Before the Independent Hearings Panel
at Waimakariri District Council

under: the Resource Management Act 1991

in the matter of: Proposed private plan change RCP31 to the Operative Waimakariri District Plan

and: **Rolleston Industrial Developments Limited**
Applicant

Evidence of Nicholas Peter Fuller

Dated: 7 July 2023

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EVIDENCE OF NICHOLAS PETER FULLER

1 My full name is Nicholas Peter Fuller.

2 I am a Principal Transport Engineer at Novo Group Limited and have worked on resource management transport planning and engineering projects for over 20 years. My experience during this time includes development planning, preparing Traffic and Transport Assessments for resource consents, preparation of Project Feasibility and Scheme Assessment Reports for Council's and the New Zealand Transport Agency.

3 My qualifications include a Bachelor of Engineering (Honours) in Civil Engineering. I have prepared Integrated Transport Assessments for a range of activities and Plan Change requests. This specifically includes several recent Plan Change requests in Rolleston.

4 I am familiar with private plan change 31 (*Plan Change*). I prepared the Integrated Transport Assessment (*ITA*) attached to the application.

CODE OF CONDUCT

5 Although this is not an Environment Court hearing, I note that in preparing my evidence I have reviewed the Code of Conduct for Expert Witnesses contained in Part 9 of the Environment Court Practice Note 2023. I have complied with it in preparing my evidence. I confirm that the issues addressed in this statement of evidence are within my area of expertise, except where relying on the opinion or evidence of other witnesses. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

6 My evidence relates to:

6.1 Traffic effects of the Plan Change, including road safety and efficiency;

6.2 Transport infrastructure upgrades required to accommodate the Plan Change site; and

6.3 Additional subjects in the Waimakariri District Council's (*Council*) S42A report and submissions

7 I have read the relevant parts of the Section 42A Report and accompanying technical assessment by Mr Shane Binder.

8 My evidence should be read alongside the other evidence provided for the Applicant, including in particular the evidence of:

8.1 **Mr Simon Milner** on public transport;

8.2 **Mr Paul Farrelly** on greenhouse gas emissions;

8.3 **Mr Garth Falconer** on urban design; and

8.4 **Mr Tim Walsh** on planning.

9 Some of the "transport-related" matters raised in the Section 42A Report and Mr Binder's assessment are more specifically covered in the evidence outlined above.

SUMMARY

10 Changes have been proposed to the development content of the Plan Change, most notably the proposal to replace the high school with a potential 250 pupil primary school. The overall effect is a slight reduction in traffic generation from the Plan Change site.

11 The intersections in the immediate vicinity of the Plan Change site are predicted to operate satisfactorily with the development traffic added to the network, as is the Mill Road / Ōhoka Road intersection. Similarly, the Tram Road / State Highway 1 interchange will operate satisfactorily, with a consenting requirement providing scope to consider the need for, and nature of, any upgrades over and above 250 allotments. Notably, if required, I consider that upgrades within the existing bridge width of the interchange can fully accommodate the Plan Change's traffic.

12 The existing road links are generally able to accommodate the predicted increase in traffic associated with the Plan Change. The exception is the segment of Tram Road between Bradleys Road and Jacksons Road, which requires widening to meet the Waimakariri District Plan standards.

13 Satisfactory access arrangements to the Plan Change site can be accommodated. The internal road cross-sections generally comply with the requirements of the Waimakariri District Plan, although on-street car parking is not currently proposed. That said, Council will have discretion at subdivision stage to consider road cross-sections and intersection spacing to ensure these details are acceptable.

14 The proposed commercial areas and potential primary school provide for walking and cycling trips within the site. This is supported by the internal pedestrian and cycle network along road corridors and as recreational routes. The site also fits within the

Council's proposed walking and cycling network that will ultimately link the site to wider destinations.

15 The section 42A report identifies concerns regarding potential safety effects on Tram Road. However, I understand that this is already being addressed by Council and funding is allocated in their Infrastructure Strategy.

16 Lastly, I note that Clause 3.8 of the National Policy Statement on Urban Development 2020 (*NPS-UD*) requires that local authorities have particular regard to the development capacity of plan changes if they are "well-connected along transport corridors". Tram Road is an Arterial Road and Mill Road is a Collector Road and therefore, the plan change site is consistent with this requirement.

SUMMARY OF PROPOSED PLAN CHANGE

Development Content

17 The Plan Change seeks to allow for a range of scenarios, which are:

17.1 Option 1: Up to 850 dwellings, two commercial zones plus a 250 pupil primary school;

17.2 Option 2: Up to 892 dwellings plus two commercial zones; and

17.3 Option 3: As per Options 1 and 2, although with an allowance to replace one dwelling with four retirement villas.

18 The revised Option 1 still has the highest peak hour traffic generation and therefore remains the focus of my assessment of transport effects. In that regard, the traffic generation of Option 1 is estimated as being:

18.1 AM Peak Hour: 949 vehicles per hour;

18.2 PM Peak Hour: 803 vehicles per hour; and

18.3 Daily: 7,400 vehicles per day.

19 Vehicle access to the Plan Change site will be from Bradleys Road (two intersections); Mill Road (one intersection) and Whites Road (four intersections). Concept intersection arrangements for each of these roads are illustrated on the plans in **Attachment 1**. I consider this confirms that suitable access can be achieved to the Plan Change site, although this will still need to undergo further and detailed design analysis and approvals through the standard subdivision process.

ADDITIONAL ANALYSIS SINCE APPLICATION

Traffic Modelling

20 Given the slight reduction in traffic volumes associated with the Plan Change compared to that set out in the ITA (as set out above), the operation of the adjacent intersections will be marginally better than previously assessed.

21 Furthermore, the most recent Council counts of traffic volumes on the roads surrounding the Plan Change site and those counted for the ITA are contained in **Attachment 2**. These indicate that the current traffic volumes are typically less than those counted for the ITA modelling. As such, no updates to these volumes are considered necessary.

22 Given the traffic generation of the Plan Change is slightly lower than that assessed in the ITA and the background traffic volumes are consistent with those counted, I have not updated the intersection models presented in the ITA as they are still applicable. In brief, these ITA model results indicate that:

22.1 Tram Road / Bradleys Road: This intersection operates with some movements at Level of Service E[1], which I consider acceptable for peak periods;

22.2 Tram Road / Whites Road: This intersection operates with some movements at Level of Service E, which I consider acceptable for peak periods;

22.3 Mill Road / Bradleys Road: The intersection is predicted to operate well, with no approach operating worse than Level of Service A; and

22.4 Mill Road / Whites Road: This intersection is also predicted to operate well, with no approach operating worse than Level of Service A.

23 I consider that having some movements at intersections operating at Level of Service E is acceptable at peak periods. Although this indicates that delays are increasing, they are tolerable and drivers would not become frustrated.

24 I also note that the Council's Long Term Plan includes a proposed upgrade to the Tram Road / McHughes Road / Bradleys Road intersection, which would be a roundabout.

[1] Where Level of Service A is considered excellent, E is approaching or at capacity and F is over-capacity.

State Highway 1 / Tram Road Operation

25 For the purposes of my evidence (noting it was not addressed in the ITA), I have undertaken traffic modelling of the State Highway 1 / Tram Road interchange to understand the effects of the Plan Change at this location. This assessment included:

25.1 Undertaking traffic counts at the intersection, along with monitoring queue lengths;

25.2 Creating a base model of the existing operation;

25.3 Creating a version of the model with factored traffic volumes to account for the potential effects of rolling high school teacher strikes taking place at the time (only required for the AM peak hour); and

25.4 Adding the predicted Plan Change traffic to the interchange.

26 Traffic diagrams that set out the volumes associated with the above steps are included in **Attachment 3**. Traffic model outputs for the existing and with the Plan Change scenarios are included in **Attachment 4** and **Attachment 5** respectively. These model results indicate that the interchange would require upgrading over time to accommodate the Plan Change traffic.

27 I have considered the type of upgrade that would be required and note that a number of solutions could be implemented over time in response to the progressive growth in traffic from the Plan Change and/or the wider area.

28 I have modelled one of these potential solutions, entailing an additional eastbound traffic lane on the bridge and signalising the off-ramp in order to provide additional capacity to accommodate eastbound through traffic and right-turning traffic off of the off-ramp. The existing width of the bridge is approximately 13.5m between barriers, suggesting that three lanes could be accommodated whilst retaining clearance to the barriers (accepting that some work would be required to the existing raised kerbs). The indicative arrangement is illustrated in **Figure 1**.

29 The results of the modelling illustrating the road network performance with this upgrade (including the Plan Change) are included in **Attachment 6**. In summary, that modelling confirms that the improvements shown in **Figure 1** would ensure that the road network functions safely and efficiently with the growth in traffic from the fully developed Plan Change site.

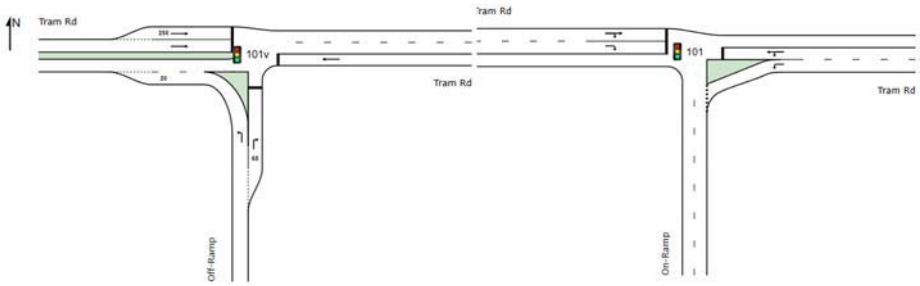

Figure 1: Tram Road Interchange Indicative Upgrade

30 Furthermore, I have undertaken iterative modelling of the existing interchange with incremental increases in traffic from the Plan Change site. This is on the basis that development commences at the north of the Plan Change site (I refer to the staging proposal in **Mr Falconer's** design report, which confirms this development approach) where it is more likely some of these drivers would use Mill Road to access the Ōhoka Road / State Highway 1 interchange. This modelling (included in **Attachment 7**) indicates that 250 allotments could be readily accommodated by the existing Tram Road / State Highway 1 interchange. Further development beyond 250 allotments would either require justification through further assessment (e.g. accounting for changes to the environment or travel patterns, additional traffic modelling, etc) or an upgrade to be undertaken to the interchange. As described above, such upgrades may entail the ultimate solution shown in **Figure 1** or further, interim solutions.

31 Accounting for the above, **Mr Walsh** has recommended a rule requiring consent as a restricted discretionary activity and written approval from Waka Kotahi, for any subdivision consent resulting in more than 250 allotments within the Plan Change site. Discretion for such applications would be restricted to effects on the safety and efficiency of the Tram Road interchange, meaning that Council and Waka Kotahi would have broad scope to assess any upgrade works proposed, or changes in travel patterns that may remove or reduce the need for such improvements. I support that approach and accounting for my evidence above, I consider that any effects of the Plan Change on the safety and efficiency of the Tram Road interchange will be acceptable.

Mill Road / Ōhoka Road

32 For the purposes of my evidence (noting it was not addressed in the ITA) I have undertaken traffic modelling of the Mill Road / Ōhoka Road intersection to determine the effects of the proposed Plan Change at this location. **Attachment 8** sets out the results of the calibrated base traffic model, which indicates that this intersection is currently operating well and no movement is worse than Level of Service C.

33 Not all of the Plan Change traffic that uses Mill Road is anticipated to use the Mill Road / Ōhoka Road intersection, as a portion of drivers would use Threlkelds Road to travel to / from Rangiora. As such, the Plan Change traffic at the Mill Road / Ōhoka Road intersection is predicted to be:

33.1 AM Peak: 27 eastbound vehicles and 7 westbound vehicles; and

33.2 PM Peak: 13 eastbound vehicles and 22 westbound vehicles.

34 The above traffic has been added to the base model and the updated results are contained in **Attachment 9**. These indicate that the operation of the intersection remains satisfactory with no movement operating worse than Level of Service C.

Road Link Capacity

35 I outlined a series of link upgrades that I had anticipated as being required to accommodate the Plan Change traffic in the ITA. This was based on the requirements of Austroads. However, the Council Section 42A report indicates a preference for the standards of the District Plan, which mean that only Tram Road (between Bradleys Road and Jacksons Road) would require widening. I understand there is funding within the Council's Long Term Plan and Infrastructure Strategy for Tram Road Safety projects, which may already include this widening.

36 I am satisfied that the above would provide sufficient link capacity to accommodate the proposed Plan Change.

Traffic Capacity Summary

37 Based on the above, the only intersection that may require upgrading as a direct result of the Plan Change is the Tram Road / State Highway 1 interchange. The existing design and capacity of this interchange could readily accommodate development of up to 250 allotments at the Plan Change site and beyond this, a restricted discretionary activity consent would be required to assess the further upgrades required or the justification otherwise. Such upgrades may entail incremental changes to the interchange or the establishment of an additional traffic lane as shown in **Figure 1**, but importantly, such upgrades are readily achievable.

38 Tram Road requires widening between Bradleys Road and Jacksons Road and I consider it appropriate that this Plan Change contributes toward these improvements through the usual development contributions process. Similarly, although the Tram Road / Bradleys Road / McHughes Road intersection is within capacity with the Plan Change traffic added to the network, I consider that it is reasonable that development contributions are provided by the Plan Change, in the usual manner, to assist with the funding of this upgrade.

39 With regards to development contributions, I understand these are typically set by Council separate to the Plan Change process. These would be based on the extent to which the subsequent development occurs at the Plan Change site and I understand this is typically sought at subdivision or building consent stage. I also understand that the contribution would be proportionate to the level of traffic generated at that location by this Plan Change (relative to the background traffic volumes). That said, the detail of this is best assessed by others.

40 Lastly, I note that in my experience, it is commonplace for road network improvements to be required in response to the provision of additional development capacity through Council-initiated or private plan changes. For example, I have provided traffic engineering evidence in respect of a number of recent greenfield residential and industrial rezonings (now operative) which have relied on road network upgrades of a similar or far greater magnitude than those described here. For example, Selwyn District Council PC66 and PC80 (industrial rezonings at Rolleston) relied on the establishment of a new State Highway overpass and intersection, respectively, as a precursor to development. In making this point, I stress that the key matter in my view is whether there are fundamental or insurmountable road network capacity constraints to a proposal. For the reasons stated above, I do not consider that to be the case for this proposal.

Speed Limits & Threshold Treatments

41 With the development of the Plan Change site and introduction of site access intersections, I consider it would be beneficial to reduce the speed limits of the roads in the immediate vicinity of the Plan Change site. I consider this is also consistent with the anticipated outcomes of the Waimakariri Speed Management Plan, which suggests that rural sealed roads be reduced to 80km/h (from the current 100km/h). These are illustrated in **Figure 2**.

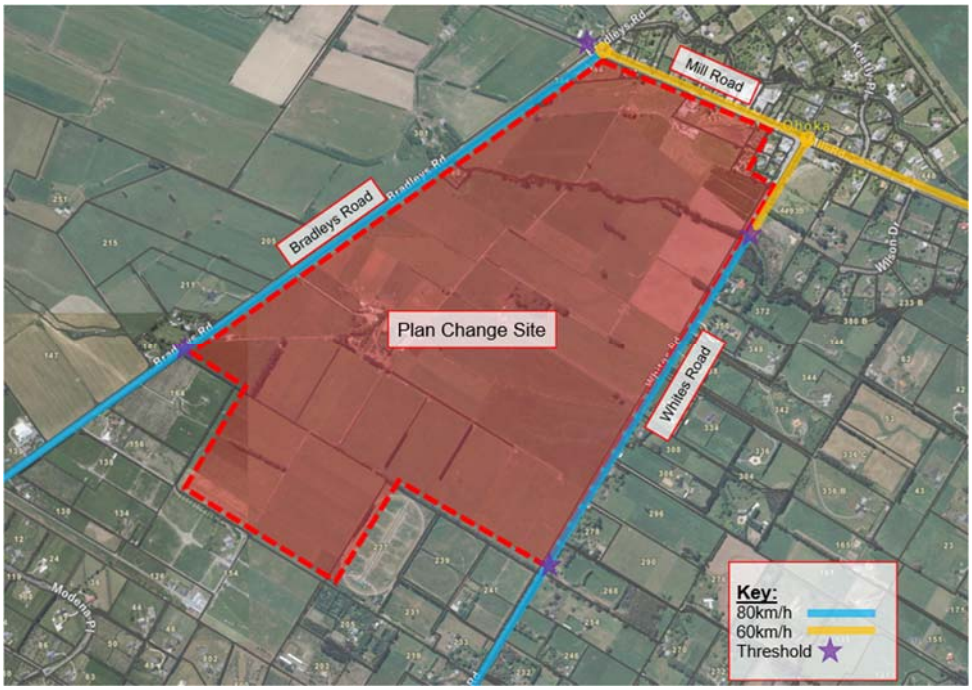

Figure 2: Proposed Speed Limit Alterations

42 The details of the threshold treatments would need to be agreed with the Council, although **Figure 3** illustrates a typical example of the layout of these facilities.

Figure 3: Example Threshold Treatment (Source Road Traffic Standard 15)

43 The threshold treatments will be provided as part of the Plan Change development, although the alterations to the speed limits is ultimately a matter for Council as the Road Controlling Authority to address and implement as required.

Site Access Arrangements

44 The Illustrative Masterplan (attached to **Mr Falconer's** evidence) proposes the following road links to the adjacent network:

44.1 Bradleys Road: Two intersections plus an access to the Polo fields;

44.2 Mill Road: One intersection; and

44.3 Whites Road: Four intersections.

45 Typical intersection arrangements for these road frontages are contained in **Attachment 1** to confirm that a workable arrangement can be achieved. These accesses are anticipated to operate safely and efficiently because of the good visibility that can be achieved along the frontage roads and the relatively low volumes using and passing the accesses.

46 The separation of the intersections is approximately as follows:

46.1 Bradleys Road: 430m to 486m between intersections;

46.2 Whites Road: 330m to 435m south of Ōhoka Stream and 250m north of Ōhoka Stream: and

46.3 Mill Road: At least 225m separation to intersections.

47 The required District Plan intersection separation distances are 550m for intersections to Whites Road and Bradleys Road (80km/h) and 160m for Whites Road and 160m for Mill Road (60km/h). As such the Mill Road intersection separation complies with the District Plan requirements, but not the Whites Road or Bradleys Road intersections.

48 As set out in the ITA, Austroads guidance regarding the separation of intersections suggests that 139m is acceptable for a 100km/h speed environment. However, I anticipate that the speed limits on Whites Road and Bradelys Road will reduce to 80km/h, further assisting in confirming that there is sufficient separation distance between intersection to provide safe and efficient access.

49 The notified version of the Outline Development Plan included direct property access to Bradleys Road and Whites Road for the Residential 4a land. This is no longer proposed, with all property access now being via the internal road network and this is considered to be a safer arrangement compared to the notified Plan Change as it reduces the number of driveways to the existing road network, which would have higher traffic volumes.

Internal Layout

50 The internal site layout has been further developed, as discussed in the Evidence of **Mr Falconer**, including his Design Report. The proposal remains at a Plan Change level and the detail of roading patterns would need to be revisited at subdivision stage, including an assessment of the proposed cross-sections and intersection separation. However, the updated Illustrative Masterplan within **Mr Falconer's** Design Report provides an indication of how the Plan Change site could be developed.

51 The indicative cross-sections provided in the Design Report are a hybrid between the requirements of a rural and urban transport network. The rural elements include the provision of 6.4m to 7.0m wide carriageways that accommodate parking within the carriageway (i.e. there are no dedicated parking lanes).

52 **Table 1** summarises the proposed cross-section elements of the road design to those required by the District Plan (for Residential areas). The primary difference is that the currently proposed cross-sections do not include on-street car parking and this is a matter that can be resolved through the subdivision stage.

Table 1: District Plan vs Proposed Cross-Sections

Road Standard	Corridor Width	Lane Width	No. of Lanes	Parking	Footpaths	Cycleways
District Plan Residential Collector	20m	3.3m	2	2 x 2.5m	2 x 1.5m	2
Proposed Collector	22m	3.5m	2	-	1 x 1.8m	Shared path one side (3.0m)
District Plan Residential Local Road	16m	3m	2	1 x 2m	1 x 1.5m	-
Proposed Local Road A	17m	3.2m	2		2 x 1.8m	-
Proposed Local Road B	19m	3.2m	2		2 x 1.8m	-

53 I consider that the indicative cross-sections are generally acceptable for the proposed development with regards to accommodating

transport modes within the site, despite not exactly following the District Plan requirements.

Walking & Cycling Provision

Internal Walking & Cycling

54 The site will include a walking and cycling network as illustrated in the Design Report. This includes primary and secondary walking / cycling networks that incorporate a shared path along the Collector Road network. This includes footpaths that are also provided alongside the Collector Roads and both sides of the Local Roads. The proposed footpaths would be 1.8m wide and the shared path 3.0m wide.

55 In addition, there are recreational shared paths along the east-west recreational corridors that link to the north – south Collector Road. These routes provide a connected network that links to the Commercial area in the north-eastern corner of the site. I understand (from the evidence of **Ms Natalie Hampson**) that the Commercial areas could accommodate a small supermarket of approximately 460m^2 to 710m^2, with the ability to increase to 1,000m^2. I consider this would provide for day-to-day convenience shopping needs of not only the residents of the Plan Change site, but also existing residents in Ōhoka. This would be within walking and cycling distance for these people.

56 Furthermore, the site is proposed to accommodate a 250 pupil primary school that would also be within walking distance for a number of the residents of the Plan Change site.

57 I consider these routes to be more than sufficient to provide for the walking and cycling needs of residents within the Site. These links also provide multiple connections to the shared paths proposed on Bradleys Road, Mill Road and Whites Road as discussed below.

Off-Site Walking & Cycling

58 Council has a recommended Walking and Cycling Network Plan that includes the area surrounding the Plan Change site. The road frontages of the Plan Change site include Grade 2 routes, which are described as 'unsealed path' (less than 2.5m wide). I consider these should be made at least 2.5m wide along the site boundaries to assist in accommodating both walking and cycling trips to / from the proposed commercial areas from the wider area.

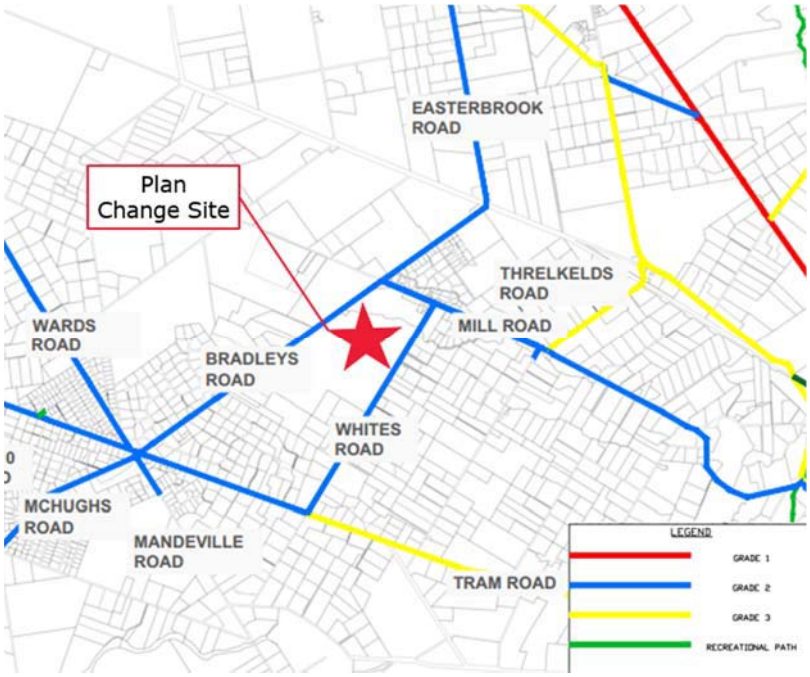

Figure 4: WDC Walking & Cycling Strategy Extract

59 The development of the Plan Change site will upgrade the existing path along Mill Road (between Bradleys Road and Whites Road) and provide these facilities along the site frontages of Bradleys Road and Whites Road.

60 The above indicates that the Plan Change site is located within a cycle network that is already planned by Council and will therefore be able to utilise these links for access to Rangiora and Kaiapoi. I acknowledge that there is no funding in place for these routes at present, although I would expect that the development of the Plan Change site would instigate this funding (via the standard development contributions process).

61 That cycle network would place the site within an approximately 10km cycle from the centre of Rangiora and 9km from the centre of Kaiapoi. These distances would take approximately 30 minutes to cycle, so they are achievable (particularly with the take up of e-bikes), although I accept that it is unlikely that many residents would choose to cycle for purposes other than recreation. This aspect is also covered in **Mr Paul Farrelly's** evidence.

SECTION 42A REPORT

Intersection Operation

62 Further assessment has been requested of the Mill Road / Ōhoka Road intersection and the Tram Road / State Highway 1 interchange. I addressed the operation of the Tram Road / State Highway 1 interchange at paragraph 25 to 31 and consider this may

require an upgrade after 250 allotments have been constructed at the Plan Change.

Mill Road / Ōhoka Road Intersection

63 I have discussed the operation of the Mill Road / Ōhoka Road intersection at paragraph 32 to 34 and found that it will operate satisfactorily with the proposed Plan Change traffic added to the network.

Tram Road / Whites Road

64 Council has requested that the Tram Road / Whites Road intersection be upgraded and queried whether blocking back of right turning traffic is accounted for within the model. I confirm that the effects of right turn and through queues at the intersection would affect left turning traffic in the model and this has been accounted for.

65 With regards to the overall operation of the intersection, I have discussed this at paragraph 22 and concluded it is acceptable and therefore no upgrade is required.

Tram Road Safety Concerns

66 The Section 42A report identifies concerns regarding the safety of Tram Road, particularly in the context of increased traffic associated with the proposed Plan Change site. The report also notes (at paragraph 39) that Council has prepared a programme of works to mitigate the risk although this is not fully funded. That said, I note that Council's Infrastructure Strategy and Long Term Plan (2021 – 2031) include funding of $12m specifically for road safety improvements to Tram Road between 2021 and 2032[2]. I anticipate that development contributions would be collected from any future development within the Plan Change site and used to assist funding that programme of works.

67 I also note that it is likely the speed limit on Tram Road will be reduced as part of the Waimakariri Speed Management Plan, which suggests a speed limit of 80km/h for rural sealed roads. This will assist in reducing safety concerns on Tram Road.

Development Contributions

68 Council has suggested that the Plan Change provide development contributions toward upgrades of the Tram Road / Bradleys Road/ McHughs Road intersection, as well as the Tram Road / Whites Road intersection and Tram Road widening (between Jacksons Road and Bradleys Road). As identified at paragraph 39, I understand that this occurs separate to the Plan Change process and that development contributions would be required in the usual manner.

[2] Page 108 of the Long Term Plan 2021 – 2031.

Surrounding Road Link Upgrades

69 The ITA included a recommendation that various surrounding roads be widened to meet the road formation standards of Austroads. The Section 42A report indicates a preference for the District Plan Roading Standards over those I had assumed from Austroads (at paragraph 18 clause d). I am satisfied that these District Plan road width standards would be acceptable and that the only widening required would be on Tram Road between Bradleys Road and Jacksons Road.

Non-Motorised Accessibility

70 I have considered the accessibility of the site by non-motorised transport modes. I consider that the provision of the commercial centres and the potential for a Primary School accommodates day to day retail and places primary education within walking distance of the majority of residents within the site. This will also be within walking distance for existing residents of Ōhoka.

71 I accept that commuting to work from the site is likely to be undertaken by car. That said, the site is within an area with planned cycle links that could be brought forward to assist in accommodating cycle trips to Rangiora and Kaiapoi.

72 I also note that **Mr Simon Milner** addresses the potential for public transport to serve the Plan Change site within his evidence.

Internal Road Design

73 I have outlined the indicative cross-sections for the internal road arrangements in paragraph 50 to 53 and identified that the primary difference between what is proposed and the District Plan standards is the lack of on-street car parking proposed. I also note that it is now proposed to assess the cross-sections and intersection spacing of the proposed development at subdivision stage, which gives Council the discretion at that time to consider the internal road arrangements and account for an agreed internal design speed for the site.

74 I also note that the ODP has been updated to include additional detail regarding the cycling network. This is in conjunction with the proposed road cross-sections that illustrate how the shared path will be included within the proposed road corridors and along the recreational routes.

75 Given the above, I consider that the internal transport network is acceptable and that Council will have sufficient discretion at subdivision stage to ensure a satisfactory roading layout is provided.

Transport Policy

Vehicle-Kilometres Travelled

76 The Section 42A report raises concerns regarding the increase in vehicle kilometres travelled as a result of the location of the Plan Change site. I acknowledge that the site is some distance from employment centres, high schools and larger retail areas when compared to locations such as Rangiora and Kaiapoi. That said, the evidence of **Mr Tim Walsh** addresses why development may not be able occur in those locations.

77 The proposal includes measures to seek to minimise the travel distance for certain day to day activities, such as top-up shopping and travel to primary school. These facilities will be within walking and cycling distance of residents of the Plan Change site.

78 I also accept that more vehicle kilometres travelled leads to the potential for increased road safety risks in a general sense. That said, this would occur to some extent with any development and I am not aware of a specific concern (other than the need for improvements to Tram Road already discussed) that would be exacerbated by increased travel.

Well-Functioning Urban Environment

79 Policy 1c of the NPS-UD notes that:

Planning decisions contribute to well-functioning urban environments, which are urban environments that, as a minimum:

… …

have good accessibility for all people between housing, jobs, community services, natural spaces, and open spaces, including by way of public or active transport; and

… …

80 I note that this is does not make accessibility exclusive to public transport and active modes, although these do form an important part of a well-functioning urban environment.

81 As identified previously, the site includes commercial areas that are considered to be able to support a small supermarket. There is also the potential for a primary school within the site. These, plus the proposed internal active modes network mean that walking and cycling are provided for within the site. Furthermore, shared paths are proposed along the site boundaries to assist in accommodating trips to the site from other locations.

82 The site is also within an area of a planned cycle network. Although this is yet to be established, I would anticipate that this Plan Change would bring forward the development of the proposed infrastructure. This would make cycling an option for residents of the site, albeit most likely for recreational purposes.

83 **Mr Milner** discusses accessibility by passenger transport for the Plan Change site.

84 The above indicates that the site is accessible by a range of modes for a range of purposes. Although it would most likely rely on vehicle travel for the majority trips, this is not to say that alternate modes are not catered for.

85 The NPS-UD also requires that local authorities have regard to plan changes if they area "well-connected along transport corridors"[3]. I note that the District Plan identifies Tram Road as an Arterial Road and Mill Road as a Collector Road and therefore the site is consistent with this requirement. Furthermore, the NZTA One Network Road Classification (ONRC) identifies Bradleys Road as a Collector Road.

TRANSPORT SUBMISSIONS

86 I have reviewed the submissions received on the Plan Change and address the transport themes in the following sections.

Sight Lines At Intersections

Mill Road / Whites Road Sight Line

87 Concerns were raised with regards to the visibility at the Mill Road / Whites Road intersection. The obstructions I identified on site are illustrated in **Figure 5**. These are the use of informal on-street car parking on Mill Road (west of the intersection) and a street tree on Mill Road (east of the intersection).

[3] Clause 3.8 sub-clause 2(b) of the NPS-UD.

Figure 5: Mill Road / Whites Road Sight Obstructions

88 The solution to the above would be to prohibit the car parking in this location and relocate the street tree. These are relatively straight forward measures to address the sight line concern at this location.

Tram Road / Whites Road Sight Line

89 The sight line concern at the Tram Road / Whites Road intersection primarily relates to overhanging vegetation from the property in the north-western corner of the intersection (see **Figure 6**). This could be overcome through trimming of the vegetation, which Council is entitled to request. I also note that the speed limit on Tram Road is likely to be reduced to 80km/h, which will effectively assist in achieving sight lines at this location.

Figure 6: Tram Road / Whites Road Vegetation to be Trimmed

Mill Road / Bradleys Road Angle of Approach

90 A concern was raised regarding the angle that drivers need to turn their head through at the Bradleys Road / Mill Road intersection. Austroads requires that new intersections meet ideally at an angle of 90 degrees, with an allowance of plus or minus 20 degrees being acceptable (i.e. 70 to 110 degrees). The current angle of this intersection is 122 degrees.

91 The increase in traffic through this intersection as a result of the Plan Change is predicted to be reasonably low (in the range of 60 to 90 vehicles per hour) and I consider that this increase will not lead to adverse safety effects at this location even allowing for the less than ideal angle of approach. There is also a proposal for a threshold treatment on the western Mill Road approach to assist in ensuring that vehicle speeds are consistent with the 60km/h speed limit through this area.

Tram Road Safety

92 Concerns have been raised regarding the general safety of Tram Road. This has been discussed at paragraph 66, which identifies that Council is already planning on upgrades. I anticipate that development contributions would be sought from this Plan Change in the usual manner to assist in bringing forward those upgrades and mitigate these concerns.

Road Safety At Ōhoka Primary School

93 Concerns were raised regarding the potential traffic effects at Ōhoka Primary School as a result of the Plan Change. I note that on-street car parking for the School occurs approximately 150m south of Mill Road on Jacksons Road. The Plan Change is not anticipated to increase traffic on Jacksons Road, so there would be no additional traffic passing the School.

94 Furthermore, the proposal includes the potential for a Primary School within the Plan Change site, so it may be that there would not be additional pupils at the existing School in the longer-term.

95 Overall, I consider that the effects of the Plan Change on road safety at the school are acceptable.

Road Safety During Markets

96 Concerns have been raised regarding the road safety effects on the network during running of the Ōhoka Market. I have observed vehicles parking on-street / roadside berms in the vicinity of the market and pedestrians crossing Whites Road at these times.

97 The predicted traffic volumes on Whites Road remain reasonably low during peak times with the Plan Change traffic added to the network (in the order of 200 vehicles per hour). I note that the volumes

outside these peak periods will be lower and consider that pedestrian will still be able to adequately cross this road.

98 I also note that the proposed Plan Change will include a sizable parking area in the commercial area on Whites Road that would be available to users of the market. This will assist in rationalising the on-street parking that currently occurs and lessen the potential safety concerns. Furthermore, the Outline Development Plan proposes 2 pedestrian/cycle crossing facilities between the Ōhoka Stream and the northeastern corner of the Whites Road commercial area. This will assist with providing users of the market to safely cross Whites Road to attend the market at Ōhoka Domain.

Whites Road Upgrade Arrangements

99 Submission 640 (J Docherty) highlighted a concern regarding the ability to undertake road widening of Whites Road within the constraints of the existing road corridor. As identified at paragraph 35 to 36, it is considered that the existing road width of Whites Road has sufficient capacity to accommodate the predicted traffic volumes as it meets the District Plan road cross section requirements. On that basis, the widening initially anticipated in the ITA is not required and the existing formed width at this location will be acceptable.

Accessibility

100 Several of the submissions identified that the Plan Change site is not accessible by walking and cycling. I have discussed this matter earlier in this evidence. In brief, I consider that the proposed commercial centres will be sufficient to accommodate the day to day shopping needs of the residents through walking and cycling. There is also the potential that a Primary School is established at the Site, which would be within walking distance for the residents.

101 Although the site is approximately 10km from the centre of Rangiora and 9km from the centre of Kaiapoi, these are achievable cycling distances particularly for recreation and cyclists on e-bikes. The site is also located within an area that has a planned cycle strategy to assist in accommodating these demands as that network is developed.

Traffic Capacity

102 Concerns have been raised in submissions regarding the traffic capacity effects on the surrounding network. The modelling presented in the ITA and as updated in this evidence indicate that there is generally sufficient capacity to accommodate the proposed development. The only intersection that may require upgrading as a direct result of the Plan Change is the Tram Road / State Highway 1 interchange. The existing design and capacity of this interchange could readily accommodate development of up to 250 allotments at the Plan Change site and beyond this, a restricted discretionary

activity consent would be required to assess the further upgrades required or the justification otherwise.

CONCLUSION

103 For the reasons set out above, I consider that the transport effects of the Plan Change are acceptable subject to:

103.1 Tram Road widening (between Bradleys Road and Jacksons Road);

103.2 A consenting requirement providing scope to consider the need for, and the nature of, any upgrades for the Tram Road / State Highway 1 interchange above 250 allotments; and

103.3 Provision of shared paths on the Whites Road and Bradleys Road frontage, with an upgrade of the existing Mill Road path.

Dated: 7 July 2023

Nicholas Peter Fuller

ATTACHMENT 1: CONCEPT ACCESS INTERSECTION ARRANGEMENTS

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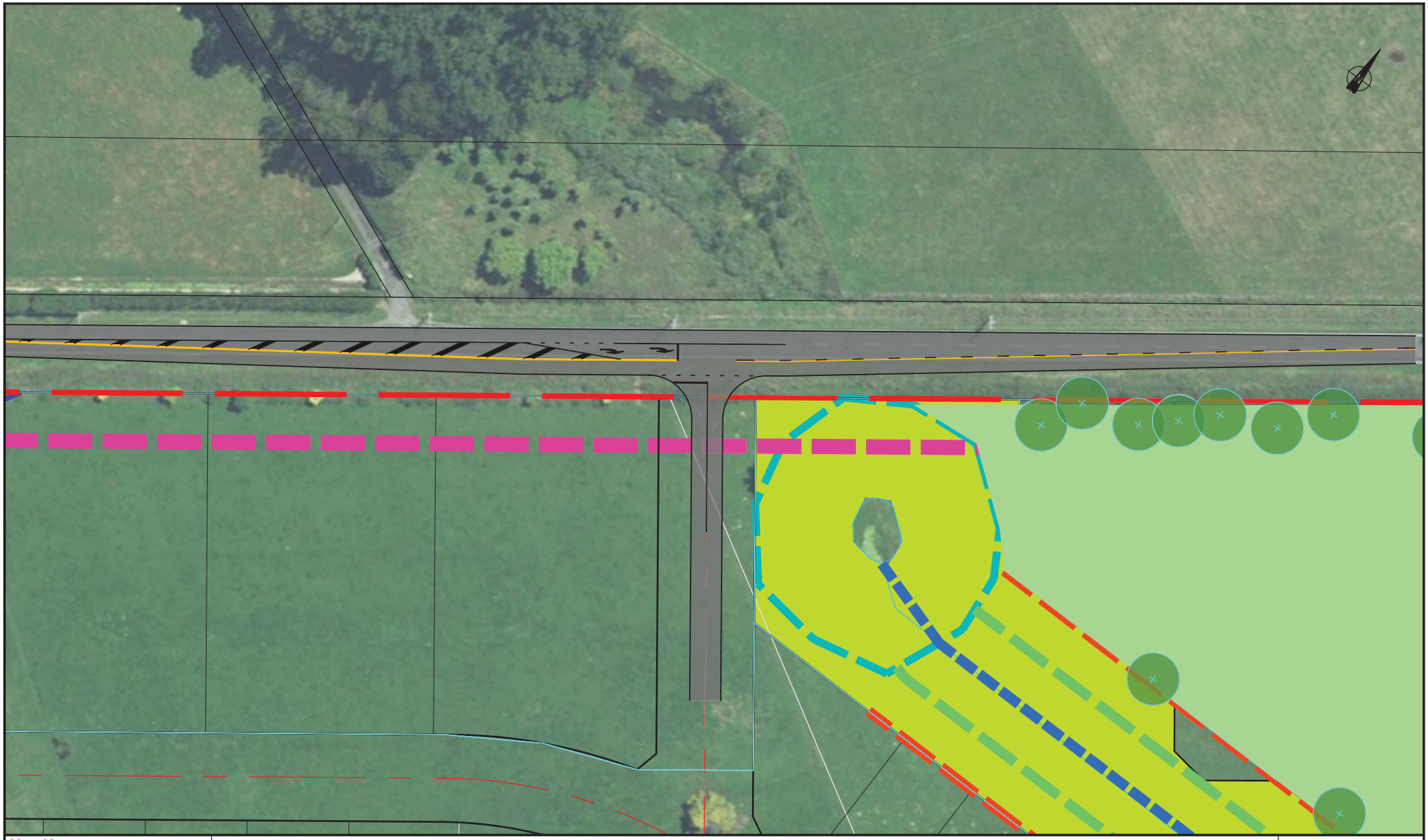
Example Whites Road Access Layout

For Information

Drawing: 0021-034-SK100X-B

Sheet
0021-034-TR1001-B

Scale @A3 1/500
Date: 04/07/2023
By N Fuller
Project #0021-034



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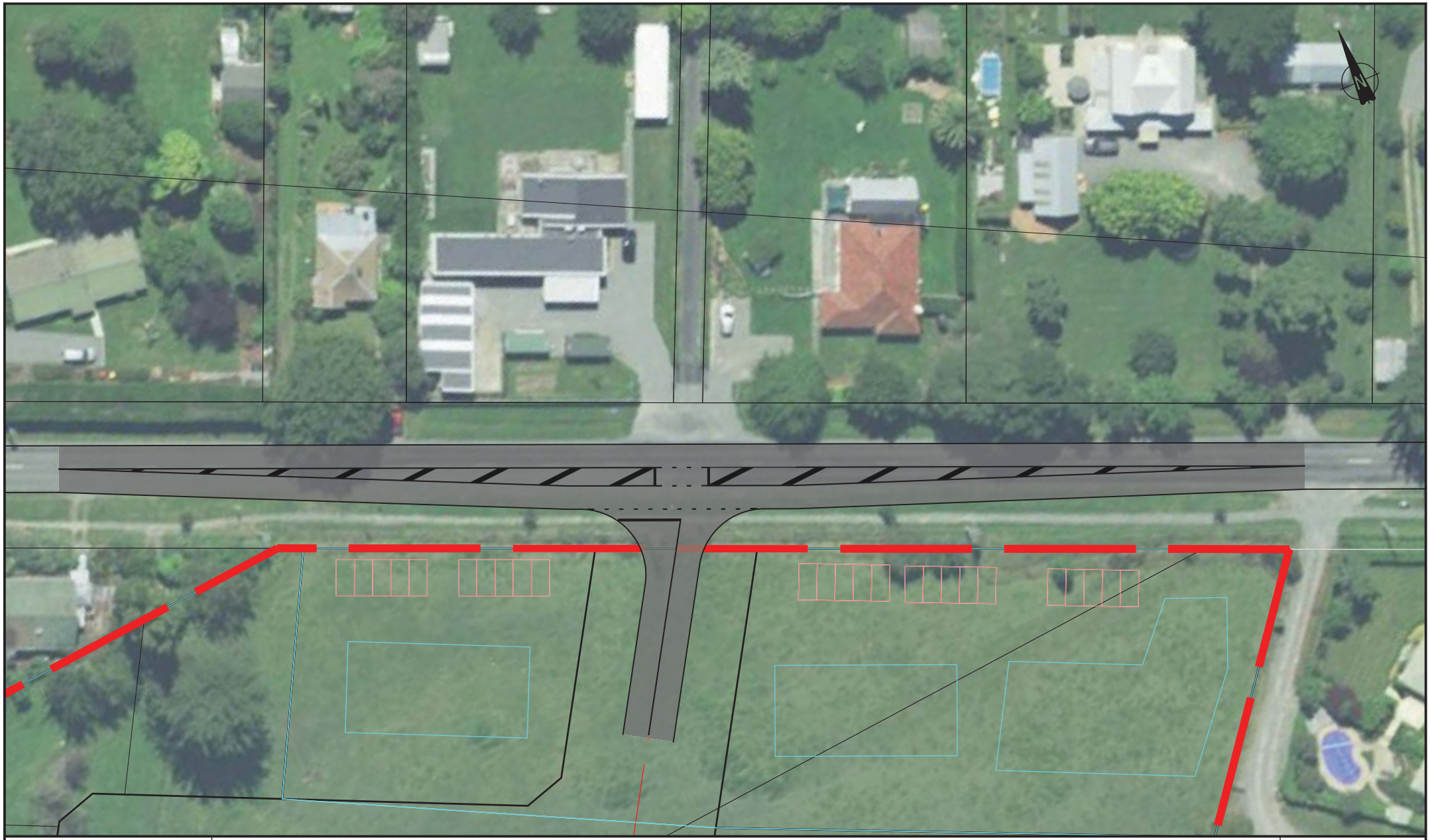
Example Bradleys Road Access Layout

For Information

Drawing: 0021-034-SK100X-B

Sheet
0021-034-TR1002-B

Scale @A3 1/750
Date: 04/07/2023
By N Fuller
Project #0021-034



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Mill Road Access Layout

For Information

Drawing: 0021-034-SK100X-B

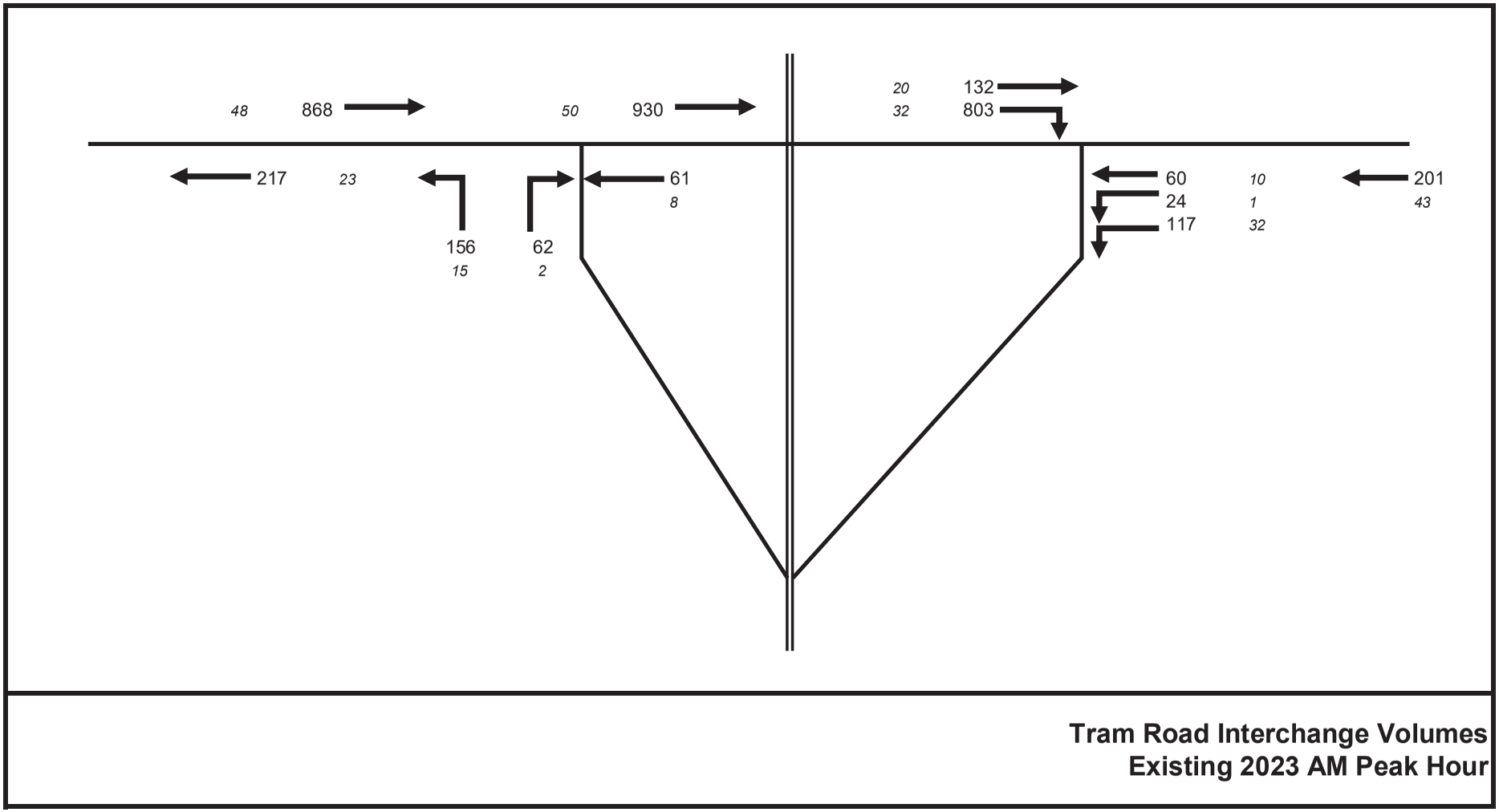
Sheet
0021-034-TR1003-B

Scale @A3 1/500
Date: 04/07/2023
By N Fuller
Project #0021-034

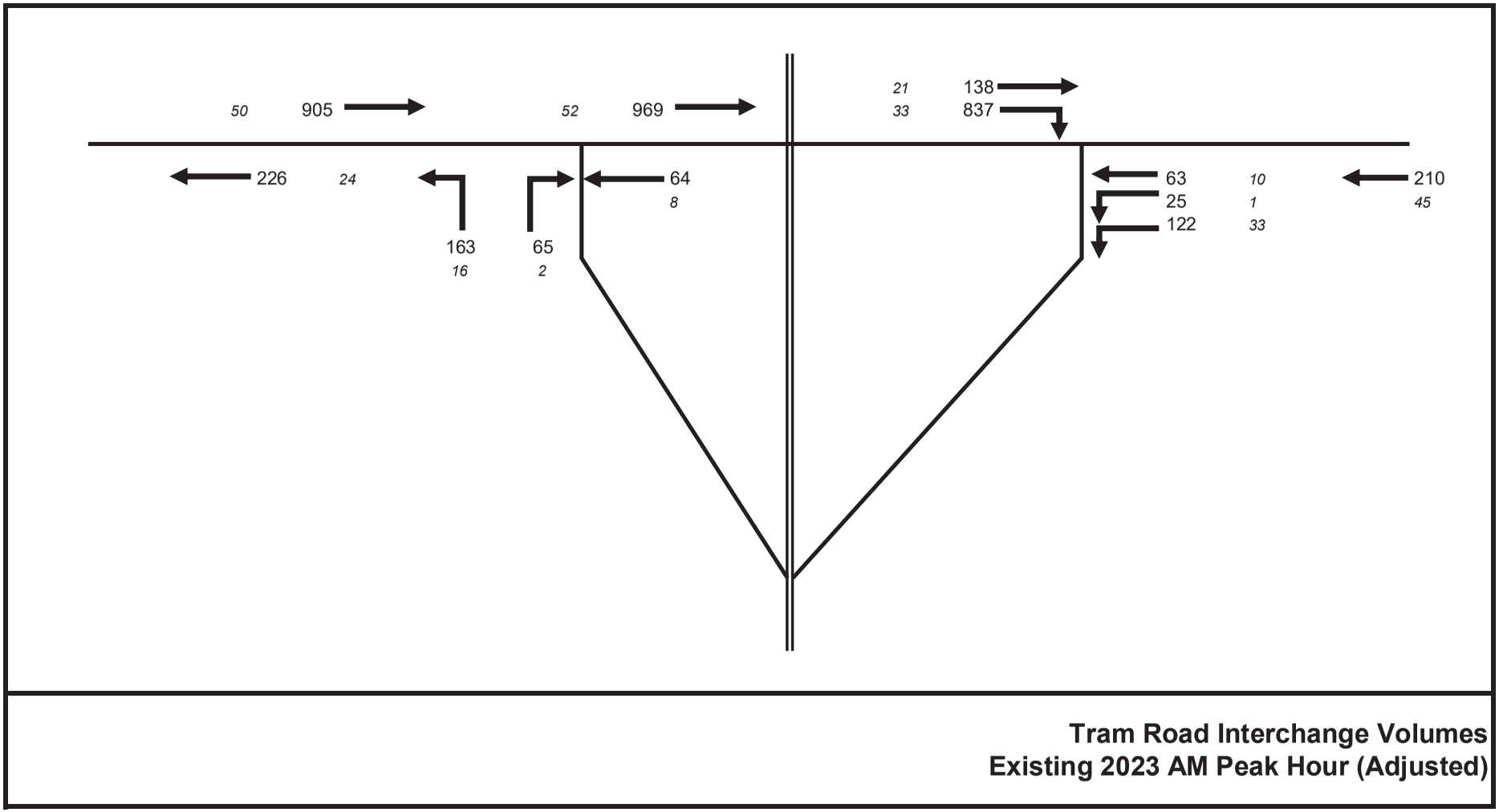
ATTACHMENT 2: TRAFFIC COUNT COMPARISON

Location	Source	AM Peak (07:00 to 08:00)	PM Peak (17:00 to 18:00)
Bradleys Road (south of Mill Road)	ITA	76	133
	Council Count	67	123
Bradleys Road (north of Mill Road)	ITA	17	24
	Council Count	17	22
Tram Road (east of Whites Road)	ITA	763	827
	Council Count	753	776
Tram Road (east of Bradley Road)	ITA	674	778
	Council Count	624	647
Tram Road (west of Bradley Road)	ITA	447	483
	Council Count	374	416
Whites Road (north of Tram Road)	ITA	44	69
	Council Count	54	76

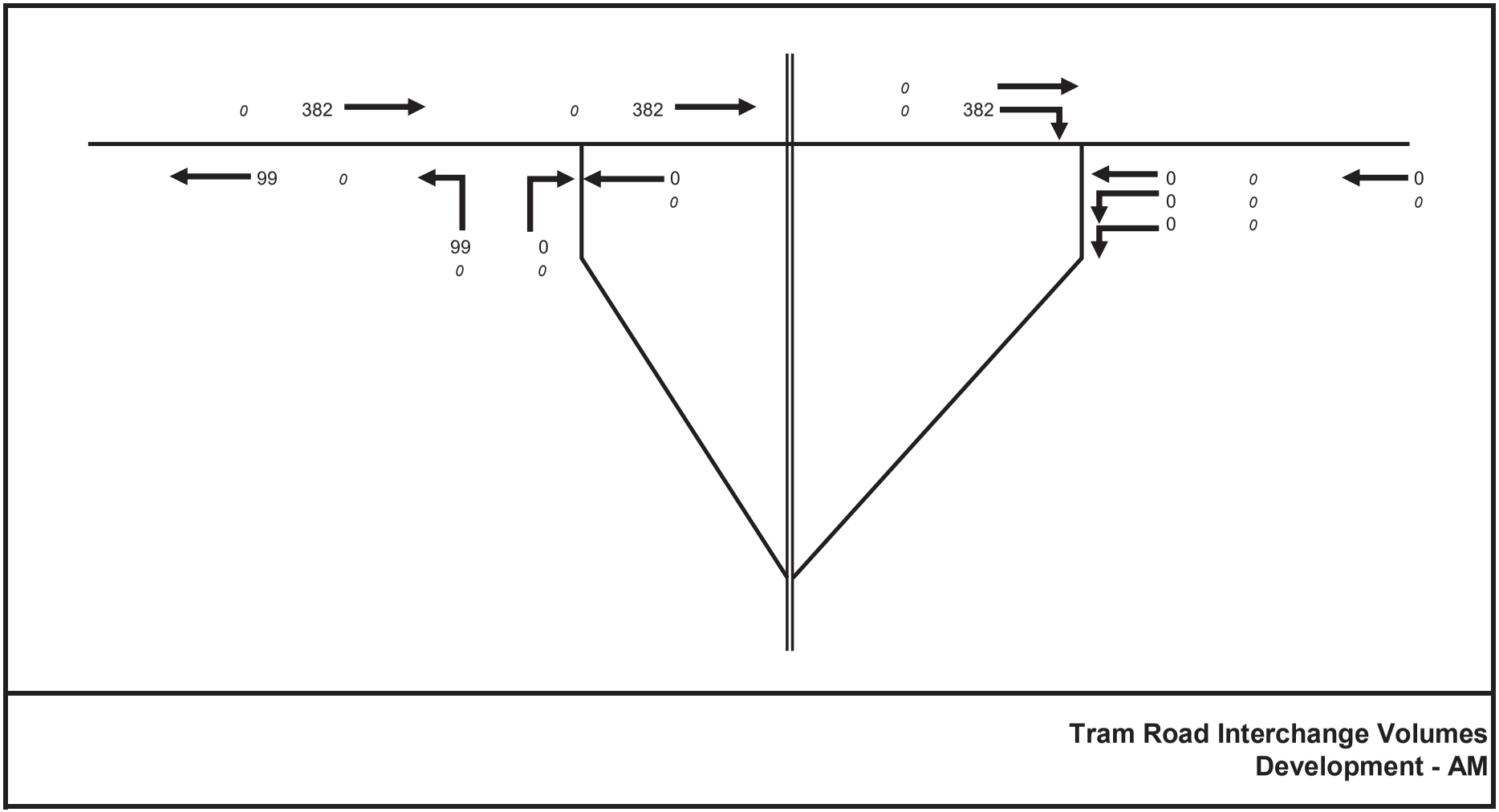
ATTACHMENT 3: TRAM ROAD INTERCHANGE TRAFFIC VOLUMES



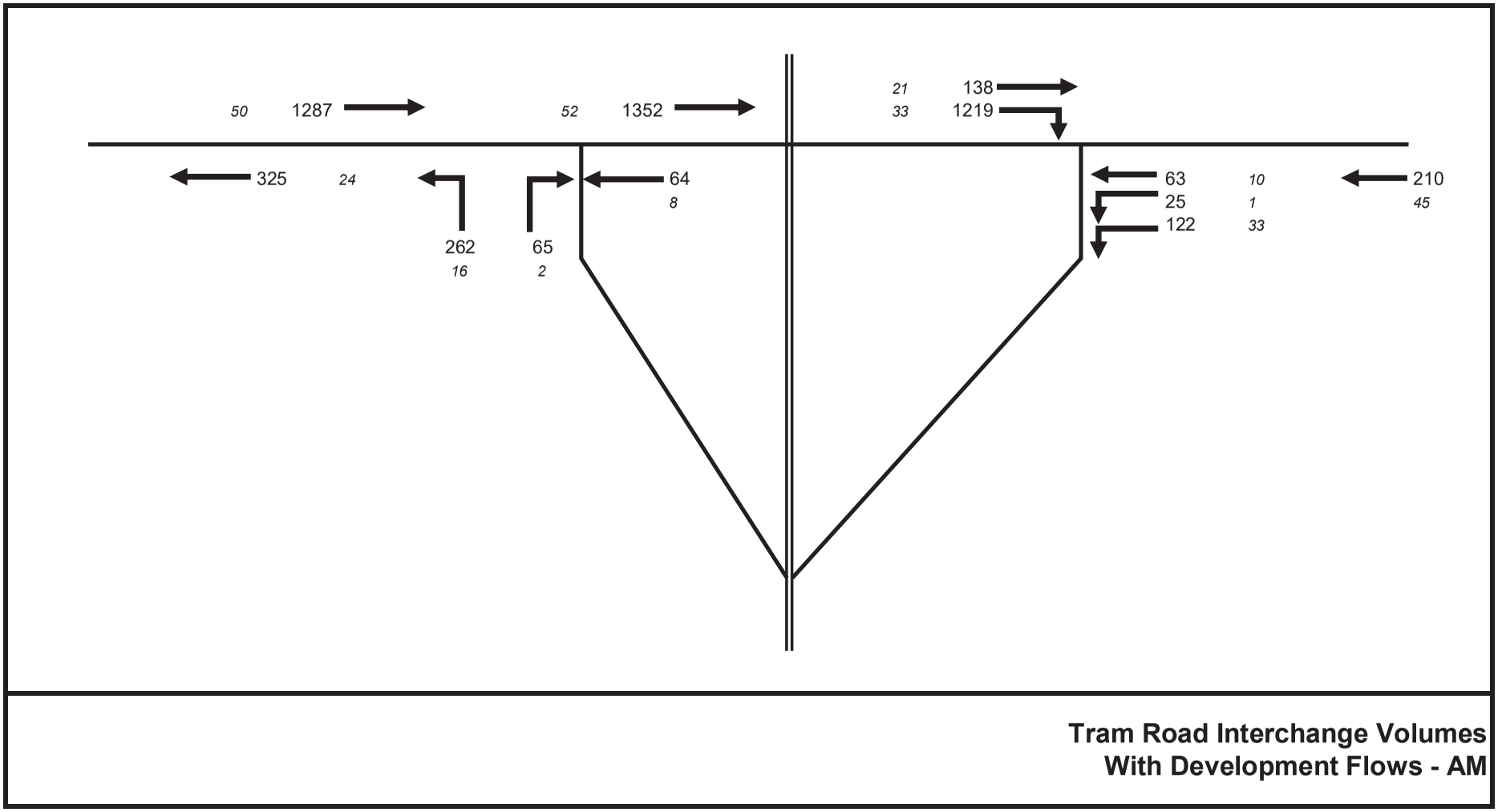
Tram Road Interchange Volumes
Existing 2023 AM Peak Hour



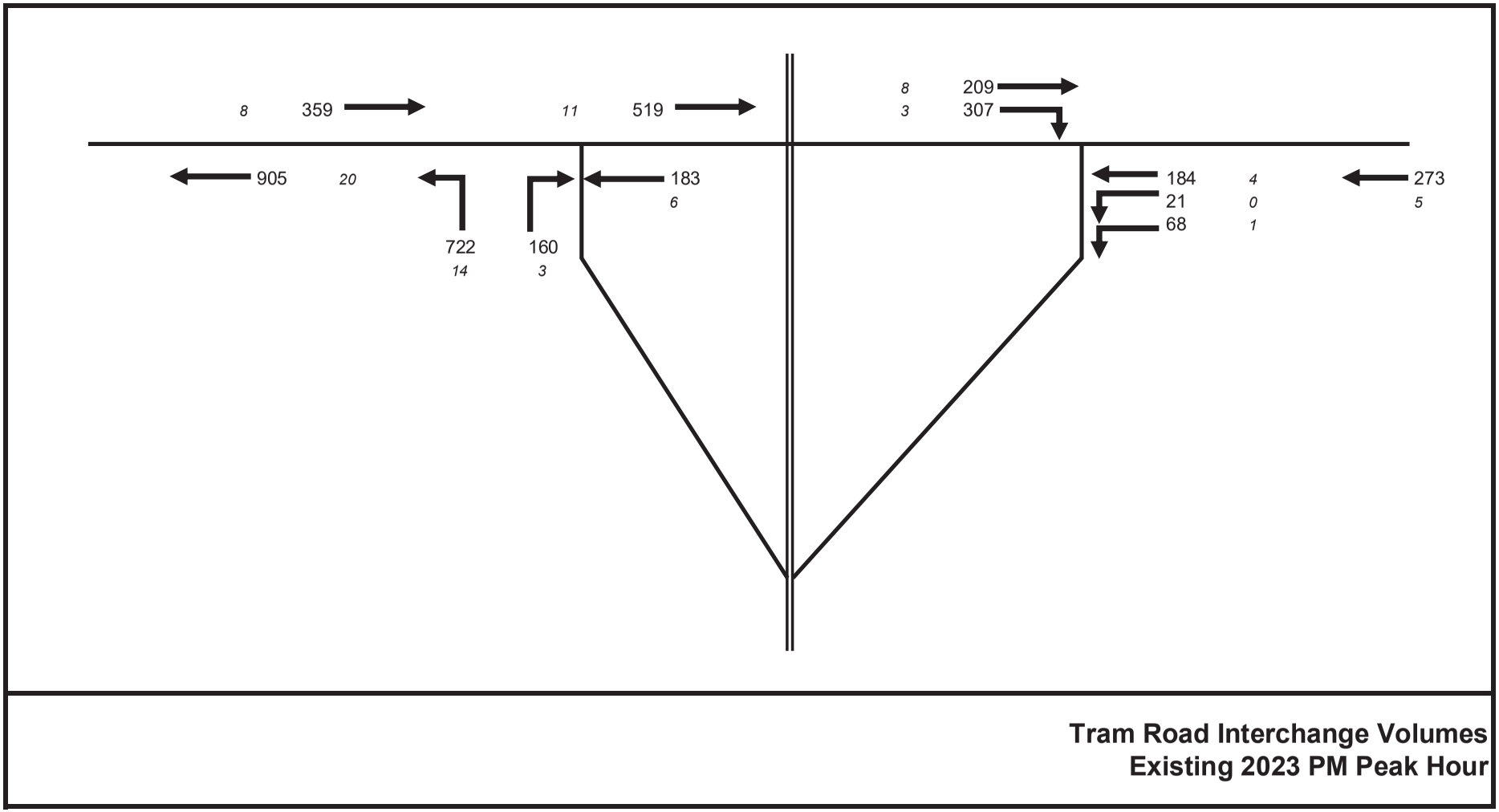
Tram Road Interchange Volumes
Existing 2023 AM Peak Hour (Adjusted)



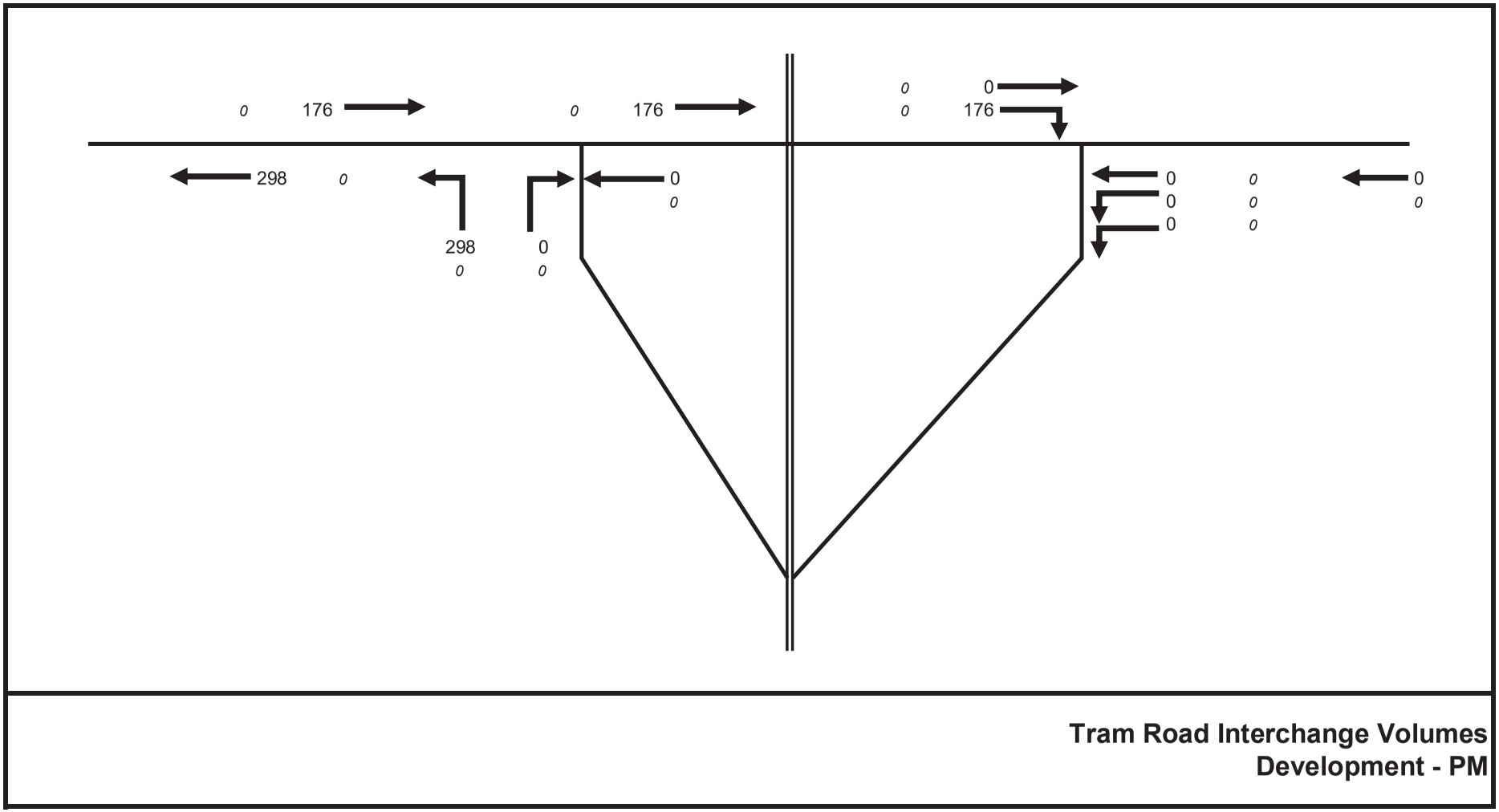
Tram Road Interchange Volumes
Development - AM



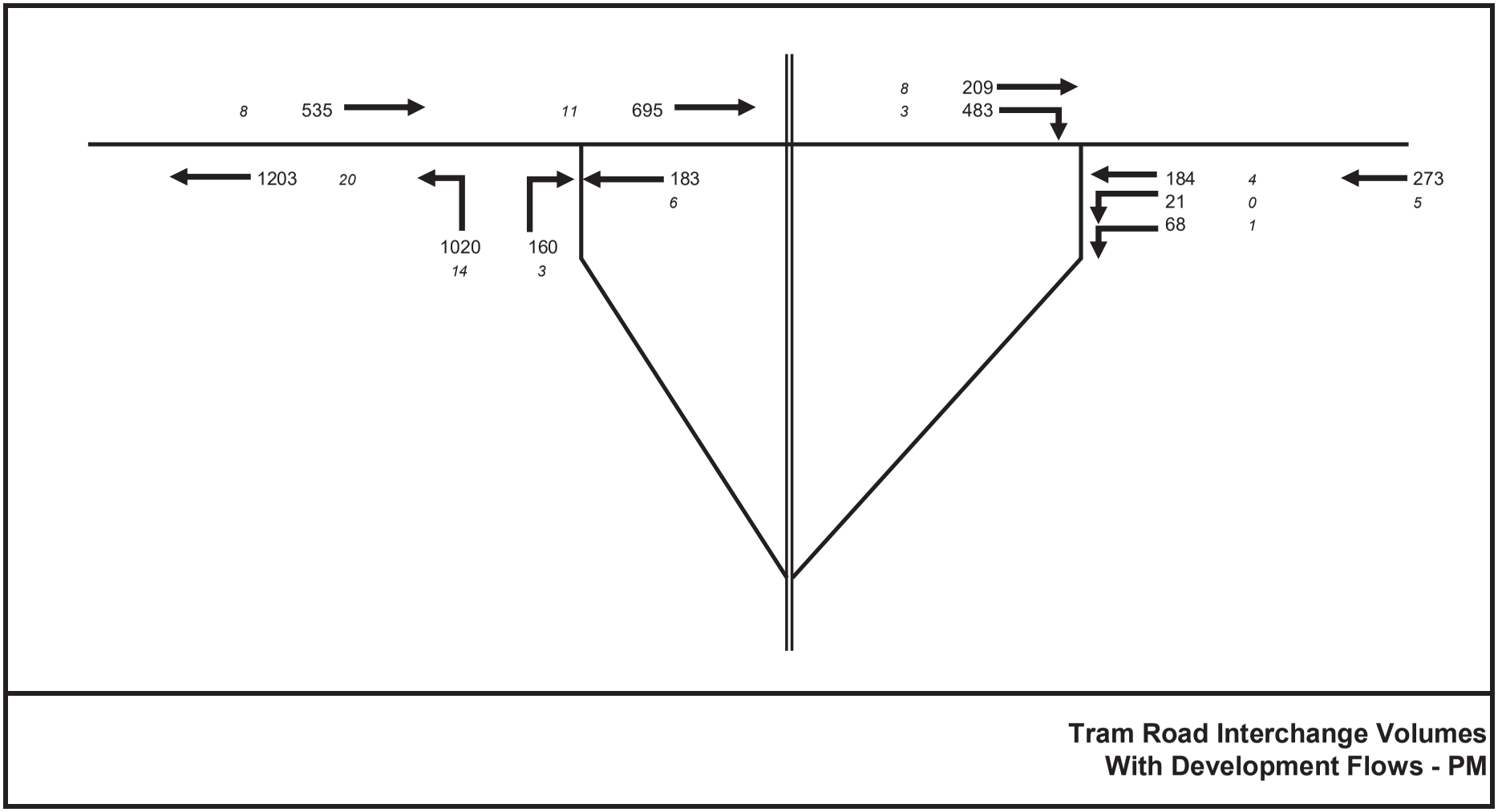
Tram Road Interchange Volumes
With Development Flows - AM



Tram Road Interchange Volumes
Existing 2023 PM Peak Hour



Tram Road Interchange Volumes
Development - PM



Tram Road Interchange Volumes
With Development Flows - PM

ATTACHMENT 4: EXISTING TRAM ROAD INTERCHANGE MODEL RESULTS

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 AM Base (Site Folder: Tram Rd Int Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 AM Base (Network Folder: General)]

New Site
Site Category: (None)
Signals - Actuated Isolated Cycle Time = 55 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	157	21.5	157	21.5	0.096	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	50.1
5	T1	All MCs	100	11.6	100	11.6	* 0.377	25.1	LOS C	1.6	12.2	0.92	0.72	0.92	19.5
Approach			257	17.6	257	17.6	0.377	13.4	LOS B	1.6	12.2	0.36	0.59	0.36	40.5
West: Tram Rd															
11	T1	All MCs	160	13.2	160	13.2	* 0.890	12.1	LOS B	15.3	112.0	0.90	0.91	0.96	31.6
12	R2	All MCs	879	3.8	879	3.8	0.890	17.7	LOS B	15.3	112.0	0.90	0.91	0.96	46.2
Approach			1039	5.3	1039	5.3	0.890	16.8	LOS B	15.3	112.0	0.90	0.91	0.96	44.5
All Vehicles			1296	7.7	1296	7.7	0.890	16.1	LOS B	15.3	112.0	0.79	0.84	0.84	43.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd Off-Ramp - 2023 AM Base (Site Folder: Tram Rd Int Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 AM Base (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	180	8.8	180	8.8	0.097	9.1	LOS A	0.0	0.0	0.00	0.63	0.00	70.1
3	R2	All MCs	67	3.1	67	3.1	0.578	26.8	LOS D	0.4	2.8	0.90	1.04	1.16	42.2
Approach			247	7.2	247	7.2	0.578	13.9	LOS B	0.4	2.8	0.24	0.74	0.32	63.5
East: Tram Rd															
5	T1	All MCs	73	11.6	73	11.6	0.040	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach			73	11.6	73	11.6	0.040	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
West: Tram Rd															
11	T1	All MCs	964	5.2	964	5.2	0.503	0.2	LOS A	0.6	4.5	0.00	0.00	0.00	59.6
Approach			964	5.2	964	5.2	0.503	0.2	NA	0.6	4.5	0.00	0.00	0.00	59.6
All Vehicles			1284	6.0	1284	6.0	0.578	2.8	NA	0.6	4.5	0.05	0.14	0.06	60.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 PM Base (Site Folder: Tram Rd Int Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 PM Base (Network Folder: General)]

New Site
Site Category: (None)
Signals - Actuated Isolated Cycle Time = 42 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	73	1.4	73	1.4	0.039	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	51.0
5	T1	All MCs	220	1.9	220	1.9	* 0.434	15.1	LOS B	2.4	17.2	0.86	0.70	0.86	26.6
Approach			293	1.8	293	1.8	0.434	12.8	LOS B	2.4	17.2	0.64	0.66	0.64	35.9
West: Tram Rd															
11	T1	All MCs	228	3.7	228	3.7	* 0.646	10.3	LOS B	5.6	39.7	0.81	0.78	0.81	34.8
12	R2	All MCs	326	1.0	326	1.0	0.646	15.9	LOS B	5.6	39.7	0.81	0.78	0.81	50.4
Approach			555	2.1	555	2.1	0.646	13.6	LOS B	5.6	39.7	0.81	0.78	0.81	45.1
All Vehicles			847	2.0	847	2.0	0.646	13.3	LOS B	5.6	39.7	0.75	0.74	0.75	42.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd Off-Ramp - 2023 PM Base (Site Folder: Tram Rd Int Base)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 PM Base (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	775	1.9	775	1.9	0.398	9.5	LOS A	0.0	0.0	0.00	0.64	0.00	72.1
3	R2	All MCs	172	1.8	172	1.8	0.276	13.2	LOS B	0.4	3.1	0.56	1.00	0.62	60.1
Approach			946	1.9	946	1.9	0.398	10.2	LOS B	0.4	3.1	0.10	0.70	0.11	70.7
East: Tram Rd															
5	T1	All MCs	199	3.2	199	3.2	0.104	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach			199	3.2	199	3.2	0.104	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
West: Tram Rd															
11	T1	All MCs	386	2.2	386	2.2	0.198	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			386	2.2	386	2.2	0.198	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles			1532	2.1	1532	2.1	0.398	6.3	NA	0.4	3.1	0.06	0.43	0.07	67.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

ATTACHMENT 5: EXISTING TRAM ROAD INTERCHANGE PLUS PLAN CHANGE MODEL RESULTS

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 AM Existing plus Dev (Site Folder: Tram Rd Int + Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 AM + Dev (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	163	21.3	163	21.3	0.100	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	50.1
5	T1	All MCs	104	11.1	104	11.1	* 0.855	84.6	LOS F	5.1	39.3	1.00	0.95	1.29	7.5
Approach			267	17.3	267	17.3	0.855	36.5	LOS D	5.1	39.3	0.39	0.68	0.50	27.0
West: Tram Rd															
11	T1	All MCs	167	13.2	162	13.3	* 0.913	7.7	LOS A	15.5	112.0	0.73	0.81	0.73	35.8
12	R2	All MCs	1318	2.6	1278	2.7	0.913	13.3	LOS B	15.5	112.0	0.73	0.81	0.73	50.9
Approach			1485	3.8	1440	3.9	0.913	12.6	LOS B	15.5	112.0	0.73	0.81	0.73	49.7
All Vehicles			1753	5.9	1708	6.0	0.913	16.4	LOS B	15.5	112.0	0.68	0.79	0.70	44.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd Off-Ramp - 2023 AM Existing plus Dev (Site Folder: Tram Rd Int + Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 AM + Dev (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	293	5.8	293	5.8	0.797	218.1	LOS F	19.4	142.3	1.00	0.95	3.73	13.8
3	R2	All MCs	71	3.0	71	3.0	2.815	1712.1	LOS F	11.8	84.9	1.00	2.55	11.61	1.1
Approach			363	5.2	363	5.2	2.815	508.3	LOS F	19.4	142.3	1.00	1.26	5.26	6.1
East: Tram Rd															
5	T1	All MCs	76	11.1	76	11.1	0.042	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach			76	11.1	76	11.1	0.042	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
West: Tram Rd															
11	T1	All MCs	1407	3.7	1407	3.7	0.728	0.6	LOS A	25.9	187.2	0.00	0.00	0.00	58.9
Approach			1407	3.7	1407	3.7	0.728	0.6	NA	25.9	187.2	0.00	0.00	0.00	58.9
All Vehicles			1846	4.3	1846	4.3	2.815	100.4	NA	25.9	187.2	0.20	0.25	1.03	16.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 PM Existing plus Dev (Site Folder: Tram Rd Int + Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 PM + Dev (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 34 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	73	1.4	73	1.4	0.039	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	51.0
5	T1	All MCs	220	1.9	220	1.9	* 0.644	15.9	LOS B	2.3	16.7	0.98	0.84	1.12	25.9
Approach			293	1.8	293	1.8	0.644	13.4	LOS B	2.3	16.7	0.73	0.77	0.84	35.3
West: Tram Rd															
11	T1	All MCs	228	3.7	228	3.7	* 0.830	14.0	LOS B	8.6	60.7	0.93	1.00	1.23	30.8
12	R2	All MCs	512	0.6	512	0.6	0.830	19.5	LOS B	8.6	60.7	0.93	1.00	1.23	46.1
Approach			740	1.6	740	1.6	0.830	17.8	LOS B	8.6	60.7	0.93	1.00	1.23	42.2
All Vehicles			1033	1.6	1033	1.6	0.830	16.6	LOS B	8.6	60.7	0.88	0.93	1.12	40.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd Off-Ramp - 2023 PM Existing plus Dev (Site Folder: Tram Rd Int + Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 PM + Dev (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	1088	1.4	1088	1.4	0.557	10.5	LOS B	0.0	0.0	0.00	0.63	0.00	72.2
3	R2	All MCs	172	1.8	172	1.8	0.362	16.5	LOS C	0.6	4.3	0.69	1.04	0.89	54.6
Approach			1260	1.4	1260	1.4	0.557	11.3	LOS B	0.6	4.3	0.09	0.69	0.12	70.6
East: Tram Rd															
5	T1	All MCs	199	3.2	199	3.2	0.104	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach			199	3.2	199	3.2	0.104	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
West: Tram Rd															
11	T1	All MCs	572	1.5	572	1.5	0.291	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach			572	1.5	572	1.5	0.291	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.8
All Vehicles			2031	1.6	2031	1.6	0.557	7.0	NA	0.6	4.3	0.06	0.43	0.07	67.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

ATTACHMENT 6: UPGRADED TRAM ROAD INTERCHANGE PLUS PLAN CHANGE MODEL RESULTS

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 AM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 AM Upgrade (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 40 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	189	18.3	189	18.3	0.525	24.5	LOS C	1.7	13.2	0.97	0.79	1.00	40.4
5	T1	All MCs	78	14.9	78	14.9	* 0.525	18.6	LOS B	1.7	13.2	0.97	0.78	0.99	22.3
Approach			267	17.3	267	17.3	0.525	22.8	LOS C	1.7	13.2	0.97	0.79	1.00	37.2
West: Tram Rd															
11	T1	All MCs	167	13.2	167	13.2	* 0.731	4.0	LOS A	4.9	35.8	0.53	0.73	0.58	41.4
12	R2	All MCs	1318	2.6	1318	2.6	0.731	10.5	LOS B	5.9	42.6	0.59	0.78	0.65	54.3
Approach			1485	3.8	1485	3.8	0.731	9.7	LOS A	5.9	42.6	0.59	0.77	0.64	53.3
All Vehicles			1753	5.9	1753	5.9	0.731	11.7	LOS B	5.9	42.6	0.64	0.77	0.70	50.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101v [Tram Rd Off-Ramp - 2023 AM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 AM Upgrade (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 40 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	293	5.8	293	5.8	0.154	9.0	LOS A	0.0	0.0	0.00	0.63	0.00	71.0
3	R2	All MCs	71	3.0	71	3.0	* 0.249	25.1	LOS C	0.8	5.8	0.92	0.75	0.92	42.3
Approach			363	5.2	363	5.2	0.249	12.1	LOS B	0.8	5.8	0.18	0.66	0.18	66.2
East: Tram Rd															
5	T1	All MCs	76	11.1	76	11.1	0.076	9.6	LOS A	0.9	6.6	0.99	0.47	0.99	47.7
Approach			76	11.1	76	11.1	0.076	9.6	LOS A	0.9	6.6	0.99	0.47	0.99	47.7
West: Tram Rd															
11	T1	All MCs	1407	3.7	1407	3.7	* 0.662	7.1	LOS A	6.1	44.4	0.76	0.68	0.76	48.7
Approach			1407	3.7	1407	3.7	0.662	7.1	LOS A	6.1	44.4	0.76	0.68	0.76	48.7
All Vehicles			1846	4.3	1846	4.3	0.662	8.2	LOS A	6.1	44.4	0.65	0.67	0.66	52.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 PM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 PM Upgrade (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 30 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	73	1.4	73	1.4	0.167	16.2	LOS B	0.6	3.9	0.83	0.72	0.83	48.9
5	T1	All MCs	220	1.9	220	1.9	* 0.487	11.6	LOS B	1.8	13.2	0.91	0.74	0.91	30.6
Approach			293	1.8	293	1.8	0.487	12.7	LOS B	1.8	13.2	0.89	0.73	0.89	38.4
West: Tram Rd															
11	T1	All MCs	228	3.7	228	3.7	* 0.533	7.4	LOS A	2.6	18.5	0.77	0.71	0.77	39.7
12	R2	All MCs	512	0.6	512	0.6	0.533	15.2	LOS B	3.1	21.7	0.89	0.79	0.89	49.8
Approach			740	1.6	740	1.6	0.533	12.8	LOS B	3.1	21.7	0.85	0.77	0.85	47.6
All Vehicles			1033	1.6	1033	1.6	0.533	12.8	LOS B	3.1	21.7	0.86	0.76	0.86	45.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101v [Tram Rd Off-Ramp - 2023 PM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 PM Upgrade (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 30 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	1211	1.2	1211	1.2	0.619	15.5	LOS B	0.0	0.0	0.00	0.63	0.00	72.2
3	R2	All MCs	412	0.8	412	0.8	* 0.717	19.8	LOS B	3.8	26.9	0.95	0.88	1.13	48.1
Approach			1622	1.1	1622	1.1	0.717	16.6	LOS B	3.8	26.9	0.24	0.70	0.29	67.4
East: Tram Rd															
5	T1	All MCs	424	1.5	424	1.5	* 0.732	14.0	LOS B	4.1	29.2	1.00	0.92	1.16	43.6
Approach			424	1.5	424	1.5	0.732	14.0	LOS B	4.1	29.2	1.00	0.92	1.16	43.6
West: Tram Rd															
11	T1	All MCs	509	1.7	509	1.7	0.433	9.7	LOS A	2.0	13.9	0.85	0.70	0.85	45.6
Approach			509	1.7	509	1.7	0.433	9.7	LOS A	2.0	13.9	0.85	0.70	0.85	45.6
All Vehicles			2556	1.3	2556	1.3	0.732	14.8	LOS B	4.1	29.2	0.49	0.73	0.54	59.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

ATTACHMENT 7: EXISTING TRAM ROAD INTERCHANGE PLUS 250 ALLOTMENTS MODEL RESULTS

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 AM Staged (Site Folder: Tram Rd Int + Staged Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 + Staged AM (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 64 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	163	21.3	163	21.3	0.100	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	50.1
5	T1	All MCs	104	11.1	104	11.1	* 0.608	33.1	LOS C	2.1	16.2	1.00	0.81	1.09	16.0
Approach			267	17.3	267	17.3	0.608	16.5	LOS B	2.1	16.2	0.39	0.63	0.43	37.9
West: Tram Rd															
11	T1	All MCs	167	13.2	167	13.2	* 0.893	18.7	LOS B	15.4	112.0	0.85	0.94	1.04	26.6
12	R2	All MCs	1013	3.4	1013	3.4	0.893	24.3	LOS C	15.4	112.0	0.85	0.94	1.04	40.7
Approach			1180	4.8	1180	4.8	0.893	23.5	LOS C	15.4	112.0	0.85	0.94	1.04	39.1
All Vehicles			1447	7.1	1447	7.1	0.893	22.2	LOS C	15.4	112.0	0.77	0.88	0.93	38.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd Off-Ramp - 2023 AM Staged (Site Folder: Tram Rd Int + Staged Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 + Staged AM (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	213	7.9	213	7.9	0.114	9.1	LOS A	0.0	0.0	0.00	0.63	0.00	70.3
3	R2	All MCs	71	3.0	71	3.0	0.883	47.8	LOS E	0.7	4.9	0.98	1.14	1.88	28.5
Approach			283	6.7	283	6.7	0.883	18.7	LOS C	0.7	4.9	0.24	0.76	0.47	58.3
East: Tram Rd															
5	T1	All MCs	76	11.1	76	11.1	0.042	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach			76	11.1	76	11.1	0.042	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
West: Tram Rd															
11	T1	All MCs	1102	4.8	1102	4.8	0.574	0.3	LOS A	7.8	57.2	0.00	0.00	0.00	59.5
Approach			1102	4.8	1102	4.8	0.574	0.3	NA	7.8	57.2	0.00	0.00	0.00	59.5
All Vehicles			1461	5.5	1461	5.5	0.883	3.8	NA	7.8	57.2	0.05	0.15	0.09	59.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2023 PM Staged (Site Folder: Tram Rd Int + Staged Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 + Staged PM (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 30 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Tram Rd															
4	L2	All MCs	73	1.4	73	1.4	0.039	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	51.0
5	T1	All MCs	220	1.9	220	1.9	* 0.568	13.0	LOS B	2.0	14.1	0.95	0.79	1.01	28.9
Approach			293	1.8	293	1.8	0.568	11.2	LOS B	2.0	14.1	0.71	0.73	0.76	37.8
West: Tram Rd															
11	T1	All MCs	228	3.7	228	3.7	* 0.791	12.2	LOS B	5.9	42.0	0.94	0.98	1.21	32.6
12	R2	All MCs	372	0.8	372	0.8	0.791	17.8	LOS B	5.9	42.0	0.94	0.98	1.21	48.1
Approach			600	1.9	600	1.9	0.791	15.7	LOS B	5.9	42.0	0.94	0.98	1.21	43.3
All Vehicles			893	1.9	893	1.9	0.791	14.2	LOS B	5.9	42.0	0.86	0.90	1.06	41.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd Off-Ramp - 2023 PM Staged (Site Folder: Tram Rd Int + Staged Dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

Network: N101 [2023 + Staged PM (Network Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	Aver. Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Off-Ramp															
1	L2	All MCs	852	1.7	852	1.7	0.437	9.7	LOS A	0.0	0.0	0.00	0.64	0.00	72.1
3	R2	All MCs	172	1.8	172	1.8	0.292	13.9	LOS B	0.5	3.4	0.58	1.02	0.67	58.9
Approach			1023	1.7	1023	1.7	0.437	10.4	LOS B	0.5	3.4	0.10	0.70	0.11	70.7
East: Tram Rd															
5	T1	All MCs	199	3.2	199	3.2	0.104	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	60.0
Approach			199	3.2	199	3.2	0.104	0.0	NA	0.0	0.0	0.00	0.00	0.00	60.0
West: Tram Rd															
11	T1	All MCs	432	2.0	432	2.0	0.221	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			432	2.0	432	2.0	0.221	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
All Vehicles			1654	2.0	1654	2.0	0.437	6.4	NA	0.5	3.4	0.06	0.43	0.07	67.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).

Vehicle movement LOS values are based on average delay per movement.

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

NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).

Two-Way Sign Control Capacity Model: SIDRA Standard.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

ATTACHMENT 8: EXISTING MILL ROAD / ŌHOKA ROAD MODEL RESULTS

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Ohoka Rd - 2023 AM Base (Site Folder: Mill Rd & Ohoka Rd)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Ohoka Rd															
1	L2	All MCs	28	0.0	28	0.0	0.126	7.0	LOS A	0.0	0.0	0.00	0.08	0.00	72.3
2	T1	All MCs	212	6.0	212	6.0	0.126	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	78.4
Approach			240	5.3	240	5.3	0.126	0.8	NA	0.0	0.0	0.00	0.08	0.00	77.6
North: Skewbridge Rd															
8	T1	All MCs	578	3.8	578	3.8	0.304	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
9	R2	All MCs	1	0.0	1	0.0	0.001	7.3	LOS A	0.0	0.0	0.33	0.55	0.33	63.4
Approach			579	3.8	579	3.8	0.304	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.7
West: Mill Rd															
10	L2	All MCs	1	0.0	1	0.0	0.100	9.7	LOS A	0.3	2.3	0.61	1.00	0.61	58.3
12	R2	All MCs	51	6.3	51	6.3	0.100	15.8	LOS C	0.3	2.3	0.61	1.00	0.61	56.4
Approach			52	6.1	52	6.1	0.100	15.7	LOS C	0.3	2.3	0.61	1.00	0.61	56.5
All Vehicles			871	4.4	871	4.4	0.304	1.2	NA	0.3	2.3	0.04	0.08	0.04	77.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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MOVEMENT SUMMARY

Site: 101 [Mill Rd & Ohoka Rd - 2023 PM Base (Site Folder: Mill Rd & Ohoka Rd)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Ohoka Rd															
1	L2	All MCs	65	1.6	65	1.6	0.405	7.1	LOS A	0.0	0.0	0.00	0.05	0.00	71.8
2	T1	All MCs	728	0.7	728	0.7	0.405	0.1	LOS A	0.0	0.0	0.00	0.05	0.00	78.7
Approach			794	0.8	794	0.8	0.405	0.7	NA	0.0	0.0	0.00	0.05	0.00	78.1
North: Skewbridge Rd															
8	T1	All MCs	326	1.6	326	1.6	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	2	50.0	2	50.0	0.005	15.6	LOS C	0.0	0.2	0.70	0.75	0.70	45.7
Approach			328	1.9	328	1.9	0.169	0.1	NA	0.0	0.2	0.00	0.00	0.00	79.5
West: Mill Rd															
10	L2	All MCs	2	0.0	2	0.0	0.156	13.9	LOS B	0.4	2.9	0.76	1.01	0.78	52.9
12	R2	All MCs	41	7.7	41	7.7	0.156	22.2	LOS C	0.4	2.9	0.76	1.01	0.78	51.0
Approach			43	7.3	43	7.3	0.156	21.8	LOS C	0.4	2.9	0.76	1.01	0.78	51.1
All Vehicles			1165	1.4	1165	1.4	0.405	1.3	NA	0.4	2.9	0.03	0.08	0.03	77.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

ATTACHMENT 9: MILL ROAD / ŌHOKA ROAD WITH PLAN CHANGE MODEL RESULTS

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Ohoka Rd - 2023 PM + Dev (Site Folder: Mill Rd & Ohoka Rd)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Ohoka Rd															
1	L2	All MCs	88	1.2	88	1.2	0.417	7.0	LOS A	0.0	0.0	0.00	0.07	0.00	71.7
2	T1	All MCs	728	0.7	728	0.7	0.417	0.1	LOS A	0.0	0.0	0.00	0.07	0.00	78.4
Approach			817	0.8	817	0.8	0.417	0.9	NA	0.0	0.0	0.00	0.07	0.00	77.6
North: Skewbridge Rd															
8	T1	All MCs	326	1.6	326	1.6	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	All MCs	2	50.0	2	50.0	0.006	16.2	LOS C	0.0	0.2	0.72	0.76	0.72	45.4
Approach			328	1.9	328	1.9	0.169	0.1	NA	0.0	0.2	0.00	0.00	0.00	79.5
West: Mill Rd															
10	L2	All MCs	2	0.0	2	0.0	0.191	14.2	LOS B	0.5	3.8	0.77	1.01	0.82	53.3
12	R2	All MCs	55	5.8	55	5.8	0.191	21.4	LOS C	0.5	3.8	0.77	1.01	0.82	51.8
Approach			57	5.6	57	5.6	0.191	21.2	LOS C	0.5	3.8	0.77	1.01	0.82	51.9
All Vehicles			1202	1.3	1202	1.3	0.417	1.6	NA	0.5	3.8	0.04	0.10	0.04	76.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Ohoka Rd - 2023 AM + Dev (Site Folder: Mill Rd & Ohoka Rd)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Ohoka Rd															
1	L2	All MCs	36	0.0	36	0.0	0.130	7.0	LOS A	0.0	0.0	0.00	0.09	0.00	72.0
2	T1	All MCs	212	6.0	212	6.0	0.130	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	78.1
Approach			247	5.1	247	5.1	0.130	1.0	NA	0.0	0.0	0.00	0.09	0.00	77.2
North: Skewbridge Rd															
8	T1	All MCs	578	3.8	578	3.8	0.304	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
9	R2	All MCs	1	0.0	1	0.0	0.001	7.3	LOS A	0.0	0.0	0.34	0.55	0.34	63.3
Approach			579	3.8	579	3.8	0.304	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.7
West: Mill Rd															
10	L2	All MCs	1	0.0	1	0.0	0.144	9.7	LOS A	0.5	3.4	0.62	1.00	0.62	58.7
12	R2	All MCs	79	4.0	79	4.0	0.144	15.3	LOS C	0.5	3.4	0.62	1.00	0.62	57.4
Approach			80	3.9	80	3.9	0.144	15.2	LOS C	0.5	3.4	0.62	1.00	0.62	57.4
All Vehicles			906	4.2	906	4.2	0.304	1.7	NA	0.5	3.4	0.05	0.12	0.05	76.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Two-Way Sign Control Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.