Before an Independent Hearings Panel
Appointed by Waimakariri District Council

under: the Resource Management Act 1991

in the matter of: Submissions and further submissions on the Proposed Waimakariri District Plan

and: Hearing Stream 12: Rezoning requests (larger scale)

and: **Carter Group Property Limited**
(Submitter 237)

and: **Rolleston Industrial Developments Limited**
(Submitter 160)

Statement of evidence of Nicholas Peter Fuller (Transport) on behalf of Carter Group Limited and Rolleston Industrial Developments Limited

Dated: 5 March 2024

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STATEMENT OF EVIDENCE OF NICHOLAS PETER FULLER ON BEHALF OF CARTER GROUP LIMITED AND ROLLESTON INDUSTRIAL DEVELOPMENTS LIMITED

INTRODUCTION

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 the submitters' request to rezone land bound by Mill Road, Whites Road, Bradleys Road (the *Site*).

5 I was involved in private Plan Change 31 (*PC31*) to rezone this land under the operative District Plan.

CODE OF CONDUCT

6 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

7 My evidence will address:

7.1 Traffic effects of the rezoning request, including road safety and efficiency; and

7.2 Transport infrastructure upgrades required to accommodate the rezoning request.

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 In preparing my evidence, I have reviewed:

9.1 The evidence of those experts listed in paragraph 8 above;

9.2 The Proposed Waimakariri District Plan;

9.3 Further submissions relevant to my expertise relating to the rezoning of the Site; and

9.4 The relevant documents from PC31.

SUMMARY OF EVIDENCE

10 Subject to appropriate upgrades, the traffic generated by the proposed rezoning can be accommodated by the surrounding transport network. These upgrades should be expected to occur independently to the rezoning to provide safety and capacity improvements to accommodate background traffic growth and relate to:

10.1 Tram Road / Bradleys Road intersection (already planned and funded by Council);

10.2 Tram Road / Whites Road intersection;

10.3 Flaxton Road / Threlkelds Road intersection;

10.4 Tram Road Interchange; and

10.5 Tram Road widening and corridor safety upgrades (already planned by Council).

11 To further assist the Tram Road related upgrades, the rezoning will provide for development contributions to be paid to the Council.

12 The rezoning will include a mechanism for confirming the extent of traffic effects at the time of seeking subdivision. This will allow a discussion regarding the specific nature of delays and safety effects associated with the relevant stage of development against the actual traffic growth and road network upgrades that have occurred at the relevant time.

13 The Site is within the Council's planned walking and cycling network. There is also the ability to use Main Drain Road to travel to / from

Kaiapoi subject to accommodating cyclists with the upgrade to the Skew Bridge, which is funded for improvements in the Council's Long Term Plan in 2028/2031).

14 A copy of the Integrated Transport Assessment (ITA) for this proposed rezoning is included as **Attachment 1** to this evidence.

THE PROPOSED REZONING

Development Content

15 The rezoning seeks to allow for a range of scenarios, which are:

15.1 Option 1: Up to 850 dwellings, a commercial zone plus a 250 pupil primary school;

15.2 Option 2: Up to 892 dwellings plus a commercial zone (without a primary school); and

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

16 Option 1 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:

16.1 AM Peak Hour: 949 vehicles per hour;

16.2 PM Peak Hour: 803 vehicles per hour; and

16.3 Daily: 7,400 vehicles per day.

17 Vehicle access to the 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 included in the ITA. I consider this confirms that suitable access can be achieved to the Site, although this will still need to undergo further and detailed design analysis and approvals through the standard subdivision process.

Baseline Intersection Capacity

18 Models of the following existing intersections shown in **Figure 1** below have been created to understand the operation of the transport network.

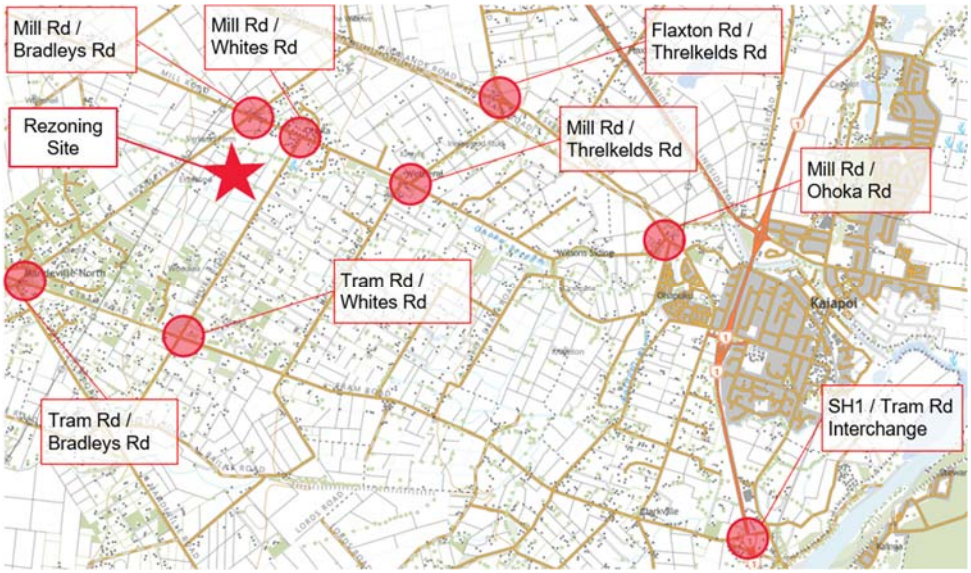

Figure 1: Intersection Models

19 In addition to the existing traffic volumes on the network, the following traffic growth (derived from the Christchurch Traffic Model (*CTM*)) has been assumed:

19.1 Tram Road Corridor: 20% over ten-years (or linear increases of 2% per year); and

19.2 Flaxton Road Corridor: 35% over ten-years (or linear increases of 3.5% per year).

20 Applying this growth to the through movements on the Tram Road and Flaxton Road corridors indicates that the following locations will be over-capacity by 2028. As such, I would expect the Council and the NZ Transport Agency to be working through intersection safety and capacity improvements to:

20.1 Tram Road / Whites Road intersection;

20.2 Tram Road / State Highway 1 Interchange;

20.3 Flaxton Road / Threlkelds Road intersection; and

20.4 Mill Road / Ōhoka Road intersection.

21 The modelling of the Bradleys Road / Tram Road intersection was also undertaken on the basis of the Council's proposed roundabout at that location, which is already planned and anticipated to be constructed prior to 2028. This roundabout can satisfactorily accommodate the predicted traffic volumes.

Development Traffic Generation & Distribution

22 The traffic generation of the proposed activity was set out in paragraph 16. This traffic has been distributed onto the surrounding

network in accordance with the distribution provided by the CTM. This model predicts the following distribution.

Table 1: Rezoning Traffic Distribution

	AM Peak	PM Peak
Tram Road West	12%	11%
Tram Road East (to SH1 south)	45%	32%
Bradleys Road North	3%	3%
Ōhoka Road to Kaiapoi	12%	24%
Flaxton Road to Rangiora	28%	30%
Total	***100%***	***100%***

23 In addition to the above, I understand that the earliest that development could practically commence at this Site is in 2028. That said, longer-term modelling that assesses the effects of the proposed rezoning in 2033 is presented later in my evidence.

Wider Network Operation

24 An assessment of the operation of the intersections identified in **Figure 1** has been undertaken on the basis of ten-years background growth (to 2033) and full development of the Site. This modelling indicates:

24.1 Bradleys Road / Tram Road: The Council's proposed roundabout can satisfactorily accommodate the predicted traffic volumes;

24.2 Whites Road / Tram Road: A roundabout can satisfactorily accommodate the predicted traffic volumes;

24.3 Tram Road Interchange: An additional eastbound traffic lane (for straight through and right turns to the on-ramp) would provide sufficient capacity;

24.4 Flaxton Road / Threlkelds Road: A roundabout can satisfactorily accommodate the predicted traffic volumes. This would also negate the need to upgrade the Ōhoka Road / Mill Road intersection;

24.5 Mill Road / Threlkelds Road: Although the existing arrangement can accommodate the predicted traffic volumes, it is anticipated that the priorities would be altered (in conjunction with the Flaxton Road / Threlkelds Road roundabout) to promote traffic between Mill Road (west) and Threlkelds Road. I expect that this intersection can still

accommodate the predicted traffic volumes with the priorities altered;

24.6 Mill Road / Bradleys Road: No upgrades required as the existing intersection can already accommodate the predicted traffic volumes; and

24.7 Mill Road / Whites Road: No upgrades required as the existing intersection can already accommodate the predicted traffic volumes.

25 The upgrades identified above would need to occur regardless of whether the rezoning also occurs to accommodate background traffic growth predicted on the network (as set out in paragraph 20). The proposed rezoning traffic can be accommodated with the proposed upgrades.

26 I understand that the proposed rules for the Site include the need for a further assessment of intersection road safety and capacity at subdivision. The purpose of this assessment will be to confirm actual traffic growth on the network at that time, the anticipated effects of the predicted traffic from the subdivision and any mitigating matters then in place or planned that may facilitate development ahead of the upgrades. Mitigating measures may include interim safety upgrades, the specific details of delay at the intersection (and whether this only applies to a small volume) and the timing of development relative to the timing of completing the intersection upgrades.

27 Furthermore, the proposal would provide development contributions for widening to Tram Road (between Bradleys Road and Jacksons Road) as well as the Council's currently planned Tram Road corridor improvements.

Speed Limits & Threshold Treatments

28 With the development of the 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 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**.

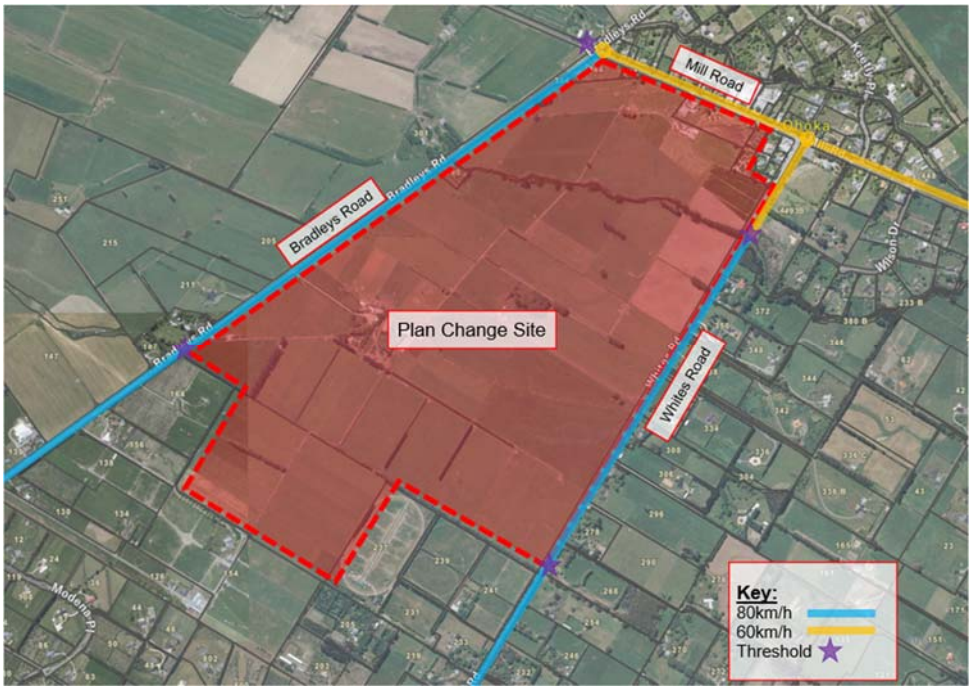

Figure 2: Proposed Speed Limit Alterations

29 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.

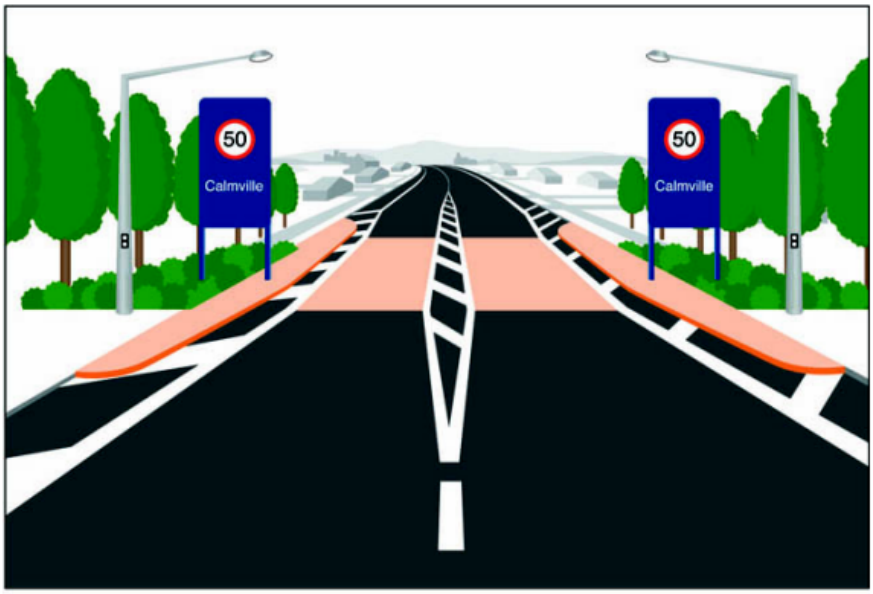

Figure 3: Example Threshold Treatment (Source Road Traffic Standard 15)

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

Site Access Arrangements

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

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

31.2 Mill Road: One intersection; and

31.3 Whites Road: Four intersections.

32 Typical intersection arrangements for these road frontages are contained in the ITA 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.

33 The separation of the intersections is approximately as follows:

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

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

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

34 The required Proposed District Plan intersection separation distances are 800m for intersections to Whites Road and Bradleys Road (100km/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.

35 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 the intersections to provide safe and efficient access.

36 All property access is via the proposed internal road network and this is considered to be a safe arrangement as it minimises the number of driveways to the existing road network.

Internal Layout

37 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 rezoning level and the detail of roading patterns would need to be further confirmed at subdivision stage, including an assessment of the proposed cross-sections and intersection separation. As such, whilst I consider the proposed

roading and internal transport network to be acceptable it will be subject to further reviews and approvals from the Council at the time of seeking subdivision consent.

Walking & Cycling Provision

Internal Walking & Cycling

38 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.

39 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 area could accommodate a small supermarket of approximately 460m^2 to 710m^2, or slightly larger. I consider this would provide for day-to-day convenience shopping needs of not only the residents of the Site, but also existing residents in Ōhoka. This would be within walking and cycling distance for these people.

40 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 Site.

41 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

42 The Council has a recommended Walking and Cycling Network Plan that includes the area surrounding the Site. The road frontages of the 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 area from the wider area.

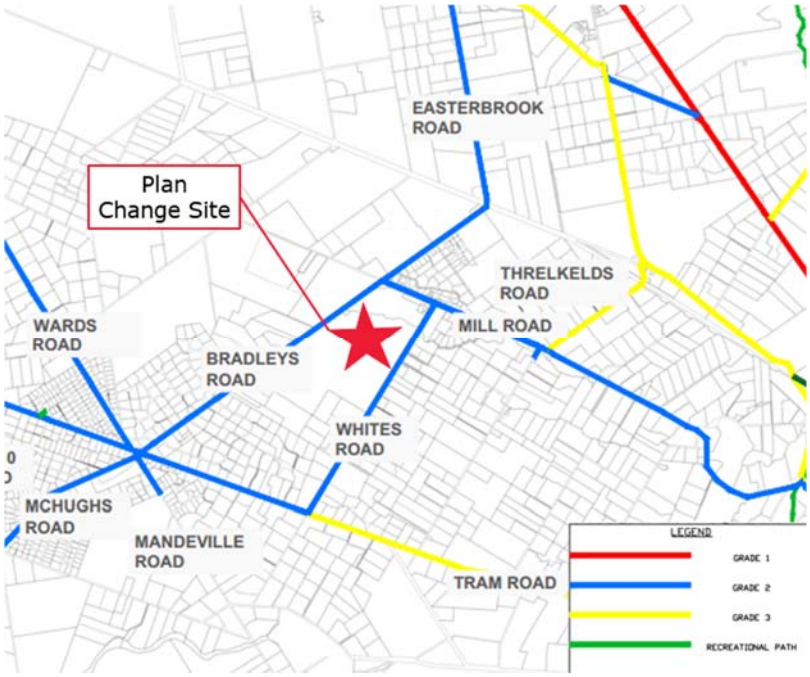

Figure 4: WDC Walking & Cycling Strategy Extract

43 The development of the 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.

44 The above indicates that the Site is located within a cycle network that is already planned by the 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 Site would instigate this funding (via the standard development contributions process).

45 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.

46 Kaiapoi is approximately 9km from the centre of the Site via the Main Drain Road route. This is an achievable cycling distance and would become more attractive if the Skewbridge Road bridge accommodated safe cycle crossing facilities.

47 There is also the potential that the proposed Threlkelds Road / Flaxton Road roundabout (along with alterations to the Mill Road / Threlkelds Road intersection) could reduce traffic volumes on Mill Road east of Threlkelds Road. This may make this an attractive cycle route through to the Mill Road / Ōhoka Road intersection. I

understand that the Council are investigating cycle crossing opportunities at that location that would enable a link to the existing cycle facilities on the eastern side of Ōhoka Road, which would than provide an alternate option to get to Kaiapoi.

Passenger Transport

48 The provision of passenger transport is covered in more detail by **Mr Simon Milner**. However, I understand that a bus route is proposed to provide a link between the Site and the existing Kaiapoi Central Park & Ride, as well as Kaiapoi itself. The existing Park & Ride in turn provides access to a direct bus service to / from Christchurch City centre and well as services to / from Rangiora and Woodend. As such, residents of the Site will be able to make use of the wider public transport as part of their travel patterns.

CONCLUSION

49 Subject to appropriate upgrades as identified above, the transport effects of the proposed rezoning are considered acceptable.

Dated: 5 March 2024

_____

Nicholas Peter Fuller

ATTACHMENT 1

Integrated Transport Assessment

Prepared for

ROLLESTON INDUSTRIAL DEVELOPMENTS LTD

535 Mill Road, Ōhoka
Waimakariri

February 2024

Integrated Transport Assessment
Prepared for

Rolleston Industrial Developments Ltd

535 Mill Road, Ōhoka
Waimakariri

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Project Reference:	021-034
Project Manager:	Tim Walsh, Planning Consultant
Prepared by:	Nick Fuller, Principal Transport Engineer
Reviewed by	Rhys Chesterman, Director and Traffic Engineer/Planner

Table of Contents

Appendices

List of Figures and Tables

Introduction

1. Rolleston Industrial Developments Ltd has commissioned Novo Group to prepare an Integrated Transport Assessment (ITA) for the rezoning of Rural land to Residential that would facilitate approximately 850 residential lots, a commercial area and a special purpose area at 535 Mill Road, Ōhoka.

2. This report provides an assessment of the transport aspects of the proposed development. It also describes the transport environment in the vicinity of the site, describes the transport related components of the proposal and identifies compliance issues with the transport provisions in the District Plan. It has been prepared broadly in accordance with the Integrated Transportation Assessment Guidelines specified in New Zealand Transport Agency Research report 422, November 2010.

3. It is proposed to rezone the site of approximately 156 ha at 535 Mill Road as a predominantly residential area that can accommodate approximately 850 residential lots plus a local commercial centre and a special purpose area, which would be either a school or additional housing. A copy of the proposed Outline Development Plan is included **Appendix 1**. The site location is illustrated in **Figure 1**.

4. The Rezoning is predicted to generate 803 to 949 vehicle movements per hour in the weekday peak hours and 7,480 vehicle movements per day.

Figure 1: Site Location

Transport Environment

Road Links

Whites Road

5. The transport details of Whites Road are set out in **Table 1** with a typical view looking south at the site boundary included in **Figure 2**.

Table 1: Whites Road Transport Details

Key Feature or Characteristic	Comment
Road Classification	Local Road in the Proposed District Plan
Cross-Section Description	6.9m wide carriageway with wide grass berms.
Traffic Volumes	56 vph[1] in the AM peak hour, 67 vph in the PM peak hour and 843 vpd[2].
Speed Limit	Speed limit of 60km/h from Mill Road to a point 240m south of the intersection. 100km/h beyond that point. Mean operating speed of 58km/h[3].
Pedestrian & Cycling Infrastructure	None provided.
Public Transport	School buses were observed using this road.
Additional Notes	Whites Road is well used for parking associated with the Ōhoka Farmers Market at the Ōhoka Domain near Mill Road. That market occurs 09:00 to 12:30 every Friday. Extensive car parking can occur on Whites Road associated with the Ōhoka Farmers Market. This is more significant during Summer. Access is provided to a reserve on the eastern side of Whites Road, approximately 315m south of Mill Road. There is a service station in the south-western corner of the Whites Road / Mill Road intersection. The verge on the eastern side of Whites Road is used to accommodate parking associated with the service station. There are several culverts with headwalls in close proximity to the carriageway, plus drainage channels / stream along the corridor, as well as utility poles.

Figure 2: Whites Road Looking South

[1] Vehicles per Hour from a traffic count on 28th and 29th July 2021.
[2] Vehicles per day from Waimakariri District Council data.
[3] Mean operating speeds taken from NZTA Mega Maps.

Bradleys Road

6. **Table 2** sets out the transport characteristics of Bradleys Road with a typical view looking north to Mill Road shown in **Figure 3**.

Table 2: Bradleys Road Transport Characteristics

Key Feature or Characteristic	Comment
Road Classification	Collector Road in the Proposed District Plan
Cross-Section Description	6.4m wide carriageway with wide grass berms.
Traffic Volumes	113 vph in the AM peak hour, 134 vph in the PM peak hour and 1,409 vpd.
Speed Limit	Speed limit of 60km/h from Mill Road to a point 53m south of the intersection. 100km/h beyond that point to just north of Modena Place, where it reduces to 80km/h. Mean operating speed of 69km/h.
Pedestrian & Cycling Infrastructure	None provided at present, although this is on the route of a Council proposed off-road unsealed shared path.
Public Transport	This road is used as a school bus route.
Additional Notes	There are several culverts with headwalls in close proximity to the carriageway, plus drainage channels / stream and utility poles along the corridor .

Figure 3: Bradleys Road Looking North to Mill Road

Mill Road

7. The transport details of Mill Road are set out in **Table 3** with a typical view looking west included in **Figure 4**.

Table 3: Mill Road Transport Details

Key Feature or Characteristic	Comment
Road Classification	Collector Road in the Proposed District Plan
Cross-Section Description	7m wide carriageway with wide grass berms.
Traffic Volumes	146 vph in the AM peak hour, 148 vph in the PM peak hour and 1,336 vpd.
Speed Limit	Speed limit of 60km/h within the vicinity of the site. Mean operating speed of 69km/h.
Pedestrian & Cycling Infrastructure	A 1.4m wide gravel path is provided on the southern side of this road between Bradleys Road and Whites Road. A 1.5m wide shared path on the southern side of Mill Road east of Whites Road to Jacksons Road, which links to Ōhoka School. An off-road unsealed shared path is proposed by Council on Mill Road from Bradleys Road to Threlkelds Road.
Public Transport	This road is used as a school bus route. A bus was observed stopping immediately west of the Whites Road intersection.
Additional Notes	Mill Road provides access to Ōhoka School on Jacksons Road. There are drainage channels / stream along the corridor, as well as utility poles.

Figure 4: Mill Road Looking West

Tram Road

8. The transport details of Tram Road are set out in **Table 4** with a typical view looking east at the intersection with Bradleys Road included in **Figure 5**.

Table 4: Tram Road Transport Details

Key Feature or Characteristic	Comment
Road Classification	Arterial Road in the Proposed District Plan
Cross-Section Description	6.8m wide carriageway with 1.0m wide shoulders and wide grass berms both sides.
Traffic Volumes	789 vph in the AM peak hour, 809 vph in the PM peak hour and 7,764 vpd.
Speed Limit	Speed limit of 100km/h, although reduced to 80km/h at the intersection with Bradleys Road. Mean operating speed of 95km/h immediately east of Whites Road.
Pedestrian & Cycling Infrastructure	None provided. Council are proposing an off-road unsealed shared path for approximately 450m from the Bradleys Road intersection to the east, which then alters to on-road cycle lanes or shoulders to the east.
Public Transport	This road is used as a school bus route and there is a bus stop located on the northern site of the road to the east of the Bradleys Road intersection.

Figure 5: Tram Road Looking East

Threlkelds Road

10. The transport details of Threlkelds Road are set out in **Table 5** with a typical view looking north east included in **Figure 6**.

Table 5: Threlkelds Road Transport Details

Key Feature or Characteristic	Comment
Road Classification	Collector Road in the Proposed District Plan
Cross-Section Description	7.2m wide carriageway and wide grass berms both sides.
Traffic Volumes	124 vph in the AM peak hour, 203 vph in the PM peak hour and 1,714 vpd.
Speed Limit	Speed limit of 80km/h and mean operating speed of 76km/h.
Pedestrian & Cycling Infrastructure	None provided. Council are proposing on-road cycle lanes or shoulders linking to Flaxton Road.
Public Transport	Part of a school bus route (to Rangiora New Life School).

Figure 6: Threlkelds Road Looking North East

Flaxton Road / Skewbridge Road

11. The transport details of Flaxton Road are set out in **Table 6**.

Table 6: Flaxton Road Transport Details

Key Feature or Characteristic	Comment
Road Classification	Arterial Road in the Proposed District Plan
Cross-Section Description	6.8m wide carriageway with 1.0m wide shoulders and wide grass berms both sides.
Traffic Volumes	718 vph in the AM peak hour, 923 vph in the PM peak hour and 7,052 vpd.
Speed Limit	Speed limit of 80km/h. Mean operating speed of 85km/h.
Pedestrian & Cycling Infrastructure	None provided. Council are proposing on-road cycle lanes or shoulders linking to Rangiora and Silverstream / Kaiapoi.
Public Transport	This road is used as a school bus route.

Intersections

Tram Road / Bradleys Road / McHughes Road

12. This intersection is currently a four-arm priority-controlled cross-roads, with Tram Road having the priority. This intersection includes right turn bays and left turn deceleration lanes on Tram Road. The Bradleys Road and McHughes Road approaches are 'Stop' controlled. This is in an 80km/h speed limit area.

Figure 7: Tram Road / Bradleys Road / McHughes Road Intersection

13. Traffic counts have been undertaken at this intersection (on 28th and 29th July 2021) and these are illustrated on Diagrams 1 & 2 contained in **Appendix 2** (noting that a check of link volumes in the area

indicated minimal change in volumes between the 2021 counts and 2023 data). These volumes (along with the existing road geometry) have been used to create a SIDRA model of this intersection.

14. Observed delays on the through and right turn movements on the Bradleys Road and McHughes Road approaches have been used to assist in calibrating the operation of these minor approaches at the intersection. **Table 7** sets out the delay observed on site (in the peak hour), the initial modelled delay, the adjusted delay after validation and the adjustments made in the model. The changes made have been kept consistent between the AM and PM peak hour models.

Table 7: Tram Road / Bradleys Road Delay Validation

Approach	Time	Movement	Observed Average Delay (s)	Initial Model Average Delay (s)	Adjusted Model Average Delay (s)	Adjustments Made
Bradleys Road	AM Peak	Through	15	23	22	The Light Vehicle *Gap Acceptance* and *Opposing Vehicle* factors have both been altered to 0.95 for the through movements and right turns.
		Right	13	23	22	
	PM Peak	Through	13	29	26	
		Right	25	28	25	
McHughes Road	AM Peak	Through	10	27	21	The Light Vehicle *Gap Acceptance* and *Opposing Vehicle* factors have been altered to 0.95 for the through movements and 0.8 for the right turns.
		Right	15	37	23	
	PM Peak	Through	18	29	24	
		Right	18	38	23	

15. The above indicates that the delays modelled on the minor arms at the Tram Road / Bradleys Road intersection have been reduced to be closer to the observed delays. None of these have been reduced to below the observed delays, typically remaining well above the observed delays to provide a robust platform for assessing the effects of the proposed Rezoning.

16. The results of the existing intersection operation are included in **Appendix 3**, which indicate that this intersection is currently operating satisfactorily.

17. In addition to the above, the Waimakariri Long Term Plan (LTP) includes funding for safety improvements to Tram Road, which includes the Tram Road / Bradleys Road / McHughes Road intersection. It is understood that this is likely to result in a roundabout being constructed at this location, which is illustrated in **Figure 8**. There is budget in the 2024 / 2025 financial year for the intersection upgrade and we understand the land has been purchased for the upgrade. Other safety improvements are also proposed to Tram Road in the LTP, although we are not aware of specific details for these schemes.

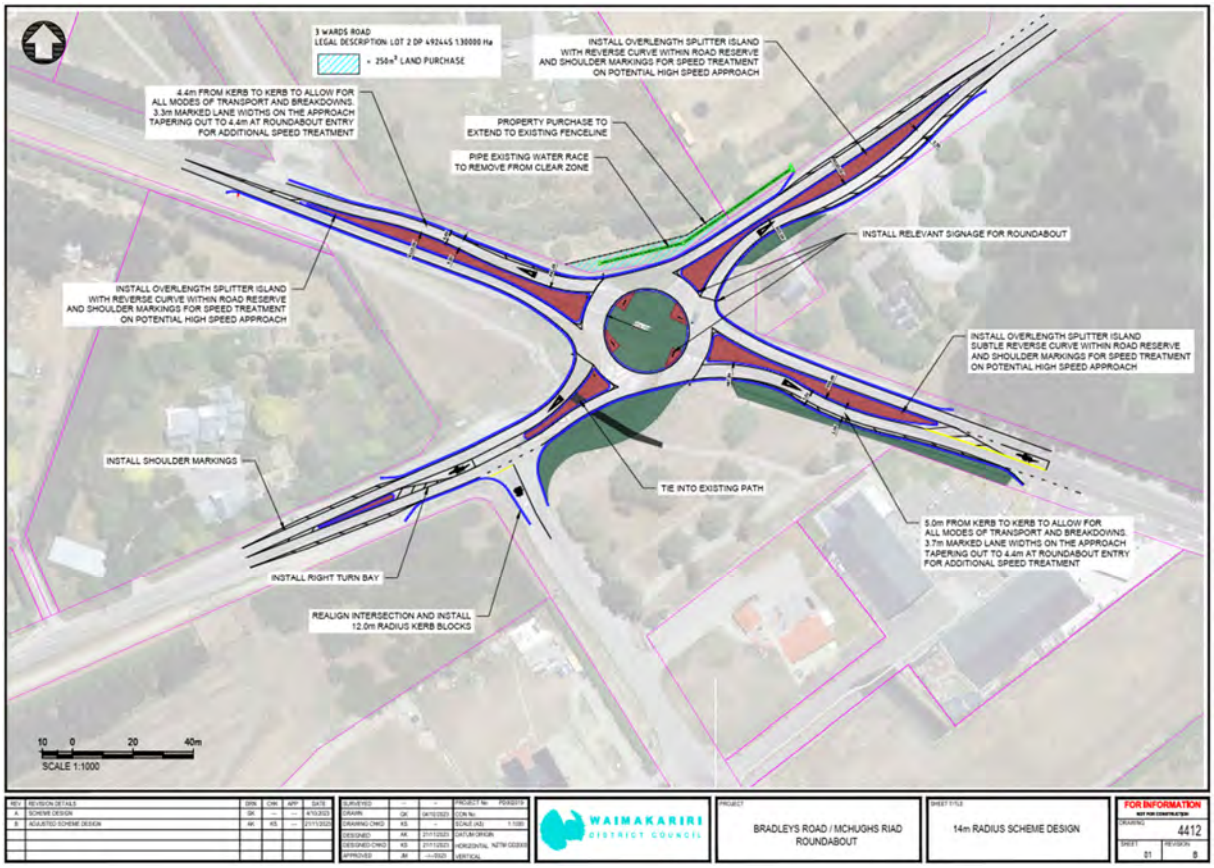


Figure 8: Council Proposed Tram Road / Bradleys Road / McHughes Road Roundabout

Tram Road / Whites Road

18. This intersection is currently a four-arm priority-controlled cross-roads, with Tram Road having the priority. This intersection includes right turn bays on Tram Road. The Whites Road approaches are 'Stop' controlled and this intersection is in a 100km/hr speed limit area.

Figure 9: Tram Road / Bradleys Road / McHughes Road Intersection

19. The counted traffic volumes presented in **Appendix 2** along with the existing road geometry have been used to create a SIDRA model of this intersection. Observed delays on the through and right turn movements on the Whites Road approaches have been used to assist in calibrating the operation of these minor approaches at the intersection. **Table 8** sets out the delay observed on site (in the peak hours), the initial modelled delay, the adjusted delay after validation and the adjustments made in the model. The changes made have been kept consistent between the AM and PM peak hour models.

Table 8: Tram Road / Whites Road Delay Validation

Approach	Time	Movement	Observed Average Delay (s)	Initial Model Average Delay (s)	Adjusted Model Average Delay (s)	Adjustments Made
Whites Road North	AM Peak	Left	10	14	13	The Light Vehicle *Gap Acceptance* and *Opposing Vehicle* factors have both been altered to 0.9 for the left turn movements, 0.95 for the through movements and 0.7 for the right turns.
		Through	12	27	25	
		Right	18	48	43	
	PM Peak	Left	4	10	10	
		Through	26	32	27	
		Right	19	45	25	
Whites Road South	AM Peak	Left	5	11	10	The Light Vehicle *Gap Acceptance* and *Opposing Vehicle* factors have both been altered to 0.9 for the left turn movements, 0.95 for the through movements and 0.8 for the right turns.
		Through	21	24	21	
		Right	15	29	20	
	PM Peak	Left	8	14	13	
		Through	27	25	23	
		Right	13	30	20	

20. The above indicates that the delays modelled on the minor arms at the Tram Road / Whites Road intersection have been reduced to be closer to the observed delays. Generally, these remain above observed delays to provide a robust platform for assessing the effects of the proposed Rezoning. The exception to this is the through movement from the Whites Road south approach in the PM peak, although only one vehicle was observed undertaking this movement at this time, retaining a consistent approach to the AM peak was preferred.

21. The results of the existing intersection operation are included in **Appendix 4** which indicate that this intersection is currently operating satisfactorily.

Mill Road / Bradleys Road

22. This intersection is currently a four-arm priority-controlled cross-roads, with Mill Road having the priority. The Bradleys Road approaches are 'Stop' controlled, with the northern arm serving a limited rural residential catchment. This is in a 60km/hr speed limit area.

Figure 10: Mill Road / Bradleys Road Intersection

23. The counted traffic volumes presented in **Appendix 2** along with the existing road geometry have been used to create a SIDRA model of this intersection. The results of the existing intersection operation are included in **Appendix 5** and again indicate that this intersection is operating well at present.

Mill Road / Whites Road

24. This intersection is currently a three-arm priority-controlled cross-roads, with Mill Road having the priority. The Whites Road approach is 'Stop' controlled. This is in a 60km/hr speed limit area.

Figure 11: Mill Road / Whites Road Intersection

25. The counted traffic volumes presented in **Appendix 2** along with the existing road geometry have been used to create a SIDRA model of this intersection. The results of the existing intersection operation are included in **Appendix 6** and these indicate this intersection currently operates well.

Mill Road / Threlkelds Road

26. This intersection is a three-arm priority-controlled intersection with Mill Road having the priority. The Threlkelds Road approach is 'Stop' controlled and the intersection is approximately 1.5km east of the site. This is in a 60km/hr speed limit area.

Figure 12: Mill Road / Threlkelds Road Intersection

27. The counted traffic volumes presented in **Appendix 2** along with the existing road geometry have been used to create a SIDRA model of this intersection. The results of the existing intersection operation are included in **Appendix 7** and indicate that this intersection operates well.

Threlkelds Road / Flaxton Road

28. This intersection is also a three-arm priority-controlled intersection with Flaxton Road / Skewbridge Road having the priority and a right turn bay is provided to accommodate traffic turning into Threlkelds Road. The Threlkelds Road approach is 'Give-way' controlled. This is in an 80km/hr speed limit area and is approximately 3.3km north-east of the site.

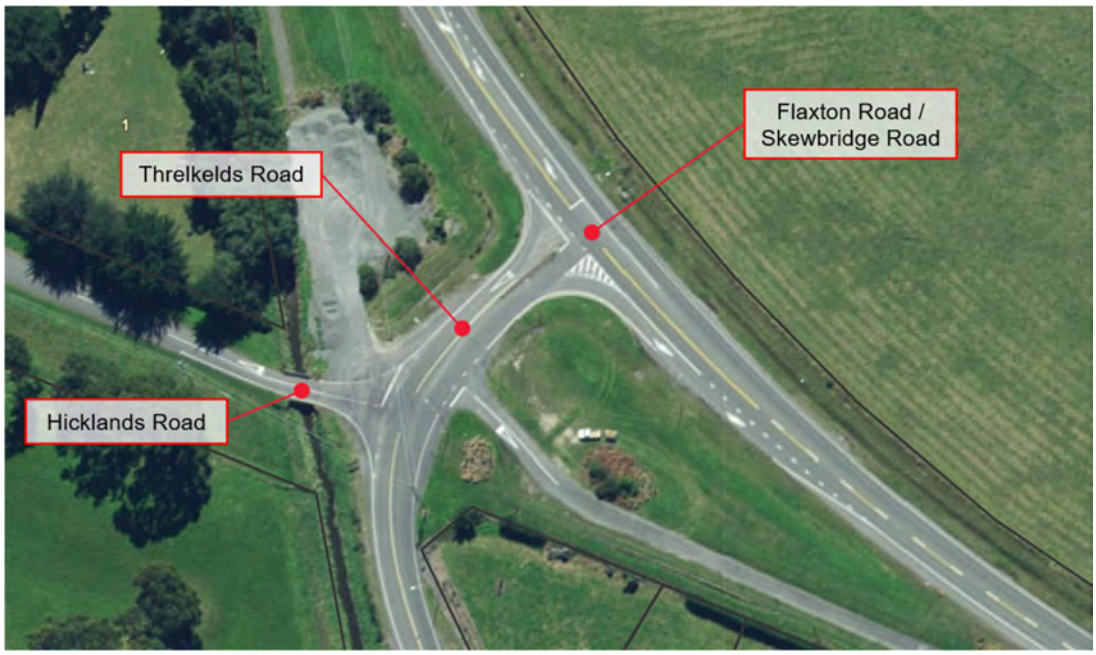


Figure 13: Flaxton Road / Threlkelds Road Intersection

29. The counted traffic volumes presented in **Appendix 2** along with the existing road geometry have been used to create a SIDRA model of this intersection. The delay of traffic turning right out of Threlkelds Road was observed to calibrate the intersection and the default parameters are considered to lead to a reasonable representation of the existing operation.

30. The results of the existing intersection operation are included in **Appendix 8** and indicate that this intersection operates satisfactorily.

Mill Road / Ōhoka Road

31. This intersection is also a three-arm priority-controlled intersection with Ōhoka Road / Skewbridge Road having the priority and a right turn bay is provided to accommodate traffic turning into Mill Road. The Mill Road approach is 'Stop' controlled. This is in an 80km/hr speed limit area and is approximately 5km east of the site.

Figure 14: Mill Road / Ōhoka Road Intersection

32. The counted traffic volumes presented in **Appendix 2** along with the existing road geometry have been used to create a SIDRA model of this intersection. The delay of traffic turning right out of Mill Road was observed to calibrate the intersection, with the observed, initial model and validated model delays set out as follows:

    i. Observed delays: AM peak of 21 seconds and PM peak of 30 seconds;

    ii. Initial model delays: AM peak of 21 seconds and PM peak of 34 seconds; and

    iii. Calibrated model delays[4]: AM peak of 21 seconds and PM peak of 30 seconds.

33. The results of the existing intersection operation are included in **Appendix 9** and indicate that this intersection operates satisfactorily.

Tram Road Interchange

34. The State Highway 1 (SH1) / Tram Road interchange provides access to the State highway network, particularly for traffic heading to / from Christchurch and is approximately 8.9km east of the site. The interchange was upgraded in 2020 to signalise the on-ramp intersection with Tram Road.

35. The interchange is currently being further upgraded to signalise the off-ramp to address safety concerns. The free left turn from the off-ramp to Tram Road is also being altered to improve the merge arrangement. A cycle lane is being installed to accommodate westbound cyclists on the southern side of the bridge. This facility crosses the free left turn from the off-ramp at 90-degrees and continues along Tram Road westwards. An image of this arrangement is included below.

36. We have modelled the proposed interchange arrangement in SIDRA as a network using the existing traffic volumes at that location. The results of this modelling are included in **Appendix 10** and indicate that the interchange is predicted to operate satisfactorily.

[4] Alters the Gap Acceptance Factor for the right turn out of Mill Road to 0.98 in the AM and 0.95 in the PM.

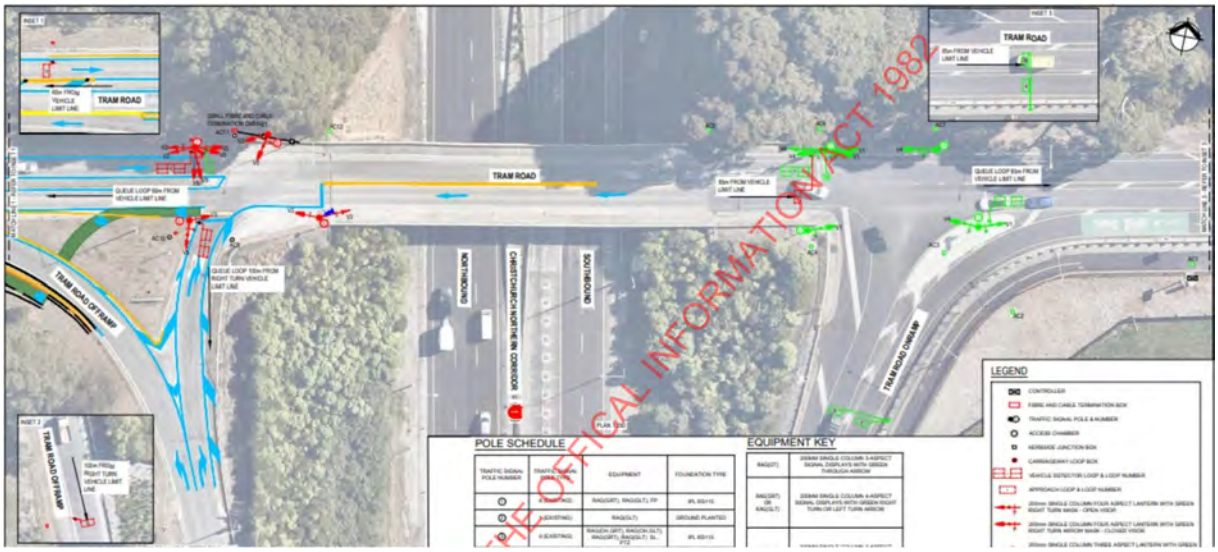


Figure 15: Proposed Tram Road Interchange Signal Arrangement

Crash History

37. The NZ Transport Agency Crash Analysis System (CAS) has been reviewed to identify crashes that have been reported within the area illustrated in **Figure 16**, which is also in the collision diagram for this area. The review encompasses the five-year period 01 September 2018 to 01 September 2023. The crashes are summarised in **Table 9** and broken down by elements of the transport network.

Figure 16: CAS Collision Diagram

Table 9: CAS Summary

Location	Crash Description	Comments
Tram Road / Bradleys Road Intersection	Serious injury and Minor crashes because of a failure to give-way pulling out of Bradleys Road north.	For the serious injury crash, Tram Road traffic was obscured by a large vehicle that turned left into Bradleys Road.
	Vehicle turning right into Bradleys Road (north) has failed to give-way to through traffic.	-
	Vehicle turning right into Bradleys Road (north) has failed to give-way to through traffic.	-
Bradleys Road (Mid-block)	Minor injury crash when a southbound driver hit stray cows on the road.	-
	Driver lost control with sun strike.	-
Mill Road / Whites Road Intersection	Non-injury crash where a driver has missed the intersection when travelling north on Whites Road.	Anti-social behaviour suspected as a cause.
Whites Road (Mid-block)	A non-injury crash where a driver pulling out of an access failed to give-way to southbound traffic on Whites Road	-
Tram Road / Whites Road Intersection	Serious injury crash when a driver turning right into Whites Road north failed to give-way to oncoming traffic.	-
	Driver lost control when turning left into Whites Road (south).	-
	A vehicle turning from Whites Road (south) onto Tram Road has been hit by a following vehicle undertaking the same turn. This was a non-injury crash.	Appears to be a road-rage incident.
Mill Road / Threlkelds Road Intersection	Driver turning right into Threlkelds Road has failed to give-way to on-coming traffic. Non-injury crash.	-
Tram Road Corridor	34 crashes reported on the corridor between (but excluding) Bradleys Road and the SH1 Interchange, including one Fatal, six Serious, twelve Minor and 15 Non-injury crashes. The fatal involved a vehicle that strayed across the centreline. Main causes of crashes were loss of control (four serious, five minor and four non-injury crashes) and a cluster of failing to give-way at the intersection with South Eyre Road.	
Tram Road Interchange	13 crashes including one Serious, four Minor and eight Non-injury crashes. The predominant crash types are failure to give-way turning right off the off-ram and red light running at the on-ramp.	
Mill Road Corridor	Four crashes were reported, including one Minor injury and three Non-injury crashes. The predominant crash type was loss of control (three crashes).	
Threlkelds Road Corridor	Two crashes were reported, comprising a Minor injury crash and Non-injury crash. Both of these were loss of control.	

38. Council commissioned a review of potential road safety upgrades for the Tram Road corridor in 2020[5]. This report identified a range of concerns and upgrades to address the safety record and to accommodate traffic growth. These measures include:

    i. Widening of shoulders to provide 1.5m to 2.0m of seal to enable a driver to 'recover' if a vehicle leaves the main carriageway. This would coincide with the draft Cycle strategy to provide a connection along Tram Road between SH1 and Oxford Road;

[5] Tram Road Safety Improvements – Scheme Route Assessment report by WSP in August 2020.

ii. Potential for a further 0.5m of seal widening to provide a wide centreline to provide further separation between road users;

iii. Upgraded street lighting at intersections;

iv. Installation of Rural Intersection Activated Warning Signs at key locations;

v. Undergrounding power poles at critical intersections; and

vi. Upgrading intersections, typically to provide separation between traffic turning left off Tram Road and through traffic.

39. We understand that the above proposals are being funded through the Long Term Plan.

40. With regards to the crashes reported at the SH1 / Tram Road interchange, the upgrade works set out in paragraph 35 are intended to improve the safety record of this location. In particular, we understand that the signalisation of the right turn from the off-ramp will reduce / remove the crashes associated with this movement.

41. We also note that the Long Term Plan includes a budget for district wide transport improvements, which includes Flaxton Road and Skewbridge Road safety improvements.

Passenger Transport

42. Although there are no public bus services in the immediate vicinity of the site, there are two park and ride facilities within Kaiapoi. The northern Park and Ride site is on Charles Street in Kaiapoi. The southern Kaiapoi Park and Ride site is close to the Tram Road interchange with State Highway 1. The bus that serves these facilities has four buses into central Christchurch in the morning[6] and five return services in the evening[7]. The trip to / from the City takes approximately 30 minutes and has no interim stops (after the Kaiapoi southern Park and Ride). The bus is able to use the 'T2' lanes on the State highway to avoid congestion.

43. The locations of the Park and Ride facilities are illustrated in **Figure 17**.

Figure 17: Kaiapoi Park & Ride

[6] Departing the southern Park and Ride at 6:45, 7:15, 7:45 and 8:15.
[7] Departing the City Centre at 15:50, 16:20, 16:50, 17:20 and 17:50.

44. Two Ministry of Education funded school bus services operate in the immediate vicinity of the proposed Site, servicing Ōhoka School. The routes are shown below in **Figure 18**[8].

Figure 18: Ōhoka Primary School Bus Services

45. The first route commences on Mill Road, heads west in the morning to collect students in the McRoberts Road / Patterson Road area, before turning south-east onto Tram Road, through Mandeville North and then back toward the school along Bradleys Road.

46. The second route commences in the Wilson's Siding area to the east of Ōhoka, travels south via Raddens Road, then through the southern part of Mandeville via Edmunds Road and Baileys Road before heading towards the school along Whites Road.

47. Ōhoka township is also linked to Kaiapoi High School via an anti-clockwise loop service (Mandeville (Eyreton 2) that operates along Mill Road, Dawsons Road, Tram Road and Island Road. The AM route path is shown below in **Figure 19**[9]. The proposed development would be zoned for Kaiapoi High School.

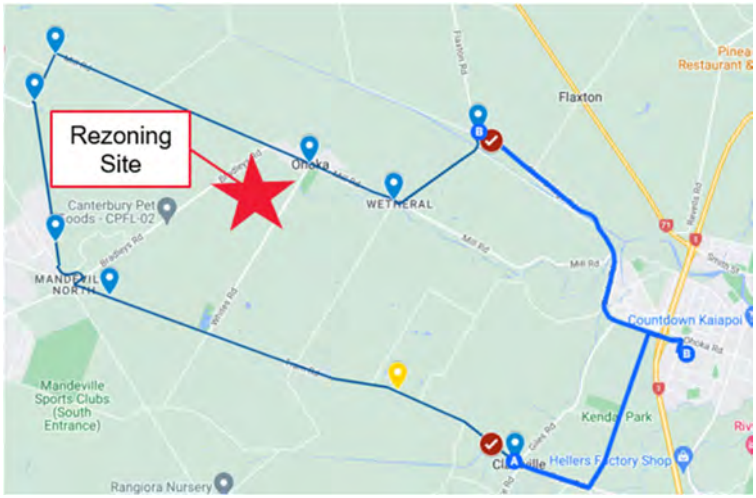


Figure 19: Mandeville (Eyreton 2) School Bus Route

[8] Sourced from https://www.education.govt.nz/school/property-and-transport/transport/school-bus-route-maps/
[9] Sourced from https://www.kaiapoi.school.nz/bus-routes/#mandeville

Cycle Network

48. Council has a recommended *Walking and Cycling Network Plan* that includes the area surrounding the Rezoning site. The road frontages of the Rezoning site include Grade 2 routes, which are described as 'unsealed path' (less than 2.5m wide). This network is illustrated in **Figure 20** and illustrates that the Rezoning site is well located within this planned network. That said, this network is yet to be established.

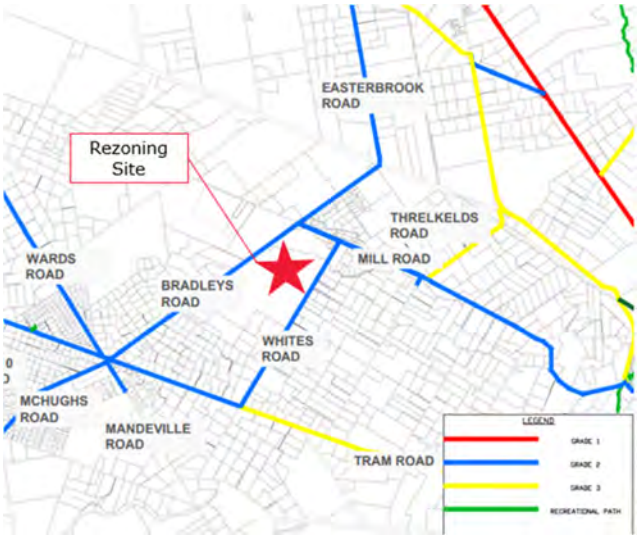


Figure 20: WDC Proposed Walking & Cycling Network

49. In additional to the above, Main Drain Road links from Bradleys Road and Threlkelds Road eastwards to Kaiapoi via Skewbank Lane and following the Cust and Kaiapoi Rivers. Although Main Drain Road and Skewbank Lane are roads, these are very lightly trafficked and cyclists could be safely accommodated. The exception to this is the required crossing of the Skewbridge Road bridge, although the Long Term Plan (2021 to 2031) has funding for a replacement in 2028 to 2031. A safe cycle crossing of that bridge could be included in the proposed design to continue this existing recreational route. This route is illustrated in **Figure 21**.

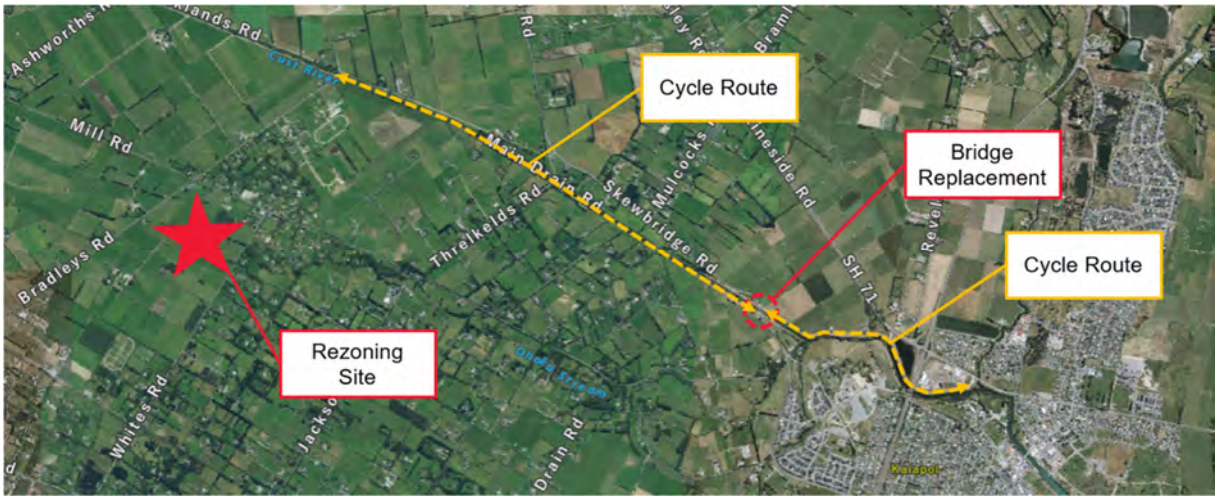


Figure 21: Main Drain Road Cycle Route

The Proposal

50. The proposed Rezoning would enable a range of development scenarios as follows (and in no particular order):

    i. **Option 1:** Up to 850 dwellings plus a commercial zone and a 250-pupil primary school;

    ii. **Option 2:** Up to 892 dwellings plus a commercial zone; and

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

51. A copy of the ODP is included in **Figure 22** and included in more detail in **Appendix 1**. The following sets out the transport details of the proposed Rezoning. Unless otherwise stated, it is proposed to adopt the transport provisions of the Proposed District Plan.

Figure 22: Proposed ODP Layout

Site Layout

Access Intersections

52. Vehicle access to the Rezoning 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 **Appendix 11** to confirm that suitable access can be achieved to the Rezoning site, although this will still need to undergo further and detailed design analysis and approvals through the standard subdivision process.

53. The separation of the intersections is approximately as follows:

i. Bradleys Road: 430m to 486m between intersections;

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

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

54. All property access will be from within the Rezoning site and not to the existing road network. This is to reduce the number of vehicle crossings to these roads.

New Road Standards

55. A concept internal road arrangement and associated cross-sections are provided in the Design Report and on the Illustrative Masterplan. The Rezoning rules propose that the cross-sections and intersection spacing of the proposed development are confirmed 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.

Internal Pedestrian & Cycle Links

56. 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 also 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.

57. 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.

Off-site Pedestrian & Cycle Links

58. Council's proposed walking and cycling network in Ōhoka was illustrated in **Figure 20**, which illustrated a proposed Grade 2 network along the Rezoning site boundaries. The Rezoning site will establish these networks along the Site boundary as at least 2.5m wide routes.

Speed Limits & Threshold Treatments

59. With the development of the Rezoning site and introduction of site access intersections, it would be beneficial to reduce the speed limits of the roads in the immediate vicinity of the Rezoning site. 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 23**.

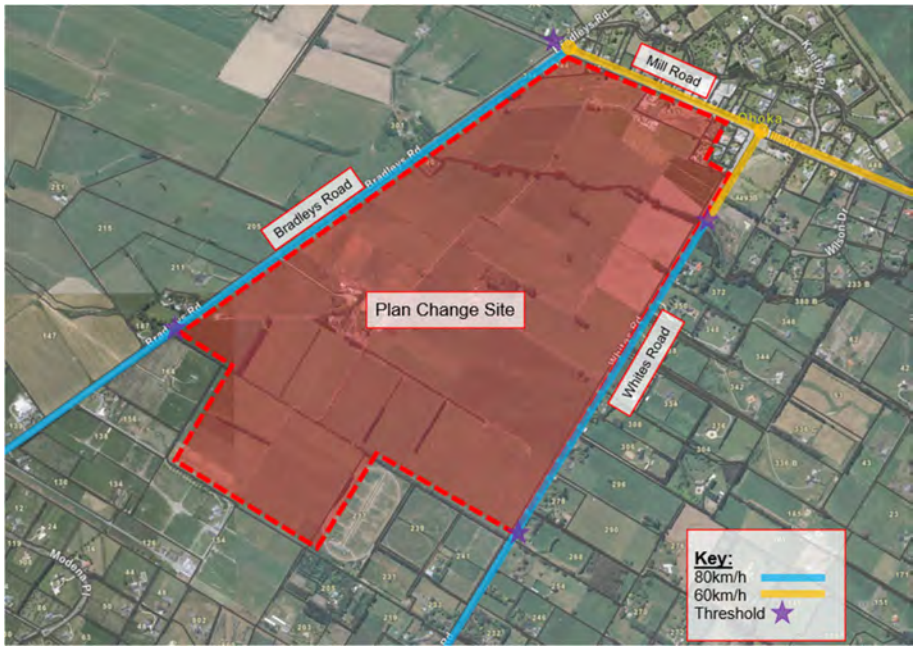


Figure 23: Proposed Speed Limit Alterations

60. The details of the threshold treatments would need to be agreed with the Council, although **Figure 24** illustrates a typical example of the layout of these facilities.

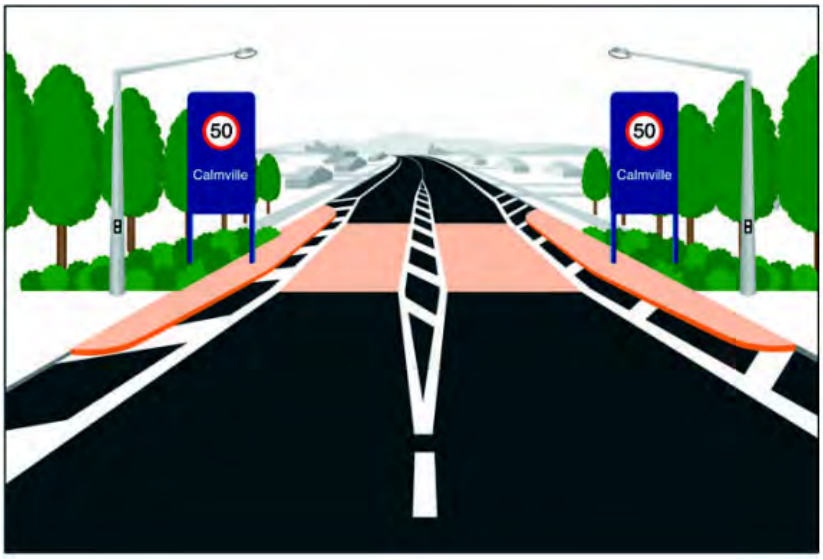


Figure 24: Example Threshold Treatment (Source – Road Traffic Standard 15)

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

Passenger Transport

62. It is proposed to establish a bus service that will serve the Rezoning site and travel to / from Kaiapoi, broadly as illustrated in the following figure. This service would be provided by the developer of the

Rezoning site for ten-years and it would run on a half-hourly frequency during the peak periods and hourly off-peak. This would broadly travel between the proposed Park & Ride site within the Rezoning land and the existing Kaiapoi Central Park & Ride.

Figure 25: Proposed Rezoning Bus Service

Traffic Growth, Generation & Assignment

Traffic Growth

63. Traffic growth on the surrounding road network has also been taken from the Christchurch Traffic Model. This indicates the following growth on the road network in the vicinity of the Rezoning site over a ten year period.

    i. Tram Road west of Bradleys Road: Approximately 20% growth; and

    ii. Flaxton Road west of Threlkelds Road: Approximately 35% growth.

64. This growth is illustrated on the following diagrams in **Appendix 2:**

    i. Diagrams 3 & 4 – Additional traffic to 2028 (i.e. half of the ten-year growth);

    ii. Diagrams 5 & 6 – 2028 network traffic volumes (i.e. the counted volumes plus growth to 2028);

    iii. Diagrams 7 & 8 - Additional traffic to 2033 (i.e. ten-years of growth); and

    iv. Diagrams 9 & 10 – 2033 network traffic volumes (i.e. the counted volumes plus growth to 2033).

Traffic Generation

Residential Traffic Generation

65. The traffic generation is proposed to be based on an 85th percentile rate of 0.9 vehicles per dwelling in the peak hours and 8.2 vehicles per dwelling per day[10]. That survey data does not include arrival or departure splits, so the following are proposed (and agreed with WDC):
    i. AM Peak – 20% arrivals / 80% departures;
    ii. PM Peak – 63% arrivals / 37% departures: and
    iii. Daily – 50% arrivals / 50% departures.

66. The above leads to the traffic generation rates as set out in **Table 10.**

Table 10: Assumed Residential Traffic Generation Rates

Time Period	Arrivals	Departures	Total
AM Peak Hour	0.18	0.72	0.9
PM Peak Hour	0.57	0.33	0.9
Daily	4.1	4.1	8.2

67. Applying the above traffic generation rates to the 850 dwellings proposed (of land use Option 1) leads to the traffic generation set out in **Table 11**.

Table 11: Predicted Residential Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour	153	612	765
PM Peak Hour	482	283	765
Daily	3,485	3,485	6,970

School Traffic Generation

68. The traffic generation assessment of the school has been based on a Primary School with 250 pupils. The traffic generation is as predicted by the *NZ Household Travel Survey School Travel Model* that accompanies NZTA Research Report 467. Adopting a 250 pupil Primary School in a Rural Area leads to the peak hour traffic generation estimates in **Table 12**.

[10] [10] Based on Outer Suburban dwellings in the NZTA Research Report 453 – *Trips and Parking Related to Land Use*.

Table 12: Predicted School Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour (08:00 to 09:00)	92	92	184
PM Peak Hour (15:00 to 16:00)	72	72	144
Daily	255	255	510

69. The PM peak hour of 15:00 to 16:00 is not consistent with the surrounding network peak. Data from the TRICS database for primary schools has been used to provide a ratio between traffic during the school peak period of 15:00 to 16:00 and a network peak period that could occur at 16:00 to 18:00. The resultant school traffic generation during the road network peak periods is set out in **Table 13**.

Table 13: Factored School Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour (08:00 to 09:00)	92	92	184
PM Peak Hour (16:00 to 17:00)	19	19	38
Daily	255	255	501

70. The above school traffic generation of 38 vehicles per hour in the PM peak is the equivalent of approximately 42 dwellings[11]. As such, the traffic generated by Option 2 (up to 892 dwellings and no school) is equal to or less than that of Option 1 (850 dwellings plus the school).

Retirement Village Generation

71. Option 3 is as per Options 1 and 2, although with the ability to trade one dwelling for four retirement villas. The typical traffic generation rates for retirement villas are 0.1 to 0.2 vehicles per dwelling in the peak hours and 1 to 2 vehicles per dwelling per day[12]. Comparing this to a standard residential traffic generation rate of 0.9 vehicles per dwelling per hour in the peak and 8.2 vehicles per day indicates that the number of villas per dwelling could be in the range of four to eight, with the lower number proposed.

Commercial Area Traffic Generation

72. Whilst a commercial area is proposed within the Rezoning site, this is primarily intended to accommodate the day-to-day shopping needs of the residents of the site. This is not intended to draw traffic to the site from the wider area, so no dedicated traffic generation has been assumed from this area.

Total Traffic Generation

73. Based on the traffic generation estimates set out above, the traffic generation from the Rezoning site is summarised in **Table 14**.

[11] 38 vehicles per hour divided by 0.9 vehicles per dwelling per hour = 42 dwellings.
[12] From the RTA *Guide to Traffic Generating Developments*.

Table 14: Rezoning Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour	245	704	949
PM Peak Hour	501	302	803
Daily	3,740	3,740	7,480

Traffic Distribution

74. The traffic distribution is based on traffic model data from the Christchurch Traffic Model. The distribution of traffic is summarised in **Table 15**.

Table 15: Site Distribution

	AM Peak	PM Peak
Tram Road West	12%	11%
Tram Road East (to SH1 south)	45%	32%
Bradleys Road North	3%	3%
Ōhoka Road to Kaiapoi	12%	24%
Flaxton Road to Rangiora	28%	30%
Total	***100%***	***100%***

75. These distributions are illustrated on Diagrams 11 & 12 in **Appendix 2**, with the predicted development traffic assigned to the network on Diagrams 13 & 14.

76. Diagrams 15 & 16 in **Appendix 2** illustrate the 2021 existing traffic plus growth and full Rezoning site traffic on the network.

Development Timing

77. We understand that the work required to facilitate development at the site (such as obtaining subdivision consent and undertaking earthworks and primary infrastructure provision) means that the earliest establishment of dwellings at the site would occur is 2028. Dwellings would then be constructed at the site in a staged manner over several years, rather than all released at the same time.

Assessment of Effects

78. Key matters for the assessment of transport effects associated with the proposed Rezoning are considered to be:

    i. **Parking, Loading & Internal Network:** Whether the District Plan rules adequately provide for the layout and provision of car parking and loading at the application site, as well as the acceptability of the proposed road standards within the site;

ii. **Access Arrangements:** Where the accesses are anticipated to operate safely and efficiently and whether the District Plan rules adequately provide for access; and

iii. **Wider Network Effects:** Whether the effects of the proposed activity can be satisfactorily accommodated by the surrounding road network. Whether the proposed Rezoning will be accessible by a range of transport modes.

79. The above matters are assessed in turn in the following sections.

Parking, Loading & Internal Arrangements

Parking & Loading

80. The proposed District Plan rules regarding parking and loading will be adopted for this Rezoning. This is considered to be sufficient to confirm that parking and loading will be satisfactorily provided for in a functional and practical manner.

Internal Access Roads

81. The internal road layout is proposed to be bespoke for the subdivision. As such, a separate approvals process will be developed with Council to agree that the proposed cross-sections are satisfactory. The internal layout will also be subject to subdivision approval and Road Safety Audits and this is considered to be sufficient to confirm the internal network will operate safely and efficiently.

82. Access to individual properties within the Rezoning site are also proposed to comply with the District Plan requirements. Any non-compliances will either be sought at subdivision stage or addressed on an individual basis and the effects of this on safety and efficiency considered at that stage.

83. The above is considered to be sufficient to confirm that the internal transport network will be safe and efficient.

Access Arrangements

Site Accesses

Intersection Capacity

84. The engineering details of the proposed access intersection arrangements are yet to be determined, although it is considered there will be sufficient space to accommodate satisfactory designs. The intersections will be designed to comply with relevant design standards, including sight line requirements. These will also be subject to road safety audit requirements to confirm they are anticipated to operate safely.

85. The traffic diagrams in **Appendix 2** simplify the access arrangements therefore over-stating the volumes at the Bradleys Road and Whites Road accesses by representing only one access to these roads, whereas there will be two to Bradleys Road and four to Whites Road. However, the highest major road volumes at the accesses occur at the southern access to Whites Road. An intersection model of this location has been developed and the results are included in **Appendix 12**. These results indicate that the site access intersection will be able to operate satisfactorily.

Intersection Spacing

86. The District Plan requires the Rezoning road access intersections with Bradleys Road and Whites Road to be separated by 800m, as these are within a 100km/h speed limit area (although this would reduce to 550m if the speed limit were reduced to 80km/h). The access intersection to Mill Road is required to be separated to adjacent intersections by 160m, as this is within a 60km/hr speed limit area. The proposed intersection spacings are as follows:

    i. Bradleys Road: Separation of between 430m and 466m;

    ii. Whites Road: Separation ranges between 330m and 435m; and

    iii. Mill Road: Separation of at least 225m.

87. Regarding intersection separation, Austroads *Guide to Road Design Part 4a (Unsignalised and Signalised Intersections)* states:

    Desirably, intersections should be separated by at least five seconds of travel time at the design speed to provide time for drivers to process information relating to traffic, the road layout and traffic signs.[13]

88. A travel time of five seconds equates to the following distances:

    i. 83m for a speed of 60km/hr;

    ii. 111m for a speed of 80km/hr; and

    iii. 139m for a speed of 100km/hr.

89. It is considered that sufficient spacing of intersections can be provided to meet the above requirements through consultation with Council at the subdivision stage (when future speed limits are better known).

Wider Effects

Tram Road / Bradleys Road / McHughes Road Intersection

90. The timing of development (set out in paragraph 77) suggests that the earliest dwellings are constructed is in 2028, which is after the anticipated completion date for the proposed Tram Road / Bradleys Road roundabout. As such, the full development of the Rezoning site has been modelled through the proposed Tram Road / Bradleys Road / McHughes Road roundabout (in 2033), as indicatively illustrated in **Figure 8**. The results of this model are contained in **Appendix 13** and indicate that the proposed arrangement can satisfactorily accommodate the predicted traffic volumes including growth to 2033 and the full rezoning development content.

91. Although road safety concerns have been identified at the existing intersection, these would be addressed with the proposed roundabout at this location. As such, no further assessment of road safety is considered necessary.

Tram Road / Whites Road Intersection

92. The operation of the Tram Road / Whites Road intersection with background traffic growth to 2028 has been assessed in SIDRA. These results (included in **Appendix 14**) indicate that the right turn movement from Whites Road north is predicted to operate at Level of Service E during the AM peak, which is

[13] Refer to B.2.2 – Proximity to Other Intersections

consistent with the 2021 model. Council has previously indicated that Level of Service E is not acceptable, so it is considered that an intersection upgrade would be required at this location. That said, we consider there should be scope for discussion regarding the operation of Level of Service E as there may be circumstances that mean it is acceptable and given our experience that some Territorial Authorities are willing to consider Level of Service F to be the point at which upgrades are required.

93. It is proposed to require assessment of the Rezoning traffic effects at each stage of subdivision to allow the potential for development ahead of the above intersection upgrade, subject to agreement with the Council. This could include interim safety upgrades at this intersection to address the effects of the background traffic growth plus the Rezoning traffic. The details of these upgrades will need to be agreed with Council, but could potentially include:

    i. Visibility splay / sightline improvements;
    ii. Improved signage on the approaches; and
    iii. Rural Intersection Activated Warning Signs (RIAWS).

94. It is anticipated that the long-term upgrade to this intersection would be a roundabout, similar to that proposed at the Tram Road / Bradleys Road intersection, although it is acknowledged that this would require land from landowners surrounding the intersection. This is similar to the need to purchase land at the Tram Road / Bradleys Road intersection, where the council has just acquired land for that upgrade. An indicative model of a single lane roundabout has been created and the results are included in **Appendix 15**, which indicates the full Rezoning development plus growth to 2033 can be satisfactorily accommodated with this upgrade.

Mill Road / Bradleys Road Intersection

95. The operation of the Mill Road / Bradleys Road intersection has been assessed in the SIDRA model of the existing intersection, with the full Rezoning development traffic on the network. The model results are included in **Appendix 16** and indicate that this intersection will continue to operate satisfactorily with the Rezoning traffic on the network.

96. No safety assessment has been undertaken of this intersection because it is within a lower speed environment (compared to those on Tram Road) and the volumes through the intersection are also reasonably low. As such, it is anticipated that this intersection will operate safely.

Mill Road / Whites Road

97. The operation of the Mill Road / Whites Road intersection has been assessed in the SIDRA model of the existing intersection, again with the full Rezoning traffic on the network. The full results are contained in **Appendix 17**, which indicate that this intersection is predicted to operate satisfactorily with the Rezoning traffic added to the network. As with the Mill Road / Bradleys Road intersection, no safety assessment is considered necessary at this location.

Flaxton Road / Threlkelds Road

98. The intersection modelling included in **Appendix 18** is of the existing Flaxton Road / Threlkelds Road intersection with traffic growth to 2028, but no Rezoning traffic on the network. This model indicates that the right turn out of Threlkelds Road is over-capacity (Level of Service E in the PM peak) and so an intersection upgrade is required regardless of this development proposal. Again, we consider that there should be scope for discussion regarding the operation of Level of Service E.

99. The most likely upgrade would be a roundabout, to safely and efficiently accommodate the traffic anticipated at this location. An indicative roundabout has been modelled in SDIRA (using the 2033 plus Rezoning traffic volumes) and the results are included in **Appendix 19**. This indicates that a roundabout could satisfactorily accommodate the predicted traffic volumes.

100. It is also anticipated that the arrangement of the Mill Road / Threlkelds Road intersection would be reconfigured at the same time as constructing the roundabout. This is to promote travel from Mill Road (west) through to Threlkelds Road and vice versa. This would encourage drivers from Ōhoka to access the Flaxton Road / Skewbridge Road corridor at this location, rather than using the Ohoka Road / Mill Road intersection that is likely to have similar capacity constraints.

Mill Road / Threlkelds Road

101. The operation of the Mill Road / Threlkelds Road intersection has been assessed in the SIDRA model of the existing intersection. This is on the basis the existing intersection arrangement, although alterations to priorities are anticipated as identified above. The full results are contained in **Appendix 20**, which indicate that this intersection is predicted to operate satisfactorily with the Rezoning traffic added to the network. As with the Mill Road / Bradleys Road intersection, no safety assessment is considered necessary at this location.

Tram Road Interchange

102. The Tram Road interchange has been modelled with the 10% growth on the Tram Road corridor included on the network to represent 2028, but not the Rezoning traffic. The output of this model is included in **Appendix 21**, which indicates that the arrangement that is currently under construction is predicted to be overcapacity with this growth. The over-capacity movement is the Tram Road approach from the west in the AM peak hour, which has a degree of saturation of 0.952 compared to a typical upper limit of 0.9 for traffic signals. Similarly, the off-ramp in the AM peak is predicted to operate with a degree of saturation of 0.917.

103. We 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 in the wider area and to accommodate the proposed Rezoning traffic. The bridge has an overall width of approximately 13.4m between the barriers and this could be split as follows:

    i. **Option 1:** Provision of a central 3.0m wide right turning lane, plus 2 x 3.5m traffic lanes, 1.2m clearance to the barrier on the southern side of the bridge and a 2.2m shared path on the northern side of the bridge (see **Figure 26**).

    ii. **Option 2:** Provision of a central 3.5m right turning lane plus 2 x 3.5m wide traffic lanes both with 0.7m shoulders (to achieve a 4.2m wide effective lane to accommodate on-road cycles) A clip-on pedestrian bridge would be provided on the northern side (see **Figure 27**); and

    iii. **Option 3:** As per Option 2, although with a wider clip-on bridge to be a shared path.

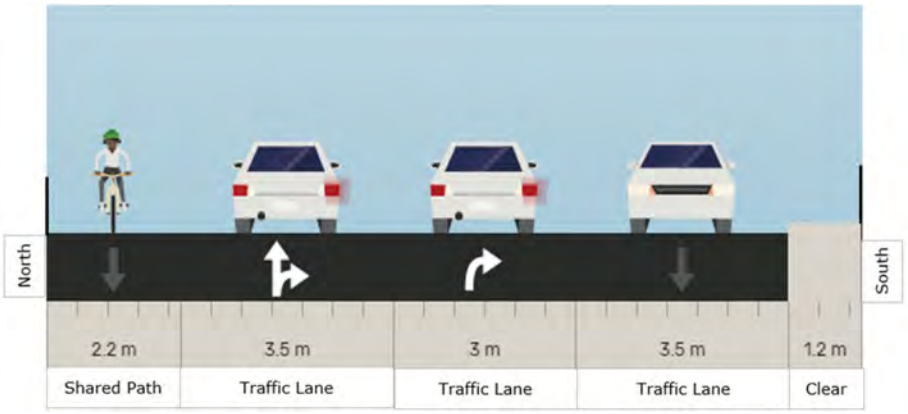


Figure 26: Tram Road Bridge Cross-Section – Option 1

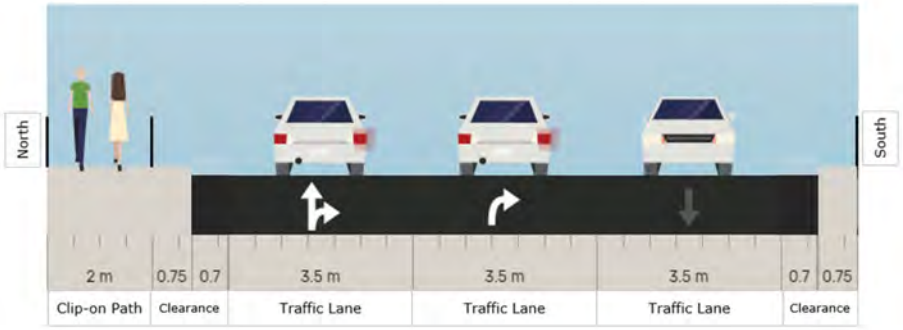


Figure 27: Tram Road Bridge Cross-Section – Option 2

104. Each of the above options has advantages and disadvantages. For example, the Option 1 arrangement includes a right turn bay that is narrower than desirable, although it is consistent with the right turn bays on the Lineside Road interchange. Similarly, the shared path proposed in Option 1 is consistent with the minimum typical requirement for a local access path. That said, negligible pedestrian and cycling demands were observed crossing the Tram Road interchange during our site visits.

105. Option 2 accommodates cyclists in the road by providing additional shoulder space to have an effective lane width of 4.2m (3.5m plus the 0.7m shoulder). This option (and Option 3) would require an additional structure to accommodate pedestrians, which is assumed to be on the northern side of the bridge. This is because there are barriers / fencing on the existing shared-path on the south eastern side of the interchange that prevent cyclists and pedestrians from travelling across the bridge (see **Figure 28**). A path on the northern side would be able to extend to the Tram Road / Main North Road intersection (to the east), although a termination point to the west would need to be agreed with Waka Kotahi and Waimakariri District Council.

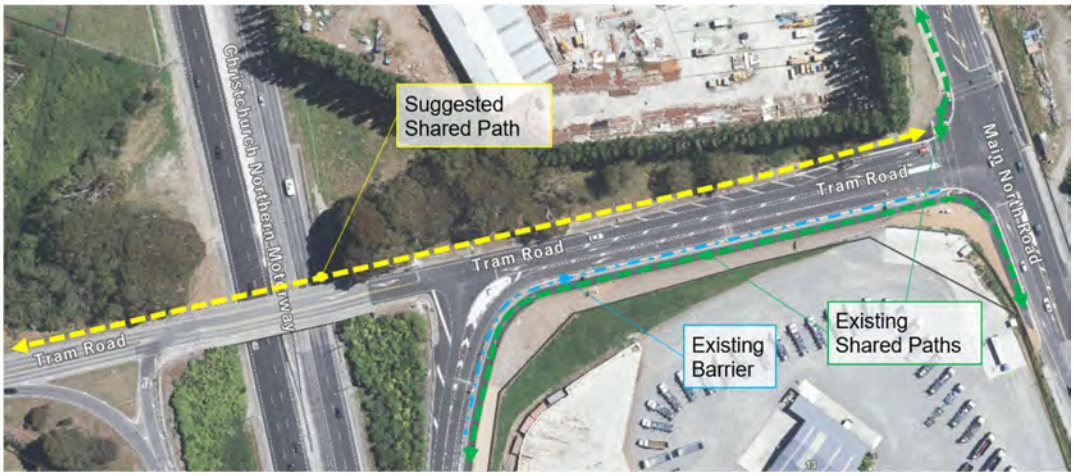


Figure 28: Existing & Suggested Tram Road Interchange Pedestrian & Cycle Routes

106. Overall, we consider that there are options to accommodate all modes of transport across the Tram Road interchange although the details of these need to be agreed with the relevant Road Controlling Authorities.

107. The proposed traffic arrangement with the additional right turn lane to the SH1 on-ramp has been modelled as a network model in SIDRA. The indicative arrangement is illustrated in **Figure 29**.

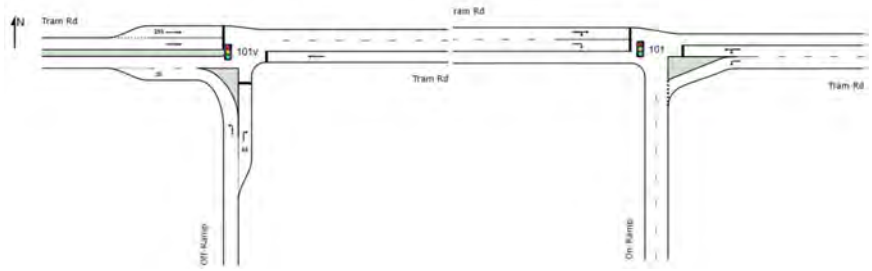


Figure 29: Tram Road Interchange Indicative Upgrade

108. The results of the modelling illustrating the road network performance with this upgrade (including growth to 2033 plus the Rezoning traffic) are included in **Appendix 22**. In summary, that modelling confirms that the improvements shown in **Figure 29** would ensure that the road network functions safely and efficiently with the background growth in traffic plus the fully developed Rezoning site.

Link Cross-Sections

109. The need for upgrades to the surrounding road links (Whites Road, Bradleys Road, Mill Road, Tram Road and Threlkelds Road) was discussed at the Plan Change 31 Hearing. The Council indicated that the only upgrades sought were widening of Tram Road between Bradleys Road and Jacksons Road and it is proposed that the Rezoning site would provide development contributions to provide this.

Tram Road Safety

110. As identified in paragraph 38, Council has already undertaken a review of safety along the Tram Road corridor and is planning on upgrades. It is expected that development contributions would be sought

from this Rezoning in the usual manner to assist in bringing forward those upgrades and mitigate these concerns.

Pedestrian & Cycle Provision

111. The proposed Rezoning site will include comprehensive internal walking and cycling routes to link the residential activities to the proposed commercial and special purpose area. The provision of the commercial area is also intended to reduce the need to drive to day-to-day facilities, not only for the residents of the Rezoning site but also the existing residents in Ōhoka. As such, there will be pedestrian and walkability benefits to the existing Ōhoka residents through the provision of this commercial area.

112. The Rezoning also provides for the shared path on Bradleys Road, Whites Road and Mill Road that will link to the wider shared path routes being planned by Council.

113. The centre of Rangiora is 10.5km from the centre of the ODP. This is approximately 30 minutes cycle from the site, which is considered to be within comfortable cycling distance. Furthermore, the uptake in e-bikes is anticipated to increase the distance that cyclists will be willing to travel through the increased ease with which they cycle.

114. Kaiapoi is approximately 9km from the centre of the Rezoning site via the Main Drain Road route. This is an achievable cycling distance and would become more attractive if the Skewbridge Road bridge accommodated safe cycle crossing facilities.

115. There is also the potential that the proposed Threlkelds Road / Flaxton Road roundabout (along with alterations to the Mill Road / Threlkelds Road intersection) could reduce traffic volumes on Mill Road east of Threlkelds Road. This may make this an attractive cycle route through to the Mill Road / Ohoka Road intersection. We understand that Council are investigating cycle crossing opportunities at that location that would enable a link to the existing cycle facilities on the eastern side of Ohoka Road, which would than provide an alternate option to get to Kaiapoi.

116. The retail area at Mandeville is approximately 2km south of the Rezoning site boundary on Bradleys Road. These are within comfortable cycling distance of the site and cyclists would be able to use the shared path along Bradleys Road.

117. Overall, it is considered that the pedestrian and cycle provision for the Rezoning site is acceptable.

Passenger Transport

118. The proposed bus route set out in paragraph 62 provides a link between the Rezoning site and the existing Kaiapoi Central Park & Ride, as well as Kaiapoi itself. The existing Park & Ride in turn provides access to a direct bus service to / from Christchurch City centre and well as services to / from Rangiora and Woodend. As such, residents of the Rezoning site will be able to make use of the wider public transport as part of their travel patterns.

119. The Greater Christchurch Public Transport Futures interim report (June 2021) indicates that Kaiapoi and Southbrook could be a heavy rail passenger transport route. Kaiapoi is indicated as potentially being on a ‘street running corridor focussed’ route, with Ohoka Road and Tram Road stops illustrated on a ‘street running limited stops’ route. These stop locations are likely to become the focus for park and ride sites and the residents of the Rezoning site would be able to make use of these.

120. Additional passenger transport services could be routed through (or near) the site in the future, should ECan choose to do so. This could include routes that are to / from Oxford linking to the Park & Ride site at Kaiapoi (or other destinations as ECan chooses).

Summary & Conclusion

Summary

121. It is proposed to Rezone the site at 535 Mill Road as a predominantly residential area that can accommodate approximately 850 residential Lots, local commercial activities and a special purpose area for a school or additional housing. The Rezoning area is predicted to generate up to 949 vehicle movements per hour in the weekday peak hours and 7,480 vehicle movements per day.

122. Three development options for the land have been assessed as follows (in no particular order):

    i. **Option 1:** Up to 850 dwellings plus a commercial zone and a 250-pupil primary school;

    ii. **Option 2:** Up to 892 dwellings plus a commercial zone; and

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

123. New intersections would be created to Whites Road, Mill Road and Bradleys Road to provide access to the internal road network. These intersections are predicted to operate satisfactorily. The design of the intersections will be undertaken at the subdivision stage and would be subject to Road Safety Audits. The intersection spacing between proposed internal roads and the existing road network would comply with the requirements set out in Austroads and are considered to be acceptable.

124. A shared path is proposed along Whites Road, Bradleys Road and Mill Road, as per the Council's proposed route. The internal site layout includes a network of walking and cycling routes to facilitate these modes within the site. The provision of a commercial centre within the Rezoning site also places day-to-day shopping needs within walking and cycling distance of the residents within the Rezoning site and within Ōhoka. The site is located within the Council's proposed walking and cycling network. The site can also make use of other routes, such as Main Drain Road which would become more attractive if the proposed replacement of Skew Bridge accommodates a safe cycle crossing.

125. Passenger transport is provided to link the Rezoning site to the Park and Ride sites in Kaiapoi. This in turn provides a passenger transport link to Christchurch City Centre as well as Rangiora and Woodend.

126. The operation of the external road network has been assessed. Council indicated through the Plan Change 31 process that they would not typically accept Level of Service E operation on the rural network. Adopting that as a threshold, the following intersections would require upgrades prior to 2028 (regardless of this Rezoning application):

    i. Tram Road / Whites Road;

    ii. Flaxton Road / Threlkelds Road; and

    iii. Tram Road / State Highway 1 Interchange.

127. This report has identified potential solutions to provide additional traffic capacity at those locations and it is anticipated that the Rezoning would provide development contributions toward those needing to be

undertaken by the Council. It is proposed to include a rule that would enable assessment of these intersections again at subdivision stage to determine whether a level of development could be achieved at the Rezoning site with acceptable traffic effects. This may also require interim road safety upgrades to address potential safety concerns.

128. In addition, the Bradleys Road / Tram Road intersection is anticipated to be upgraded to a roundabout prior to development commencing. That roundabout is anticipated to be able to accommodate the predicted future traffic volumes with the Rezoning.

129. Widening of Tram Road between Bradleys Road and Jacksons Road has also been identified as being required. Again, the proposed activity would provide development contributions toward this and other safety improvements proposed by the Council along the Tram Road corridor.

Conclusion

130. Subject to the above road upgrades occurring, the traffic effects of the proposed Rezoning are considered to be acceptable.

Appendix 1

Outline Development Plan

LEGEND

- Outline Development Plan Area
- Settlement Zone
- Settlement (Educational Overlay)
- Settlement (Polo Grounds Overlay)
- Large Lot Residential Zone
- Local Centre Zone
- Natural Open Space Zone
- Indicative Reserves (Size and Location to be Confirmed)
- Indicative (Collector) Road
- Indicative Local Road Connection
- Village Threshold / Gateway
- Potential Minor Threshold
- Indicative Pedestrian-Cycle Network
- Indicative Pedestrian Path
- Indicative Stormwater Management Areas (size and location to be confirmed)
- Existing / Modified Waterways
- Existing Springs and Associated Setback (30m)
- Stormwater Conveyance Flow Path
- Groundwater seep and associated setback (20m)
- Groundwater Seep Channel
- Existing Pond (size and location to be confirmed)
- A Landscape Treatment A
- B Landscape Treatment B
- C Landscape Treatment C
- Pedestrian / Cycle Crossing
- Overhead 66kV Power Lines

A. OUTLINE DEVELOPMENT PLAN - 535 MILL ROAD, OHOKA

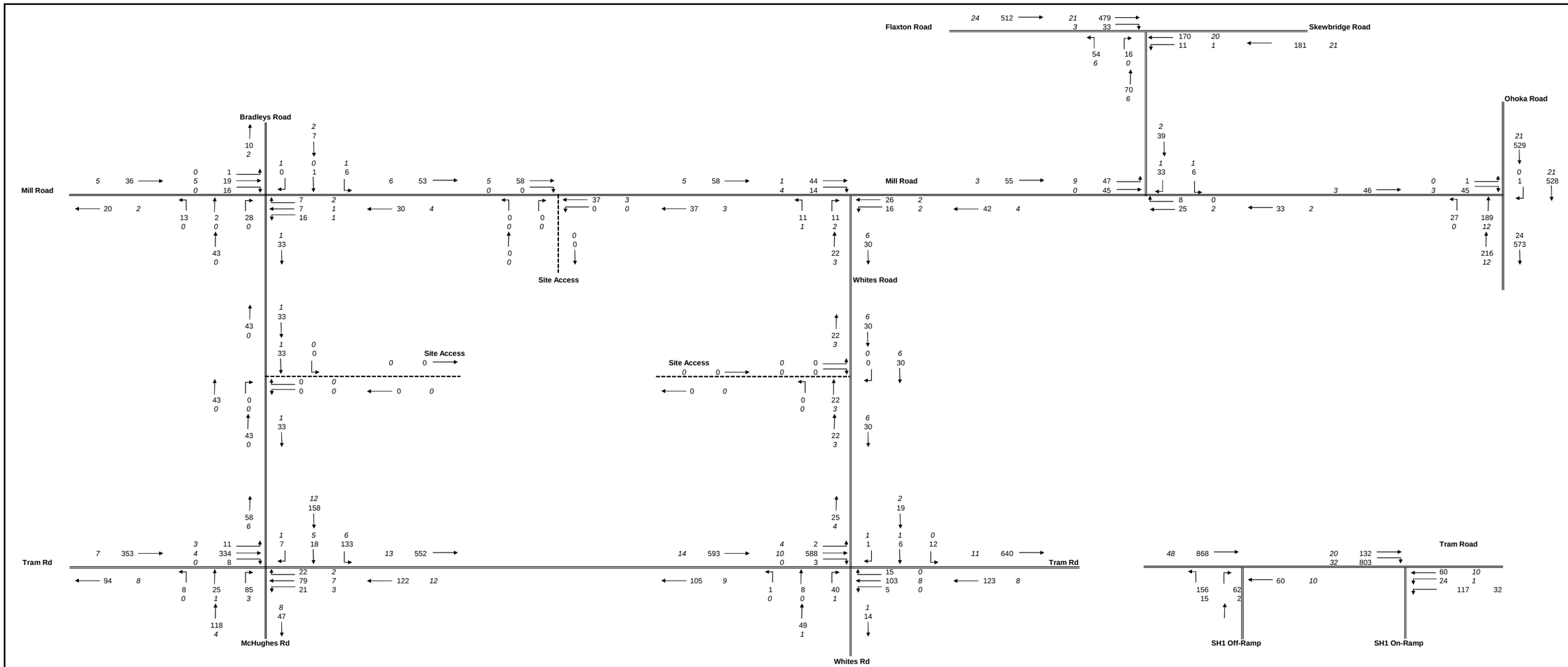
0 50 100 200 500
1:10000

PROPOSAL - OUTLINE DEVELOPMENT PLAN

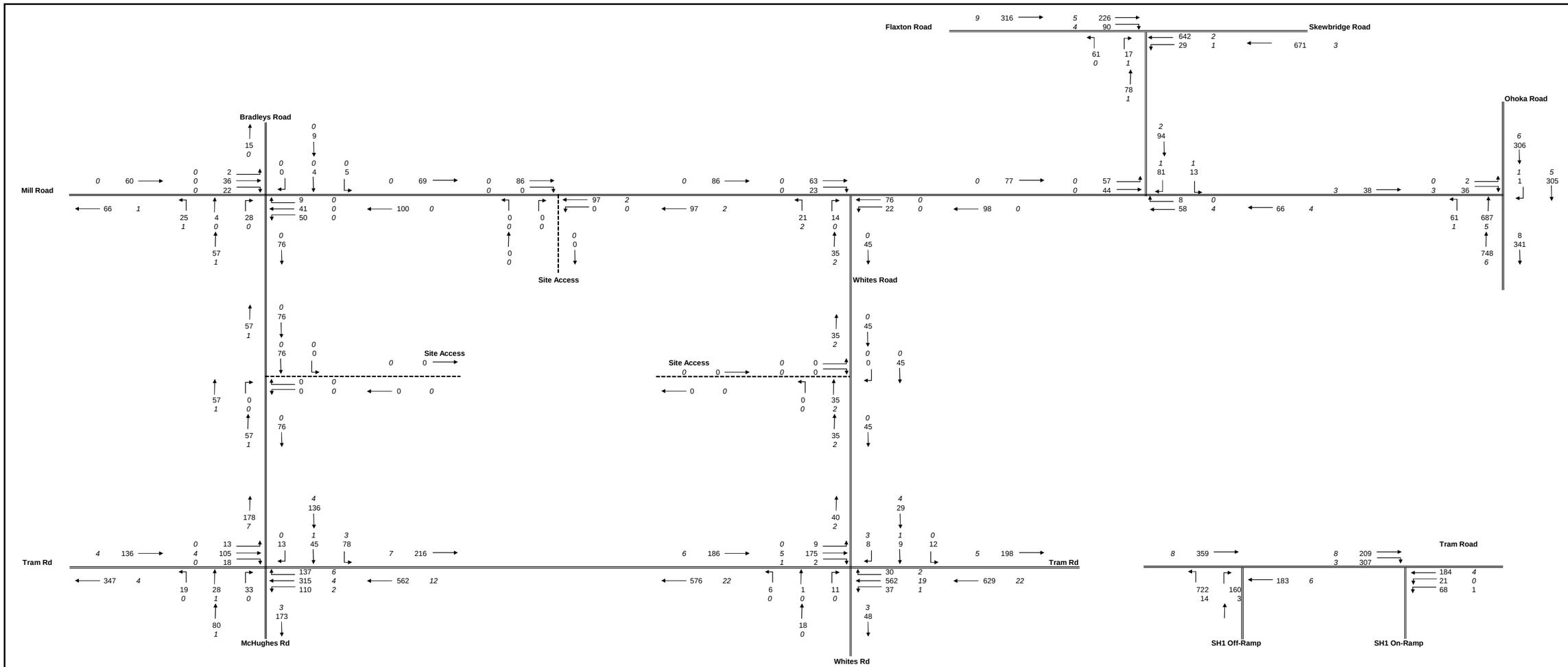
535 MILL ROAD, OHOKA - PROPOSED DISTRICT PLAN SUBMISSION

Appendix 2

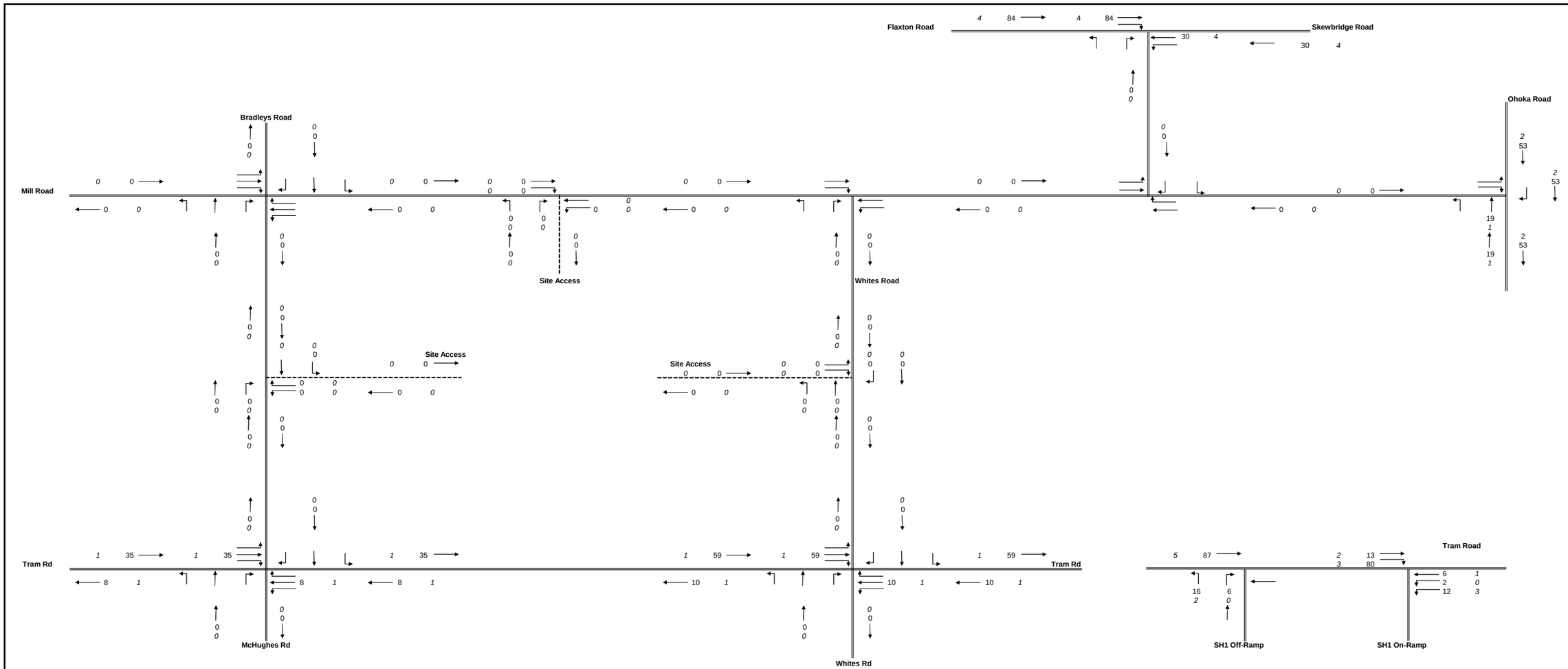
2021 / 2023 Traffic Count Data



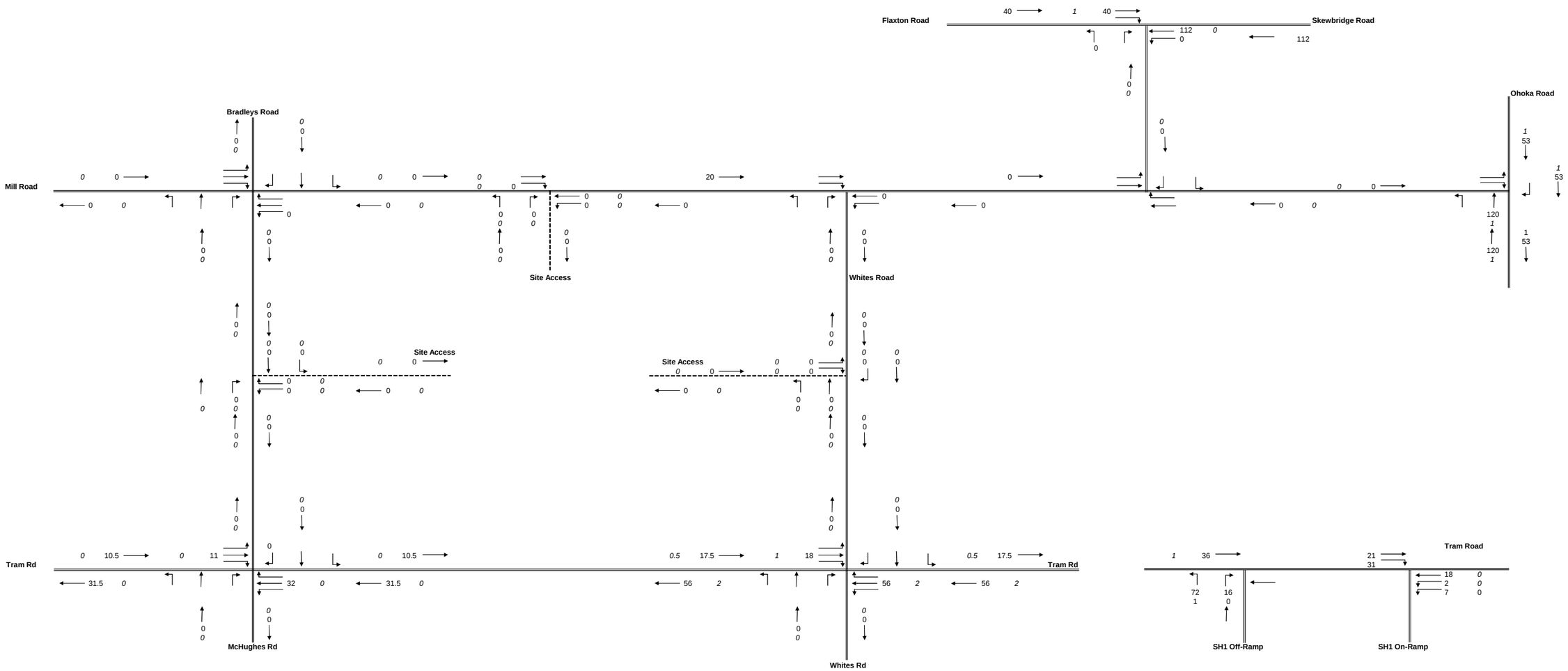
021-034: Ohoka Plan Change
2021 Existing Volumes - AM Peak
Diagram 1



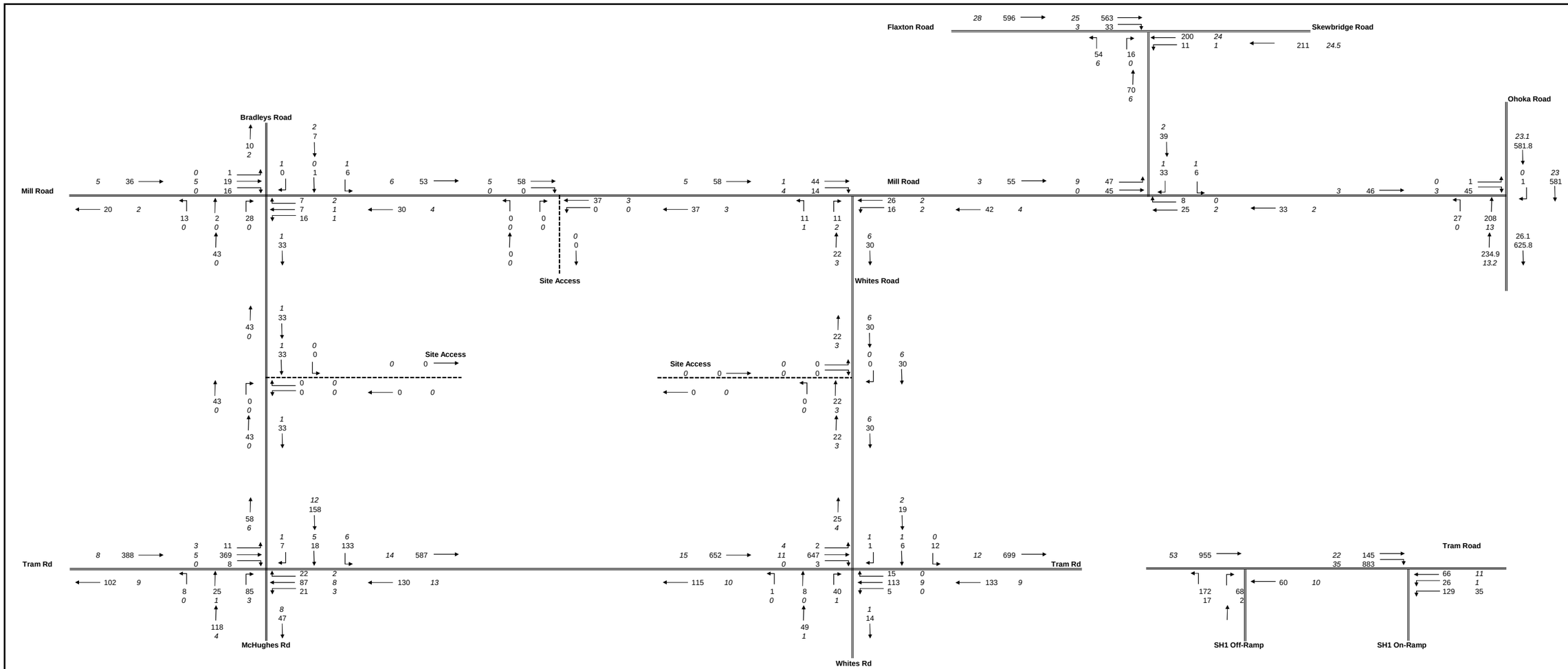
021-034: Ohoka Plan Change
2021 Existing Volumes - PM Peak
Diagram 2



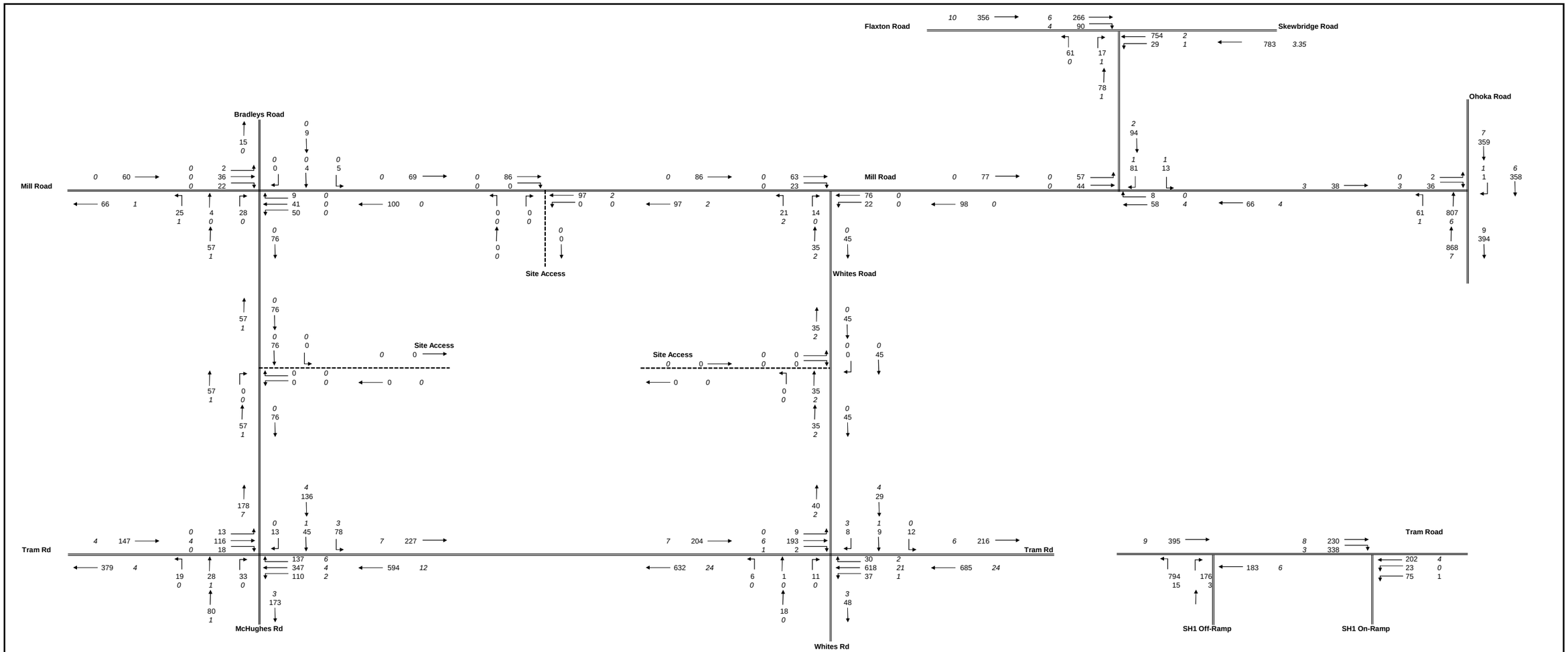
021-034: Ohoka Plan Change
2028 Background Growth - AM Peak
Diagram 3



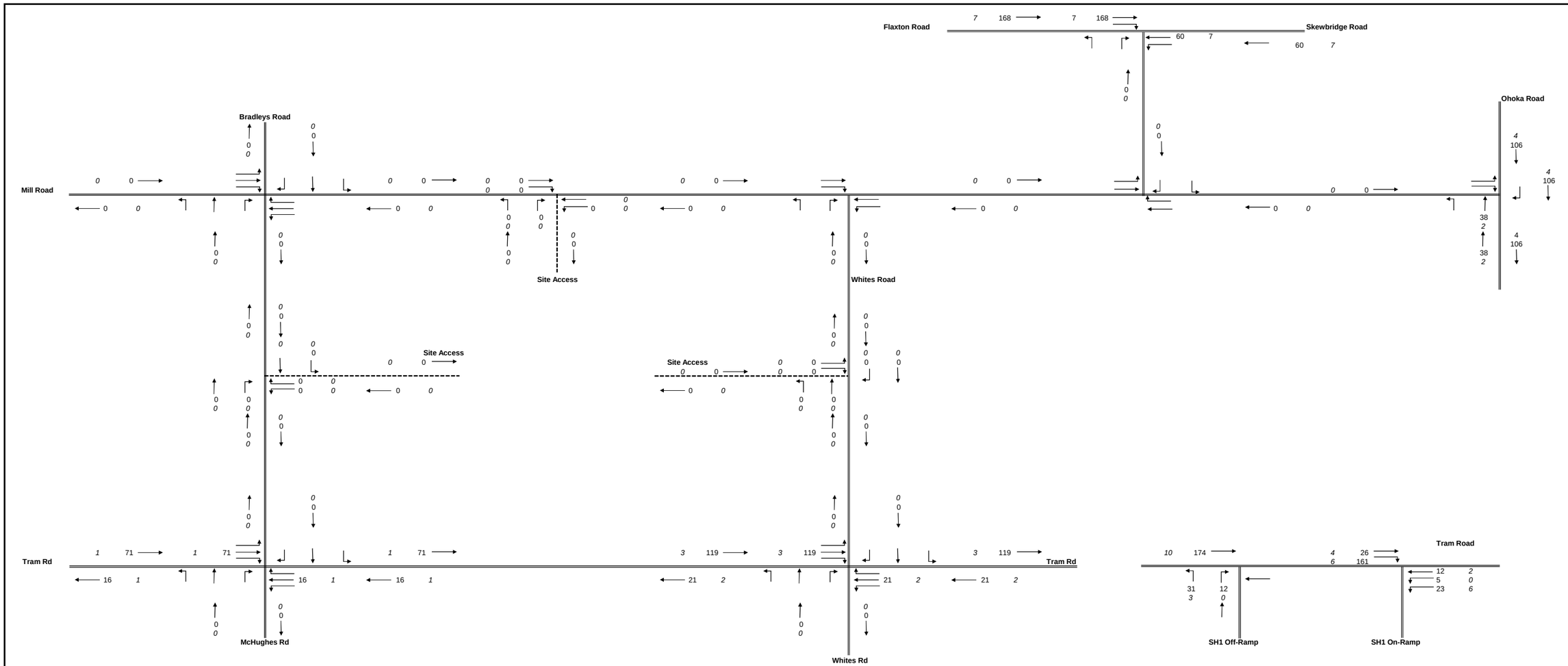
021-034: Ohoka Plan Change
2028 Background Growth - PM Peak
Diagram 4



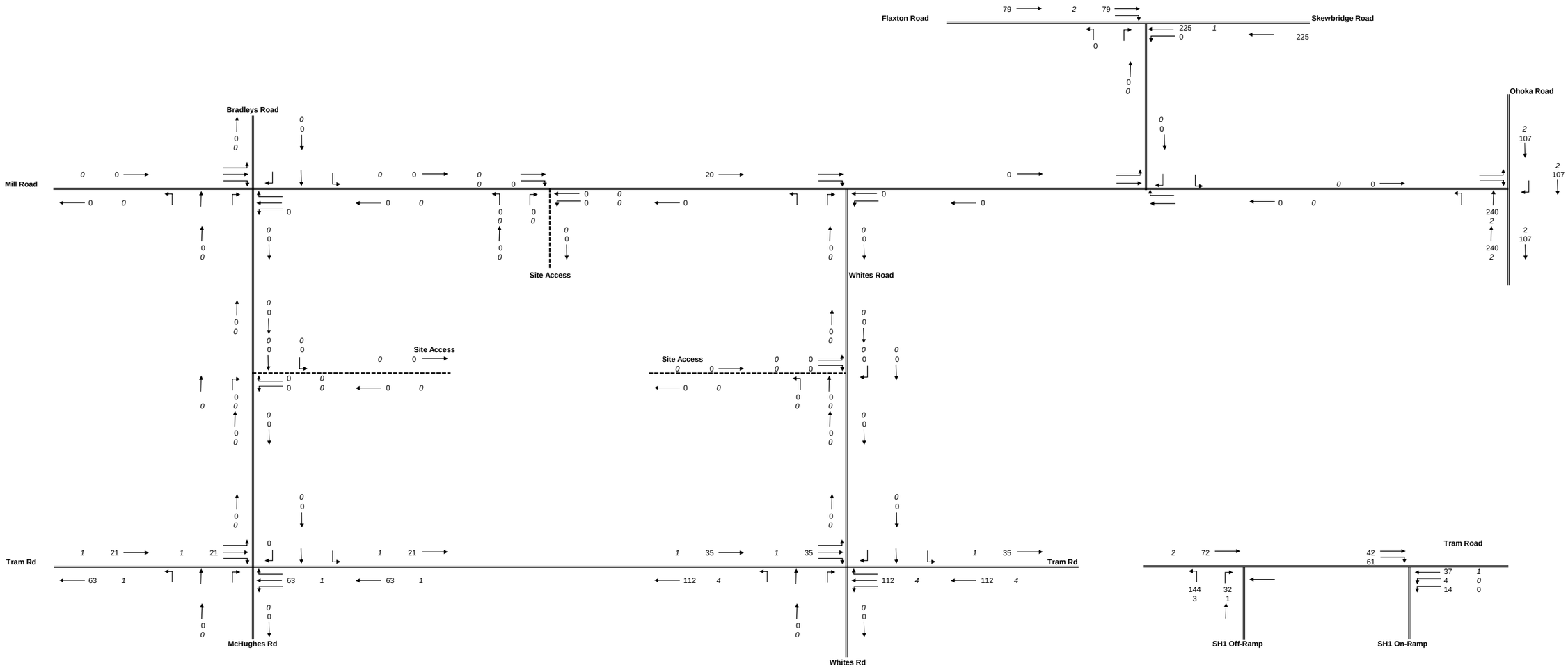
021-034: Ohoka Plan Change
2028 Network Traffic - AM Peak
Diagram 5



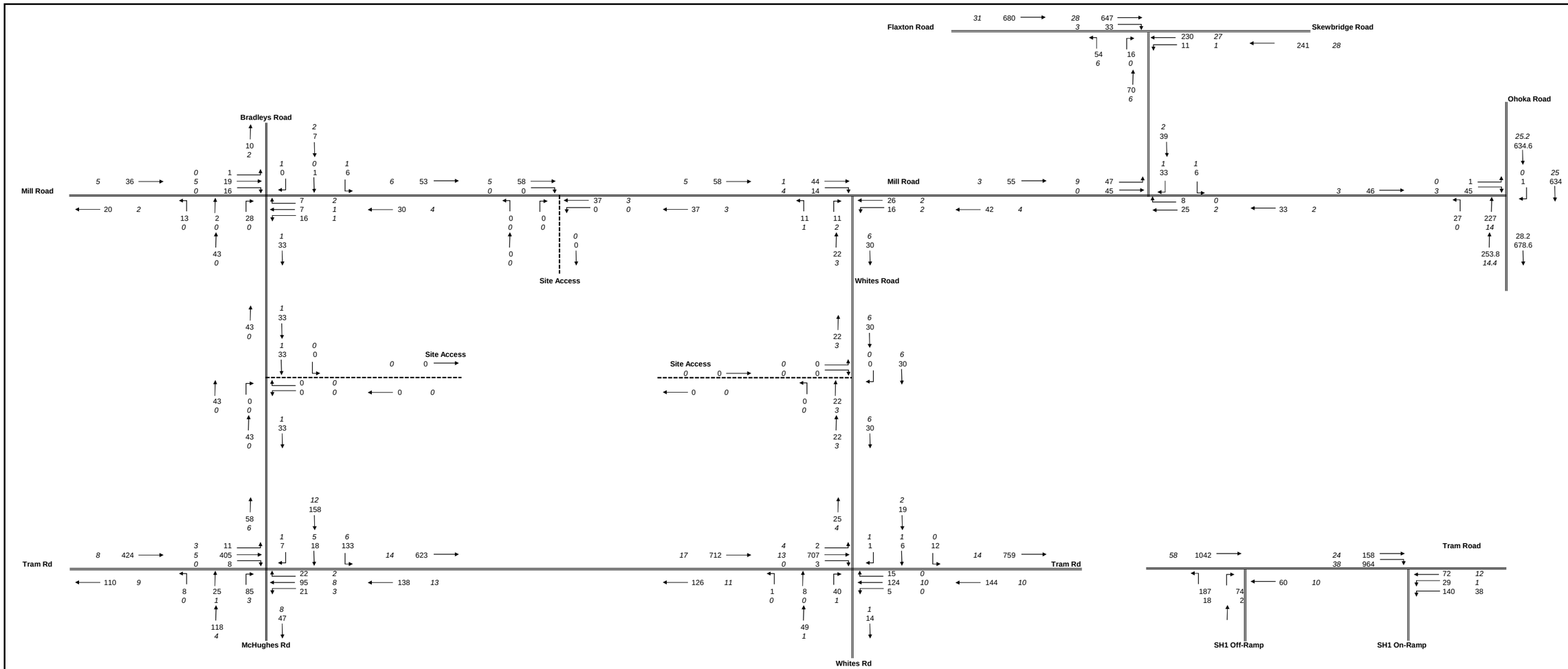
021-034: Ohoka Plan Change
2028 Network Traffic - PM Peak
Diagram 6



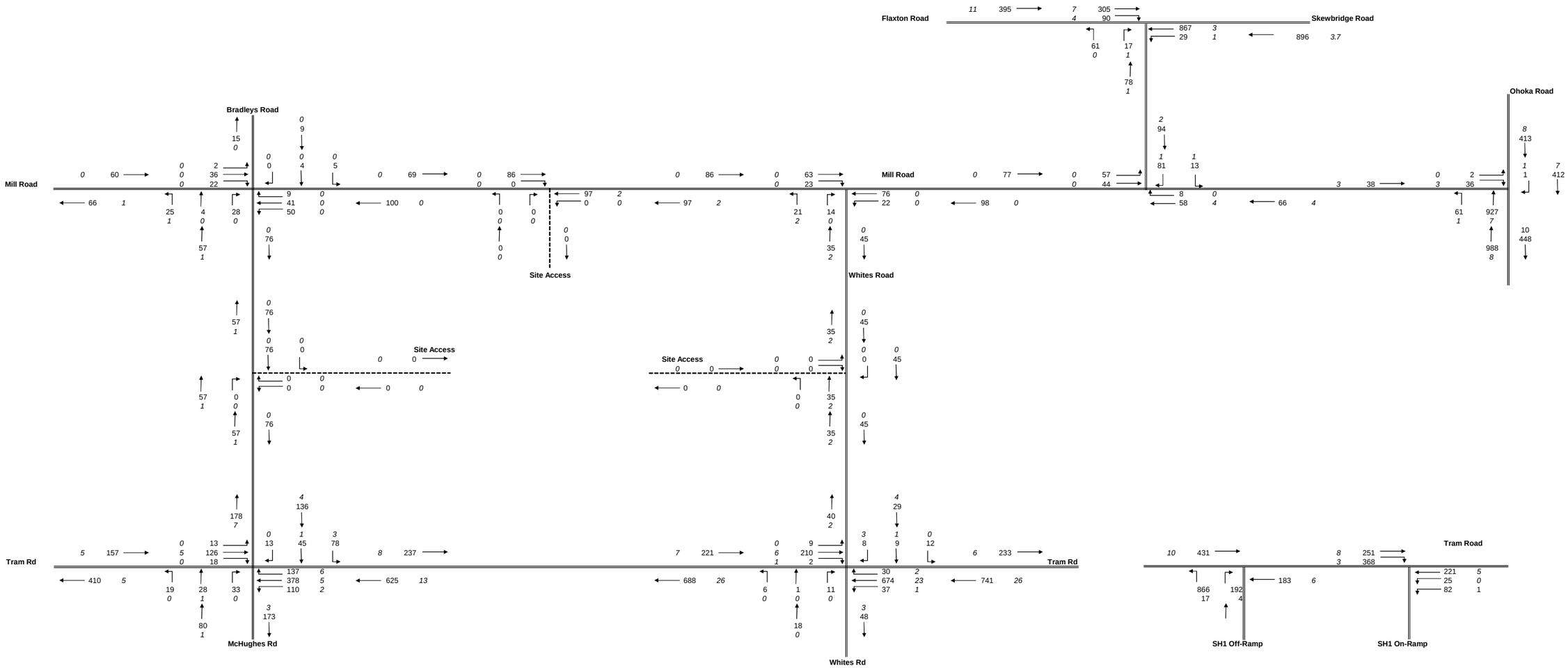
021-034: Ohoka Plan Change
2033 Background Growth - AM Peak
Diagram 7



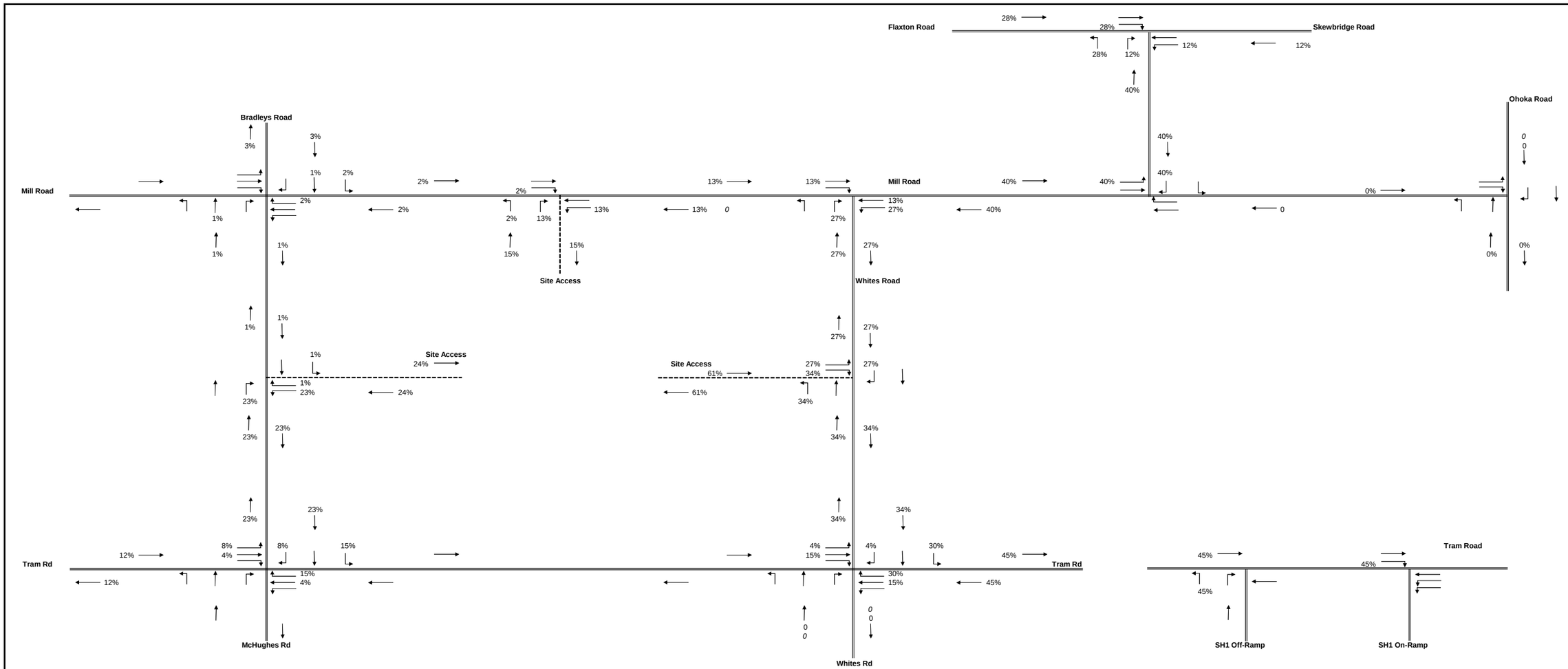
021-034: Ohoka Plan Change
2033 Background Growth - PM Peak
Diagram 8



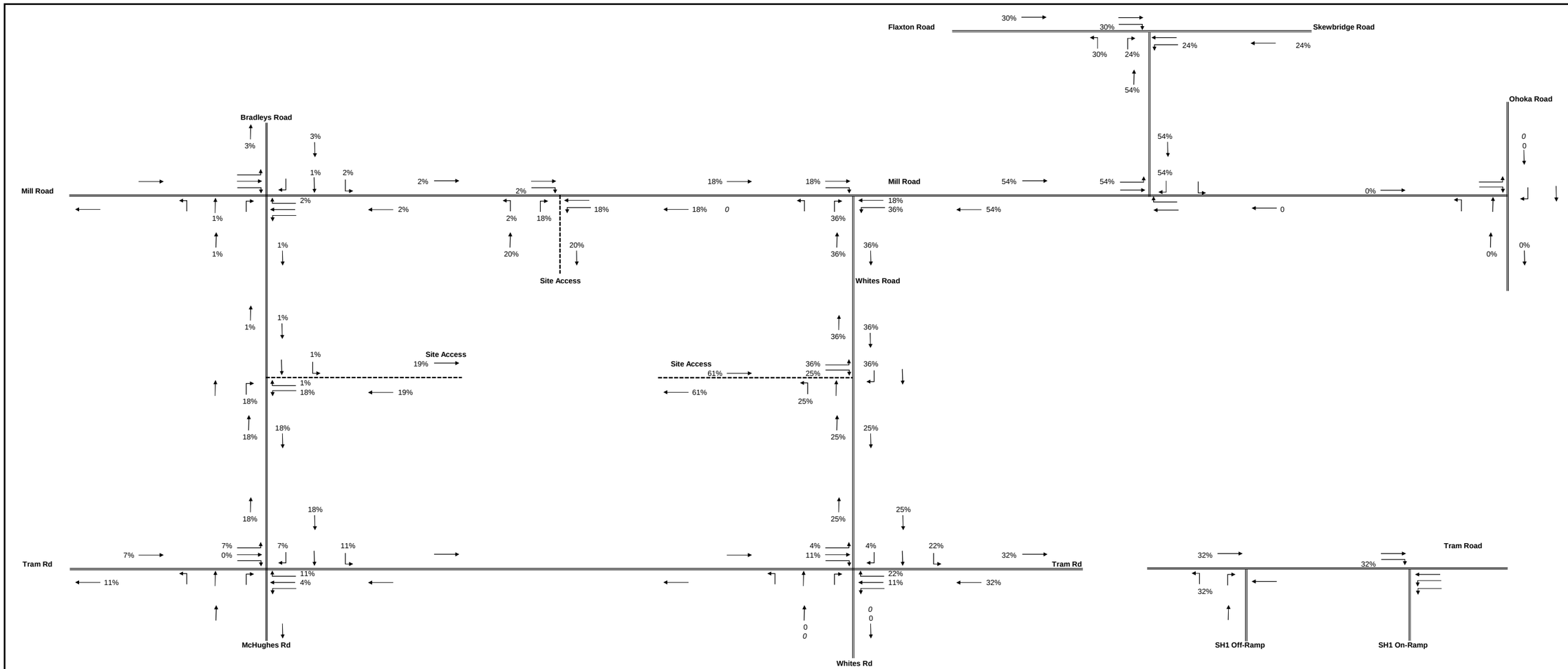
021-034: Ohoka Plan Change
2033 Network Traffic - AM Peak
Diagram 9



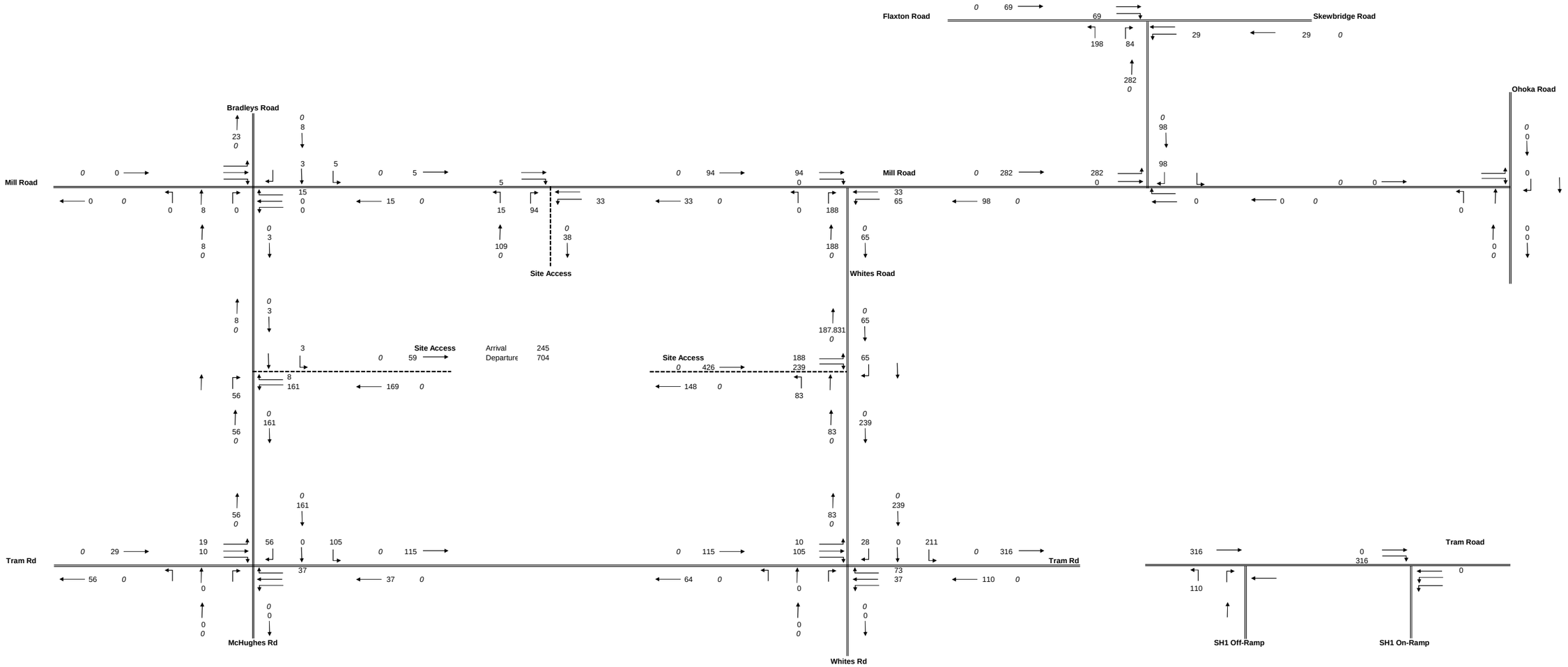
021-034: Ohoka Plan Change
2033 Network Traffic - PM Peak
Diagram 10



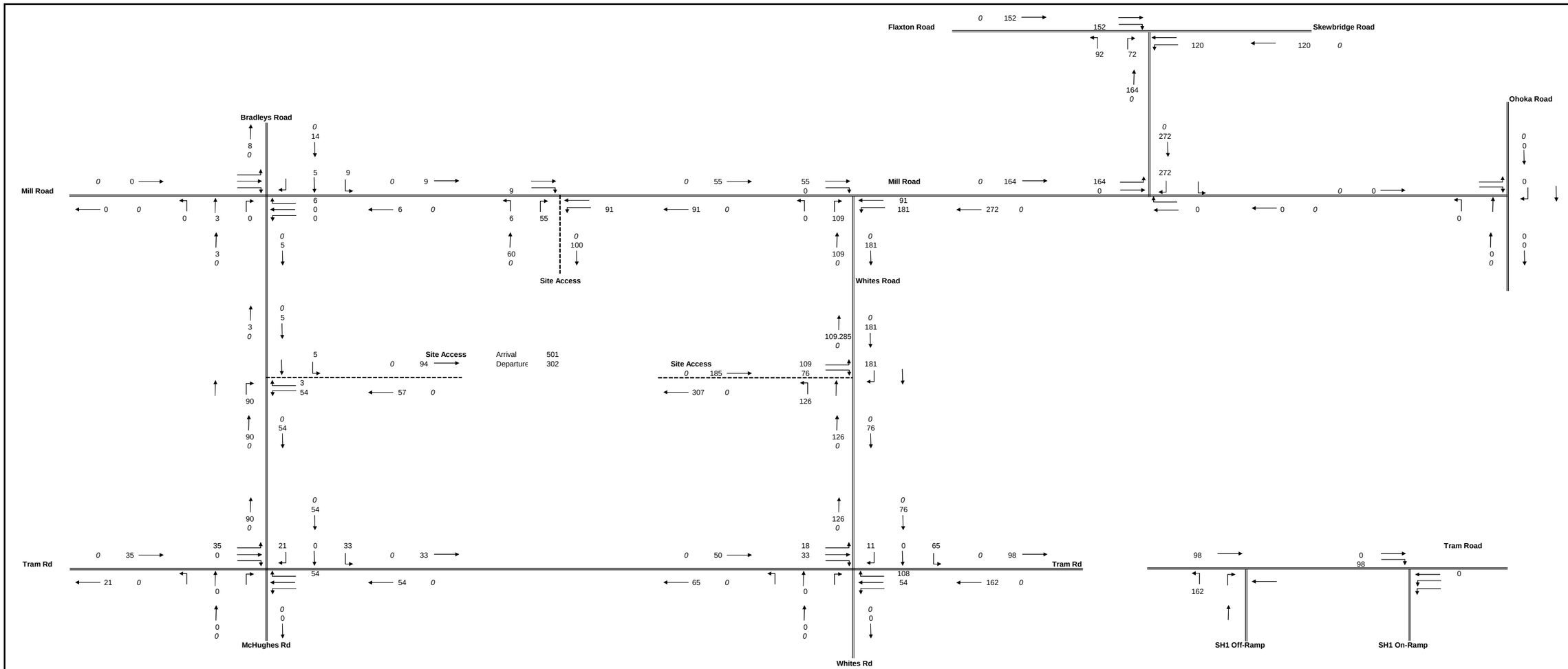
021-034: Ohoka Plan Change
Distribution - AM Peak
Diagram 11



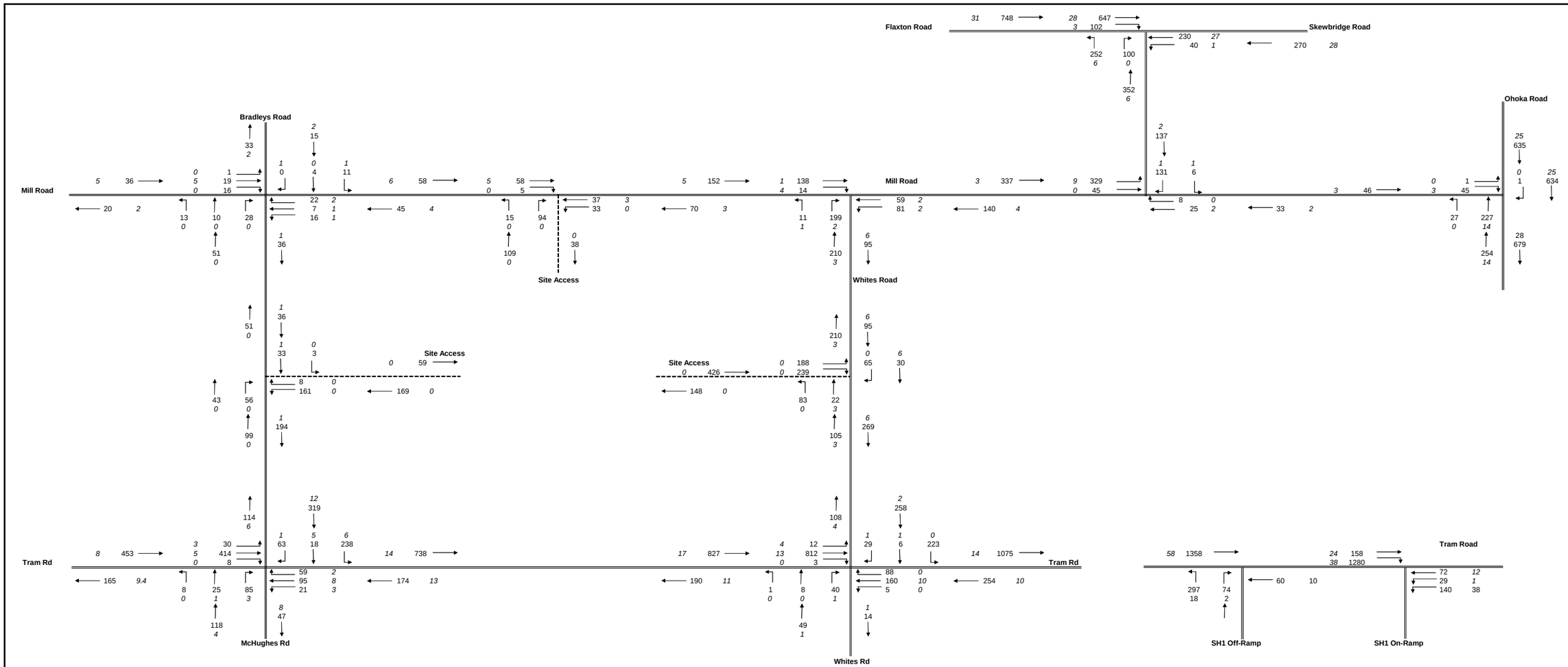
021-034: Ohoka Plan Change
Distribution - PM Peak
Diagram 12



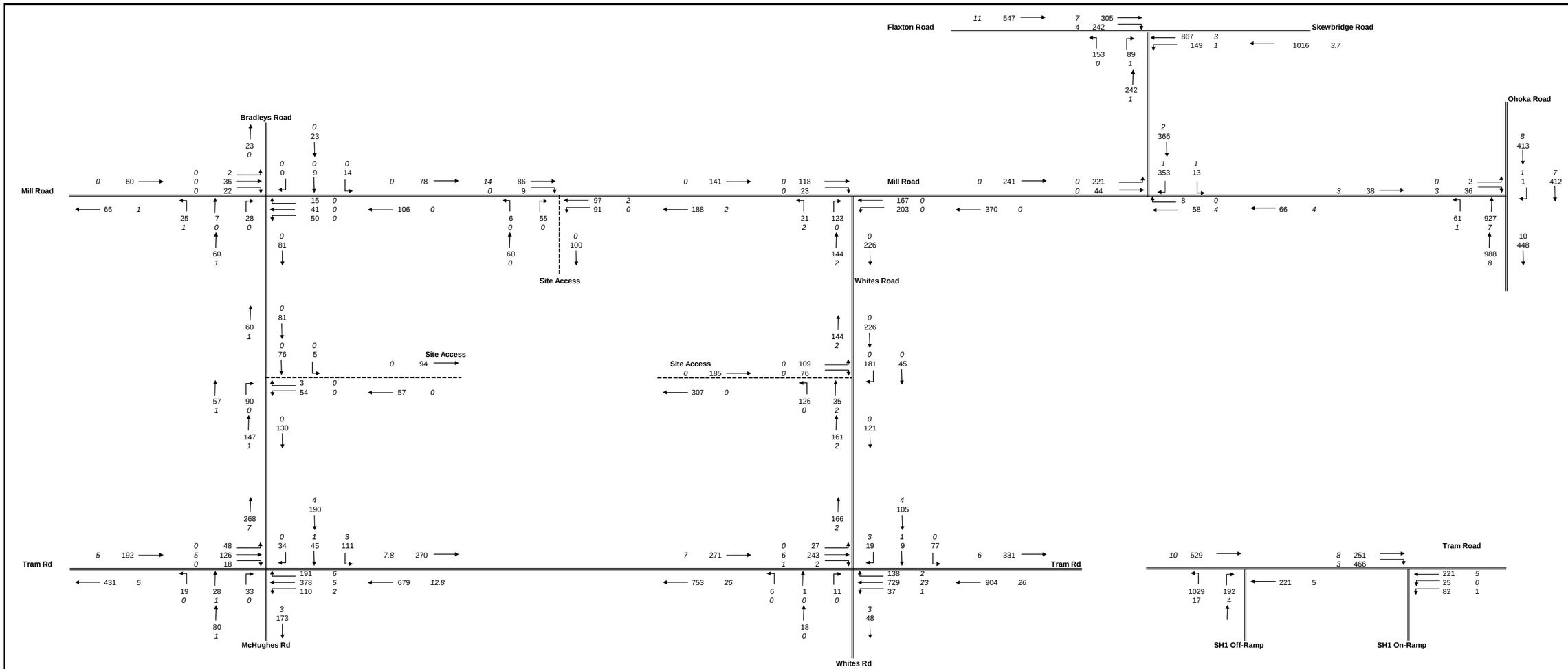
021-034: Ohoka Plan Change
Assignment - AM Peak
Diagram 13



021-034: Ohoka Plan Change
Assignment - PM Peak
Diagram 14



021-034: Ohoka Plan Change
2033 plus Development - AM Peak
Diagram 15



021-034: Ohoka Plan Change
2033 plus Development - PM Peak
Diagram 16

Appendix 3

Tram Rd / Bradleys Rd Intersection - Existing Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Bradleys Rd - 2021 AM Peak - Calibrate (Site Folder: Tram Rd & Bradleys Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: McHughes Rd														
1	L2	8	0	8	0.0	0.008	9.2	LOS A	0.0	0.2	0.19	0.88	0.19	62.5
2	T1	26	1	27	3.8	0.401	20.8	LOS C	1.7	12.1	0.74	1.06	1.01	51.0
3	R2	88	3	93	3.4	0.401	23.4	LOS C	1.7	12.1	0.74	1.06	1.01	51.1
Approach		122	4	128	3.3	0.401	21.9	LOS C	1.7	12.1	0.71	1.05	0.95	51.7
East: Tram Rd														
4	L2	23	2	24	8.7	0.014	7.1	LOS A	0.0	0.0	0.00	0.63	0.00	61.8
5	T1	86	7	91	8.1	0.049	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
6	R2	25	3	26	12.0	0.030	9.0	LOS A	0.1	0.9	0.43	0.66	0.43	58.9
Approach		134	12	141	9.0	0.049	2.9	NA	0.1	0.9	0.08	0.23	0.08	71.6
North: Bradleys Rd														
7	L2	139	6	146	4.3	0.190	11.5	LOS B	0.7	5.2	0.47	0.93	0.47	59.7
8	T1	23	5	24	21.7	0.128	21.6	LOS C	0.4	3.3	0.66	1.01	0.66	48.5
9	R2	8	1	8	12.5	0.128	21.8	LOS C	0.4	3.3	0.66	1.01	0.66	50.3
Approach		170	12	179	7.1	0.190	13.4	LOS B	0.7	5.2	0.50	0.94	0.50	57.4
West: Tram Rd														
10	L2	14	3	15	21.4	0.009	7.3	LOS A	0.0	0.0	0.00	0.63	0.00	58.1
11	T1	338	4	356	1.2	0.182	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	8	0	8	0.0	0.007	7.5	LOS A	0.0	0.2	0.22	0.57	0.22	63.5
Approach		360	7	379	1.9	0.182	0.5	NA	0.0	0.2	0.00	0.04	0.00	78.3
All Vehicles		786	35	827	4.5	0.401	7.0	NA	1.7	12.1	0.23	0.42	0.27	66.7

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

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Bradleys Rd - 2021 PM Peak - Calibrate (Site Folder: Tram Rd & Bradleys Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: McHughes Rd														
1	L2	19	0	20	0.0	0.024	10.7	LOS B	0.1	0.6	0.40	0.87	0.40	61.5
2	T1	29	1	31	3.4	0.264	24.3	LOS C	1.0	6.7	0.77	1.02	0.88	50.3
3	R2	33	0	35	0.0	0.264	23.3	LOS C	1.0	6.7	0.77	1.02	0.88	51.1
Approach		81	1	85	1.2	0.264	20.7	LOS C	1.0	6.7	0.68	0.99	0.76	52.9
East: Tram Rd														
4	L2	112	2	118	1.8	0.066	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	64.0
5	T1	319	4	336	1.3	0.173	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
6	R2	143	6	151	4.2	0.121	7.5	LOS A	0.5	3.7	0.25	0.61	0.25	62.2
Approach		574	12	604	2.1	0.173	3.2	NA	0.5	3.7	0.06	0.27	0.06	71.4
North: Bradleys Rd														
7	L2	81	3	85	3.7	0.082	9.6	LOS A	0.3	2.2	0.23	0.89	0.23	61.2
8	T1	46	1	48	2.2	0.281	26.3	LOS D	1.0	7.3	0.78	1.03	0.91	49.0
9	R2	13	0	14	0.0	0.281	25.0	LOS D	1.0	7.3	0.78	1.03	0.91	49.4
Approach		140	4	147	2.9	0.281	16.5	LOS C	1.0	7.3	0.46	0.95	0.52	55.5
West: Tram Rd														
10	L2	13	0	14	0.0	0.008	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	64.6
11	T1	109	4	115	3.7	0.060	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	80.0
12	R2	18	0	19	0.0	0.021	9.1	LOS A	0.1	0.6	0.46	0.66	0.46	62.3
Approach		140	4	147	2.9	0.060	1.8	NA	0.1	0.6	0.06	0.14	0.06	75.5
All Vehicles		935	21	984	2.2	0.281	6.5	NA	1.0	7.3	0.18	0.42	0.19	67.0

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

Appendix 4

Tram Rd / Whites Rd
Intersection - Existing Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Whites Rd - 2021 AM Existing Calibrate (Site Folder: Tram Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	1	0	1	0.0	0.165	10.0	LOS A	0.6	3.9	0.72	1.00	0.72	60.8
2	T1	8	0	8	0.0	0.165	20.9	LOS C	0.6	3.9	0.72	1.00	0.72	60.8
3	R2	41	1	43	2.4	0.165	19.9	LOS C	0.6	3.9	0.72	1.00	0.72	60.1
Approach		50	1	53	2.0	0.165	19.8	LOS C	0.6	3.9	0.72	1.00	0.72	60.3
East: Tram Rd														
4	L2	5	0	5	0.0	0.065	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	86.7
5	T1	111	8	117	7.2	0.065	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.0
6	R2	15	0	16	0.0	0.018	10.3	LOS B	0.1	0.5	0.56	0.72	0.56	70.7
Approach		131	8	138	6.1	0.065	1.5	NA	0.1	0.5	0.06	0.11	0.06	94.2
North: Whites Rd														
7	L2	12	0	13	0.0	0.020	13.1	LOS B	0.1	0.5	0.53	0.91	0.53	68.6
8	T1	7	1	7	14.3	0.052	25.3	LOS D	0.1	1.2	0.77	1.01	0.77	51.0
9	R2	2	1	2	50.0	0.052	42.6	LOS E	0.1	1.2	0.77	1.01	0.77	45.1
Approach		21	2	22	9.5	0.052	20.0	LOS C	0.1	1.2	0.63	0.95	0.63	58.9
West: Tram Rd														
10	L2	6	4	6	66.7	0.328	9.6	LOS A	0.0	0.0	0.00	0.01	0.00	62.3
11	T1	598	10	629	1.7	0.328	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
12	R2	3	0	3	0.0	0.002	7.7	LOS A	0.0	0.1	0.23	0.59	0.23	73.6
Approach		607	14	639	2.3	0.328	0.2	NA	0.0	0.1	0.00	0.01	0.00	99.0
All Vehicles		809	25	852	3.1	0.328	2.1	NA	0.6	3.9	0.07	0.11	0.07	92.9

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

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Whites Rd - 2021 PM Existing - Calibrate (Site Folder: Tram Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	6	0	6	0.0	0.052	13.0	LOS B	0.2	1.2	0.69	0.98	0.69	64.0
2	T1	1	0	1	0.0	0.052	22.8	LOS C	0.2	1.2	0.69	0.98	0.69	64.0
3	R2	11	0	12	0.0	0.052	19.9	LOS C	0.2	1.2	0.69	0.98	0.69	63.9
Approach		18	0	19	0.0	0.052	17.7	LOS C	0.2	1.2	0.69	0.98	0.69	63.9
East: Tram Rd														
4	L2	38	1	40	2.6	0.341	7.9	LOS A	0.0	0.0	0.00	0.04	0.00	86.2
5	T1	581	19	612	3.3	0.341	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	98.5
6	R2	32	2	34	6.3	0.023	8.4	LOS A	0.1	0.8	0.31	0.61	0.31	70.6
Approach		651	22	685	3.4	0.341	0.9	NA	0.1	0.8	0.02	0.07	0.02	95.8
North: Whites Rd														
7	L2	12	0	13	0.0	0.011	10.2	LOS B	0.0	0.3	0.27	0.86	0.27	72.6
8	T1	10	1	11	10.0	0.101	26.7	LOS D	0.3	2.8	0.80	1.01	0.80	54.4
9	R2	11	3	12	27.3	0.101	25.4	LOS D	0.3	2.8	0.80	1.01	0.80	51.0
Approach		33	4	35	12.1	0.101	20.3	LOS C	0.3	2.8	0.61	0.95	0.61	58.4
West: Tram Rd														
10	L2	9	0	9	0.0	0.103	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	87.8
11	T1	180	5	189	2.8	0.103	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	98.9
12	R2	3	1	3	33.3	0.005	12.4	LOS B	0.0	0.2	0.60	0.70	0.60	59.0
Approach		192	6	202	3.1	0.103	0.6	NA	0.0	0.2	0.01	0.04	0.01	97.3
All Vehicles		894	32	941	3.6	0.341	1.9	NA	0.3	2.8	0.05	0.12	0.05	93.0

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

Appendix 5

Mill Rd / Bradleys Rd
Intersection - Existing Operation

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Bradleys Rd - 2021 AM Existing (Site Folder: Mill Rd & Bradleys Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bradleys Rd														
1	L2	13	0	14	0.0	0.043	8.0	LOS A	0.1	1.0	0.06	0.96	0.06	51.9
2	T1	2	0	2	0.0	0.043	8.0	LOS A	0.1	1.0	0.06	0.96	0.06	51.6
3	R2	28	0	29	0.0	0.043	7.9	LOS A	0.1	1.0	0.06	0.96	0.06	51.3
Approach		43	0	45	0.0	0.043	7.9	LOS A	0.1	1.0	0.06	0.96	0.06	51.5
East: Mill Rd														
4	L2	17	1	18	5.9	0.021	5.7	LOS A	0.1	0.5	0.07	0.43	0.07	54.2
5	T1	8	1	8	12.5	0.021	0.1	LOS A	0.1	0.5	0.07	0.43	0.07	55.9
6	R2	9	2	9	22.2	0.021	5.8	LOS A	0.1	0.5	0.07	0.43	0.07	52.8
Approach		34	4	36	11.8	0.021	4.4	NA	0.1	0.5	0.07	0.43	0.07	54.2
North: Bradleys Rd														
7	L2	7	1	7	14.3	0.008	8.7	LOS A	0.0	0.3	0.10	0.97	0.10	50.9
8	T1	1	0	1	0.0	0.008	8.0	LOS A	0.0	0.3	0.10	0.97	0.10	51.2
9	R2	1	1	1	100.0	0.008	12.4	LOS B	0.0	0.3	0.10	0.97	0.10	47.0
Approach		9	2	9	22.2	0.008	9.0	LOS A	0.0	0.3	0.10	0.97	0.10	50.5
West: Mill Rd														
10	L2	1	0	1	0.0	0.024	5.6	LOS A	0.1	0.6	0.07	0.25	0.07	55.8
11	T1	24	5	25	20.8	0.024	0.0	LOS A	0.1	0.6	0.07	0.25	0.07	57.3
12	R2	16	0	17	0.0	0.024	5.6	LOS A	0.1	0.6	0.07	0.25	0.07	55.2
Approach		41	5	43	12.2	0.024	2.3	NA	0.1	0.6	0.07	0.25	0.07	56.4
All Vehicles		127	11	134	8.7	0.043	5.2	NA	0.1	1.0	0.07	0.59	0.07	53.6

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

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Bradleys Rd - 2021 PM Existing (Site Folder: Mill Rd & Bradleys Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bradleys Rd														
1	L2	26	1	27	3.8	0.058	8.3	LOS A	0.2	1.5	0.15	0.93	0.15	51.6
2	T1	4	0	4	0.0	0.058	8.3	LOS A	0.2	1.5	0.15	0.93	0.15	51.5
3	R2	28	0	29	0.0	0.058	8.3	LOS A	0.2	1.5	0.15	0.93	0.15	51.2
Approach		58	1	61	1.7	0.058	8.3	LOS A	0.2	1.5	0.15	0.93	0.15	51.4
East: Mill Rd														
4	L2	50	0	53	0.0	0.056	5.6	LOS A	0.1	0.5	0.03	0.34	0.03	55.4
5	T1	41	0	43	0.0	0.056	0.0	LOS A	0.1	0.5	0.03	0.34	0.03	56.8
6	R2	9	0	9	0.0	0.056	5.6	LOS A	0.1	0.5	0.03	0.34	0.03	54.7
Approach		100	0	105	0.0	0.056	3.3	NA	0.1	0.5	0.03	0.34	0.03	55.9
North: Bradleys Rd														
7	L2	5	0	5	0.0	0.009	8.1	LOS A	0.0	0.2	0.12	0.95	0.12	51.8
8	T1	4	0	4	0.0	0.009	8.4	LOS A	0.0	0.2	0.12	0.95	0.12	51.5
9	R2	1	0	1	0.0	0.009	8.2	LOS A	0.0	0.2	0.12	0.95	0.12	51.2
Approach		10	0	11	0.0	0.009	8.2	LOS A	0.0	0.2	0.12	0.95	0.12	51.6
West: Mill Rd														
10	L2	2	0	2	0.0	0.035	5.8	LOS A	0.1	0.9	0.14	0.23	0.14	55.9
11	T1	36	0	38	0.0	0.035	0.2	LOS A	0.1	0.9	0.14	0.23	0.14	57.4
12	R2	22	0	23	0.0	0.035	5.8	LOS A	0.1	0.9	0.14	0.23	0.14	55.2
Approach		60	0	63	0.0	0.035	2.4	NA	0.1	0.9	0.14	0.23	0.14	56.5
All Vehicles		228	1	240	0.4	0.058	4.5	NA	0.2	1.5	0.10	0.49	0.10	54.6

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

Appendix 6

Mill Rd / Whites Rd Intersection - Existing Operation

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Whites Rd - 2021 AM Existing (Site Folder: Mill Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	12	1	13	8.3	0.009	8.5	LOS A	0.0	0.3	0.10	0.94	0.10	51.4
3	R2	13	2	14	15.4	0.014	8.5	LOS A	0.0	0.4	0.20	0.91	0.20	50.8
Approach		25	3	26	12.0	0.014	8.5	LOS A	0.0	0.4	0.15	0.92	0.15	51.1
East: Mill Rd														
4	L2	18	2	19	11.1	0.027	5.7	LOS A	0.0	0.0	0.00	0.23	0.00	55.9
5	T1	28	2	29	7.1	0.027	0.0	LOS A	0.0	0.0	0.00	0.23	0.00	58.0
Approach		46	4	48	8.7	0.027	2.2	NA	0.0	0.0	0.00	0.23	0.00	57.2
West: Mill Rd														
11	T1	45	1	47	2.2	0.038	0.1	LOS A	0.1	0.9	0.09	0.16	0.09	58.4
12	R2	18	4	19	22.2	0.038	5.9	LOS A	0.1	0.9	0.09	0.16	0.09	55.4
Approach		63	5	66	7.9	0.038	1.7	NA	0.1	0.9	0.09	0.16	0.09	57.5
All Vehicles		134	12	141	9.0	0.038	3.2	NA	0.1	0.9	0.07	0.33	0.07	56.1

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

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Whites Rd - 2021 PM Existing (Site Folder: Mill Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	23	2	24	8.7	0.019	8.7	LOS A	0.1	0.6	0.18	0.90	0.18	51.4
3	R2	14	0	15	0.0	0.015	8.2	LOS A	0.0	0.3	0.26	0.87	0.26	51.4
Approach		37	2	39	5.4	0.019	8.5	LOS A	0.1	0.6	0.21	0.89	0.21	51.4
East: Mill Rd														
4	L2	22	0	23	0.0	0.054	5.6	LOS A	0.0	0.0	0.00	0.13	0.00	57.2
5	T1	76	0	80	0.0	0.054	0.0	LOS A	0.0	0.0	0.00	0.13	0.00	58.8
Approach		98	0	103	0.0	0.054	1.3	NA	0.0	0.0	0.00	0.13	0.00	58.4
West: Mill Rd														
11	T1	63	0	66	0.0	0.049	0.1	LOS A	0.1	1.0	0.12	0.16	0.12	58.1
12	R2	23	0	24	0.0	0.049	5.8	LOS A	0.1	1.0	0.12	0.16	0.12	56.2
Approach		86	0	91	0.0	0.049	1.6	NA	0.1	1.0	0.12	0.16	0.12	57.6
All Vehicles		221	2	233	0.9	0.054	2.6	NA	0.1	1.0	0.08	0.27	0.08	56.8

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

Appendix 7

Mill Rd / Threlkelds Rd Intersection – Existing Operation

MOVEMENT SUMMARY

Site: 101 [Mill & Threlkelds - 2023 AM (Site Folder: Mill & Threlkelds)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Mill Rd														
5	T1	27	2	28	7.4	0.020	0.1	LOS A	0.0	0.4	0.10	0.14	0.10	58.3
6	R2	8	0	8	0.0	0.020	5.8	LOS A	0.0	0.4	0.10	0.14	0.10	56.2
Approach		35	2	37	5.7	0.020	1.4	NA	0.0	0.4	0.10	0.14	0.10	57.8
North: Threlkelds Rd														
7	L2	7	1	7	14.3	0.041	8.8	LOS A	0.1	1.0	0.18	0.91	0.18	51.4
9	R2	34	1	36	2.9	0.041	8.1	LOS A	0.1	1.0	0.18	0.91	0.18	51.4
Approach		41	2	43	4.9	0.041	8.2	LOS A	0.1	1.0	0.18	0.91	0.18	51.4
West: Mill Rd														
10	L2	56	9	59	16.1	0.059	5.7	LOS A	0.0	0.0	0.00	0.32	0.00	55.1
11	T1	45	0	47	0.0	0.059	0.0	LOS A	0.0	0.0	0.00	0.32	0.00	57.3
Approach		101	9	106	8.9	0.059	3.2	NA	0.0	0.0	0.00	0.32	0.00	56.0
All Vehicles		177	13	186	7.3	0.059	4.0	NA	0.1	1.0	0.06	0.42	0.06	55.2

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

MOVEMENT SUMMARY

Site: 101 [Mill & Threlkelds - 2023 PM (Site Folder: Mill & Threlkelds)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Mill Rd														
5	T1	62	4	65	6.5	0.040	0.0	LOS A	0.1	0.4	0.05	0.07	0.05	59.1
6	R2	8	0	8	0.0	0.040	5.8	LOS A	0.1	0.4	0.05	0.07	0.05	56.9
Approach		70	4	74	5.7	0.040	0.7	NA	0.1	0.4	0.05	0.07	0.05	58.9
North: Threlkelds Rd														
7	L2	14	1	15	7.1	0.097	8.5	LOS A	0.3	2.4	0.20	0.91	0.20	51.6
9	R2	82	1	86	1.2	0.097	8.2	LOS A	0.3	2.4	0.20	0.91	0.20	51.3
Approach		96	2	101	2.1	0.097	8.2	LOS A	0.3	2.4	0.20	0.91	0.20	51.4
West: Mill Rd														
10	L2	57	0	60	0.0	0.055	5.6	LOS A	0.0	0.0	0.00	0.33	0.00	55.6
11	T1	44	0	46	0.0	0.055	0.0	LOS A	0.0	0.0	0.00	0.33	0.00	57.0
Approach		101	0	106	0.0	0.055	3.1	NA	0.0	0.0	0.00	0.33	0.00	56.2
All Vehicles		267	6	281	2.2	0.097	4.3	NA	0.3	2.4	0.09	0.47	0.09	55.0

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

Appendix 8

Flaxton Rd / Threlkelds Rd Intersection – Existing Operation

MOVEMENT SUMMARY

Site: 101 [Threlkelds / Flaxton - 2023 AM (Site Folder: Threlkelds & Flaxton)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Threlkelds Rd														
1	L2	60	6	63	10.0	0.111	8.1	LOS A	0.4	3.0	0.38	0.67	0.38	59.3
3	R2	16	0	17	0.0	0.111	16.7	LOS C	0.4	3.0	0.38	0.67	0.38	62.2
Approach		76	6	80	7.9	0.111	9.9	LOS A	0.4	3.0	0.38	0.67	0.38	59.9
East: Skewbridge Rd														
4	L2	12	1	13	8.3	0.007	7.1	LOS A	0.0	0.0	0.00	0.63	0.00	62.6
5	T1	190	20	200	10.5	0.110	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		202	21	213	10.4	0.110	0.4	NA	0.0	0.0	0.00	0.04	0.00	78.6
West: Flaxton Rd														
11	T1	500	21	526	4.2	0.276	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	36	3	38	8.3	0.034	7.8	LOS A	0.1	1.0	0.33	0.62	0.33	61.2
Approach		536	24	564	4.5	0.276	0.6	NA	0.1	1.0	0.02	0.04	0.02	78.2
All Vehicles		814	51	857	6.3	0.276	1.4	NA	0.4	3.0	0.05	0.10	0.05	76.1

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

MOVEMENT SUMMARY

Site: 101 [Threlkelds / Flaxton - 2023 PM (Site Folder: Threlkelds & Flaxton)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Threlkelds Rd														
1	L2	61	0	64	0.0	0.204	11.6	LOS B	0.7	5.0	0.70	0.89	0.72	57.3
3	R2	18	1	19	5.6	0.204	26.1	LOS D	0.7	5.0	0.70	0.89	0.72	55.8
Approach		79	1	83	1.3	0.204	14.9	LOS B	0.7	5.0	0.70	0.89	0.72	56.9
East: Skewbridge Rd														
4	L2	30	1	32	3.3	0.017	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	64.3
5	T1	644	2	678	0.3	0.348	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		674	3	709	0.4	0.348	0.4	NA	0.0	0.0	0.00	0.03	0.00	78.9
West: Flaxton Rd														
11	T1	231	5	243	2.2	0.126	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	94	4	99	4.3	0.168	11.8	LOS B	0.6	4.5	0.63	0.87	0.63	58.7
Approach		325	9	342	2.8	0.168	3.4	NA	0.6	4.5	0.18	0.25	0.18	72.4
All Vehicles		1078	13	1135	1.2	0.348	2.4	NA	0.7	5.0	0.11	0.16	0.11	74.7

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

Appendix 9

Mill Rd / Ohoka Rd Intersection – Existing Operation

MOVEMENT SUMMARY

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

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Ohoka Rd														
1	L2	27	0	28	0.0	0.126	7.0	LOS A	0.0	0.0	0.00	0.08	0.00	73.3
2	T1	201	12	212	6.0	0.126	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	78.4
Approach		228	12	240	5.3	0.126	0.8	NA	0.0	0.0	0.00	0.08	0.00	77.8
North: Skewbridge Rd														
8	T1	549	21	578	3.8	0.304	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
9	R2	1	0	1	0.0	0.001	7.3	LOS A	0.0	0.0	0.33	0.55	0.33	63.9
Approach		550	21	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	1	0	1	0.0	0.164	9.7	LOS A	0.6	4.2	0.74	1.00	0.74	54.9
12	R2	48	3	51	6.3	0.164	20.6	LOS C	0.6	4.2	0.74	1.00	0.74	53.1
Approach		49	3	52	6.1	0.164	20.4	LOS C	0.6	4.2	0.74	1.00	0.74	53.1
All Vehicles		827	36	871	4.4	0.304	1.5	NA	0.6	4.2	0.04	0.08	0.04	76.9

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

MOVEMENT SUMMARY

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

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Ohoka Rd														
1	L2	62	1	65	1.6	0.405	7.1	LOS A	0.0	0.0	0.00	0.05	0.00	72.8
2	T1	692	5	728	0.7	0.405	0.1	LOS A	0.0	0.0	0.00	0.05	0.00	78.7
Approach		754	6	794	0.8	0.405	0.7	NA	0.0	0.0	0.00	0.05	0.00	78.2
North: Skewbridge Rd														
8	T1	310	5	326	1.6	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
9	R2	2	1	2	50.0	0.005	14.7	LOS B	0.0	0.2	0.70	0.74	0.70	46.5
Approach		312	6	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	2	0	2	0.0	0.225	15.0	LOS B	0.8	5.7	0.86	1.02	0.93	48.3
12	R2	39	3	41	7.7	0.225	29.9	LOS D	0.8	5.7	0.86	1.02	0.93	46.6
Approach		41	3	43	7.3	0.225	29.2	LOS D	0.8	5.7	0.86	1.02	0.93	46.6
All Vehicles		1107	15	1165	1.4	0.405	1.6	NA	0.8	5.7	0.03	0.08	0.04	76.6

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

Appendix 10

SH1 / Tram Rd Interchange – Interim Operation

MOVEMENT SUMMARY

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

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

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 70 seconds (Network Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Tram Rd														
4	L2	157	21.5	157	21.5	0.096	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	52.0
5	T1	100	11.6	100	11.6	* 0.640	36.9	LOS D	2.2	17.2	1.00	0.82	1.13	14.8
Approach		257	17.6	257	17.6	0.640	17.9	LOS B	2.2	17.2	0.39	0.64	0.44	37.7
West: Tram Rd														
11	T1	160	13.2	160	13.2	* 0.763	1.7	LOS A	5.0	36.7	0.25	0.63	0.25	43.8
12	R2	879	3.8	879	3.8	0.763	6.9	LOS A	5.0	36.7	0.25	0.63	0.25	59.7
Approach		1039	5.3	1039	5.3	0.763	6.1	LOS A	5.0	36.7	0.25	0.63	0.25	58.1
All Vehicles		1296	7.7	1296	7.7	0.763	8.5	LOS A	5.0	36.7	0.28	0.63	0.29	52.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

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

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

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 70 seconds (Network Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Off-Ramp														
1	L2	180	8.8	180	8.8	0.097	9.1	LOS A	0.0	0.0	0.00	0.63	0.00	71.6
3	R2	67	3.1	67	3.1	* 0.417	42.9	LOS D	1.4	10.4	0.99	0.75	0.99	30.0
Approach		247	7.2	247	7.2	0.417	18.3	LOS B	1.4	10.4	0.27	0.67	0.27	58.9
East: Tram Rd														
5	T1	74	14.3	74	14.3	0.056	0.2	LOS A	0.0	0.3	0.02	0.02	0.02	59.6
Approach		74	14.3	74	14.3	0.056	0.2	LOS A	0.0	0.3	0.02	0.02	0.02	59.6
West: Tram Rd														
11	T1	964	5.2	964	5.2	* 0.678	5.0	LOS A	10.4	76.1	0.56	0.52	0.56	51.6
Approach		964	5.2	964	5.2	0.678	5.0	LOS A	10.4	76.1	0.56	0.52	0.56	51.6
All Vehicles		1285	6.1	1285	6.1	0.678	7.3	LOS A	10.4	76.1	0.47	0.52	0.47	54.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

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

Network: N101 [Interim PM Base (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Tram Rd														
4	L2	73	1.4	73	1.4	0.039	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.0
5	T1	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	38.4
West: Tram Rd														
11	T1	228	3.7	228	3.7	* 0.731	5.3	LOS A	3.5	25.1	0.66	0.74	0.75	40.0
12	R2	326	1.0	326	1.0	0.731	10.6	LOS B	3.5	25.1	0.66	0.74	0.75	57.4
Approach		555	2.1	555	2.1	0.731	8.4	LOS A	3.5	25.1	0.66	0.74	0.75	51.8
All Vehicles		847	2.0	847	2.0	0.731	9.4	LOS A	3.5	25.1	0.68	0.74	0.75	47.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

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

Network: N101 [Interim PM Base (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Off-Ramp														
1	L2	775	1.9	775	1.9	0.398	9.5	LOS A	0.0	0.0	0.00	0.64	0.00	73.7
3	R2	172	1.8	172	1.8	* 0.452	20.0	LOS C	1.5	10.5	0.92	0.79	0.92	47.9
Approach		946	1.9	946	1.9	0.452	11.4	LOS B	1.5	10.5	0.17	0.66	0.17	70.0
East: Tram Rd														
5	T1	199	3.2	199	3.2	0.260	0.2	LOS A	0.1	0.4	0.03	0.02	0.03	59.6
Approach		199	3.2	199	3.2	0.260	0.2	LOS A	0.1	0.4	0.03	0.02	0.03	59.6
West: Tram Rd														
11	T1	386	2.2	386	2.2	* 0.495	7.6	LOS A	2.7	19.5	0.79	0.67	0.79	48.1
Approach		386	2.2	386	2.2	0.495	7.6	LOS A	2.7	19.5	0.79	0.67	0.79	48.1
All Vehicles		1532	2.1	1532	2.1	0.495	9.0	LOS A	2.7	19.5	0.31	0.58	0.31	64.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Appendix 11

Concept Access Arrangements

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Christchurch 8014

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Ohoka Plan Change
Rolleston Industrial Develeopments Ltd

Example Whites Road Access Layout

For Information

Drawing: **0021-034-SK100X-B**

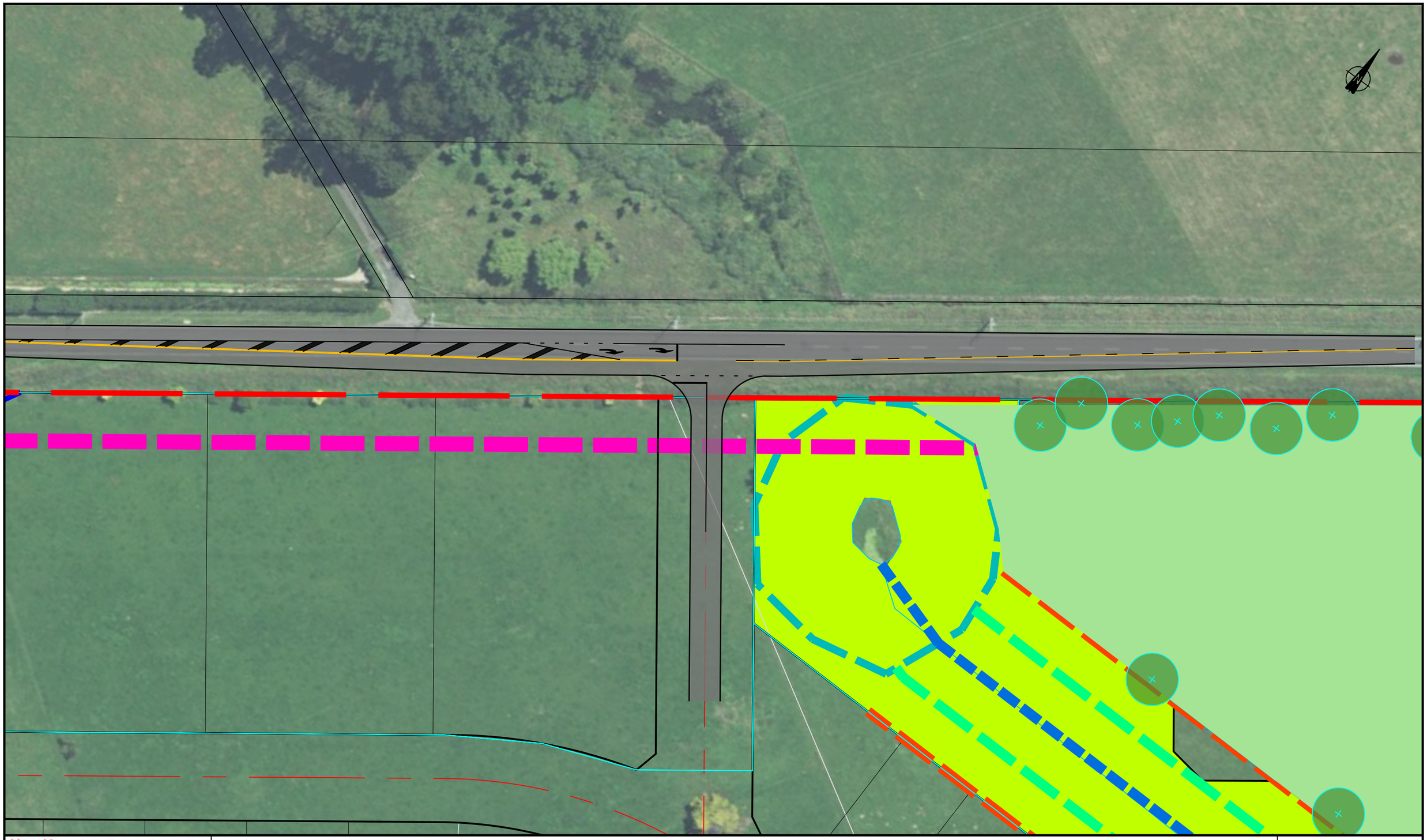
Sheet **0021-034-TR1001-B**

Scale @A3 1/500

Date: 04/07/2023

By N Fuller

Project #0021-034



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Ohoka Plan Change
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Example Bradleys Road Access Layout

For Information

Drawing: **0021-034-SK100X-B**

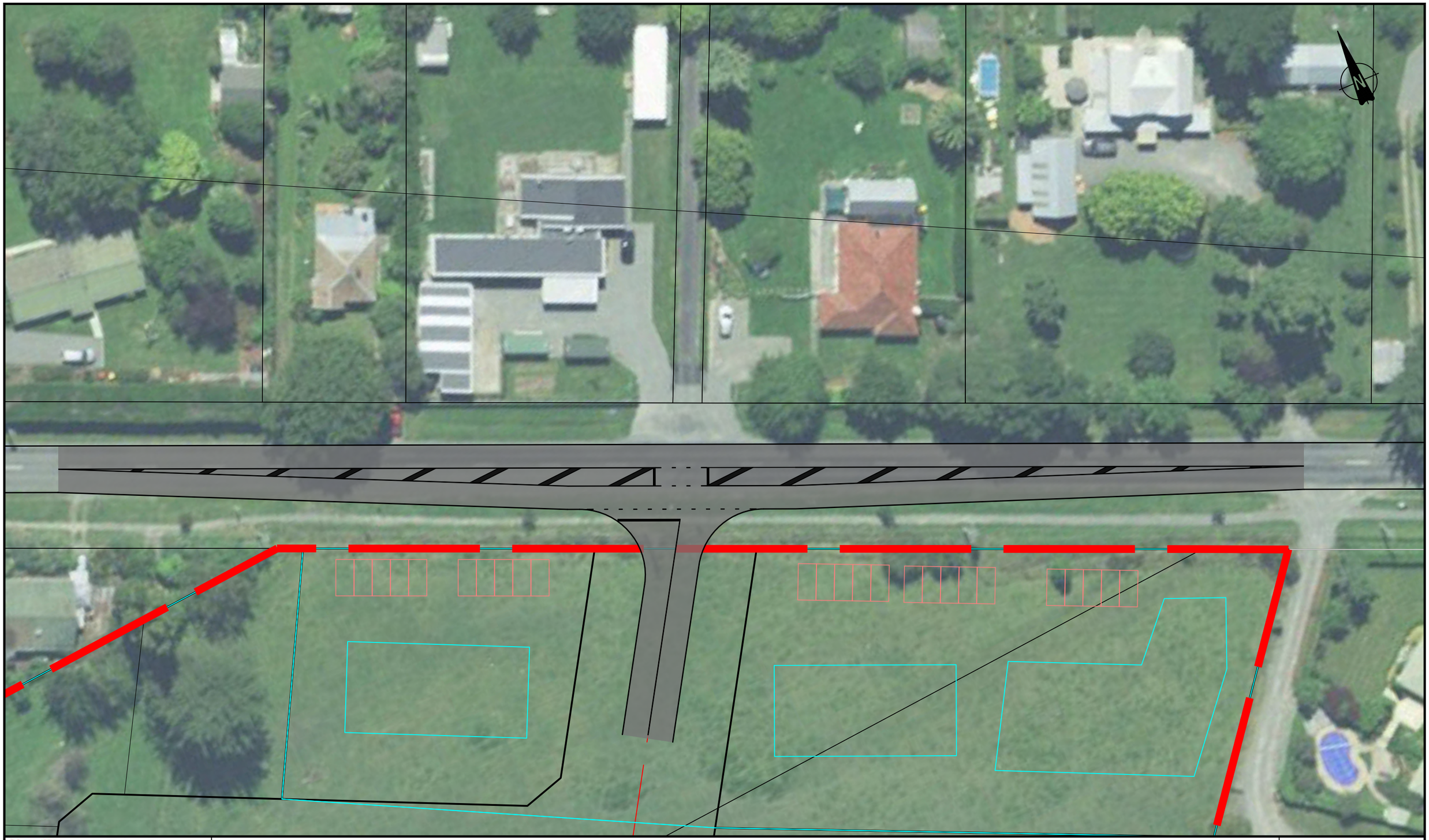
Sheet **0021-034-TR1002-B**

Scale @A3 1/750

Date: 04/07/2023

By N Fuller

Project #0021-034



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Mill Road Access Layout

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Drawing: **0021-034-SK100X-B**

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Sheet **0021-034-TR1003-B**

Scale @A3 1/500

Date: 04/07/2023

By N Fuller

Project #0021-034

Appendix 12

Whites Rd Access Intersection Operation

MOVEMENT SUMMARY

Site: 101 [Whites Access - AM Peak (Site Folder: Whites Access)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	83	0	87	0.0	0.061	7.8	LOS A	0.0	0.0	0.00	0.52	0.00	77.1
2	T1	25	3	26	12.0	0.061	0.0	LOS A	0.0	0.0	0.00	0.52	0.00	85.5
Approach		108	3	114	2.8	0.061	6.0	NA	0.0	0.0	0.00	0.52	0.00	78.9
North: Whites Rd														
8	T1	36	6	38	16.7	0.022	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	65	0	68	0.0	0.042	7.7	LOS A	0.2	1.3	0.22	0.61	0.22	56.8
Approach		101	6	106	5.9	0.042	5.0	NA	0.2	1.3	0.14	0.39	0.14	67.1
West: Access														
10	L2	188	0	198	0.0	0.428	7.6	LOS A	2.4	17.0	0.17	0.92	0.17	54.4
12	R2	239	0	252	0.0	0.428	8.8	LOS A	2.4	17.0	0.17	0.92	0.17	54.1
Approach		427	0	449	0.0	0.428	8.3	LOS A	2.4	17.0	0.17	0.92	0.17	54.3
All Vehicles		636	9	669	1.4	0.428	7.4	NA	2.4	17.0	0.14	0.77	0.14	59.2

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

MOVEMENT SUMMARY

Site: 101 [Whites Access - PM Peak (Site Folder: Whites Access)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	126	0	133	0.0	0.091	7.8	LOS A	0.0	0.0	0.00	0.52	0.00	77.2
2	T1	37	2	39	5.4	0.091	0.0	LOS A	0.0	0.0	0.00	0.52	0.00	85.6
Approach		163	2	172	1.2	0.091	6.1	NA	0.0	0.0	0.00	0.52	0.00	78.9
North: Whites Rd														
8	T1	50	0	53	0.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	100.0
9	R2	181	0	191	0.0	0.123	8.0	LOS A	0.6	4.1	0.30	0.63	0.30	56.6
Approach		231	0	243	0.0	0.123	6.2	NA	0.6	4.1	0.23	0.49	0.23	62.4
West: Access														
10	L2	109	0	115	0.0	0.197	7.6	LOS A	0.9	6.0	0.14	0.93	0.14	54.1
12	R2	76	0	80	0.0	0.197	9.9	LOS A	0.9	6.0	0.14	0.93	0.14	53.9
Approach		185	0	195	0.0	0.197	8.6	LOS A	0.9	6.0	0.14	0.93	0.14	54.0
All Vehicles		579	2	609	0.3	0.197	6.9	NA	0.9	6.0	0.14	0.64	0.14	63.0

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

Appendix 13

Tram Rd / Bradleys Rd Intersection – 2033 With Rezoning Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Bradleys Rd - 2033 AM + 850 + Sch (Site Folder: Tram Rd & Bradleys Rd)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: McHughes Rd														
1	L2	8	0	8	0.0	0.121	6.8	LOS A	0.7	4.9	0.45	0.66	0.45	61.9
2	T1	25	1	26	4.0	0.121	7.3	LOS A	0.7	4.9	0.45	0.66	0.45	62.6
3	R2	85	3	89	3.5	0.121	13.0	LOS B	0.7	4.9	0.45	0.66	0.45	62.3
Approach		118	4	124	3.4	0.121	11.4	LOS B	0.7	4.9	0.45	0.66	0.45	62.3
East: Tram Rd														
4	L2	21	3	22	14.3	0.154	6.2	LOS A	1.0	7.6	0.34	0.56	0.34	60.6
5	T1	95	8	100	8.4	0.154	6.5	LOS A	1.0	7.6	0.34	0.56	0.34	64.0
6	R2	59	2	62	3.4	0.154	12.1	LOS B	1.0	7.6	0.34	0.56	0.34	64.8
Approach		175	13	184	7.4	0.154	8.3	LOS A	1.0	7.6	0.34	0.56	0.34	63.8
North: Bradleys Rd														
7	L2	238	6	251	2.5	0.469	11.1	LOS B	3.6	26.1	0.81	0.88	0.88	60.2
8	T1	18	5	19	27.8	0.469	13.0	LOS B	3.6	26.1	0.81	0.88	0.88	56.3
9	R2	67	1	71	1.5	0.469	17.1	LOS B	3.6	26.1	0.81	0.88	0.88	61.8
Approach		323	12	340	3.7	0.469	12.5	LOS B	3.6	26.1	0.81	0.88	0.88	60.3
West: Tram Rd														
10	L2	31	3	33	9.7	0.396	6.9	LOS A	2.9	21.0	0.49	0.56	0.49	62.2
11	T1	414	5	436	1.2	0.396	7.1	LOS A	2.9	21.0	0.49	0.56	0.49	66.4
12	R2	8	0	8	0.0	0.396	12.7	LOS B	2.9	21.0	0.49	0.56	0.49	66.4
Approach		453	8	477	1.8	0.396	7.2	LOS A	2.9	21.0	0.49	0.56	0.49	66.1
All Vehicles		1069	37	1125	3.5	0.469	9.4	LOS A	3.6	26.1	0.56	0.67	0.58	63.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Bradleys Rd - 2033 PM + 850 + Sch (Site Folder: Tram Rd & Bradleys Rd)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: McHughes Rd														
1	L2	19	0	20	0.0	0.120	9.7	LOS A	0.7	5.2	0.72	0.77	0.72	61.1
2	T1	28	1	29	3.6	0.120	10.3	LOS B	0.7	5.2	0.72	0.77	0.72	61.8
3	R2	33	0	35	0.0	0.120	15.8	LOS B	0.7	5.2	0.72	0.77	0.72	62.4
Approach		80	1	84	1.3	0.120	12.5	LOS B	0.7	5.2	0.72	0.77	0.72	61.9
East: Tram Rd														
4	L2	110	2	116	1.8	0.537	6.3	LOS A	5.1	36.2	0.46	0.56	0.46	63.6
5	T1	378	5	398	1.3	0.537	6.7	LOS A	5.1	36.2	0.46	0.56	0.46	65.6
6	R2	191	6	201	3.1	0.537	12.4	LOS B	5.1	36.2	0.46	0.56	0.46	64.6
Approach		679	13	715	1.9	0.537	8.2	LOS A	5.1	36.2	0.46	0.56	0.46	65.0
North: Bradleys Rd														
7	L2	111	3	117	2.7	0.197	6.7	LOS A	1.2	8.7	0.45	0.60	0.45	64.2
8	T1	45	1	47	2.2	0.197	7.2	LOS A	1.2	8.7	0.45	0.60	0.45	66.3
9	R2	36	0	38	0.0	0.197	12.8	LOS B	1.2	8.7	0.45	0.60	0.45	66.6
Approach		192	4	202	2.1	0.197	8.0	LOS A	1.2	8.7	0.45	0.60	0.45	65.1
West: Tram Rd														
10	L2	51	3	54	5.9	0.196	7.1	LOS A	1.2	8.7	0.51	0.61	0.51	63.0
11	T1	126	4	133	3.2	0.196	7.5	LOS A	1.2	8.7	0.51	0.61	0.51	65.7
12	R2	18	0	19	0.0	0.196	13.1	LOS B	1.2	8.7	0.51	0.61	0.51	66.2
Approach		195	7	205	3.6	0.196	7.9	LOS A	1.2	8.7	0.51	0.61	0.51	65.0
All Vehicles		1146	25	1206	2.2	0.537	8.4	LOS A	5.1	36.2	0.49	0.59	0.49	64.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix 14

Tram Rd / Whites Rd Intersection – 2028 Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Whites Rd - 2028 AM Existing (Site Folder: Tram Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	1	0	1	0.0	0.183	10.1	LOS B	0.6	4.5	0.76	1.00	0.77	59.9
2	T1	8	0	8	0.0	0.183	23.6	LOS C	0.6	4.5	0.76	1.00	0.77	59.8
3	R2	41	1	43	2.4	0.183	21.2	LOS C	0.6	4.5	0.76	1.00	0.77	59.2
Approach		50	1	53	2.0	0.183	21.4	LOS C	0.6	4.5	0.76	1.00	0.77	59.3
East: Tram Rd														
4	L2	5	0	5	0.0	0.072	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	87.9
5	T1	122	9	128	7.4	0.072	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.1
6	R2	15	0	16	0.0	0.019	10.8	LOS B	0.1	0.5	0.58	0.74	0.58	70.6
Approach		142	9	149	6.3	0.072	1.4	NA	0.1	0.5	0.06	0.10	0.06	94.6
North: Whites Rd														
7	L2	12	0	13	0.0	0.022	13.8	LOS B	0.1	0.5	0.58	0.93	0.58	68.6
8	T1	7	1	7	14.3	0.051	26.6	LOS D	0.2	1.4	0.81	1.01	0.81	51.4
9	R2	2	1	2	50.0	0.051	37.8	LOS E	0.2	1.4	0.81	1.01	0.81	45.5
Approach		21	2	22	9.5	0.051	20.3	LOS C	0.2	1.4	0.68	0.96	0.68	59.2
West: Tram Rd														
10	L2	6	4	6	66.7	0.360	9.6	LOS A	0.0	0.0	0.00	0.01	0.00	62.9
11	T1	658	11	693	1.7	0.360	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.7
12	R2	3	0	3	0.0	0.002	7.8	LOS A	0.0	0.1	0.24	0.59	0.24	74.1
Approach		667	15	702	2.2	0.360	0.2	NA	0.0	0.1	0.00	0.01	0.00	99.0
All Vehicles		880	27	926	3.1	0.360	2.1	NA	0.6	4.5	0.07	0.10	0.07	93.3

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

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Whites Rd - 2028 PM Existing (Site Folder: Tram Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	6	0	6	0.0	0.061	13.7	LOS B	0.2	1.4	0.74	0.99	0.74	62.1
2	T1	1	0	1	0.0	0.061	26.0	LOS D	0.2	1.4	0.74	0.99	0.74	62.1
3	R2	11	0	12	0.0	0.061	22.2	LOS C	0.2	1.4	0.74	0.99	0.74	62.0
Approach		18	0	19	0.0	0.061	19.6	LOS C	0.2	1.4	0.74	0.99	0.74	62.0
East: Tram Rd														
4	L2	38	1	40	2.6	0.373	7.9	LOS A	0.0	0.0	0.00	0.04	0.00	86.2
5	T1	639	21	673	3.3	0.373	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	98.6
6	R2	32	2	34	6.3	0.024	8.4	LOS A	0.1	0.8	0.32	0.61	0.32	70.5
Approach		709	24	746	3.4	0.373	0.8	NA	0.1	0.8	0.01	0.06	0.01	96.1
North: Whites Rd														
7	L2	12	0	13	0.0	0.012	10.3	LOS B	0.0	0.3	0.29	0.86	0.29	72.5
8	T1	10	1	11	10.0	0.122	30.9	LOS D	0.4	3.3	0.84	1.00	0.84	51.5
9	R2	11	3	12	27.3	0.122	29.0	LOS D	0.4	3.3	0.84	1.00	0.84	48.4
Approach		33	4	35	12.1	0.122	22.8	LOS C	0.4	3.3	0.64	0.95	0.64	56.2
West: Tram Rd														
10	L2	9	0	9	0.0	0.113	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	87.9
11	T1	199	6	209	3.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.0
12	R2	3	1	3	33.3	0.005	13.2	LOS B	0.0	0.2	0.62	0.72	0.62	58.3
Approach		211	7	222	3.3	0.113	0.5	NA	0.0	0.2	0.01	0.04	0.01	97.5
All Vehicles		971	35	1022	3.6	0.373	1.9	NA	0.4	3.3	0.05	0.11	0.05	93.2

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

Appendix 15

Tram Rd / Whites Rd Intersection – 2033 with Rezoning Operation

MOVEMENT SUMMARY

Site: 101v [Tram Rd & Whites Rd - 2033 AM + 850 Dev + Sch (Site Folder: Tram Rd & Whites Rd)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	1	0	1	0.0	0.041	8.2	LOS A	0.2	1.7	0.47	0.64	0.47	67.8
2	T1	8	0	8	0.0	0.041	9.4	LOS A	0.2	1.7	0.47	0.64	0.47	68.7
3	R2	41	1	43	2.4	0.041	13.3	LOS B	0.2	1.7	0.47	0.64	0.47	68.7
Approach		50	1	53	2.0	0.041	12.6	LOS B	0.2	1.7	0.47	0.64	0.47	68.7
East: Tram Rd														
4	L2	5	0	5	0.0	0.189	6.9	LOS A	1.4	10.3	0.19	0.58	0.19	71.6
5	T1	170	10	179	5.9	0.189	8.1	LOS A	1.4	10.3	0.19	0.58	0.19	71.1
6	R2	88	0	93	0.0	0.189	12.2	LOS B	1.4	10.3	0.19	0.58	0.19	73.5
Approach		263	10	277	3.8	0.189	9.4	LOS A	1.4	10.3	0.19	0.58	0.19	71.9
North: Whites Rd														
7	L2	224	1	236	0.4	0.445	16.0	LOS B	4.0	28.4	1.00	0.96	1.09	63.4
8	T1	7	1	7	14.3	0.445	18.9	LOS B	4.0	28.4	1.00	0.96	1.09	61.4
9	R2	29	0	31	0.0	0.445	19.2	LOS B	4.0	28.4	1.00	0.96	1.09	65.0
Approach		260	2	274	0.8	0.445	16.4	LOS B	4.0	28.4	1.00	0.96	1.09	63.5
West: Tram Rd														
10	L2	16	4	17	25.0	0.667	9.1	LOS A	7.2	51.3	0.59	0.58	0.59	63.8
11	T1	825	13	868	1.6	0.667	9.3	LOS A	7.2	51.3	0.59	0.58	0.59	70.5
12	R2	3	0	3	0.0	0.667	13.5	LOS B	7.2	51.3	0.59	0.58	0.59	71.7
Approach		844	17	888	2.0	0.667	9.3	LOS A	7.2	51.3	0.59	0.58	0.59	70.4
All Vehicles		1417	30	1492	2.1	0.667	10.8	LOS B	7.2	51.3	0.59	0.66	0.60	69.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101v [Tram Rd & Whites Rd - 2033 PM + 850 Dev + Sch (Site Folder: Tram Rd & Whites Rd)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	6	0	6	0.0	0.027	14.0	LOS B	0.2	1.4	0.86	0.70	0.86	64.4
2	T1	1	0	1	0.0	0.027	15.6	LOS B	0.2	1.4	0.86	0.70	0.86	65.4
3	R2	11	0	12	0.0	0.027	18.4	LOS B	0.2	1.4	0.86	0.70	0.86	65.6
Approach		18	0	19	0.0	0.027	16.8	LOS B	0.2	1.4	0.86	0.70	0.86	65.2
East: Tram Rd														
4	L2	38	1	40	2.6	0.622	7.1	LOS A	7.6	54.5	0.29	0.53	0.29	71.1
5	T1	752	23	792	3.1	0.622	8.2	LOS A	7.6	54.5	0.29	0.53	0.29	72.0
6	R2	140	2	147	1.4	0.622	12.4	LOS B	7.6	54.5	0.29	0.53	0.29	73.2
Approach		930	26	979	2.8	0.622	8.8	LOS A	7.6	54.5	0.29	0.53	0.29	72.1
North: Whites Rd														
7	L2	77	0	81	0.0	0.096	8.2	LOS A	0.6	4.4	0.50	0.63	0.50	71.7
8	T1	10	1	11	10.0	0.096	9.7	LOS A	0.6	4.4	0.50	0.63	0.50	70.2
9	R2	22	3	23	13.6	0.096	13.6	LOS B	0.6	4.4	0.50	0.63	0.50	69.1
Approach		109	4	115	3.7	0.096	9.4	LOS A	0.6	4.4	0.50	0.63	0.50	71.0
West: Tram Rd														
10	L2	27	0	28	0.0	0.243	7.7	LOS A	1.6	11.1	0.40	0.58	0.40	71.6
11	T1	249	6	262	2.4	0.243	8.8	LOS A	1.6	11.1	0.40	0.58	0.40	72.0
12	R2	3	1	3	33.3	0.243	14.2	LOS B	1.6	11.1	0.40	0.58	0.40	63.5
Approach		279	7	294	2.5	0.243	8.8	LOS A	1.6	11.1	0.40	0.58	0.40	71.9
All Vehicles		1336	37	1406	2.8	0.622	8.9	LOS A	7.6	54.5	0.34	0.55	0.34	71.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix 16

Mill Rd / Bradleys Rd Intersection – 2033 With Rezoning Operation

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Bradleys Rd - 2033 AM + Dev + Sch (Site Folder: Mill Rd & Bradleys Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bradleys Rd														
1	L2	13	0	14	0.0	0.051	8.0	LOS A	0.2	1.3	0.07	0.98	0.07	51.8
2	T1	10	0	11	0.0	0.051	8.1	LOS A	0.2	1.3	0.07	0.98	0.07	51.5
3	R2	28	0	29	0.0	0.051	8.0	LOS A	0.2	1.3	0.07	0.98	0.07	51.3
Approach		51	0	54	0.0	0.051	8.0	LOS A	0.2	1.3	0.07	0.98	0.07	51.5
East: Mill Rd														
4	L2	17	1	18	5.9	0.030	5.7	LOS A	0.1	0.9	0.09	0.47	0.09	53.8
5	T1	8	1	8	12.5	0.030	0.1	LOS A	0.1	0.9	0.09	0.47	0.09	55.5
6	R2	24	2	25	8.3	0.030	5.6	LOS A	0.1	0.9	0.09	0.47	0.09	53.1
Approach		49	4	52	8.2	0.030	4.7	NA	0.1	0.9	0.09	0.47	0.09	53.7
North: Bradleys Rd														
7	L2	12	1	13	8.3	0.015	8.5	LOS A	0.1	0.4	0.10	0.97	0.10	51.3
8	T1	4	0	4	0.0	0.015	8.1	LOS A	0.1	0.4	0.10	0.97	0.10	51.4
9	R2	1	1	1	100.0	0.015	12.7	LOS B	0.1	0.4	0.10	0.97	0.10	47.2
Approach		17	2	18	11.8	0.015	8.6	LOS A	0.1	0.4	0.10	0.97	0.10	51.0
West: Mill Rd														
10	L2	1	0	1	0.0	0.024	5.6	LOS A	0.1	0.6	0.07	0.25	0.07	55.8
11	T1	24	5	25	20.8	0.024	0.0	LOS A	0.1	0.6	0.07	0.25	0.07	57.3
12	R2	16	0	17	0.0	0.024	5.6	LOS A	0.1	0.6	0.07	0.25	0.07	55.2
Approach		41	5	43	12.2	0.024	2.3	NA	0.1	0.6	0.07	0.25	0.07	56.4
All Vehicles		158	11	166	7.0	0.051	5.6	NA	0.2	1.3	0.08	0.63	0.08	53.3

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

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Bradleys Rd - 2033 PM + Dev + Sch (Site Folder: Mill Rd & Bradleys Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Bradleys Rd														
1	L2	26	1	27	3.8	0.062	8.3	LOS A	0.2	1.6	0.15	0.93	0.15	51.6
2	T1	7	0	7	0.0	0.062	8.4	LOS A	0.2	1.6	0.15	0.93	0.15	51.5
3	R2	28	0	29	0.0	0.062	8.4	LOS A	0.2	1.6	0.15	0.93	0.15	51.2
Approach		61	1	64	1.6	0.062	8.4	LOS A	0.2	1.6	0.15	0.93	0.15	51.4
East: Mill Rd														
4	L2	50	0	53	0.0	0.060	5.6	LOS A	0.1	0.8	0.05	0.35	0.05	55.2
5	T1	41	0	43	0.0	0.060	0.0	LOS A	0.1	0.8	0.05	0.35	0.05	56.7
6	R2	15	0	16	0.0	0.060	5.6	LOS A	0.1	0.8	0.05	0.35	0.05	54.6
Approach		106	0	112	0.0	0.060	3.4	NA	0.1	0.8	0.05	0.35	0.05	55.7
North: Bradleys Rd														
7	L2	14	0	15	0.0	0.021	8.1	LOS A	0.1	0.6	0.12	0.96	0.12	51.7
8	T1	9	0	9	0.0	0.021	8.5	LOS A	0.1	0.6	0.12	0.96	0.12	51.5
9	R2	1	0	1	0.0	0.021	8.2	LOS A	0.1	0.6	0.12	0.96	0.12	51.2
Approach		24	0	25	0.0	0.021	8.3	LOS A	0.1	0.6	0.12	0.96	0.12	51.6
West: Mill Rd														
10	L2	2	0	2	0.0	0.035	5.8	LOS A	0.1	0.9	0.14	0.23	0.14	55.9
11	T1	36	0	38	0.0	0.035	0.2	LOS A	0.1	0.9	0.14	0.23	0.14	57.4
12	R2	22	0	23	0.0	0.035	5.8	LOS A	0.1	0.9	0.14	0.23	0.14	55.2
Approach		60	0	63	0.0	0.035	2.4	NA	0.1	0.9	0.14	0.23	0.14	56.5
All Vehicles		251	1	264	0.4	0.062	4.8	NA	0.2	1.6	0.10	0.52	0.10	54.4

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

Appendix 17

Mill Rd / Whites Rd Intersection – 2033 With Rezoning Operation

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Whites Rd - 2033 AM + Dev + Sch (Site Folder: Mill Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	12	1	13	8.3	0.010	8.6	LOS A	0.0	0.3	0.16	0.90	0.16	51.4
3	R2	201	2	212	1.0	0.241	9.1	LOS A	0.9	6.4	0.39	0.92	0.39	50.9
Approach		213	3	224	1.4	0.241	9.0	LOS A	0.9	6.4	0.38	0.92	0.38	50.9
East: Mill Rd														
4	L2	83	2	87	2.4	0.082	5.6	LOS A	0.0	0.0	0.00	0.34	0.00	55.4
5	T1	61	2	64	3.3	0.082	0.0	LOS A	0.0	0.0	0.00	0.34	0.00	57.0
Approach		144	4	152	2.8	0.082	3.2	NA	0.0	0.0	0.00	0.34	0.00	56.0
West: Mill Rd														
11	T1	139	1	146	0.7	0.091	0.1	LOS A	0.2	1.1	0.08	0.07	0.08	59.2
12	R2	18	4	19	22.2	0.091	6.4	LOS A	0.2	1.1	0.08	0.07	0.08	56.1
Approach		157	5	165	3.2	0.091	0.8	NA	0.2	1.1	0.08	0.07	0.08	58.8
All Vehicles		514	12	541	2.3	0.241	4.9	NA	0.9	6.4	0.18	0.50	0.18	54.6

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

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Whites Rd - 2033 PM + Dev + Sch (Site Folder: Mill Rd & Whites Rd)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Whites Rd														
1	L2	23	2	24	8.7	0.021	9.1	LOS A	0.1	0.6	0.28	0.87	0.28	51.3
3	R2	123	0	129	0.0	0.175	9.9	LOS A	0.6	4.3	0.46	0.96	0.46	50.4
Approach		146	2	154	1.4	0.175	9.8	LOS A	0.6	4.3	0.43	0.94	0.43	50.5
East: Mill Rd														
4	L2	203	0	214	0.0	0.206	5.6	LOS A	0.0	0.0	0.00	0.32	0.00	55.6
5	T1	167	0	176	0.0	0.206	0.1	LOS A	0.0	0.0	0.00	0.32	0.00	57.1
Approach		370	0	389	0.0	0.206	3.1	NA	0.0	0.0	0.00	0.32	0.00	56.2
West: Mill Rd														
11	T1	118	0	124	0.0	0.084	0.4	LOS A	0.2	1.4	0.18	0.10	0.18	58.4
12	R2	23	0	24	0.0	0.084	7.0	LOS A	0.2	1.4	0.18	0.10	0.18	56.5
Approach		141	0	148	0.0	0.084	1.5	NA	0.2	1.4	0.18	0.10	0.18	58.1
All Vehicles		657	2	692	0.3	0.206	4.2	NA	0.6	4.3	0.13	0.41	0.13	55.2

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

Appendix 18

Flaxton Rd / Threlkelds Rd Intersection – 2028 Operation

MOVEMENT SUMMARY

Site: 101 [Threlkelds / Flaxton - 2028 AM (Site Folder: Threlkelds & Flaxton)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Threlkelds Rd														
1	L2	60	6	63	10.0	0.128	8.3	LOS A	0.5	3.4	0.44	0.69	0.44	58.4
3	R2	16	0	17	0.0	0.128	20.5	LOS C	0.5	3.4	0.44	0.69	0.44	61.2
Approach		76	6	80	7.9	0.128	10.9	LOS B	0.5	3.4	0.44	0.69	0.44	59.0
East: Skewbridge Rd														
4	L2	12	1	13	8.3	0.007	7.1	LOS A	0.0	0.0	0.00	0.63	0.00	62.6
5	T1	224	24	236	10.7	0.129	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach		236	25	248	10.6	0.129	0.4	NA	0.0	0.0	0.00	0.03	0.00	78.8
West: Flaxton Rd														
11	T1	588	25	619	4.3	0.325	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	36	3	38	8.3	0.036	8.0	LOS A	0.1	1.0	0.36	0.63	0.36	61.1
Approach		624	28	657	4.5	0.325	0.5	NA	0.1	1.0	0.02	0.04	0.02	78.4
All Vehicles		936	59	985	6.3	0.325	1.3	NA	0.5	3.4	0.05	0.09	0.05	76.4

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

MOVEMENT SUMMARY

Site: 101 [Threlkelds / Flaxton - 2028 PM (Site Folder: Threlkelds & Flaxton)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Threlkelds Rd														
1	L2	61	0	64	0.0	0.273	14.2	LOS B	1.0	6.9	0.79	0.95	0.91	53.6
3	R2	18	1	19	5.6	0.273	36.5	LOS E	1.0	6.9	0.79	0.95	0.91	52.3
Approach		79	1	83	1.3	0.273	19.3	LOS C	1.0	6.9	0.79	0.95	0.91	53.3
East: Skewbridge Rd														
4	L2	30	1	32	3.3	0.017	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	64.3
5	T1	756	2	796	0.3	0.409	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach		786	3	827	0.4	0.409	0.4	NA	0.0	0.0	0.00	0.02	0.00	78.9
West: Flaxton Rd														
11	T1	272	6	286	2.2	0.148	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	94	4	99	4.3	0.206	13.7	LOS B	0.8	5.5	0.71	0.90	0.73	56.9
Approach		366	10	385	2.7	0.206	3.5	NA	0.8	5.5	0.18	0.23	0.19	72.4
All Vehicles		1231	14	1296	1.1	0.409	2.5	NA	1.0	6.9	0.10	0.15	0.11	74.6

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

Appendix 19

Flaxton Rd / Threlkelds Rd Intersection – 2033 with Rezoning Operation

MOVEMENT SUMMARY

Site: 101 [Threlkelds / Flaxton - 2033 AM + 850 Dev (Site Folder: Threlkelds & Flaxton)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Threlkelds Rd														
1	L2	258	6	272	2.3	0.366	7.4	LOS A	2.0	14.2	0.48	0.68	0.48	63.3
3	R2	100	0	105	0.0	0.366	12.7	LOS B	2.0	14.2	0.48	0.68	0.48	65.3
Approach		358	6	377	1.7	0.366	8.8	LOS A	2.0	14.2	0.48	0.68	0.48	63.9
East: Skewbridge Rd														
4	L2	41	1	43	2.4	0.050	6.7	LOS A	0.2	1.4	0.26	0.55	0.26	65.3
5	T1	257	27	271	10.5	0.202	7.0	LOS A	1.0	7.4	0.25	0.51	0.25	64.4
Approach		298	28	314	9.4	0.202	7.0	LOS A	1.0	7.4	0.25	0.52	0.25	64.5
West: Flaxton Rd														
11	T1	675	28	711	4.1	0.493	7.0	LOS A	3.6	26.0	0.35	0.52	0.35	65.5
12	R2	105	3	111	2.9	0.128	11.9	LOS B	0.6	4.1	0.28	0.66	0.28	61.5
Approach		780	31	821	4.0	0.493	7.7	LOS A	3.6	26.0	0.34	0.54	0.34	64.9
All Vehicles		1436	65	1512	4.5	0.493	7.8	LOS A	3.6	26.0	0.36	0.57	0.36	64.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 101 [Threlkelds / Flaxton - 2033 PM + 850 Dev (Site Folder: Threlkelds & Flaxton)]

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Threlkelds Rd														
1	L2	153	0	161	0.0	0.483	14.8	LOS B	3.8	26.5	0.92	1.02	1.09	56.7
3	R2	90	1	95	1.1	0.483	20.2	LOS C	3.8	26.5	0.92	1.02	1.09	57.4
Approach		243	1	256	0.4	0.483	16.8	LOS B	3.8	26.5	0.92	1.02	1.09	57.0
East: Skewbridge Rd														
4	L2	150	1	158	0.7	0.204	7.9	LOS A	0.9	6.5	0.44	0.65	0.44	64.9
5	T1	870	3	916	0.3	0.703	8.9	LOS A	7.0	49.2	0.66	0.68	0.70	64.4
Approach		1020	4	1074	0.4	0.703	8.7	LOS A	7.0	49.2	0.62	0.68	0.66	64.5
West: Flaxton Rd														
11	T1	312	7	328	2.2	0.233	6.8	LOS A	1.4	10.1	0.28	0.50	0.28	66.5
12	R2	246	4	259	1.6	0.205	11.5	LOS B	1.2	8.4	0.28	0.64	0.28	61.8
Approach		558	11	587	2.0	0.233	8.9	LOS A	1.4	10.1	0.28	0.56	0.28	64.4
All Vehicles		1821	16	1917	0.9	0.703	9.8	LOS A	7.0	49.2	0.56	0.69	0.60	63.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
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.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Appendix 20

Mill Rd / Threlkelds Rd Intersection – 2033 with Rezoning Operation

MOVEMENT SUMMARY

Site: 101 [Mill & Threlkelds - 2033 AM + Dev (Site Folder: Mill & Threlkelds)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Mill Rd														
5	T1	27	2	28	7.4	0.022	0.5	LOS A	0.1	0.5	0.23	0.14	0.23	57.8
6	R2	8	0	8	0.0	0.022	6.9	LOS A	0.1	0.5	0.23	0.14	0.23	55.7
Approach		35	2	37	5.7	0.022	2.0	NA	0.1	0.5	0.23	0.14	0.23	57.3
North: Threlkelds Rd														
7	L2	7	1	7	14.3	0.162	8.8	LOS A	0.6	4.1	0.31	0.92	0.31	51.0
9	R2	132	1	139	0.8	0.162	8.9	LOS A	0.6	4.1	0.31	0.92	0.31	51.0
Approach		139	2	146	1.4	0.162	8.9	LOS A	0.6	4.1	0.31	0.92	0.31	51.0
West: Mill Rd														
10	L2	338	9	356	2.7	0.217	5.6	LOS A	0.0	0.0	0.00	0.51	0.00	54.0
11	T1	45	0	47	0.0	0.217	0.1	LOS A	0.0	0.0	0.00	0.51	0.00	55.5
Approach		383	9	403	2.3	0.217	5.0	NA	0.0	0.0	0.00	0.51	0.00	54.1
All Vehicles		557	13	586	2.3	0.217	5.8	NA	0.6	4.1	0.09	0.59	0.09	53.5

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

MOVEMENT SUMMARY

Site: 101 [Mill & Threlkelds - 2033 PM + Dev (Site Folder: Mill & Threlkelds)]

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

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] veh/h	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Mill Rd														
5	T1	62	4	65	6.5	0.041	0.2	LOS A	0.1	0.5	0.10	0.07	0.10	58.9
6	R2	8	0	8	0.0	0.041	6.4	LOS A	0.1	0.5	0.10	0.07	0.10	56.8
Approach		70	4	74	5.7	0.041	0.9	NA	0.1	0.5	0.10	0.07	0.10	58.7
North: Threlkelds Rd														
7	L2	14	1	15	7.1	0.417	8.8	LOS A	2.2	15.5	0.38	0.93	0.43	51.0
9	R2	354	1	373	0.3	0.417	9.4	LOS A	2.2	15.5	0.38	0.93	0.43	50.8
Approach		368	2	387	0.5	0.417	9.4	LOS A	2.2	15.5	0.38	0.93	0.43	50.8
West: Mill Rd														
10	L2	221	0	233	0.0	0.147	5.6	LOS A	0.0	0.0	0.00	0.49	0.00	54.3
11	T1	44	0	46	0.0	0.147	0.0	LOS A	0.0	0.0	0.00	0.49	0.00	55.7
Approach		265	0	279	0.0	0.147	4.7	NA	0.0	0.0	0.00	0.49	0.00	54.5
All Vehicles		703	6	740	0.9	0.417	6.8	NA	2.2	15.5	0.21	0.68	0.23	52.9

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

Appendix 21

SH1 / Tram Rd Interchange – 2028 Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2028 AM (Site Folder: Tram Rd Int Interim - 2028)]

Network: N101 [Interim 2028 AM (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 100 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Tram Rd														
4	L2	173	21.3	173	21.3	0.105	5.8	LOS A	0.0	0.0	0.00	0.52	0.00	52.0
5	T1	109	11.5	109	11.5	* 0.858	58.9	LOS E	3.7	28.7	1.00	0.96	1.45	10.2
Approach		282	17.5	282	17.5	0.858	26.4	LOS C	3.7	28.7	0.39	0.69	0.56	32.2
West: Tram Rd														
11	T1	176	13.2	176	13.2	* 0.769	2.3	LOS A	8.7	63.8	0.28	0.64	0.28	42.7
12	R2	966	3.8	966	3.8	0.769	7.5	LOS A	8.7	63.8	0.28	0.64	0.28	58.8
Approach		1142	5.3	1142	5.3	0.769	6.7	LOS A	8.7	63.8	0.28	0.64	0.28	57.1
All Vehicles		1424	7.7	1424	7.7	0.858	10.6	LOS B	8.7	63.8	0.30	0.65	0.34	49.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101v [Tram Rd Off-Ramp - 2028 AM (Site Folder: Tram Rd Int Interim - 2028)] Network: N101 [Interim 2028 AM (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 100 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Off-Ramp														
1	L2	199	9.0	199	9.0	0.107	9.1	LOS A	0.0	0.0	0.00	0.63	0.00	71.5
3	R2	74	2.9	74	2.9	* 0.917	75.4	LOS E	2.7	19.6	1.00	0.93	1.75	19.6
Approach		273	7.3	273	7.3	0.917	27.0	LOS C	2.7	19.6	0.27	0.71	0.47	50.7
East: Tram Rd														
5	T1	74	14.3	74	14.3	0.050	0.2	LOS A	0.0	0.4	0.02	0.02	0.02	59.6
Approach		74	14.3	74	14.3	0.050	0.2	LOS A	0.0	0.4	0.02	0.02	0.02	59.6
West: Tram Rd														
11	T1	1061	5.3	1061	5.3	* 0.952	41.5	LOS D	40.6	297.0	0.90	1.09	1.20	25.5
Approach		1061	5.3	1061	5.3	0.952	41.5	LOS D	40.6	297.0	0.90	1.09	1.20	25.5
All Vehicles		1407	6.1	1407	6.1	0.952	36.5	LOS D	40.6	297.0	0.73	0.96	1.00	31.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2028 PM (Site Folder: Tram Rd Int Interim - 2028)]

Network: N101 [Interim 2028 PM (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Tram Rd														
4	L2	80	1.3	80	1.3	0.043	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.0
5	T1	241	1.7	241	1.7	* 0.622	13.4	LOS B	2.2	15.8	0.96	0.83	1.08	28.4
Approach		321	1.6	321	1.6	0.622	11.5	LOS B	2.2	15.8	0.72	0.75	0.81	38.0
West: Tram Rd														
11	T1	251	3.4	251	3.4	* 0.802	6.5	LOS A	4.5	32.2	0.74	0.82	0.89	38.2
12	R2	359	0.9	359	0.9	0.802	11.7	LOS B	4.5	32.2	0.74	0.82	0.89	55.6
Approach		609	1.9	609	1.9	0.802	9.6	LOS A	4.5	32.2	0.74	0.82	0.89	49.9
All Vehicles		931	1.8	931	1.8	0.802	10.2	LOS B	4.5	32.2	0.73	0.80	0.87	46.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

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MOVEMENT SUMMARY

Site: 101v [Tram Rd Off-Ramp - 2028 PM (Site Folder: Tram Rd Int Interim - 2028)]

Network: N101 [Interim 2028 PM (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Off-Ramp														
1	L2	852	1.9	852	1.9	0.437	9.7	LOS A	0.0	0.0	0.00	0.63	0.00	73.7
3	R2	188	1.7	188	1.7	* 0.495	20.2	LOS C	1.6	11.7	0.93	0.79	0.93	47.7
Approach		1040	1.8	1040	1.8	0.495	11.6	LOS B	1.6	11.7	0.17	0.66	0.17	70.0
East: Tram Rd														
5	T1	199	3.2	199	3.2	0.260	0.2	LOS A	0.1	0.4	0.03	0.02	0.03	59.6
Approach		199	3.2	199	3.2	0.260	0.2	LOS A	0.1	0.4	0.03	0.02	0.03	59.6
West: Tram Rd														
11	T1	425	2.2	425	2.2	* 0.545	7.8	LOS A	3.1	22.0	0.81	0.69	0.81	47.8
Approach		425	2.2	425	2.2	0.545	7.8	LOS A	3.1	22.0	0.81	0.69	0.81	47.8
All Vehicles		1664	2.1	1664	2.1	0.545	9.3	LOS A	3.1	22.0	0.32	0.60	0.32	64.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Appendix 22

SH1 / Tram Rd Interchange – 2023 with Rezoning Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2033 AM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)]

Network: N101 [Upgrade AM (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Tram Rd														
4	L2	187	21.3	187	21.3	0.376	11.4	LOS B	1.3	10.7	0.72	0.75	0.72	49.9
5	T1	120	11.4	120	11.4	* 0.438	18.2	LOS B	1.4	11.0	0.95	0.74	0.95	24.0
Approach		307	17.5	307	17.5	0.438	14.0	LOS B	1.4	11.0	0.81	0.75	0.81	42.8
West: Tram Rd														
11	T1	192	13.2	192	13.2	* 0.778	5.8	LOS A	5.7	41.8	0.53	0.75	0.64	37.8
12	R2	1387	2.9	1387	2.9	0.778	11.9	LOS B	6.8	48.7	0.60	0.80	0.71	52.4
Approach		1579	4.1	1579	4.1	0.778	11.2	LOS B	6.8	48.7	0.59	0.79	0.70	51.2
All Vehicles		1886	6.3	1886	6.3	0.778	11.6	LOS B	6.8	48.7	0.63	0.78	0.72	49.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

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Project: C:\Novo Group SharePoint\OneDrive - Novo Group Limited\021034 Ohoka\Proposed District Plan Submission\01 submissions\Carter Group\Transport\02 Modelling\021-034 - Ohoka Traffic Model - 2024-01.sip9

MOVEMENT SUMMARY

Site: 101v [Tram Rd Off-Ramp - 2033 AM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)] Network: N101 [Upgrade AM (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Off-Ramp														
1	L2	332	5.7	332	5.7	0.175	9.0	LOS A	0.0	0.0	0.00	0.63	0.00	72.5
3	R2	80	2.6	80	2.6	* 0.296	25.3	LOS C	0.9	6.6	0.93	0.76	0.93	42.1
Approach		412	5.1	412	5.1	0.296	12.2	LOS B	0.9	6.6	0.18	0.66	0.18	67.4
East: Tram Rd														
5	T1	74	14.3	74	14.3	0.075	10.0	LOS B	0.9	6.9	1.00	0.78	1.00	46.8
Approach		74	14.3	74	14.3	0.075	10.0	LOS B	0.9	6.9	1.00	0.78	1.00	46.8
West: Tram Rd														
11	T1	1491	4.1	1491	4.1	* 0.719	8.5	LOS A	7.4	53.8	0.80	0.75	0.86	47.0
Approach		1491	4.1	1491	4.1	0.719	8.5	LOS A	7.4	53.8	0.80	0.75	0.86	47.0
All Vehicles		1976	4.7	1976	4.7	0.719	9.3	LOS A	7.4	53.8	0.68	0.74	0.72	52.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network 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 (Geometric Delay is included).
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 101 [Tram Rd On-Ramp - 2033 PM Upgrade (Site Folder: Tram Rd Int + Dev - 3 Lanes)]

Network: N101 [Upgrade PM (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	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: Tram Rd														
4	L2	87	1.2	87	1.2	0.106	8.4	LOS A	0.3	2.1	0.59	0.68	0.59	58.2
5	T1	264	2.0	264	2.0	* 0.683	14.1	LOS B	2.5	18.0	0.98	0.87	1.18	27.7
Approach		352	1.8	352	1.8	0.683	12.7	LOS B	2.5	18.0	0.88	0.83	1.03	38.6
West: Tram Rd														
11	T1	273	3.1	273	3.1	* 0.504	4.1	LOS A	1.8	12.7	0.51	0.53	0.51	44.9
12	R2	494	0.6	494	0.6	0.504	12.1	LOS B	2.5	17.8	0.69	0.73	0.69	53.5
Approach		766	1.5	766	1.5	0.504	9.2	LOS A	2.5	17.8	0.63	0.66	0.63	51.4
All Vehicles		1118	1.6	1118	1.6	0.683	10.3	LOS B	2.5	18.0	0.71	0.71	0.76	47.7

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Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Off-Ramp														
1	L2	1101	1.6	1101	1.6	0.565	10.8	LOS B	0.0	0.0	0.00	0.63	0.00	73.8
3	R2	206	2.0	206	2.0	* 0.544	20.5	LOS C	1.8	13.1	0.94	0.81	0.98	47.4
Approach		1307	1.7	1307	1.7	0.565	12.4	LOS B	1.8	13.1	0.15	0.66	0.15	70.4
East: Tram Rd														
5	T1	238	2.2	238	2.2	0.309	11.4	LOS B	2.2	15.7	1.00	0.82	1.00	45.5
Approach		238	2.2	238	2.2	0.309	11.4	LOS B	2.2	15.7	1.00	0.82	1.00	45.5
West: Tram Rd														
11	T1	567	1.9	567	1.9	* 0.362	7.1	LOS A	1.9	13.3	0.74	0.62	0.74	48.7
Approach		567	1.9	567	1.9	0.362	7.1	LOS A	1.9	13.3	0.74	0.62	0.74	48.7
All Vehicles		2113	1.8	2113	1.8	0.565	10.8	LOS B	2.2	15.7	0.40	0.67	0.41	62.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
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* Critical Movement (Signal Timing)