed in a review of costs in the DCP.

3.4.2 Intersection IN-01 (Access A)

Section 3.1(iv) in the Addendum Report presents the outcomes of SIDRA analysis for the operation of Access A (IN-01) under various scenarios and supports the Council's preference for signalisation of this intersection. Given that it forms a cross intersection with Ryeland Drive on a sub-arterial road (Verney Road), operation of this intersection under Give Way control is likely to result in an elevated crash rate and its treatment with either a roundabout or traffic signals is considered mandatory. As roundabouts are not conducive to assisting pedestrian cross movements, the selection of signal control is further supported on the basis of vehicle crash minimisation as well as pedestrian accessibility in close proximity to a school and shops.

3.4.3 Proposed transport and movement network

The proposed access and internal road network is considered to respond appropriately to the traffic demands expected to be generated by the precinct on the basis that it includes the following features:

- Signalised intersection at Access A (IN-01) at the time of construction of RD-01
- Signalised intersection at Access D (IN-02) at the time of construction of RD-02
- An appropriate connection to Grahamvale Road. The provision of a stand-alone intersection at IN-03 is expected to operate satisfactorily if signalised. However the recently suggested relocation of this access to the intersection of Grahamvale Road and Ford Road, by way of an additional leg to the proposed roundabout at this location, as per the VicRoads layout shown in Attachment C, is considered to provide a superior solution.
- The updated Plan 5 in the PSP has removed the external access to Ford Road at previous IN-04. This access would only be required if the development of Parcel 3 occurred at an early stage of the precinct development where alternative access to this land was not yet available through the ultimate internal road network. This access could be provided as a temporary treatment that would be closed when construction of RD-01 provided access from Parcel 3 to Verney Road or construction of RD-03 provided the permanent access connection to Grahamvale Road.
- Internal road cross section options, as discussed in Section 3.2 of the Addendum Report and summarised below (also refer Figure 4A/4B over the page), are considered appropriate for the various stages of the precinct development and are consistent with the IDM (apart from the reduced reservation width for Trunk Collector).
    - RD-01: stand-alone development for Parcels 1 & 4 - Access Street

ultimate full development - Connector Street Level 1, with the section along the community hub upgraded to Trunk Collector.

- RD-02: stand-alone development for Parcels 13, 16 & 17 – Connector Street Level 1 for first 150m, Access Street for remainder of length

  ultimate full development – Connector Level 1 where IN-03 is retained, or Trunk Collector for full length if IN-03 is closed and not connected to the proposed Ford Road/Grahamvale Road roundabout.

- RD-03: stand-alone development for Parcel 6 – Access Street full length

  ultimate development - Connector Level 1 full length whether connected to IN-03 or the roundabout.

- The PSP includes a comprehensive pedestrian and cycle path network that connects to external paths and will service the schools within the precinct. The road network also facilitates provision of a bus service through the precinct that complies with PTV guidelines.

Figure 4A: Road profiles for stand-alone developments

Figure 4B: Road profiles at full development

Legend: Access Street
Connector Street Level 1

3.4.4 Costings of transport projects

As noted earlier, the cost estimates provided in the Addendum Report are based on those contained in the DCP. These have since been subjected to a verification process using current Council contract rates and found to be within a reasonable order of accuracy.

Section 3.5.2 of the Addendum Report notes that the cost estimate for the signalisation of the intersection of Verney Road with RD-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 other intersection cost estimates in the DCP are supported but would likely require review in the light of the proposed changes to the internal road layout.

4 SUMMARY AND CONCLUSIONS

I have been engaged by Greater Shepparton City Council and the VPA to prepare an Expert Witness Statement for Shepparton North East PSP and its accompanying DCP. My investigations, as documented in this report, have drawn the following broad conclusions:

- The proposed transport and movement network in the PSP is appropriate and consistent with the IDM. The alternative easterly access proposed at the intersection of Ford Road and Grahamvale Road is the preferred solution and is expected to accrue cost savings in the DCP compared with a separate access at IN-03.
- Cost estimates for the provision of various key components of the transport infrastructure are reasonable and reflect current local contract rates
- Traffic and road infrastructure issues raised in the July 2018 submissions to the PSP have been addressed.

I have made all the inquiries that I believe are desirable and appropriate and there are no traffic-related matters of significance which I regard as relevant that have, to the best of my knowledge, been withheld from the Panel.

John Bob Citroën

Dip.E. (Civil), Grad Dip. Road Safety, M.I.E.Aust.

ATTACHMENT A: DECLARATION IN REGARD TO THIS STATEMENT

Name

John Bob Citroën – Senior Associate Traffic Engineer

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Trafficworks Pty Ltd

First Floor, 132 Upper Heidelberg Road, Ivanhoe, 3079

Qualifications

- Diploma of Engineering (Civil), Swinburne University;
- Graduate Diploma in Road Safety, University of New England;
- Member, Institution of Engineers, Australia.

Experience

I have over 48 years' experience in construction and traffic engineering, 33 years with VicRoads and 15 years in private industry as a practicing traffic and road safety engineer.

Areas of Expertise

Areas of expertise include traffic and transport planning, road safety auditing of projects, traffic and parking impact assessments for a variety of land developments and general traffic engineering and road safety issues. In addition, I have held leadership positions in road safety and traffic management.

Expertise to Prepare this Assessment

My experience gathered over 48 years practice as a civil/traffic and road safety engineer includes a broad range of assessments of developments in Victorian regional centres and rural areas and issues relating to the interaction of traffic on both arterial and local roads. I am therefore qualified to provide an expert traffic assessment in relation to the proposed development.

Preparation of this Statement

In preparing this Expert Witness Statement, I have had assistance from fellow employees at Trafficworks, including the provision of editorial and peer reviews.

However, I am the principal author of this Expert Witness Statement, as well as the 2014 TIAR and the 2018 Addendum Report, and all the conclusions and recommendations are mine.

I adopt both the 2014 TIAR and the 2018 Addendum Report with the following qualification:

Decisions on road types in the 2014 TIAR were based on the IDM Version 4.2 dated November 2013. Table 2 of that guide contained indicative maximum volumes for a Connector Street Level 1 of 3,000vpd and for a Trunk Collector of 6,000vpd. As such, RD-02 and RD-03, with traffic volumes in the range 5,000vpd and 4,000vpd respectively, were nominated as Trunk Collectors. The current IDM Version 5.10 provides a range of 2,500-6,000vpd for Connector Level 1 and 6,000-12,000vpd for Trunk Collector.

With the focus of the Addendum Report being on the impacts of closure of IN-03, the status of RD-02 was not reviewed under conditions where access to Grahamvale Road is maintained. The designation of RD-02 has had to be reviewed accordingly, as outlined in Sections 3.3.5 and 3.3.6 of this statement.

The key assumptions made in deriving the findings in the reports are included throughout the reports and I have no reason to change the opinions expressed in these reports, with the exception of the nominated road types in the 2014 TIAR.

Business Relationships and Instructions

I have been engaged by Greater Shepparton City Council and the VPA to prepare this Expert Witness Statement relating to the proposed Shepparton North East Growth Corridor PSP and the accompanying DCP and to present this Statement to the Panel.

From time to time I have undertaken traffic engineering tasks for Greater Shepparton City Council on a contract basis.

Documents Taken into Account

The primary references used in the preparation of this report are as follows:

- *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, Addendum to Traffic Impact Assessment Report,* Addendum Report B, prepared by Trafficworks Pty Ltd, dated 13 July 2018
- *Shepparton North East, Precinct Structure Plan,* prepared by the Victorian Planning Authority and dated July 2018
- *Shepparton North East, Development Contributions Plan,* prepared by the Victorian Planning Authority and dated July 2018
- Local Government Infrastructure Design Association's *Infrastructure Design Manual*, Version 5.10, released 11 Jan 2018

ATTACHMENT B: REVISED COST ESTIMATES

Figure B1: Stand-alone development cross-section (Interim 1) for RD-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	m³	10	19,200	16m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	2920	m²	40	116,800	7.3m x 450m (urban pavement)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	105	84,000	400m x 2 sides
3.2	Pedestrian Paths	1200	m²	140	168,000	400m x 1.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	22	Lm	215	4,730	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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/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			$	672,330	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		21,851	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		33,617	
10.4	Environmental Management	0.5	%		3,362	
10.5	Survey/Design	5	%		33,617	
10.6	Supervisio & Project Management	9	%		60,510	
10.7	Site Establishment	2.5	%		16,808	
10.8	Contingency	15	%		100,850	
	SUB-TOTAL DELIVERY			$	270,613	
11	**TOTAL ESTIMATED COST**			$	942,943	

Figure B2: Integrated development cross-section (Interim 2) for RD-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	m^3	10	30,000	24m wide x 0.3m x 400m + 5%
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4650	m^2	40	186,000	11.6m x 450m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1000	Lm	105	105,000	400m x 2 sides + 200m (median)
3.2	Pedestrian Paths	2000	m^2	140	280,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	36	Lm	215	7,740	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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 @ $6/$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			$	892,440	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		29,004	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		44,622	
10.4	Environmental Management	0.5	%		4,462	
10.5	Survey/Design	5	%		44,622	
10.6	Supervisio & Project Management	9	%		80,320	
10.7	Site Establishment	2.5	%		22,311	
10.8	Contingency	15	%		133,866	
	SUB-TOTAL DELIVERY			$	359,207	
11	**TOTAL ESTIMATED COST**			$	1,251,647	

Figure B3: Connector Level 1 cross-section as per PSP (Ultimate 1) for RD-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	10	28,800	24m wide x 0.3m x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4650	m^2	45	209,250	11.6m x 400m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	105	84,000	400m x 2 sides
3.2	Pedestrian Paths	2000	m^2	140	280,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	36	Lm	215	7,740	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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			$	889,390	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		28,905	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		44,470	
10.4	Environmental Management	0.5	%		4,447	
10.5	Survey/Design	5	%		44,470	
10.6	Supervisio & Project Management	9	%		80,045	
10.7	Site Establishment	2.5	%		22,235	
10.8	Contingency	15	%		133,409	
	SUB-TOTAL DELIVERY			$	357,979	
11	**TOTAL ESTIMATED COST**			$	1,247,369	

Figure B4: Trunk Collector cross-section + roundabout as per PSP (Ultimate 2) for RD-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	10	36,000	30m wide x 0.3m x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	9280	m²	40	371,200	11.6m x 2 x 450m (urban)
2.2	Pavement Other	340	m²	40	13,600	roundabout pavement
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1600	Lm	105	168,000	400m x 2 sides x 2 c'ways
3.2	Kerb & Channel	40	Lm	122	4,880	roundabout kerb + subsoil drain
3.3	Pedestrian Paths	2000	m²	140	280,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	53	Lm	215	11,395	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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			$	1,193,675	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		38,794	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		59,684	
10.4	Environmental Management	0.5	%		5,968	
10.5	Survey/Design	5	%		59,684	
10.6	Supervisio & Project Management	9	%		107,431	
10.7	Site Establishment	2.5	%		29,842	
10.8	Contingency	15	%		179,051	
	SUB-TOTAL DELIVERY			$	480,454	
11	**TOTAL ESTIMATED COST**			$	1,674,129	

Figure B5: Stand-alone development cross-section (Interim 1) for RD-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	3850	m³	10	38,500	16m wide x 0.3m x 730m + 10%
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	5860	m²	40	234,400	7.3m x 0.5m x 730m + 10%
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1460	Lm	105	153,300	730m x 2 sides
3.2	Pedestrian Paths	2400	m²	70	168,000	730m x 1.5m x 2 sides + 10%
4	**DRAINAGE**					
4.1a	Drainage - pipes	60	Lm	215	12,900	5 x 300Ø cross culverts
4.1b	Drainage - pipes	365	Lm	155	56,575	Adopt 375Ø half length
4.1c	Drainage - pipes	365	Lm	210	76,650	Adopt 450Ø half length
4.2	Drainage - pits	10	No	1800	18,000	2 @ 150m spacing
4.3	Drainage - subsoil drainage	1460	Lm	9	13,140	730 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	60	No	30	1,800	25m spacing x 2 sides
6.2	Landscaping		Item		10,000	
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			$	945,265	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		30,721	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		47,263	
10.4	Environmental Management	0.5	%		4,726	
10.5	Survey/Design	5	%		47,263	
10.6	Supervisio & Project Management	9	%		85,074	
10.7	Site Establishment	2.5	%		23,632	
10.8	Contingency	15	%		141,790	
	SUB-TOTAL DELIVERY			$	380,469	
11	**TOTAL ESTIMATED COST**			$	1,325,734	

Figure B6: Integrated development cross-section (Interim 2) for RD-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	m^3	10	54,000	30m wide x 0.3m deep x 600m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	6960	m^2	40	278,400	2 x 5.8m x 0.5m x 600m
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	2400	Lm	105	252,000	600m x 2 sides x 2 c'ways
3.2	Pedestrian Paths	3000	m^2	140	420,000	600m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	70	Lm	215	15,050	5 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	155	46,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	1800	14,400	2 @ 150m spacing
4.3	Drainage - subsoil drainage	2400	Lm	17.5	42,000	730 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			$	1,411,900	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		45,887	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		70,595	
10.4	Environmental Management	0.5	%		7,060	
10.5	Survey/Design	5	%		70,595	
10.6	Supervisio & Project Management	9	%		127,071	
10.7	Site Establishment	2.5	%		35,298	
10.8	Contingency	15	%		211,785	
	SUB-TOTAL DELIVERY			$	568,290	
11	**TOTAL ESTIMATED COST**			$	1,980,190	

Figure B7: Connector Level 1 cross-section as per PSP (Ultimate 1) for RD-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	10	43,200	24m wide x 0.3m deep x 600m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	6960	m^2	40	278,400	11.6m x 600m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1200	Lm	105	126,000	600m x 2 sides
3.2	Pedestrian Paths	3000	m^2	140	420,000	600m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	48	Lm	215	10,320	4 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	155	46,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	1800	14,400	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			$	1,224,120	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		39,784	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		61,206	
10.4	Environmental Management	0.5	%		6,121	
10.5	Survey/Design	5	%		61,206	
10.6	Supervisio & Project Management	9	%		110,171	
10.7	Site Establishment	2.5	%		30,603	
10.8	Contingency	15	%		183,618	
	SUB-TOTAL DELIVERY			$	492,708	
11	**TOTAL ESTIMATED COST**			$	1,716,828	

Figure B8: Trunk Collector cross-section + roundabout as per PSP (Ultimate 2) for RD-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	m³	10	54,000	30m wide x 0.3m deep x 600m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	6960	m²	40	278,400	2 x 5.8m x 450m (urban)
2.2	Pavement Other	340	m²	40	13,600	roundabout pavement
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	2400	Lm	105	252,000	600m x 2 sides x 2 c'ways
3.2	Kerb & Channel	40	Lm	122	4,880	roundabout kerb + subsoil drain
3.3	Pedestrian Paths	3000	m²	155	465,000	600m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	70	Lm	215	15,050	4 x 300Ø cross culverts
4.1b	Drainage - pipes	300	Lm	155	46,500	Adopt 375Ø half length
4.1c	Drainage - pipes	300	Lm	210	63,000	Adopt 450Ø half length
4.2	Drainage - pits	8	No	1800	14,400	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			$	1,475,380	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		47,950	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		73,769	
10.4	Environmental Management	0.5	%		7,377	
10.5	Survey/Design	5	%		73,769	
10.6	Supervisio & Project Management	9	%		132,784	
10.7	Site Establishment	2.5	%		36,885	
10.8	Contingency	15	%		221,307	
	SUB-TOTAL DELIVERY			$	593,840	
11	**TOTAL ESTIMATED COST**			$	2,069,220	

Figure B9: Stand-alone development cross-section (Interim 1) for RD-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	m^3	10	19,200	16m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	2920	m^2	40	116,800	7.3m x 400m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	105	84,000	400m x 2 sides
3.2	Pedestrian Paths	1200	m^2	140	168,000	400m x 1.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	22	Lm	215	4,730	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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 @ $6/$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			$	672,330	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		21,851	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		33,617	
10.4	Environmental Management	0.5	%		3,362	
10.5	Survey/Design	5	%		33,617	
10.6	Supervisio & Project Management	9	%		60,510	
10.7	Site Establishment	2.5	%		16,808	
10.8	Contingency	15	%		100,850	
	SUB-TOTAL DELIVERY			$	270,613	
11	**TOTAL ESTIMATED COST**			$	942,943	

Figure B10: Integrated development cross-section (Interim 2) for RD-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	10	28,800	24m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4640	m²	40	185,600	11.6m x 450m (urban pavement)
2.2	Pavement Other		m²			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	105	84,000	400m x 2 sides
3.2	Pedestrian Paths	2000	m²	140	280,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	35	Lm	215	7,525	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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			$	868,225	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		28,217	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		43,411	
10.4	Environmental Management	0.5	%		4,341	
10.5	Survey/Design	5	%		43,411	
10.6	Supervisio & Project Management	9	%		78,140	
10.7	Site Establishment	2.5	%		21,706	
10.8	Contingency	15	%		130,234	
	SUB-TOTAL DELIVERY			$	349,461	
11	**TOTAL ESTIMATED COST**			$	1,217,686	

Figure B11: Connector Level 1 cross-section as per PSP (Ultimate 1) for RD-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	10	28,800	24m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	4650	m^2	40	186,000	11.6m x 450m (urban pavement)
2.2	Pavement Other		m^2			
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	800	Lm	105	84,000	400m x 2 sides
3.2	Pedestrian Paths	2000	m^2	140	280,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	36	Lm	215	7,740	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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			$	866,140	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		28,150	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		43,307	
10.4	Environmental Management	0.5	%		4,331	
10.5	Survey/Design	5	%		43,307	
10.6	Supervisio & Project Management	9	%		77,953	
10.7	Site Establishment	2.5	%		21,654	
10.8	Contingency	15	%		129,921	
	SUB-TOTAL DELIVERY			$	348,621	
11	**TOTAL ESTIMATED COST**			$	1,214,761	

Figure B12: Trunk Collector cross-section + roundabout as per PSP (Ultimate 2) for RD-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	10	36,000	30m wide x 0.3m deep x 400m
1.3	Other (Description)		Item			
2	**ROAD PAVEMENT**					
2.1	New Pavement	9280	m²	40	371,200	11.6m x 2 x 450m (urban)
2.2	Pavement Other	340	m²	40	13,600	roundabout pavement
3	**CONCRETE WORKS**					
3.1	Kerb & Channel	1600	Lm	105	168,000	400m x 2 sides x 2 c'ways
3.2	Kerb & Channel	40	Lm	122	4,880	roundabout kerb + subsoil drain
3.3	Pedestrian Paths	2000	m²	140	280,000	400m x 2.5m x 2 sides
4	**DRAINAGE**					
4.1a	Drainage - pipes	53	Lm	215	11,395	3 x 300Ø cross culverts
4.1b	Drainage - pipes	200	Lm	155	31,000	Adopt 375Ø half length
4.1c	Drainage - pipes	200	Lm	210	42,000	Adopt 450Ø half length
4.2	Drainage - pits	6	No	1800	10,800	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			$	1,193,675	
10	**DELIVERY**					
10.1	Council Fees	3.25	%		38,794	
10.2	VicRoads Fees	1	%			
10.3	Traffic Management	5	%		59,684	
10.4	Environmental Management	0.5	%		5,968	
10.5	Survey/Design	5	%		59,684	
10.6	Supervisio & Project Management	9	%		107,431	
10.7	Site Establishment	2.5	%		29,842	
10.8	Contingency	15	%		179,051	
	SUB-TOTAL DELIVERY			$	480,454	
11	**TOTAL ESTIMATED COST**			$	1,674,129	

ATTACHMENT C: VICROADS INTERSECTION PLAN

Potential inclusion of precinct access in proposed treatment of the Ford Road/Grahamvale Road intersection

ATTACHMENT D: IDM TABLE 2

Table 2 from IDM Version 5.10 adopted January 2018

IDM infrastructure design manual

Table 2 Urban Road / Street Characteristics

Street Type	Indicative Maximum Traffic Volume (vehicles/ day)	Carriageway Width	Minimum Reserve Width See Note 5 & 6	Minimum Verge Width	Parking Provision within Carriageway	Pedestrian / Cycle Provision within Road Reserve See Note 7	Kerbing
Access Lane (second road frontage where permitted under Council Policy)	300	5.5m See Note 6.	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 (where permitted under Council policy)	300	6.0m See Note 6.	14.0m	3.5m See Note 2.	Yes (one side)	Footpath both sides. No separate cycle provision except for LDRZ(S) see Note 8	B2, SM2 or modified SM2. See Note 3.
Access Street	1000 - 2500	7.3m	16.0m	3.5m See Note 2.	Yes (both sides)	Footpath both sides. No separate cycle provision except for LDRZ(S) see Note 8	B2, SM2 or modified SM2. See Note 3.
Collector/ Connector Street Level 1	2500 - 6000	11.6m	24.0m	6.0m	Yes (Both sides) unless exempted from kerb and channel. See Note 9	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)	6000-12000	2 x 7.0m + 6.0m 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.