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Integrated Transport Assessment

Prepared for

ROLLESTON INDUSTRIAL DEVELOPMENTS LTD

535 Mill Road, Ohoka
Waimakariri

March 2022

Integrated Transport Assessment
Prepared for

Rolleston Industrial Developments Ltd

535 Mill Road, Ohoka
Waimakariri

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Document Date:	**2/03/2022**
Document Version/Status:	Revision E | FINAL
Project Reference:	021-034
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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, two commercial areas and a special purpose area at 535 Mill Road, Ohoka.

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 two sites for local commercial activities and a special purpose area, which would be either a school, a retirement village 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 Plan Change area is predicted to generate 826 to 1,022 vehicle movements per hour in the weekday peak hours and 8,026 vehicle movements per day.

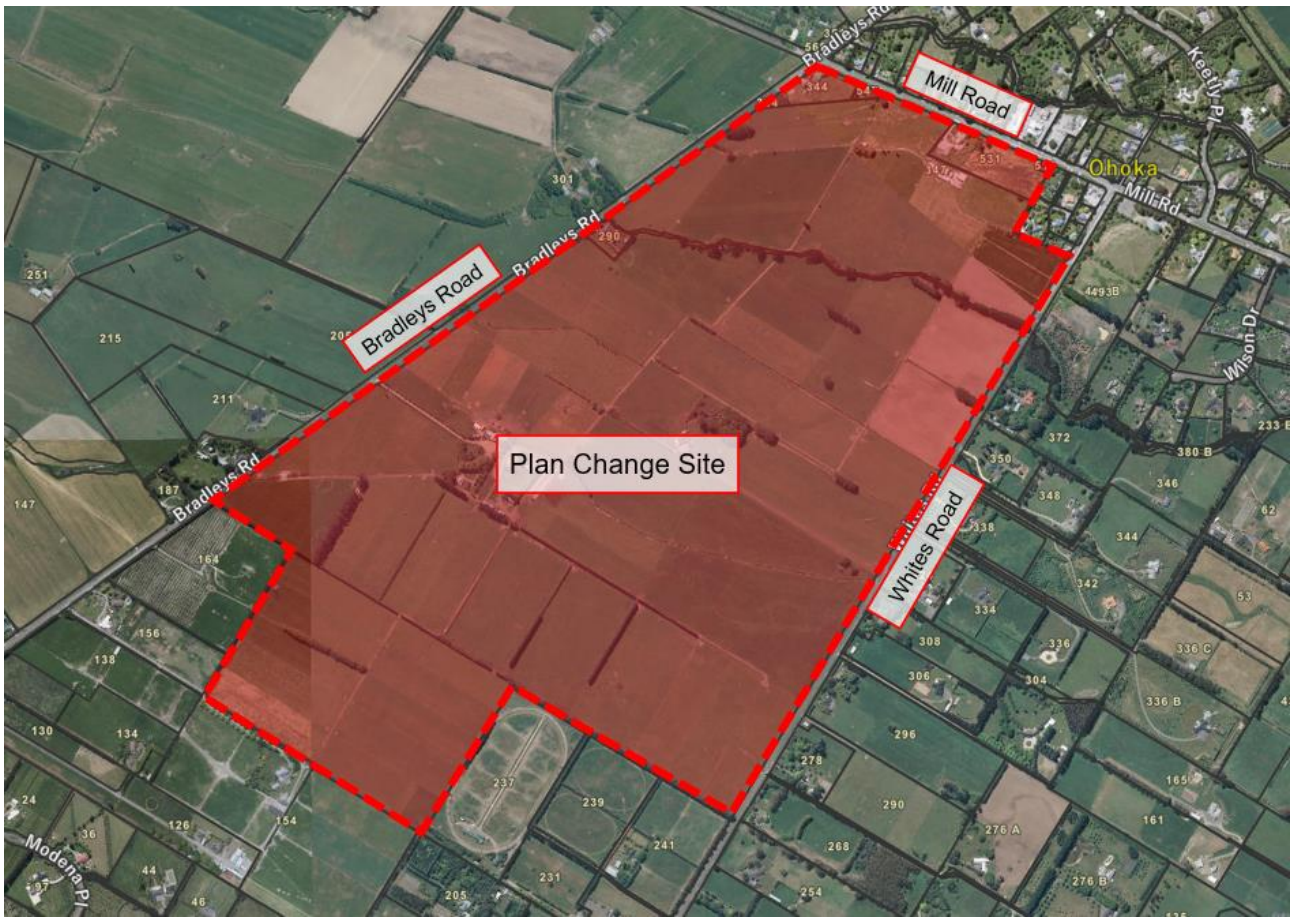


Figure 1: Site Location

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
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 752 vpd[2].
Speed Limit	70km/hr from Mill Road to a point 240m south of the intersection. 100km/hr beyond that point.
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 Ohoka Farmers Market at the Ohoka 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 Ohoka 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.

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.

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	Local Road
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 1,406 vpd.
Speed Limit	70km/hr from Mill Road to a point 53m south of the intersection. 100km/hr beyond that point.
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.

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
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 1,704 vpd.
Speed Limit	70km/hr within the vicinity of the site.
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 Ohoka 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 Ohoka School on Jacksons Road.

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
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 8,091 vpd.
Speed Limit	Generally 100km/hr, although reduced to 80km/hr at the intersection with Bradleys 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

Intersections

Tram Road / Bradleys Road / McHughes Road

10. 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/hr speed limit area.

Figure 6: Tram Road / Bradleys Road / McHughes Road Intersection

11. Traffic counts have been undertaken at this intersection (on 28th and 29th July 2021) and these are illustrated on the diagrams contained in **Appendix 2**. These volumes (along with the existing road geometry) have been used to create a SIDRA model of this intersection.

12. 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 5** 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 5: 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	21	20	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	22	21	
	PM Peak	Through	13	29	26	
		Right	25	28	25	
McHughes Road	AM Peak	Through	10	27	20	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	36	22	
	PM Peak	Through	18	29	24	
		Right	18	38	23	

13. 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 Plan Change.

14. The results of the existing intersection operation are included in **Appendix 3** and summarised in **Table 6**[3].

[3] Right turn only for the Tram Road approaches.

Table 6: Tram Road / Bradleys Road / McHughes Road Intersection – Existing

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	McHughes Rd	0.380	21	C	2
	Tram Rd (East)	0.049	9	A	0
	Bradleys Rd	0.189	13	B	1
	Tram Rd (West)	0.182	8	A	0
PM Peak Hour	McHughes Rd	0.260	21	C	1
	Tram Rd (East)	0.173	8	A	1
	Bradleys Rd	0.276	16	C	1
	Tram Rd (West)	0.060	9	A	0

15. The above intersection modelling results indicate that this intersection is currently operating satisfactorily.

16. 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, although a design is yet to be progressed for this scheme. Other safety improvements are also proposed to Tram Road in the LTP, although we are not aware of specific details for these schemes.

Tram Road / Whites Road

17. 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 7: Tram Road / Bradleys Road / McHughes Road Intersection

18. The 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 7** 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 7: 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	25	23	
		Right	18	42	32	
	PM Peak	Left	4	10	10	
		Through	26	29	27	
		Right	19	39	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	19	
	PM Peak	Left	8	14	13	
		Through	27	25	23	
		Right	13	30	20	

19. 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 Plan Change. 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.

20. The results of the existing intersection operation are included in **Appendix 4** and summarised in **Table 8**[4].

[4] Right turn only for the Tram Road approaches.

Table 8: Tram Road / Whites Road Intersection – Existing

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	Whites Rd (South)	0.157	19	C	1
	Tram Rd (East)	0.065	10	B	0
	Whites Rd (North)	0.042	18	C	0
	Tram Rd (West)	0.328	8	A	0
PM Peak Hour	Whites Rd (South)	0.052	18	C	0
	Tram Rd (East)	0.341	8	A	0
	Whites Rd (North)	0.111	20	C	0
	Tram Rd (West)	0.103	12	B	0

21. The above intersection modelling results 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 70km/hr speed limit area.

Figure 8: Mill Road / Bradleys Road Intersection

23. The 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 summarised in **Table 9**[5].

Table 9: Mill Road / Bradleys Road Intersection – Existing

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	Bradleys Rd (South)	0.043	8	A	0
	Mill Rd (East)	0.021	7	A	0
	Bradleys Rd (North)	0.008	10	A	0
	Mill Rd (West)	0.024	6	A	0
PM Peak Hour	Bradleys Rd (South)	0.058	9	A	0
	Mill Rd (East)	0.056	6	A	0
	Bradleys Rd (North)	0.009	9	A	0
	Mill Rd (West)	0.035	6	A	0

24. The above intersection modelling results indicate that this intersection operates well.

Mill Road / Whites Road

25. 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 70km/hr speed limit area.

Figure 9: Mill Road / Whites Road Intersection

[5] Right turn only for the Mill Road approaches.

26. The 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 summarised in **Table** 9 **10**[6].

Table 10: Mill Road / Whites Road Intersection – Existing

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	Whites Rd	0.014	9	A	0
	Mill Rd (East)	0.027	-	-	-
	Mill Rd (West)	0.038	7	A	0
PM Peak Hour	Whites Rd	0.117	9	A	0
	Tram Rd (East)	0.050	-	-	-
	Tram Rd (West)	0.080	7	A	A

27. The above intersection modelling results indicate this intersection currently operates well.

Crash History

28. The NZ Transport Agency Crash Analysis System (CAS) has been reviewed to identify crashes that have been reported within 100m of Bradleys Road, Mill Road, Tram Road and Whites Road (plus the intersections of these roads). **Figure 10** is the collision diagram for this area and the crashes are summarised in **Table 11**. As an overview, nine crashes were reported including one severe and one minor injury crash.

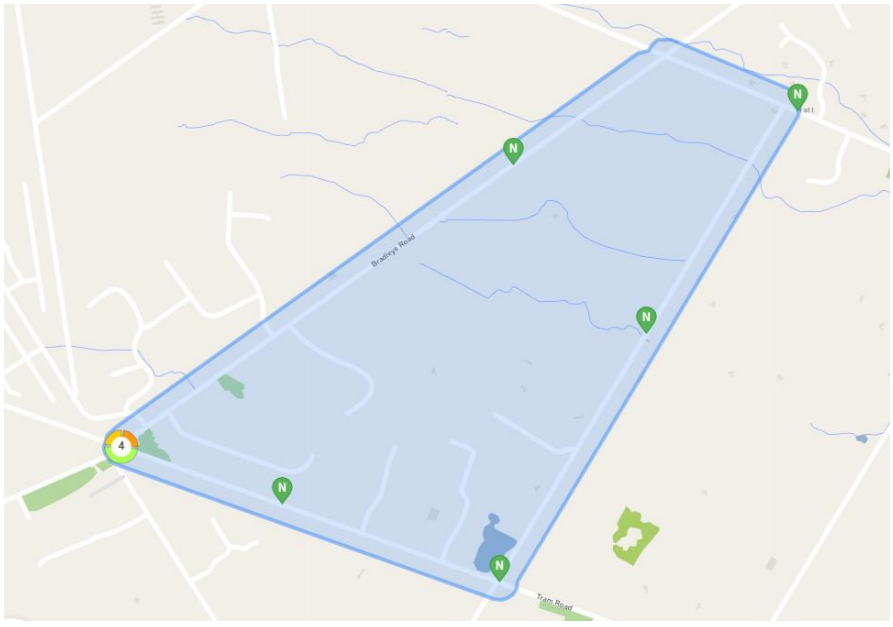


Figure 10: CAS Collision Diagram

[6] Right turn only for the Mill Road approaches.

Table 11: CAS Summary

Location	Crash Description	Comments
Tram Road / Bradleys Road Intersection	Severe injury crash where a southbound vehicle on Bradleys Road failed to give-way to through traffic on Tram Road.	Tram Road traffic was obscured by a large vehicle that turned left into Bradleys Road.
	Minor injury crash where a vehicle pulled out of Bradleys Road (north) without checking.	-
	A non-injury crash where a driver pulling out of McHughes Road has failed to give-way.	-
	A non-injury crash where a driver turning right into Bradleys Road has failed to give-way.	-
Bradleys Road (Mid-block)	A non-injury crash where one vehicle has attempted to overtake another, the lead vehicle turned into the path of the overtaking vehicle.	-
Whites Road (Mid-block)	A non-injury crash where a u-turning vehicle failed to give-way.	-
	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	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.	Appeared to be a 'road rage' incident.
Tram Road (Mid-block)	A vehicle with a poorly laden trailer lost control. This was a non-injury crash.	-

Passenger Transport

29. 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[7] and five return services in the evening[8]. 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.

30. The locations of the Park and Ride facilities are illustrated in **Figure 11**.

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

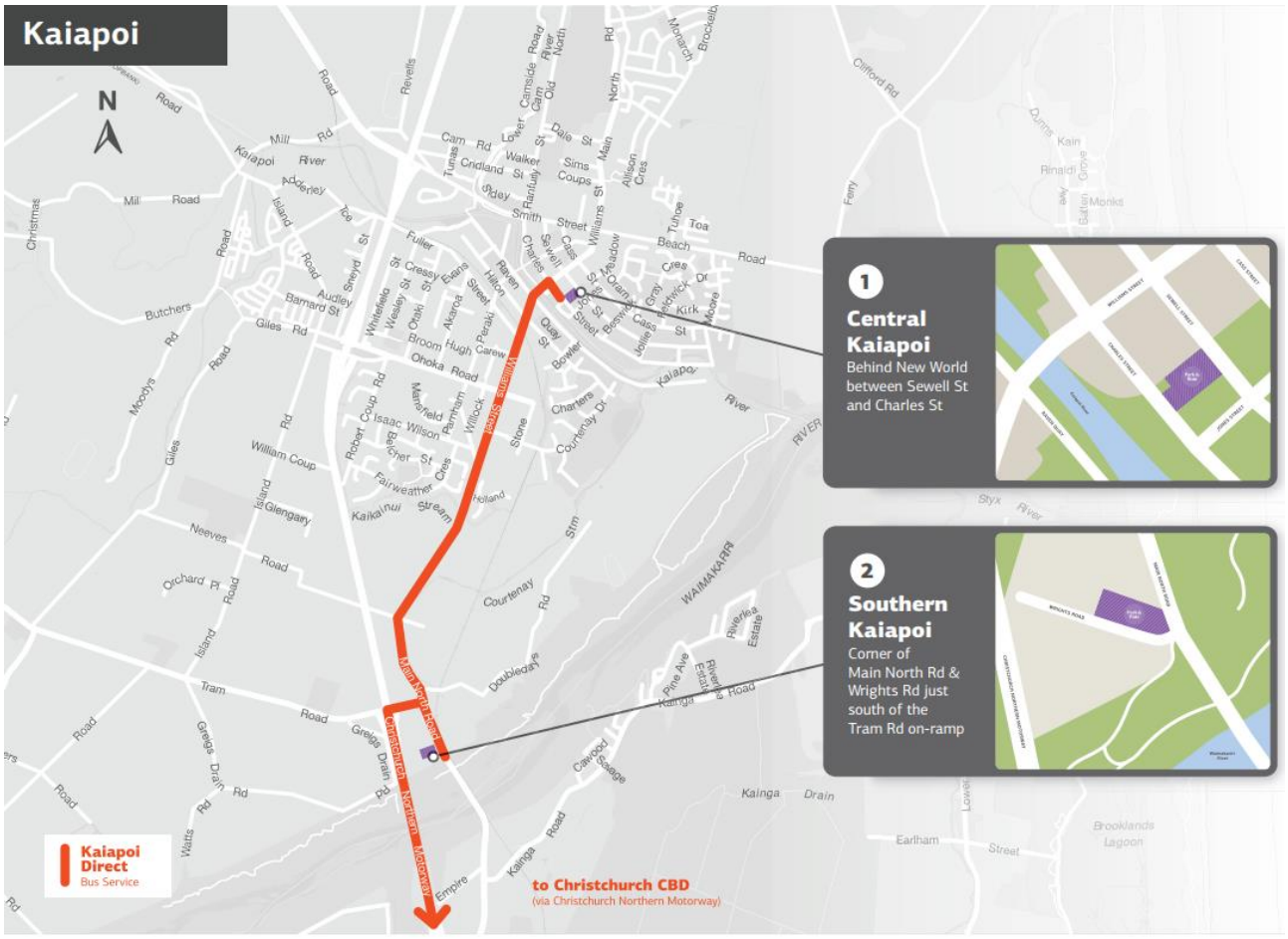


Figure 11: Kaiapoi Park & Ride

The Proposal

31. The proposed Plan Change would enable up to approximately 850 residential lots, two commercial zones and a special purpose area to be established at the application site. There are effectively three development options for the land as follows (in no particular order):

    i. Option 1: Up to 850 dwellings plus the two commercial zones and a 500 pupil school;

    ii. Option 2: Up to 850 dwellings plus the two commercial zones and a retirement village; and

    iii. Option 3: Up to 900 dwellings plus the two commercial zones. This assumes that the special purpose area is not developed for a school or retirement village and adopts the underlying residential zoning.

32. A copy of the ODP is included in **Figure 12** and included in more detail in **Appendix 1**.

33. The following sets out the transport details of the proposed Plan Change. Unless otherwise stated, it is proposed to adopt the transport provisions of the Operative District Plan or Proposed District Plan, whichever is relevant at the time.

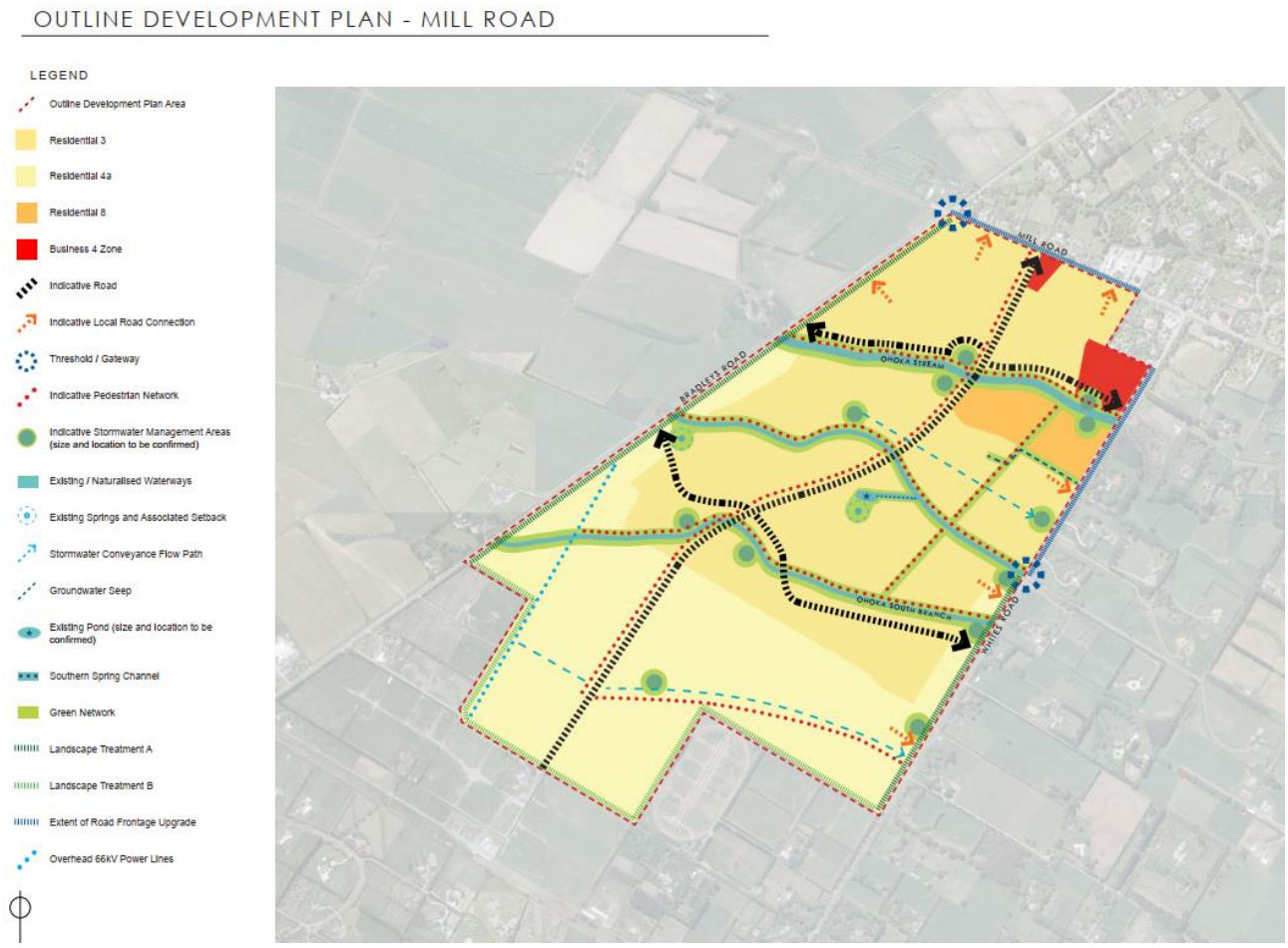


Figure 12: Proposed ODP Layout

Site Layout

Access Intersections

34. The proposed ODP provides roading links to Mill Road, Bradleys Road and Whites Road. These intersections are assumed to be priority-controlled intersections, with the priority being given to the existing road network. The sight distances at the intersections will be confirmed at subdivision stage, although these are anticipated to comply as the road alignments are straight and flat.

35. Direct property access may be taken from Whites Road and Bradleys Road for the land zoned Residential 4a. These accesses would be grouped to reduce the number of individual access locations to this road, with between two and six lots sharing accesses. **Figure 13** illustrates the proposed arrangement for access to one to three lots. **Figure 14** illustrates the proposed arrangement for access to four to six lots.

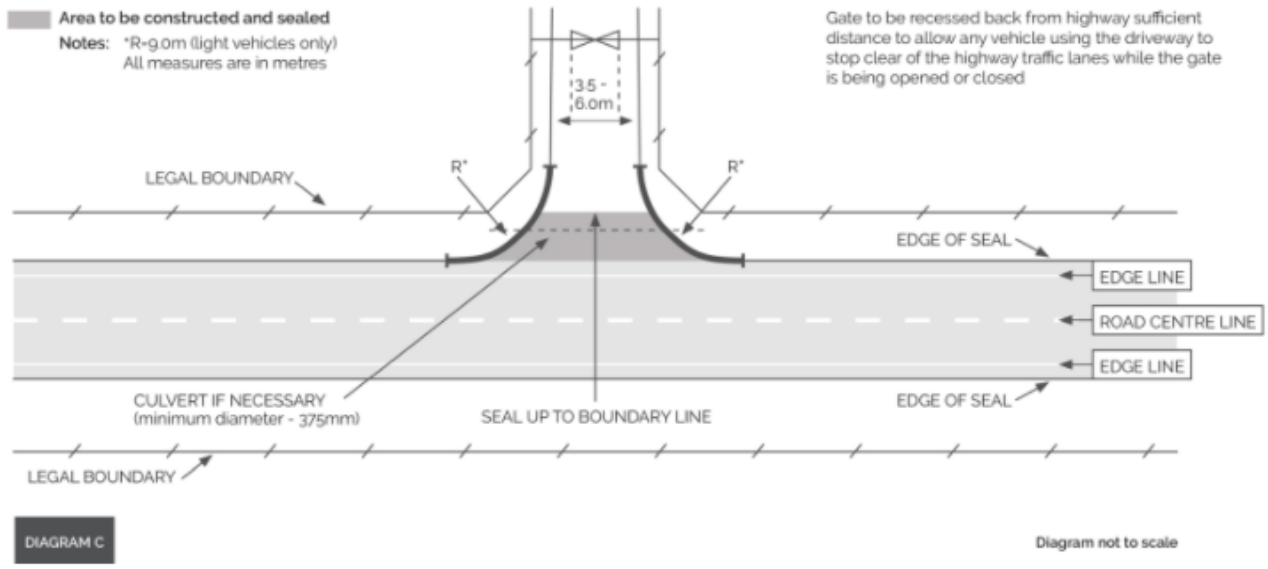


Figure 13: Access to 1 to 3 Lots (Speeds >60/hr)

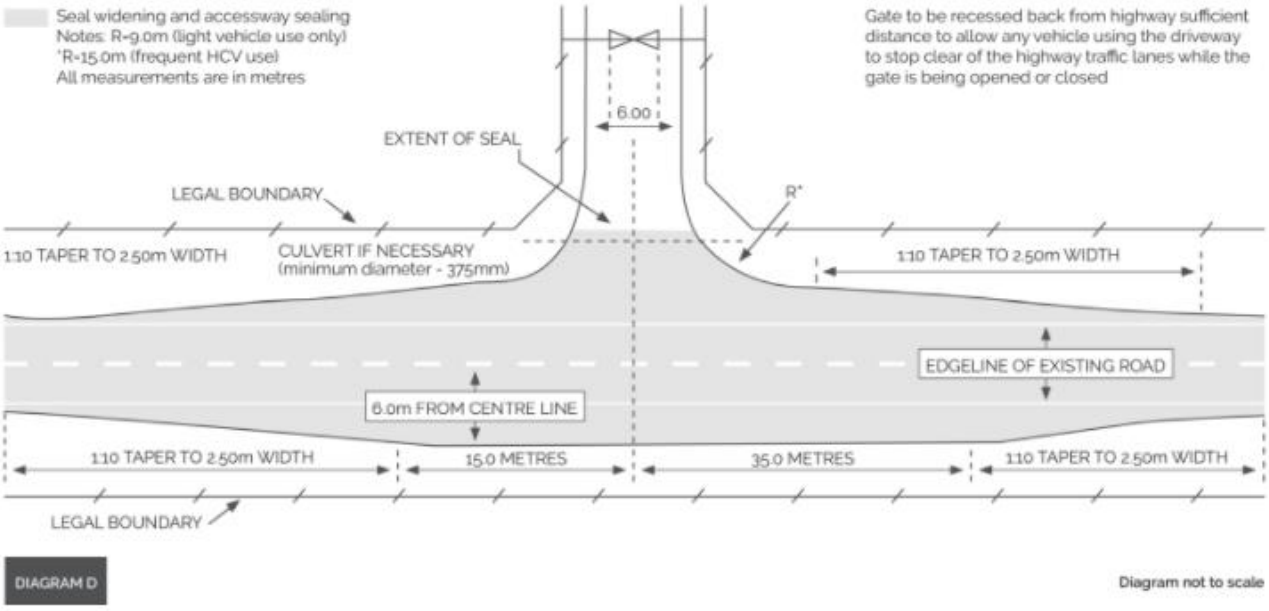


Figure 14: Access to 4 to 6 Lots (Speeds >60/hr)

36. Direct property access is proposed to Mill Road and Whites Road where the ODP identifies 'Road Frontage Upgrades'. It is intended that the speed limits on these roads be reduced through Ohoka to the east of the proposed gateway feature on Mill Road and to the north of the gateway feature on Whites Road. Gateway features are intended to signal that drivers are entering an urban environment and assist in reducing speeds. The provision of direct property access will also indicate to drivers they have entered a more urban area and that lower speeds are appropriate.

37. Ideally, the reduced speed limit through Ohoka would be 50km/hr, with gateway / threshold treatments indicated on the ODP on Whites Road and at the Bradleys Road / Mill Road intersection (although a further gateway would be required on Mill Road to the east of Whites Road to close out the 50km/hr speed limit area).

38. It is also proposed that the speed limit on Bradleys Road and Whites Road at the southern boundaries of the ODP would reduce to 70km/hr (north of that location) if direct access is proposed to these roads at subdivision stage. This would signal the locations at which increased property access would occur, although there would be fewer accesses than in the 50km/hr area. However, it is acknowledged that the setting of speed limits is outside the Plan Change process and this would need to be agreed with Council.

New Road Standards

39. The road cross-sections within the Plan Change area are proposed to be bespoke for this Plan Change to reflect the nature of the proposed subdivision. The typical cross-sections of these will be worked through with Council at a later date and subject to a separate Council approval process.

40. The internal intersection spacing may not comply with the 125m required by the Waimakariri District Plan for a 50km/hr speed environment. However, it is proposed that they would be consistent with the 40m separation requirement of the Christchurch City Council Infrastructure Design Standard, which is also similar to the intersection separation provided within the Silverstream subdivision in Kaiapoi.

Pedestrian & Cycle Links

41. A shared path is proposed along Bradleys Road and Mill Road, which is consistent with the Council's proposed facility. Greenlink connections are also provided within the ODP, which link to internal reserves and the external transport network. A footpath is also proposed along Whites Road along the area of the road frontage upgrade from Mill Road up to the proposed threshold/gateway. Depending on whether direct property accessways are proposed to the Residential 4a Lots, the footpath may extend to the southern boundary of the ODP to Mill Road. Mill Road already has a shared path running along the site boundary.

42. The primary road network has also been identified as including a 3m shared path to provide more direct internal connectivity.

Road Upgrades

43. Road upgrades in addition to the above walking and cycling provision are discussed at paragraph 91. These include seal and shoulder widening, although it is not proposed for the roads to include kerb and channel.

Traffic Generation & Assignment

Traffic Generation

Residential Traffic Generation

44. 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[9]. 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;

[9] [9] Based on Outer Suburban dwellings in the NZTA Research Report 453 – *Trips and Parking Related to Land Use*.

ii. PM Peak – 63% arrivals / 37% departures: and

iii. Daily – 50% arrivals / 50% departures.

45. The above leads to the traffic generation rates as set out in **Table 12.**

Table 12: 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

46. Applying the above traffic generation rates to the 850 dwellings proposed (of land use Options 1 and 2) leads to the traffic generation set out in **Table 13**.

Table 13: 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

Special Purpose Zone Traffic Generation

47. One of the potential uses of the Special Purpose Zone is as a school. The traffic generation assessment of the school has been based on a High School, given there is already a Primary School in Ohoka. It is assumed there are 500 pupils at the high school and the traffic generation predicted by the *NZ Household Travel Survey School Travel Model* that accompanies NZTA Research Report 467. Adopting a 500 pupil High School in a Rural Area leads to the peak hour traffic generation estimates in **Table 14**.

Table 14: Predicted School Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour (08:00 to 09:00)	163	94	257
PM Peak Hour (15:00 to 16:00)	101	166	267
Daily	528	528	1,056

48. The PM peak hour of 15:00 to 16:00 is not consistent with the surrounding network peak. Data from the TRICS database for secondary 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 15**.

Table 15: Factored School Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour (08:00 to 09:00)	163	94	257
PM Peak Hour (16:00 to 17:00)	23	38	61
Daily	528	528	1,056

49. An alternate development scenario of the Special Purpose area is that it is developed as a retirement village with ancillary facilities (such as centralised recreational and meeting facilities). The typical traffic generation rates for retirement villas is 0.1 to 0.2 vehicles per dwelling in the peak hours and 1 to 2 vehicles per dwelling per day[10]. The lowest peak hour traffic volume associated with the School option is 61 vehicles per hour in the PM peak. Converting this 61 vehicles per hour to an equivalent number of retirement villas identifies a comparable number as 305 retirement villas[11].

50. The retirement villa traffic generation rates indicate that the AM peak hour and daily traffic generation from 305 villas would be much lower than the volumes assessed for the School option, so these would be within the scope of the assessment undertaken later in this report.

51. The final development option is that the Special Purpose area is developed for approximately 50 additional dwellings. The residential traffic generation rate of 0.9 vehicles per dwelling per hour leads to a peak hour traffic generation of 45 vehicles per hour. Again, this is lower than the 61 vehicles per hour associated with the School so the traffic generation of this activity is considered to be within the scope of the assessment undertaken later in this report.

Commercial Area Traffic Generation

52. Whilst two commercial areas are proposed within the Plan Change site, these are primarily intended to accommodate the day-to-day shopping needs of the residents of the Plan Change. These are 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

53. Based on the traffic generation estimates set out above, the traffic generation from the Plan Change site is summarised in **Table 16**.

Table 16: Plan Change Traffic Generation

Time Period	Arrivals	Departures	Total
AM Peak Hour	316	706	1,022
PM Peak Hour	505	321	826
Daily	4,013	4,013	8,026

[10] From the RTA *Guide to Traffic Generating Developments*.
[11] 61 vehicles per hour divided by 0.2 vehicles per retirement villa = 305 vehicles per hour.

Traffic Distribution

Residential Traffic Distribution

54. The traffic distribution is proposed to be based on workplace destinations from the Commuter Waka website[12]. The initial data has been edited, as the indication was that 35% of people work within the Mandeville – Ohoka ward. The data also indicated that 18% of people worked from home, so there would be no car trip associated with these people. This still leaves 17% of people who travel working in Mandeville – Ohoka. This intuitively feels too high given the limited employment opportunities in the ward, so we have reduced this to 5%, which is the same amount that travelled to Rangiora Central.

55. The total percentage of trips no longer sums 100% (following the above changes), so the destinations have been adjusted on a pro-rata basis to ensure that the destinations add up to 100%.

56. The table in **Appendix 7** sets out the traffic distribution based on the above information. **Table 17** provides a summary of the routes for traffic departing the site.

57. We note that the Commuter Waka information included the destinations for the 2% of people that walked and cycled to work. In addition, some people would likely undertake a trip to school to drop-off children prior to travelling to work. However, the following is considered to be a reasonable proxy for the travel patterns associated with traffic from the Plan Change site.

58. **Table 17** provides a summary of the directions traffic is anticipated to take to / from the Plan Change site.

Table 17: Summary of Destinations

Direction	Percentage
SH1 South	65%
South-West	10%
North	18%
North-East	6%
South-East	1%
Total	***100%***

59. The diagrams in **Appendix 8** illustrate how this traffic has been distributed on the road network from the northern and southern portions of the site. **Appendix 8** also contains diagrams that illustrate the assignment of the residential traffic on the surrounding road network.

60. It is noted that the proposed Plan Change is predicted to lead to an increase of approximately 470 vehicles per hour using the SH1 / Tram Road intersection during the peak hours.

School Traffic Distribution

61. The distribution of school traffic from the Plan Change site has been based on the proportion of pupils living in surrounding Census wards, taken from the Commuter Waka website. The table in **Appendix 9** sets out the pupil numbers by ward location and the assumed origin / destination. **Appendix 10** contains diagrams that illustrate the assignment of the school traffic on the surrounding road network.

[12] https://commuter.waka.app/

Traffic Growth

62. We have reviewed the currently zoned residential land within the vicinity of the Plan Change site and the majority of this has already been developed. The exception to this is understood to be an area of land to the north of Mill Road and west of Threlkelds Road that could accommodate up to 50 dwellings. The traffic generation associated with this has been added to the road network in the diagrams included in **Appendix 11**. It is noted that the majority of this traffic will head away from the application site and would not enter the road network illustrated on these diagrams.

Combined Future Traffic Volumes

63. **Appendix 12** includes diagrams that illustrate the 2021 existing traffic plus growth and the Plan Change traffic.

Assessment of Effects

64. Key matters for the assessment of transport effects associated with the proposed Plan Change 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 Plan Change will be accessible by a range of transport modes.

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

Parking, Loading & Internal Arrangements

Parking & Loading

66. The District Plan rules regarding parking and loading will be adopted for this Plan Change. 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

67. 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.

68. The internal intersection separation is not anticipated to comply with the 125m spacing required by the Waimakariri District Plan. A minimum separation for Local Road to Local Road intersections of 40m is proposed, which is consistent with the Christchurch City Council Infrastructure Design Standard and

similar to the layout of the Silverstream subdivision at Kaiapoi. Given the proposal is consistent with these scenarios, the proposed intersection separation is considered acceptable.

69. Access to individual properties within the Plan Change 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.

70. 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

71. 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.

72. The passing volumes on Mill Road, Bradleys Road and Whites Road are considered to be sufficiently low that the access intersections can be designed that will accommodate the predicted traffic volumes. **Table 18** is an extract from Austroads *Guide to Traffic Management, Part 3 – Traffic Studies*. It provides guidelines on the levels of traffic flow that can be accommodated by an intersection without requiring detailed analysis. The highest major road volumes at the accesses occur at the southern access to Whites Road, which has a volume of 372 vehicles per hour in the AM and 468 vehicles per hour in the PM. The volume on the minor approach is 186 vehicles per hour, which is lower than the threshold for assessment. This indicates that the accesses will operate efficiently.

Table 18: Intersection Volumes below which Capacity Analysis is Unnecessary (Extract of Austroads, Table 6.1)

Major Road Type	Major Road Traffic Volume (vph)	Minor Road Traffic Volume (vph)
Two Lane	400	250
	500	200
	650	100

Intersection Spacing

73. The District Plan requires the Plan Change road access intersections with Bradleys Road and Whites Road to be separated by 800m, as these are within a 100km/hr speed limit area. The access intersection to Mill Road is required to be separated to adjacent intersections by 220m, as this is within a 70km/hr speed limit area. The proposed intersection spacings are as follows:

    i. Bradleys Road: Separation ranges between 212m and 466m;

    ii. Whites Road: Separation ranges between 148m and 323m; and

iii. Mill Road: Separations of between 106m and 203m.

74. 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]

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

i. 69m for a speed of 50km/hr;

ii. 97m for a speed of 70km/hr; and

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

76. 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).

Property Access to Bradleys Road, Whites Road & Mill Road

77. As identified at paragraph 35, direct property access will be taken to Bradleys Road and Whites Road for the Residential 4a land. **Figure 13** and **Figure 14** set out the required access designs based on the number of Lots served by that access.

78. Direct property access is also proposed to Whites Road and Mill Road where 'Road Frontage Upgrades' are identified on the ODP. It is assumed that the speed limits through these areas would be reduced to enable direct access to individual properties and the number of accesses would reinforce the lower speed limit.

79. Overall, the direct property access arrangements to Bradleys Road, Whites Road and Mill Road are considered acceptable subject to the proposed access design and speed limit reductions.

Wider Effects

Tram Road / Bradleys Road / McHughes Road Intersection

80. The operation of the Tram Road / Bradleys Road / McHughes Road intersection has been assessed in the SIDRA model of the existing intersection layout. The full results are contained in **Appendix 13** and summarised in **Table 19**.

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

Table 19: Tram Road / Bradleys Road / McHughes Road Intersection – With Plan Change[14]

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	McHughes Rd	0.646	31	D	4
	Tram Rd (East)	0.052	9	A	0
	Bradleys Rd	0.539	18	C	3
	Tram Rd (West)	0.182	8	A	0
PM Peak Hour	McHughes Rd	0.557	31	D	3
	Tram Rd (East)	0.173	8	A	1
	Bradleys Rd	0.576	23	C	3
	Tram Rd (West)	0.060	9	A	0

81. The above indicates that the Tram Road / Bradleys Road / McHughes Road intersection is predicted to operate satisfactorily with the Plan Change traffic added to the road network.

82. The safety of the Tram Road / Bradleys Road / McHughes Road intersection has also been considered using the calculations set out in Section 7.4 of the NZTA Crash Compendium. This predicts 0.46 injury crashes per year occurring at this intersection based on the existing volumes. This compares to a reported rate of two injury crashes over a five-year period (refer to paragraph 28), or an average of 0.4 injury crashes per year. This indicates that this intersection is currently operating marginally safer than the generic crash prediction model would otherwise assume.

83. When updated with the traffic flows that include the proposed development, the same model predicts an injury crash rate of 0.62 crashes per year. This is an increase of 35% likelihood of a serious injury crash occurring in any given year. Applying this over a ten-year period suggests there would be an increase of one crash during that period compared to the without Plan Change scenario (six crashes compared to five without the Plan Change). This is not such a significant increase that it is considered the timing of this Plan Change should be affected by the timing of the intersection upgrade, noting that we understand Council is already considering installing a roundabout at this location and the development contributions from the Plan Change could facilitate this.

Tram Road / Whites Road Intersection

84. The operation of the Tram Road / Whites Road intersection with the Plan Change traffic has been assessed in SIDRA. The results are included in **Appendix 14** and summarised in **Table 20**.

[14] Tram Road Delay, Level of Service and Queue length are for the right turn only.

Table 20: Tram Road / Whites Road Intersection – With Plan Change[15]

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	Whites Rd (South)	0.380	39	E	1
	Tram Rd (East)	0.132	11	B	1
	Whites Rd (North)	0.604	19	C	4
	Tram Rd (West)	0.369	8	A	0
PM Peak Hour	Whites Rd (South)	0.122	31	D	0
	Tram Rd (East)	0.372	9	A	1
	Whites Rd (North)	0.236	15	C	1
	Tram Rd (West)	0.128	13	B	0

85. The above indicates that the Tram Road / Whites Road intersection is predicted to operate satisfactorily with the Plan Change traffic added to the road network. Although the Whites Road southern arm is predicted to operate at Level of Service E in the AM peak hour, this approach has low volumes, and the delay is considered tolerable.

Mill Road / Bradleys Road Intersection

86. The operation of the Mill Road / Bradleys Road intersection has been assessed in the SIDRA model of the existing intersection. The full results are contained in **Appendix 15** and summarised in **Table 21**.

Table 21: Mill Road / Bradleys Road Intersection – With Plan Change[16]

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	Bradleys Rd (South)	0.098	9	A	0
	Mill Rd (East)	0.039	7	A	0
	Bradleys Rd (North)	0.009	10	A	0
	Mill Rd (West)	0.043	6	A	0
PM Peak Hour	Bradleys Rd (South)	0.088	9	A	0
	Mill Rd (East)	0.081	6	A	0
	Bradleys Rd (North)	0.009	9	A	0
	Mill Rd (West)	0.038	7	A	0

[15] Tram Road Delay, Level of Service and Queue length are for the right turn only.
[16] Tram Road Delay, Level of Service and Queue length are for the right turn only.

87. The above indicates that the Mill Road / Bradleys Road intersection is predicted to operate satisfactorily with the Plan Change traffic added to the road network.

Mill Road / Whites Road

88. The operation of the Mill Road / Whites Road intersection has been assessed in the SIDRA model of the existing intersection. The full results are contained in **Appendix 16** and summarised in **Table 21**.

Table 22: Mill Road / Whites Road Intersection – With Plan Change[17]

Time Period	Approach	Degree of Saturation	Delay (s)	Level of Service	95th Percentile Queue (veh)
AM Peak Hour	Whites Rd	0.139	9	A	1
	Mill Rd (East)	0.063	-	-	-
	Mill Rd (West)	0.082	7	A	0
PM Peak Hour	Whites Rd	0.079	10	A	0
	Tram Rd (East)	0.132	-	-	-
	Tram Rd (West)	0.072	7	A	0

89. The above indicates that the Mill Road / Whites Road intersection is predicted to operate satisfactorily with the Plan Change traffic added to the road network.

Link Capacities

90. The capacities of Tram Road, Bradleys Road, Whites Road and Mill Road have been compared to the traffic thresholds set out in Table 4.5 of the Austroads *Guide to Road Design Part 3: Geometric Design* that sets out the rural road width requirements for a range of daily traffic volumes. **Table 23** sets out the carriageway and shoulder widths required for a range of daily traffic volumes from the AustRoads guide.

Table 23: AustRoads Carriageway Widths

Element	Design AADT				
	1 - 150	150 - 500	500 – 1,000	1,000 – 3,000	>3,000
Traffic Lanes	3.7m (1 x 3.7m)	6.2m (2 x 3.1m)	6.2m – 7.0m (2 x 3.1m / 3.5m)	7.0m (2 x 3.5m)	7.0m (2 x 3.5m)
Total Shoulder	2.5m	1.5m	1.5m	2.0m	2.5m
Minimum Shoulder Seal	0m	0.5m	0.5m	1.0m	1.5m
Total Carriageway	8.7m	9.2m	9.2m – 10.0m	11.0m	12.0m

[17] Tram Road Delay, Level of Service and Queue length are for the right turn only.

91. **Table 24** sets out the existing daily traffic volumes on the key roads surrounding the site, the additional Plan Change traffic and the resultant daily traffic volumes. The existing road width is then compared against the AustRoads standard to identify whether improvements are required.

Table 24: Link Capacities

Link	Existing Daily Traffic	Plan Change Daily Traffic	Combined Traffic Volume	Required Carriageway	Existing Carriageway	Comments
Tram Rd	8,091	4,347	12,438	2 x 3.5m traffic lanes plus 1.5m sealed shoulder.	6.8m wide carriageway with 1.0m wide shoulders.	Widening of 1.2m, although this is also required without the Plan Change.
Bradleys Rd	1,406	2,020	3,426	2 x 3.5m traffic lanes plus 1.5m sealed shoulder.	6.4m carriageway.	Widening of 3.6m, although 2.6m would be required without the Plan Change.
Whites Rd	752	3,728	4,480	2 x 3.5m traffic lanes plus 1.5m sealed shoulder.	6.9m carriageway.	Widening of 2.1m required, although widening of 0.3m would be required without the Plan Change.
Mill Rd	1,704	2,096	3,800	2 x 3.5m traffic lanes plus 1.5m sealed shoulder.	7m carriageway.	Widening of 3.0m, although 2.0m would be required without the Plan Change.

92. Subject to the widening identified in **Table 24**, these roads are considered to be capable of accommodating the traffic generated by the Plan Change site. It is assumed that specific Development Contributions would be sought for the additional widening required as a result of the proposed Plan Change.

Pedestrian & Cycle Provision

93. The proposed Plan Change 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 commercial areas is also intended to reduce the need to drive to day-to-day facilities, not only for the residents of the Plan Change site but also the existing residents in Ohoka. As such, there will be pedestrian and walkability benefits to the existing Ohoka residents through the provision of these commercial areas.

94. The Plan Change also provides for the shared path on Bradleys Road and Mill Road that will link to the wider shared path routes being planned by Council. The Plan Change will also provide a footpath on Whites Road up to the proposed threshold / gateway treatment and possibly further to the southern boundary of the ODP, as well as a link to the shared path on Mill Road.

95. 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.

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

97. Overall, it is considered that the pedestrian and cycle provision for the Plan Change site is acceptable.

Passenger Transport

98. Although the Plan Change does not have access to passenger transport services, drivers are able to travel to / from the Park and Ride facility at Kaiapoi south. Residents could also cycle on Mill Road to the northern Kaiapoi Park and Ride site (approximately 25 to 30 minutes cycle). These in turn provides access to a direct bus service to / from Christchurch City centre. As such, residents of the Plan Change site will be able to make use of the wider public transport as part of their travel patterns.

99. 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 Plan Change site would be able to make use of these.

100. 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

101. It is proposed to rezone the site at 535 Mill Road as a predominantly residential area that can accommodate approximately 850 residential Lots, two sites for local commercial activities and a special purpose area (for a school, retirement village or residential development). The Plan Change area is predicted to generate up to 1,022 vehicle movements per hour in the weekday peak hours and 8,026 vehicle movements per day.

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

    i. Option 1: Up to 850 dwellings plus the two commercial zones and a 500 pupil school;

    ii. Option 2: Up to 850 dwellings plus the two commercial zones and a retirement village; and

    iii. Option 3: Up to 900 dwellings plus the two commercial zones. This assumes that the special purpose area is not developed for a school or retirement village and adopts the underlying residential zoning.

103. The road cross-sections within the Plan Change area are proposed to be bespoke for this Plan Change to reflect the nature of the proposed subdivision. The typical cross-sections of these will be worked through and agreed with Council at a later date.

104. 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.

105. Direct property access is proposed for the land zoned Residential 4a. These accesses would be grouped to reduce the number of individual access locations to this road, with between two and six lots sharing accesses. Access design layouts have been provided in **Figure 13** and **Figure 14** for these locations.

106. Direct property access is also proposed to Mill Road and Whites Road, where 'Road Frontage Upgrades' are identified on the ODP. The intention is that the speed limit would be reduced through these areas making direct access acceptable.

107. A shared path is proposed along Bradleys Road and Mill Road, as per the WDC proposed route. The internal site layout includes a network of walking and cycling routes to facilitate these modes within the site. The provision of commercial centres within the Plan Change site also places day-to-day shopping needs within walking and cycling distance of the residents within the Plan Change and within Ohoka.

108. Access to passenger transport is provided at the Park and Ride sites in Kaiapoi. Whilst this does not place passenger transport within walking distance of the application site, it is a viable mode for people working in central Christchurch.

109. The intersection spacing between proposed internal roads and the existing road network would comply with the requirements set out in Austroads and is considered to be acceptable. The spacing of internal intersections would be consistent with Christchurch guidance and the Silverstream subdivision (in Kaiapoi) and is also considered to be acceptable. The internal road network would also be subject to a Road Safety Audit at the subdivision stage.

110. The operation of the external road network has been assessed. The key intersections are predicted to operate satisfactorily, and it is noted that the Tram Road / Bradleys Road/ McHughes Road intersection is planned for an upgrade in the WDC LTP. Widening has been identified as being required to:

    i. Tram Road (regardless of this Plan Change);

    ii. Bradleys Road (regardless of this Plan Change);

    iii. Whites Road, where some widening is required without the Plan Change and further widening required as a result of the additional traffic associated with this Plan Change; and

    iv. Mill Road, where again some widening is already required but additional widening has been identified to accommodate the traffic associated with this Plan Change.

Conclusion

111. Subject to the above road widening, the traffic effects of the proposed Plan Change are considered to be acceptable.

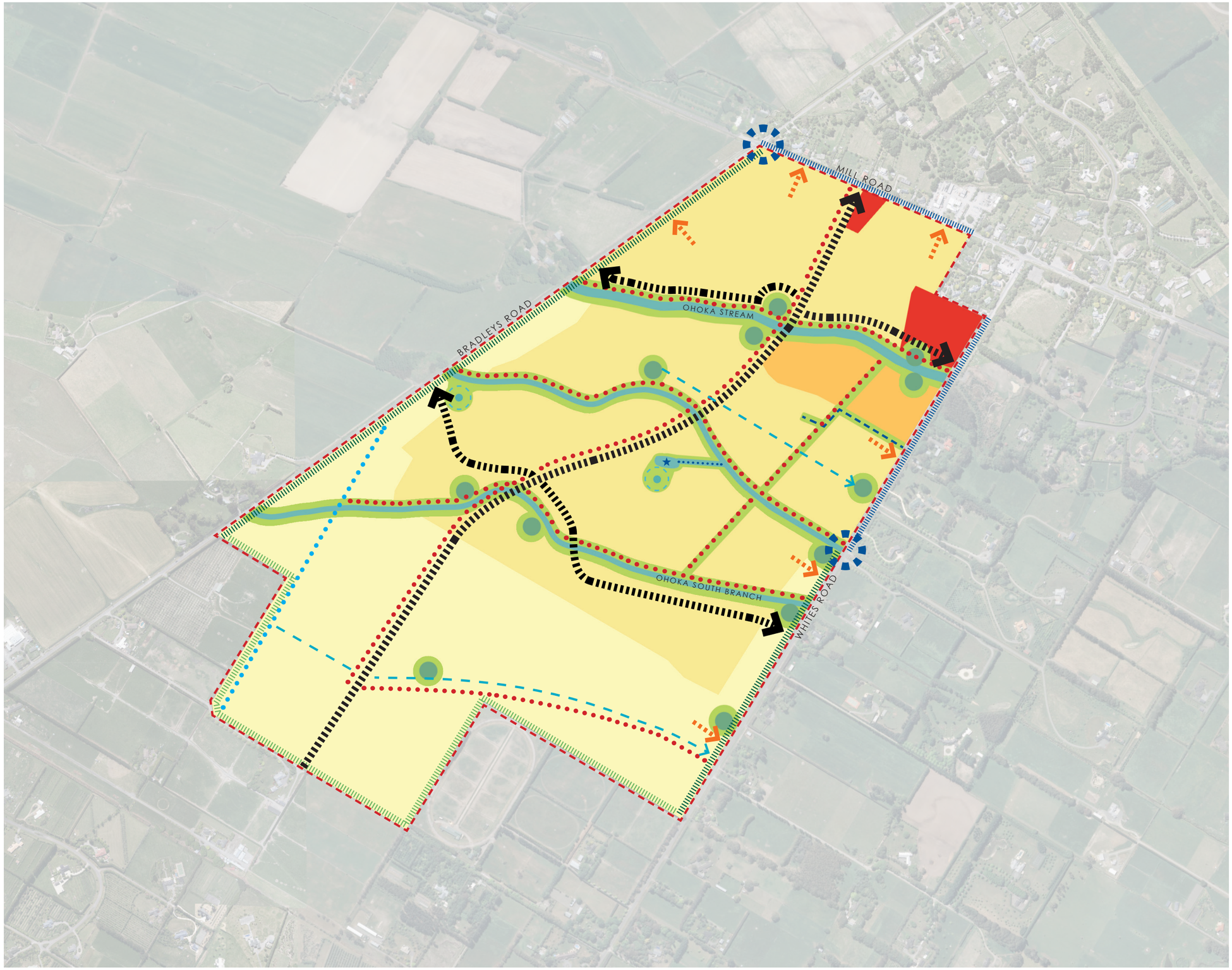
Appendix 1

Outline Development Plan

OUTLINE DEVELOPMENT PLAN - MILL ROAD

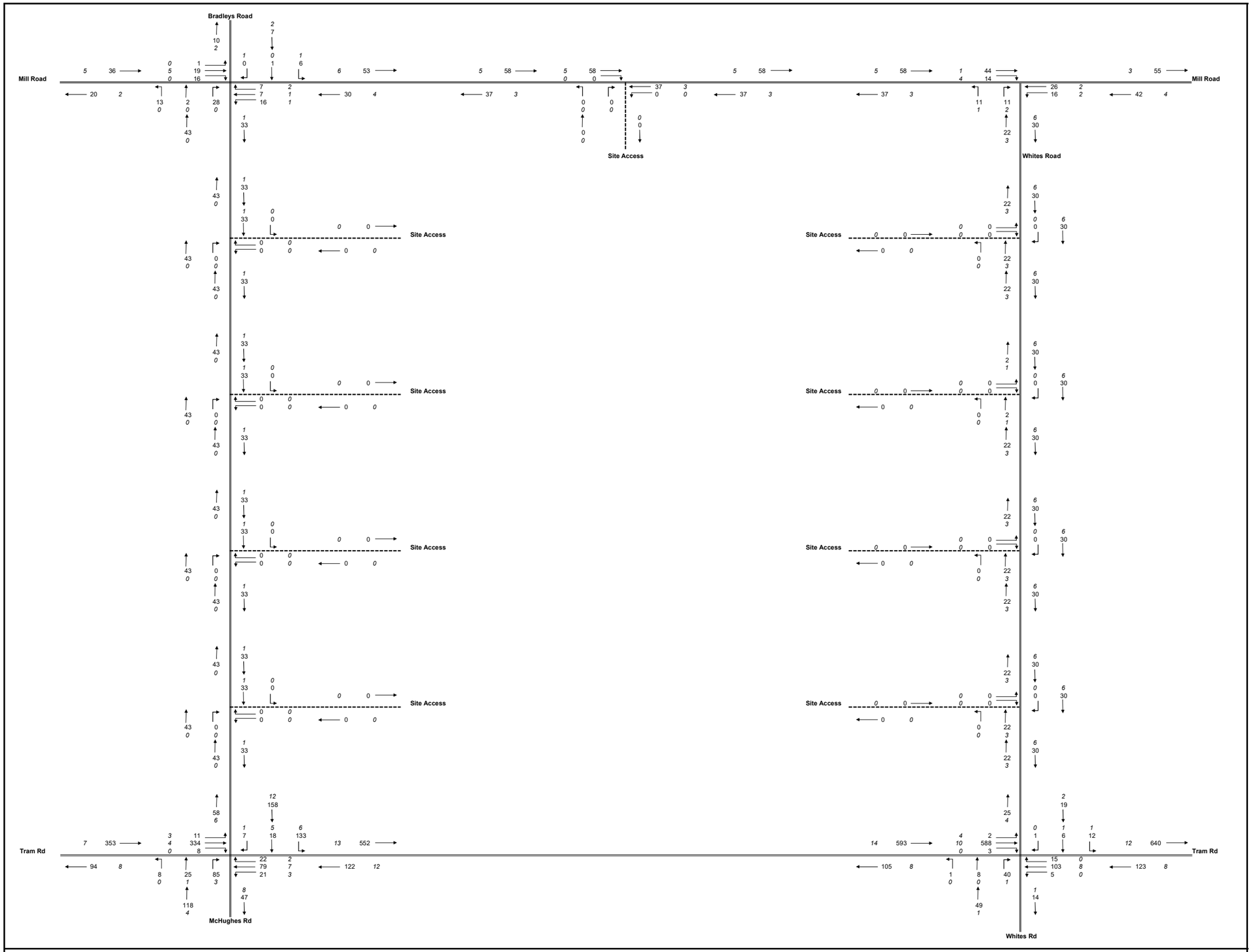
LEGEND

- Outline Development Plan Area
- Residential 3
- Residential 4a
- Residential 8
- Business 4 Zone
- Indicative Road
- Indicative Local Road Connection
- Threshold / Gateway
- Indicative Pedestrian Network
- Indicative Stormwater Management Areas (size and location to be confirmed)
- Existing / Naturalised Waterways
- Existing Springs and Associated Setback
- Stormwater Conveyance Flow Path
- Groundwater Seep
- Existing Pond (size and location to be confirmed)
- Southern Spring Channel
- Green Network
- Landscape Treatment A
- Landscape Treatment B
- Extent of Road Frontage Upgrade
- Overhead 66kV Power Lines

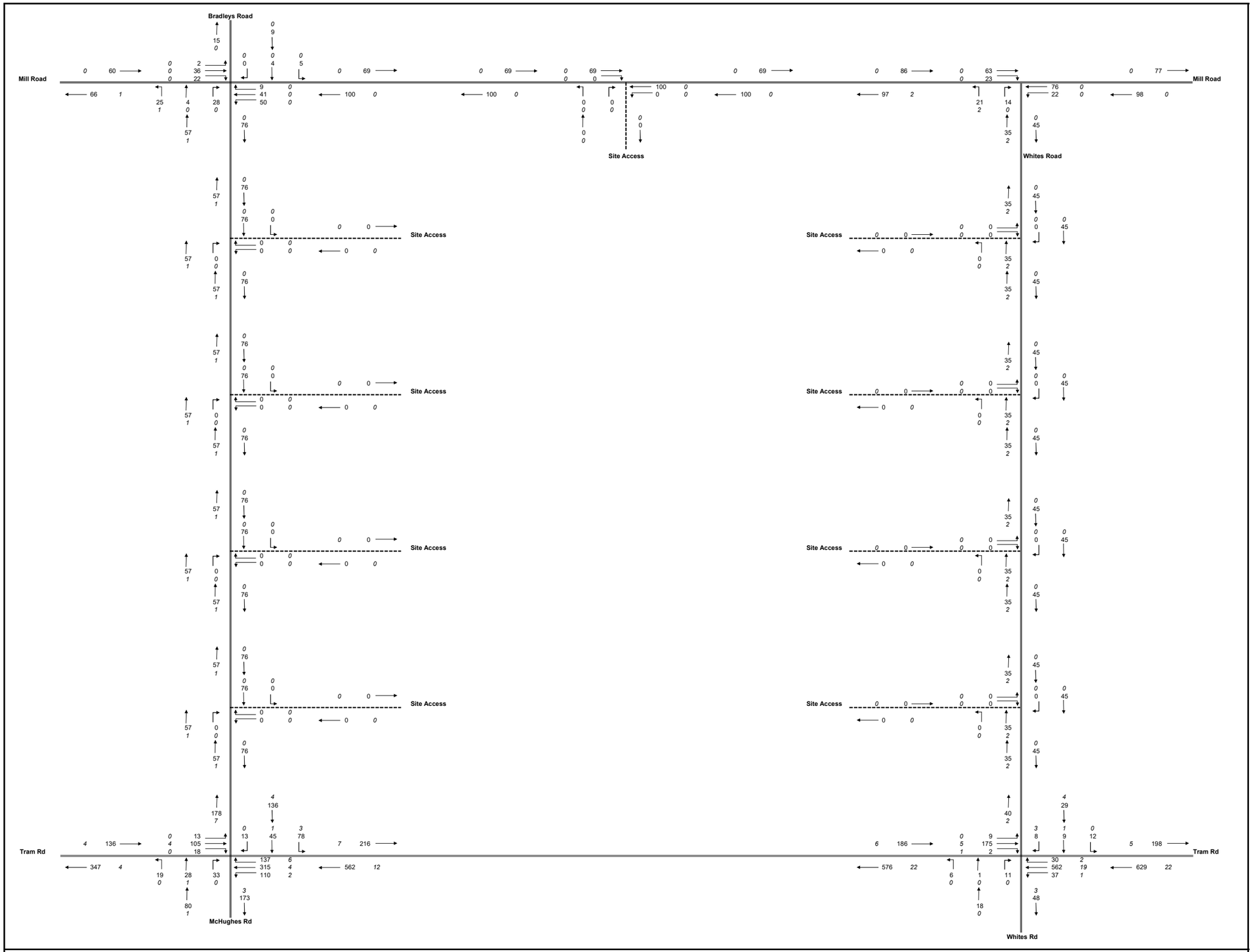


Appendix 2

2021 Traffic Count Data



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



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

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	63.2
2	T1	26	1	27	3.8	0.380	20.1	LOS C	1.6	11.8	0.73	1.05	0.96	52.3
3	R2	88	3	93	3.4	0.380	22.0	LOS C	1.6	11.8	0.73	1.05	0.96	52.6
Approach		122	4	128	3.3	0.380	20.8	LOS C	1.6	11.8	0.70	1.04	0.91	53.1
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	62.5
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	0.029	8.9	LOS A	0.1	0.9	0.43	0.66	0.43	59.5
Approach		134	12	141	9.0	0.049	2.9	NA	0.1	0.9	0.08	0.23	0.08	71.9
North: Bradleys Rd														
7	L2	139	6	146	4.3	0.189	11.5	LOS B	0.7	5.2	0.46	0.94	0.46	60.4
8	T1	23	5	24	21.7	0.119	20.3	LOS C	0.4	3.3	0.66	1.01	0.66	49.8
9	R2	8	1	8	12.5	0.119	20.7	LOS C	0.4	3.3	0.66	1.01	0.66	51.7
Approach		170	12	179	7.1	0.189	13.1	LOS B	0.7	5.2	0.50	0.95	0.50	58.2
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	58.8
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	64.4
Approach		360	7	379	1.9	0.182	0.5	NA	0.0	0.2	0.00	0.04	0.00	78.4
All Vehicles		786	35	827	4.5	0.380	6.8	NA	1.6	11.8	0.23	0.42	0.27	67.4

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 [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	62.2
2	T1	29	1	31	3.4	0.260	23.7	LOS C	0.9	6.7	0.77	1.02	0.87	51.0
3	R2	33	0	35	0.0	0.260	23.2	LOS C	0.9	6.7	0.77	1.02	0.87	51.9
Approach		81	1	85	1.2	0.260	20.5	LOS C	0.9	6.7	0.68	0.99	0.76	53.7
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	64.8
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	62.8
Approach		574	12	604	2.1	0.173	3.2	NA	0.5	3.7	0.06	0.27	0.06	71.8
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	62.0
8	T1	46	1	48	2.2	0.276	25.8	LOS D	1.0	7.2	0.78	1.03	0.90	49.8
9	R2	13	0	14	0.0	0.276	24.9	LOS C	1.0	7.2	0.78	1.03	0.90	50.2
Approach		140	4	147	2.9	0.276	16.3	LOS C	1.0	7.2	0.46	0.95	0.51	56.2
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	65.4
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	63.2
Approach		140	4	147	2.9	0.060	1.8	NA	0.1	0.6	0.06	0.14	0.06	75.8
All Vehicles		935	21	984	2.2	0.276	6.5	NA	1.0	7.2	0.18	0.42	0.19	67.5

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.

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	0.157	10.0	LOS A	0.6	3.9	0.71	0.99	0.71	62.0
2	T1	8	0	8	0.0	0.157	20.9	LOS C	0.6	3.9	0.71	0.99	0.71	62.0
3	R2	41	1	43	2.4	0.157	19.1	LOS C	0.6	3.9	0.71	0.99	0.71	61.3
Approach		50	1	53	2.0	0.157	19.2	LOS C	0.6	3.9	0.71	0.99	0.71	61.4
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	87.8
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	71.3
Approach		131	8	138	6.1	0.065	1.5	NA	0.1	0.5	0.06	0.11	0.06	94.3
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	69.4
8	T1	7	1	7	14.3	0.042	23.4	LOS C	0.1	1.2	0.77	1.01	0.77	54.1
9	R2	2	1	2	50.0	0.042	32.4	LOS D	0.1	1.2	0.77	1.01	0.77	47.6
Approach		21	2	22	9.5	0.042	18.4	LOS C	0.1	1.2	0.63	0.95	0.63	61.0
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	62.9
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	74.1
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	2.0	NA	0.6	3.9	0.07	0.11	0.07	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.

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 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	8.8	LOS A	0.2	1.5	0.15	0.92	0.15	56.7
2	T1	4	0	4	0.0	0.058	8.7	LOS A	0.2	1.5	0.15	0.92	0.15	57.5
3	R2	28	0	29	0.0	0.058	8.7	LOS A	0.2	1.5	0.15	0.92	0.15	57.3
Approach		58	1	61	1.7	0.058	8.7	LOS A	0.2	1.5	0.15	0.92	0.15	57.1
East: Mill Rd														
4	L2	50	0	53	0.0	0.056	6.4	LOS A	0.1	0.5	0.03	0.36	0.03	62.3
5	T1	41	0	43	0.0	0.056	0.0	LOS A	0.1	0.5	0.03	0.36	0.03	65.2
6	R2	9	0	9	0.0	0.056	6.2	LOS A	0.1	0.5	0.03	0.36	0.03	61.7
Approach		100	0	105	0.0	0.056	3.8	NA	0.1	0.5	0.03	0.36	0.03	63.4
North: Bradleys Rd														
7	L2	5	0	5	0.0	0.009	8.6	LOS A	0.0	0.2	0.12	0.95	0.12	57.8
8	T1	4	0	4	0.0	0.009	8.8	LOS A	0.0	0.2	0.12	0.95	0.12	57.5
9	R2	1	0	1	0.0	0.009	8.6	LOS A	0.0	0.2	0.12	0.95	0.12	57.3
Approach		10	0	11	0.0	0.009	8.7	LOS A	0.0	0.2	0.12	0.95	0.12	57.6
West: Mill Rd														
10	L2	2	0	2	0.0	0.035	6.6	LOS A	0.1	0.9	0.14	0.24	0.14	63.1
11	T1	36	0	38	0.0	0.035	0.2	LOS A	0.1	0.9	0.14	0.24	0.14	66.1
12	R2	22	0	23	0.0	0.035	6.4	LOS A	0.1	0.9	0.14	0.24	0.14	62.5
Approach		60	0	63	0.0	0.035	2.7	NA	0.1	0.9	0.14	0.24	0.14	64.6
All Vehicles		228	1	240	0.4	0.058	5.0	NA	0.2	1.5	0.10	0.50	0.10	61.7

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 [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	8.5	LOS A	0.1	1.0	0.06	0.96	0.06	57.9
2	T1	2	0	2	0.0	0.043	8.4	LOS A	0.1	1.0	0.06	0.96	0.06	57.6
3	R2	28	0	29	0.0	0.043	8.3	LOS A	0.1	1.0	0.06	0.96	0.06	57.4
Approach		43	0	45	0.0	0.043	8.3	LOS A	0.1	1.0	0.06	0.96	0.06	57.6
East: Mill Rd														
4	L2	17	1	18	5.9	0.021	6.5	LOS A	0.1	0.5	0.07	0.45	0.07	59.2
5	T1	8	1	8	12.5	0.021	0.1	LOS A	0.1	0.5	0.07	0.45	0.07	63.8
6	R2	9	2	9	22.2	0.021	6.5	LOS A	0.1	0.5	0.07	0.45	0.07	54.1
Approach		34	4	36	11.8	0.021	5.0	NA	0.1	0.5	0.07	0.45	0.07	58.7
North: Bradleys Rd														
7	L2	7	1	7	14.3	0.008	9.2	LOS A	0.0	0.3	0.10	0.97	0.10	53.6
8	T1	1	0	1	0.0	0.008	8.4	LOS A	0.0	0.3	0.10	0.97	0.10	57.1
9	R2	1	1	1	100.0	0.008	13.2	LOS B	0.0	0.3	0.10	0.97	0.10	38.1
Approach		9	2	9	22.2	0.008	9.6	LOS A	0.0	0.3	0.10	0.97	0.10	51.6
West: Mill Rd														
10	L2	1	0	1	0.0	0.024	6.4	LOS A	0.1	0.6	0.07	0.26	0.07	63.0
11	T1	24	5	25	20.8	0.024	0.0	LOS A	0.1	0.6	0.07	0.26	0.07	66.0
12	R2	16	0	17	0.0	0.024	6.2	LOS A	0.1	0.6	0.07	0.26	0.07	62.4
Approach		41	5	43	12.2	0.024	2.6	NA	0.1	0.6	0.07	0.26	0.07	64.4
All Vehicles		127	11	134	8.7	0.043	5.7	NA	0.1	1.0	0.07	0.60	0.07	59.4

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 6

Mill Rd / Whites Rd Intersection - Existing Operation

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	9.2	LOS A	0.1	0.6	0.18	0.90	0.18	55.4
3	R2	14	0	15	0.0	0.015	8.6	LOS A	0.0	0.3	0.26	0.87	0.26	57.5
Approach		37	2	39	5.4	0.019	8.9	LOS A	0.1	0.6	0.21	0.89	0.21	56.2
East: Mill Rd														
4	L2	22	0	23	0.0	0.054	6.4	LOS A	0.0	0.0	0.00	0.14	0.00	64.9
5	T1	76	0	80	0.0	0.054	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	68.1
Approach		98	0	103	0.0	0.054	1.4	NA	0.0	0.0	0.00	0.14	0.00	67.4
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	67.2
12	R2	23	0	24	0.0	0.049	6.5	LOS A	0.1	1.0	0.12	0.16	0.12	63.7
Approach		86	0	91	0.0	0.049	1.8	NA	0.1	1.0	0.12	0.16	0.12	66.2
All Vehicles		221	2	233	0.9	0.054	2.8	NA	0.1	1.0	0.08	0.27	0.08	64.8

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.

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	9.0	LOS A	0.0	0.3	0.10	0.94	0.10	55.5
3	R2	13	2	14	15.4	0.014	9.0	LOS A	0.0	0.4	0.20	0.91	0.20	53.5
Approach		25	3	26	12.0	0.014	9.0	LOS A	0.0	0.4	0.15	0.92	0.15	54.4
East: Mill Rd														
4	L2	18	2	19	11.1	0.027	6.5	LOS A	0.0	0.0	0.00	0.24	0.00	60.2
5	T1	28	2	29	7.1	0.027	0.0	LOS A	0.0	0.0	0.00	0.24	0.00	66.9
Approach		46	4	48	8.7	0.027	2.6	NA	0.0	0.0	0.00	0.24	0.00	64.1
West: Mill Rd														
11	T1	45	1	47	2.2	0.038	0.1	LOS A	0.1	0.9	0.09	0.17	0.09	67.6
12	R2	18	4	19	22.2	0.038	6.7	LOS A	0.1	0.9	0.09	0.17	0.09	57.1
Approach		63	5	66	7.9	0.038	2.0	NA	0.1	0.9	0.09	0.17	0.09	64.2
All Vehicles		134	12	141	9.0	0.038	3.5	NA	0.1	0.9	0.07	0.34	0.07	62.1

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.

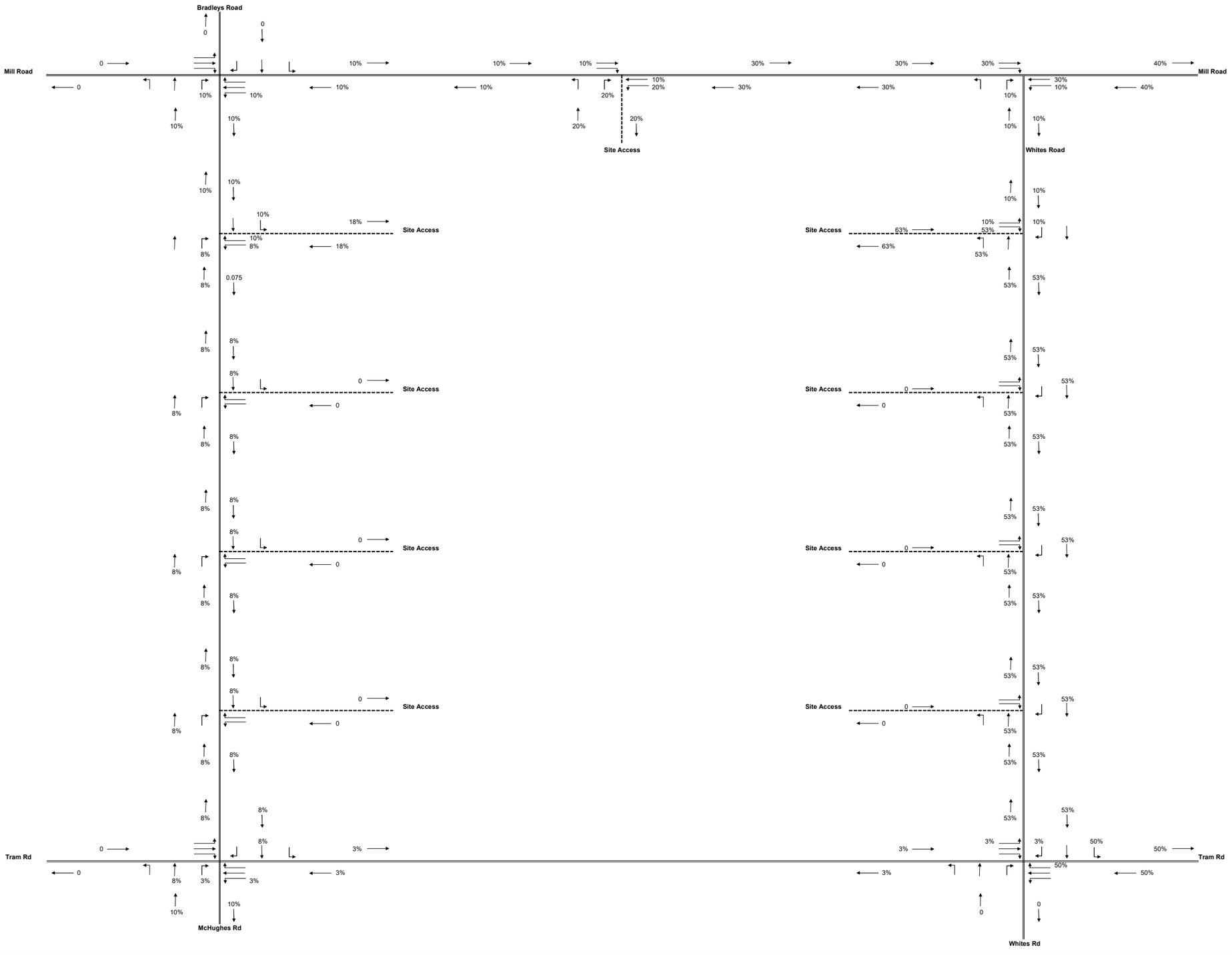
Appendix 7

Residential Traffic Distribution

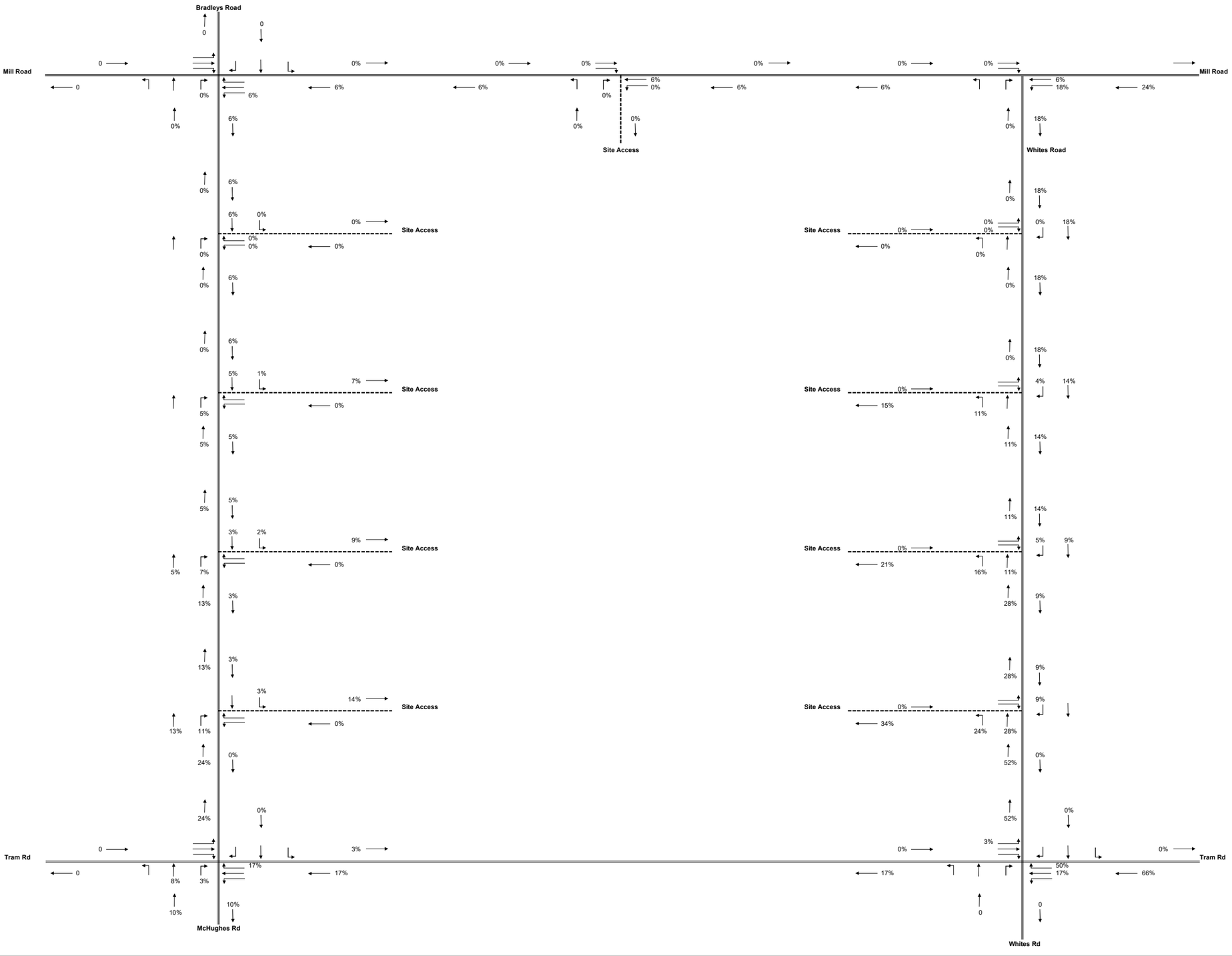
Destination	Direction	Percentage
Rangiora Central	North	8%
Mandeville-Ohoka	South-West	8%
Fernside	North	2%
Lilybrook	North	1%
Southbrook	North	7%
Kaiapoi Central	North-East	4%
Clarkville	South-East	1%
Christchurch Airport	SH1	7%
Swannanoa - Eyertron	South-West	2%
Northlands	SH1	2%
Belfast East	SH1	1%
Kaiapoi North-West	North-East	1%
Russley	SH1	6%
Riccarton Central	SH1	2%
Merrivale	SH1	2%
Northcote	SH1	1%
Christchurch Central	SH1	4%
Bromley North	SH1	1%
Islington-Hornby	SH1	3%
Hornby Central	SH1	2%
Hagley Park	SH1	3%
Christchurch Central West	SH1	4%
Christchurch Central South	SH1	3%
Sockburn South	SH1	5%
Addington North	SH1	2%
Lancaster Park	SH1	3%
Woolston South	SH1	2%
Middleton	SH1	5%
Tower Junction	SH1	3%
Sydenham Central	SH1	5%
Total	-	***100%***

Appendix 8

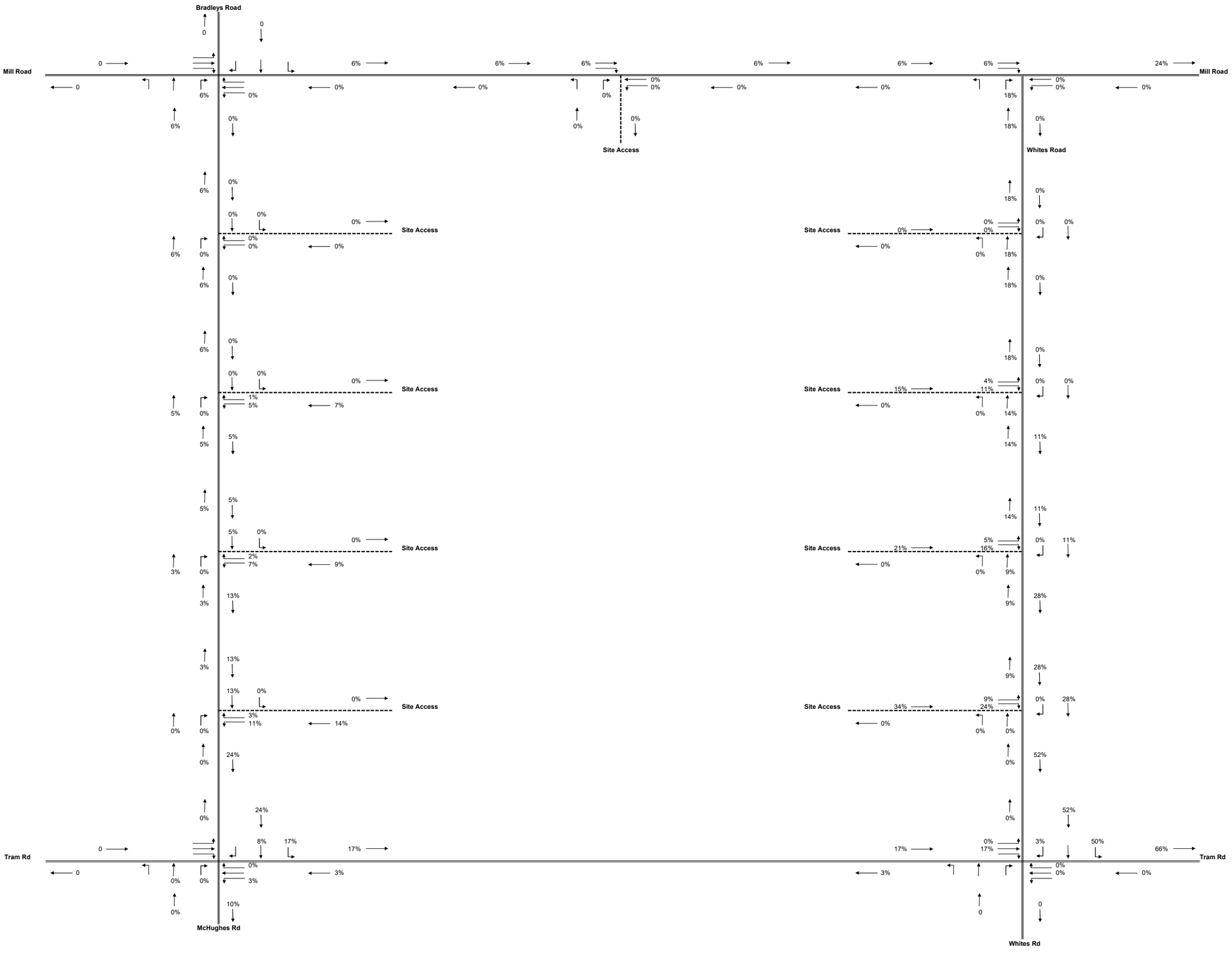
Residential Traffic Distribution & Assignment



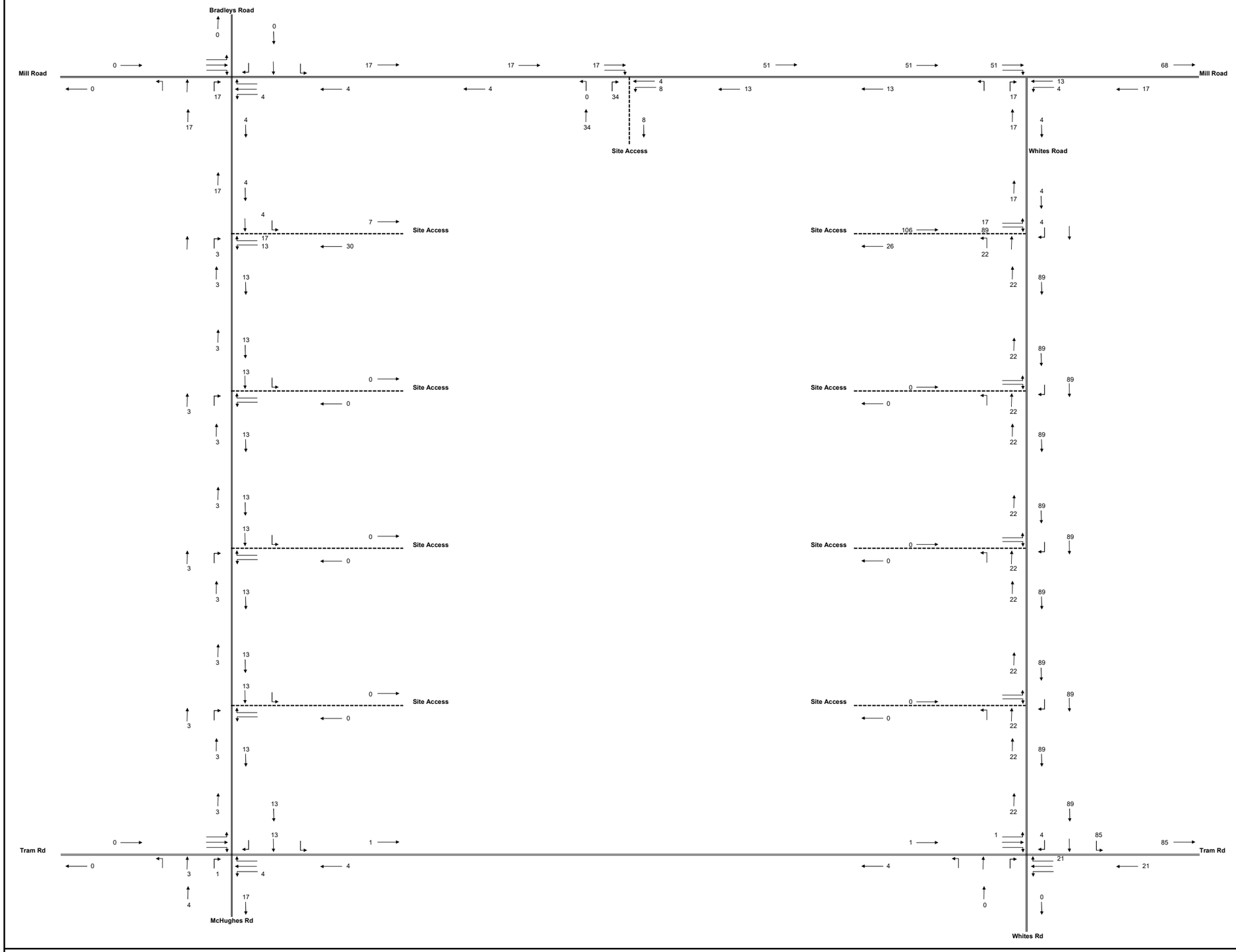
021-034: Ohoka Plan Change
Northern Site Distribution - Residential



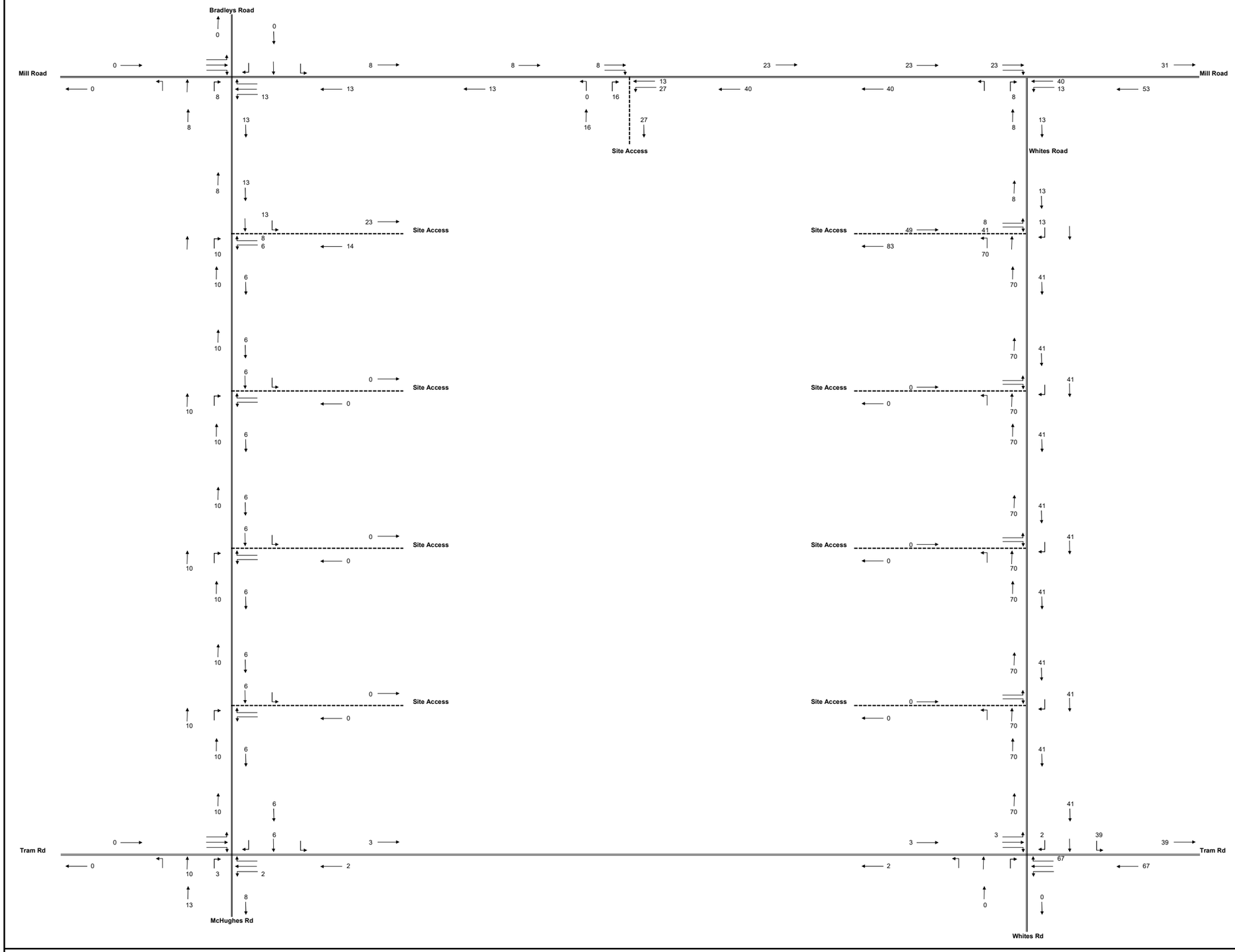
021-034: Ohoka Plan Change
Southern Site Distribution - Residential Arrivals



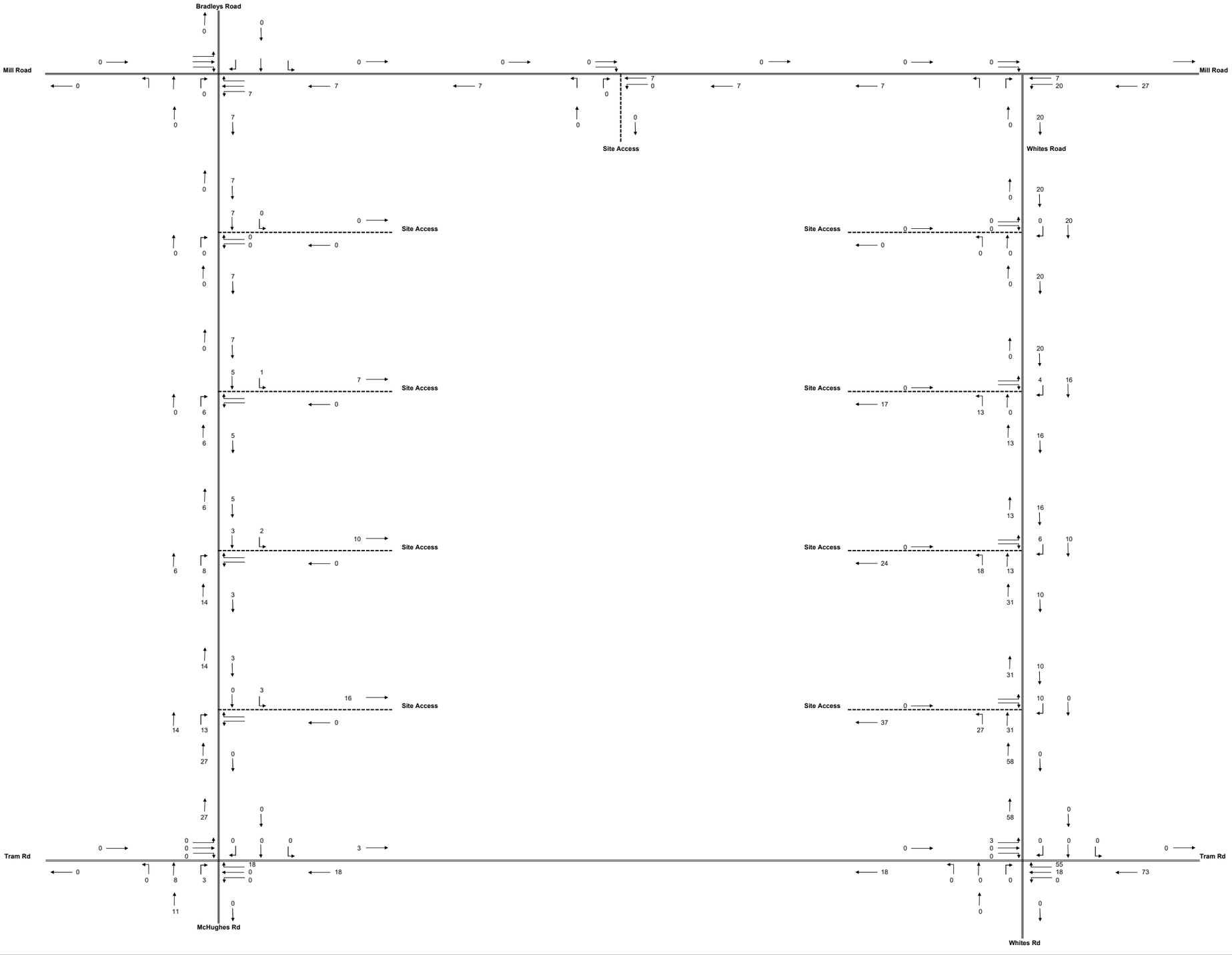
021-034: Ohoka Plan Change
Southern Site Distribution - Residential Departures



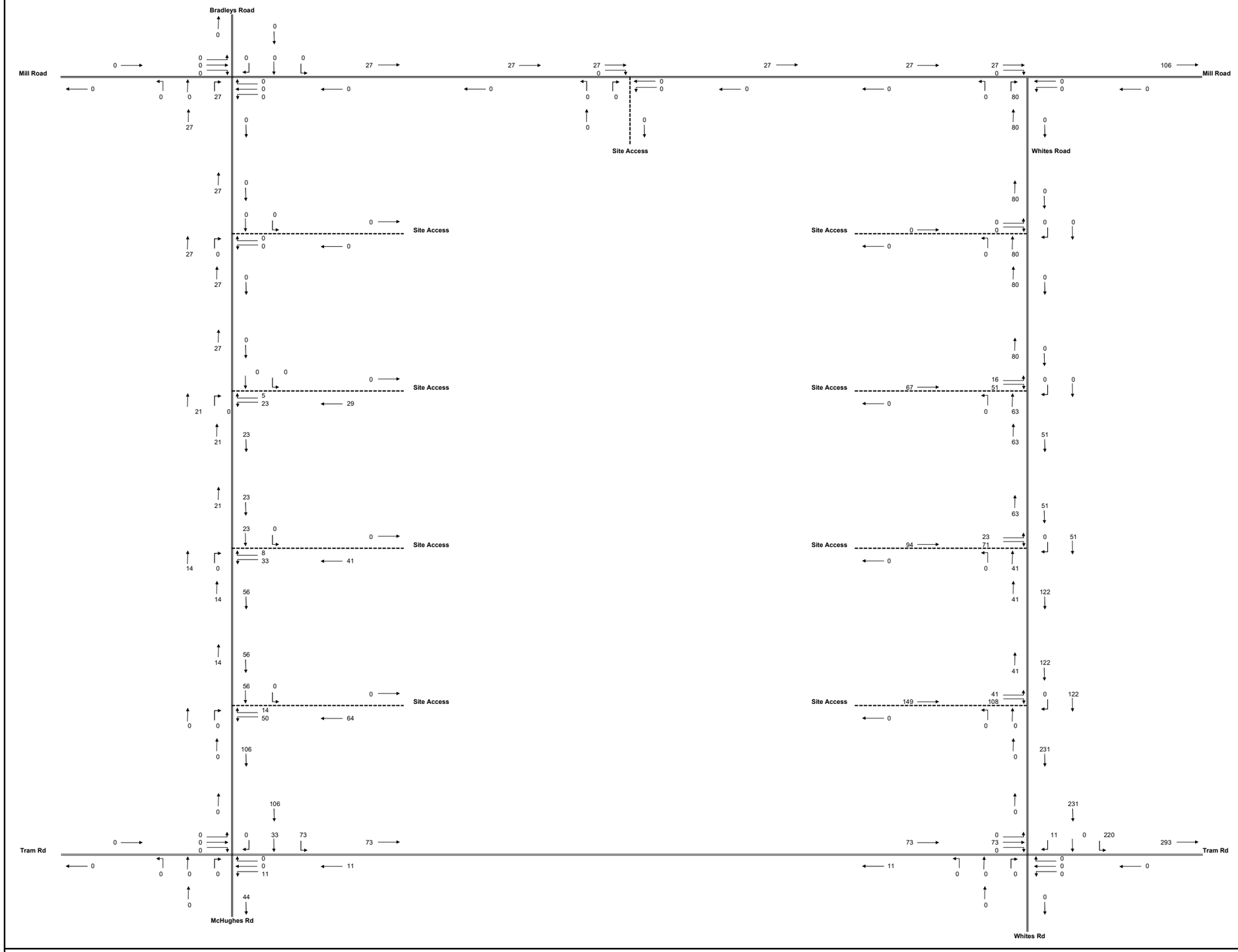
021-034: Ohoka Plan Change
Northern Site Assignment - Residential
AM Peak



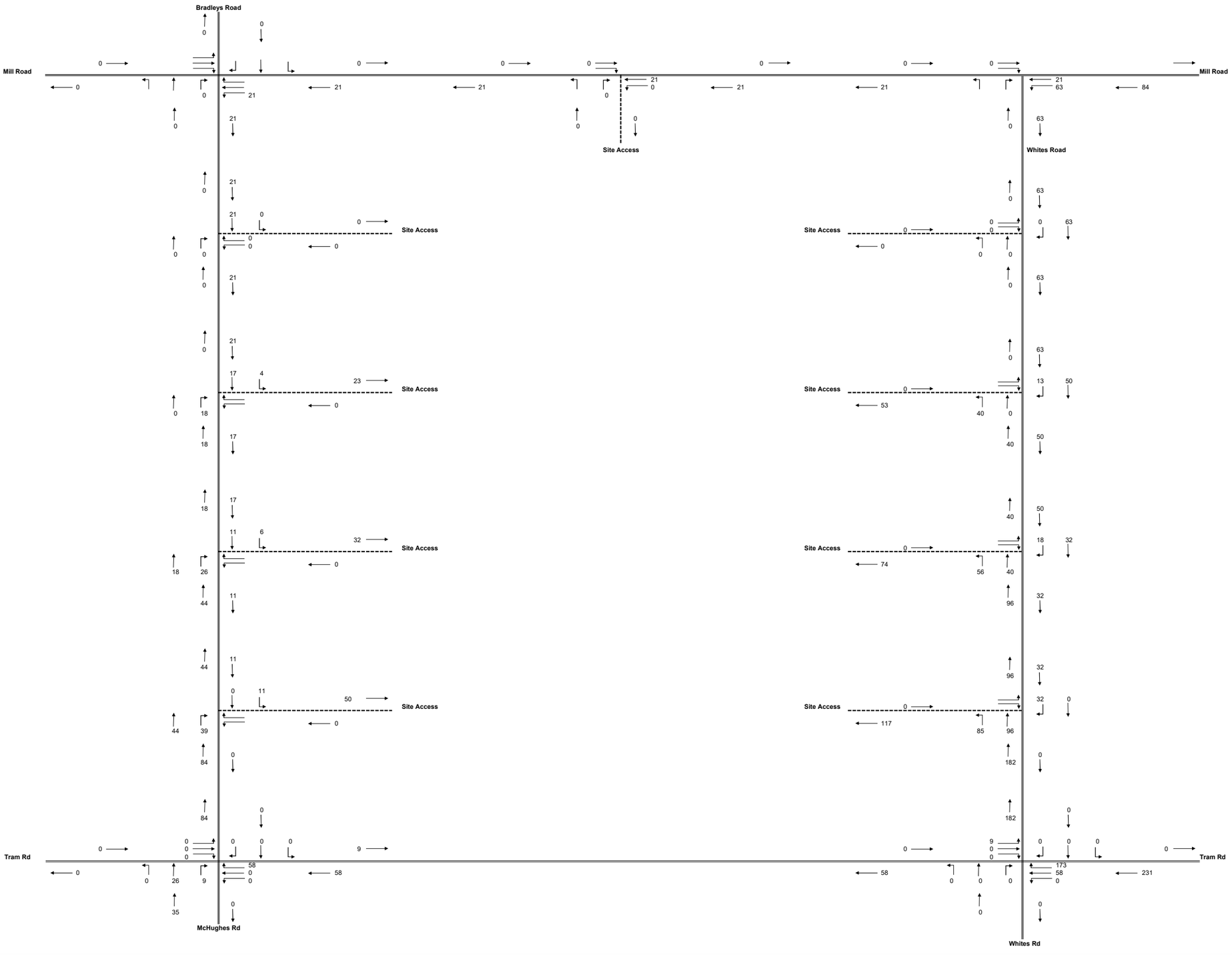
021-034: Ohoka Plan Change
Northern Site Assignment - Residential
PM Peak



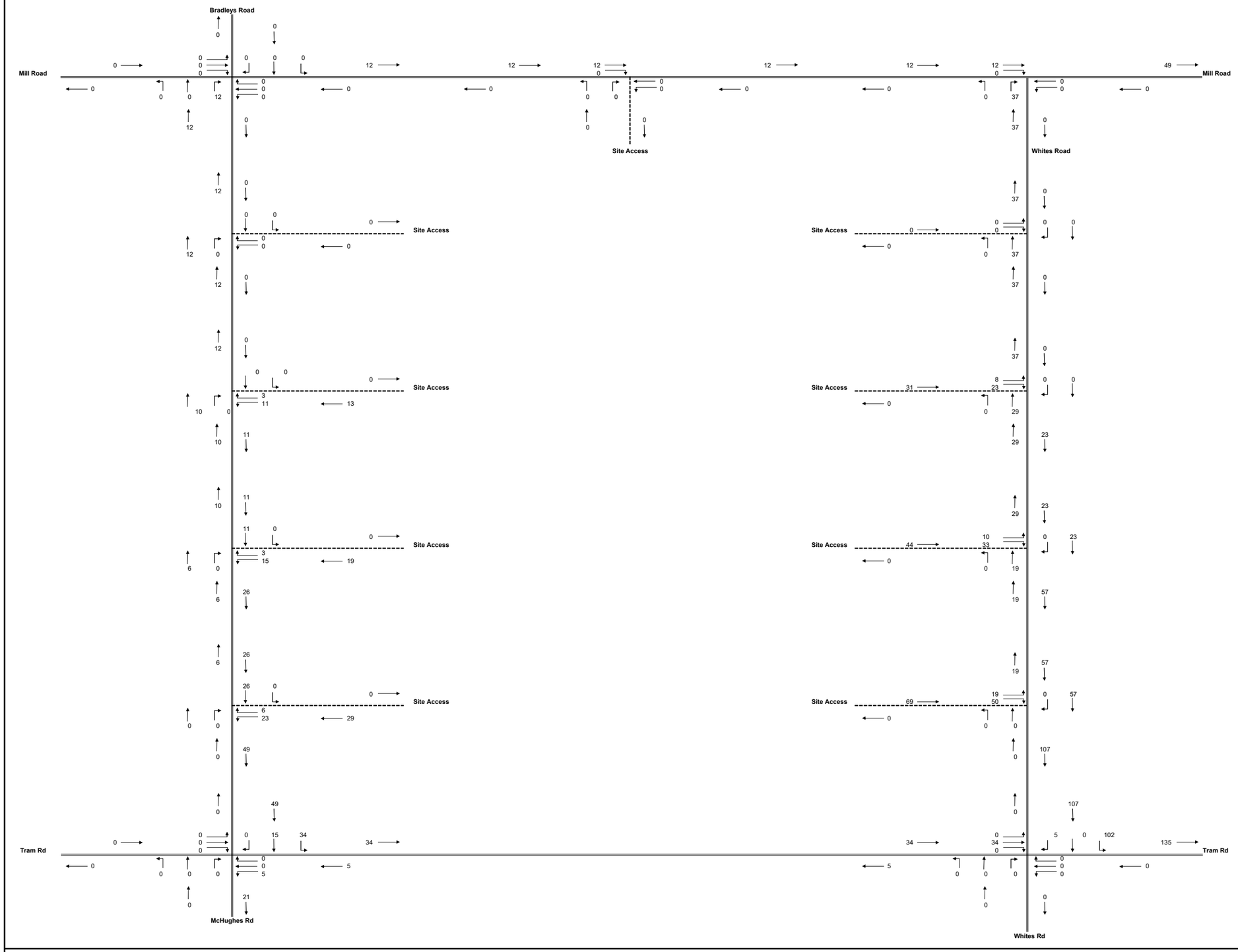
021-034: Ohoka Plan Change
Southern Site Assignment - Residential
Arrivals - AM Peak



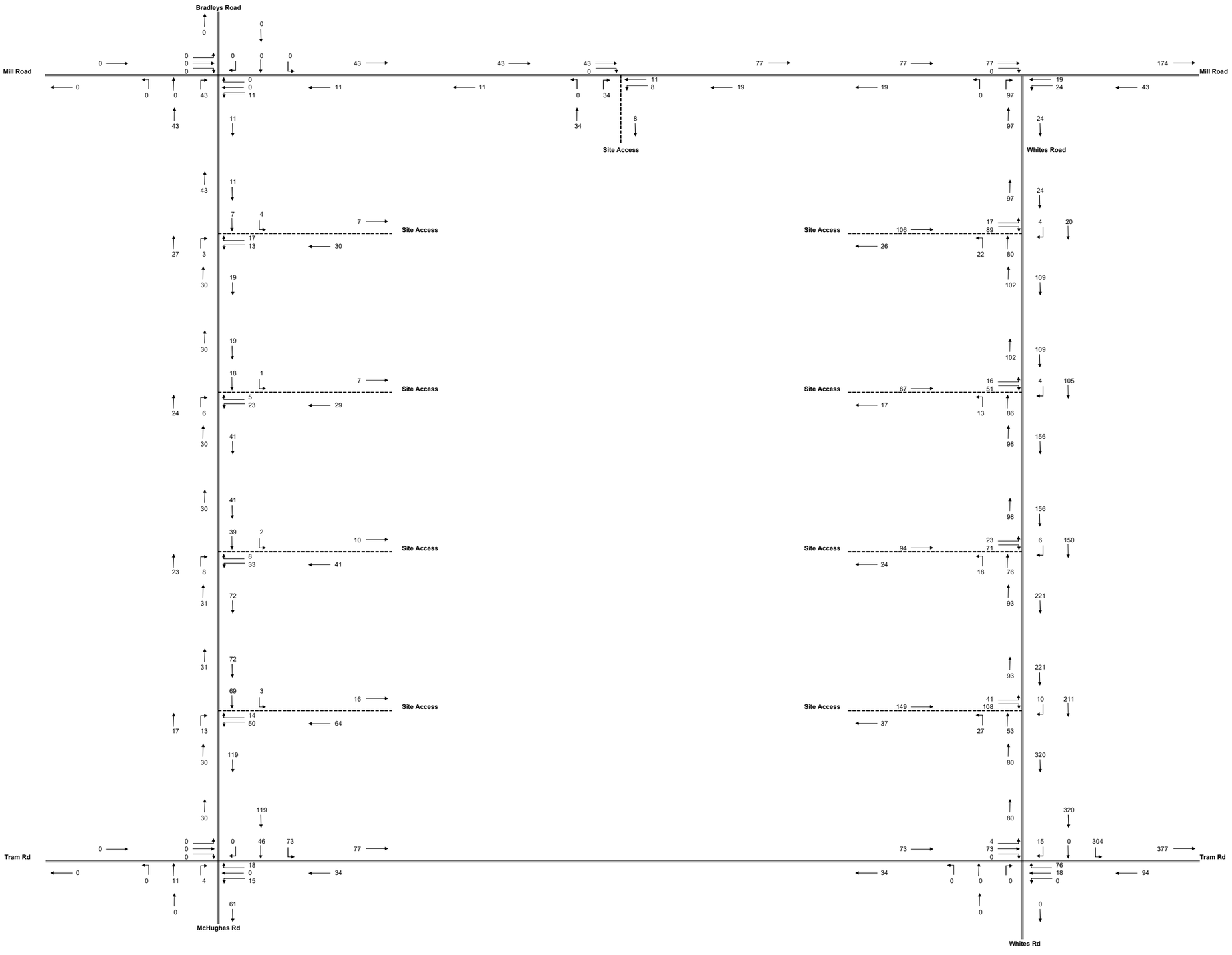
021-034: Ohoka Plan Change
Southern Site Assignment - Residential
Departures - AM



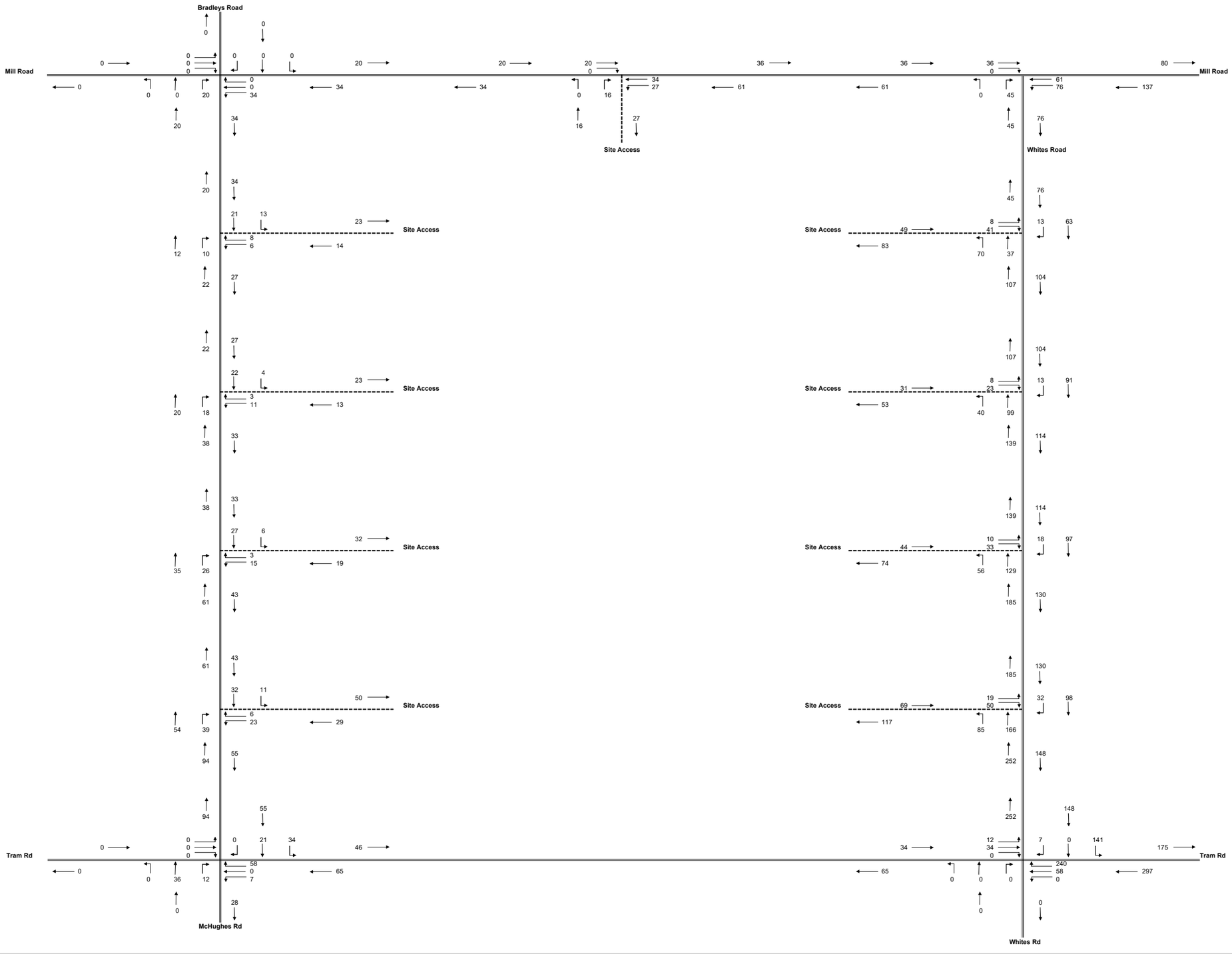
021-034: Ohoka Plan Change
Southern Site Assignment - Residential
Arrivals - PM



021-034: Ohoka Plan Change
Southern Site Assignment - Residential
Departures - PM



021-034: Ohoka Plan Change
Plan Change Traffic - Residential
AM Peak



021-034: Ohoka Plan Change
Plan Change Traffic - Residential
PM Peak

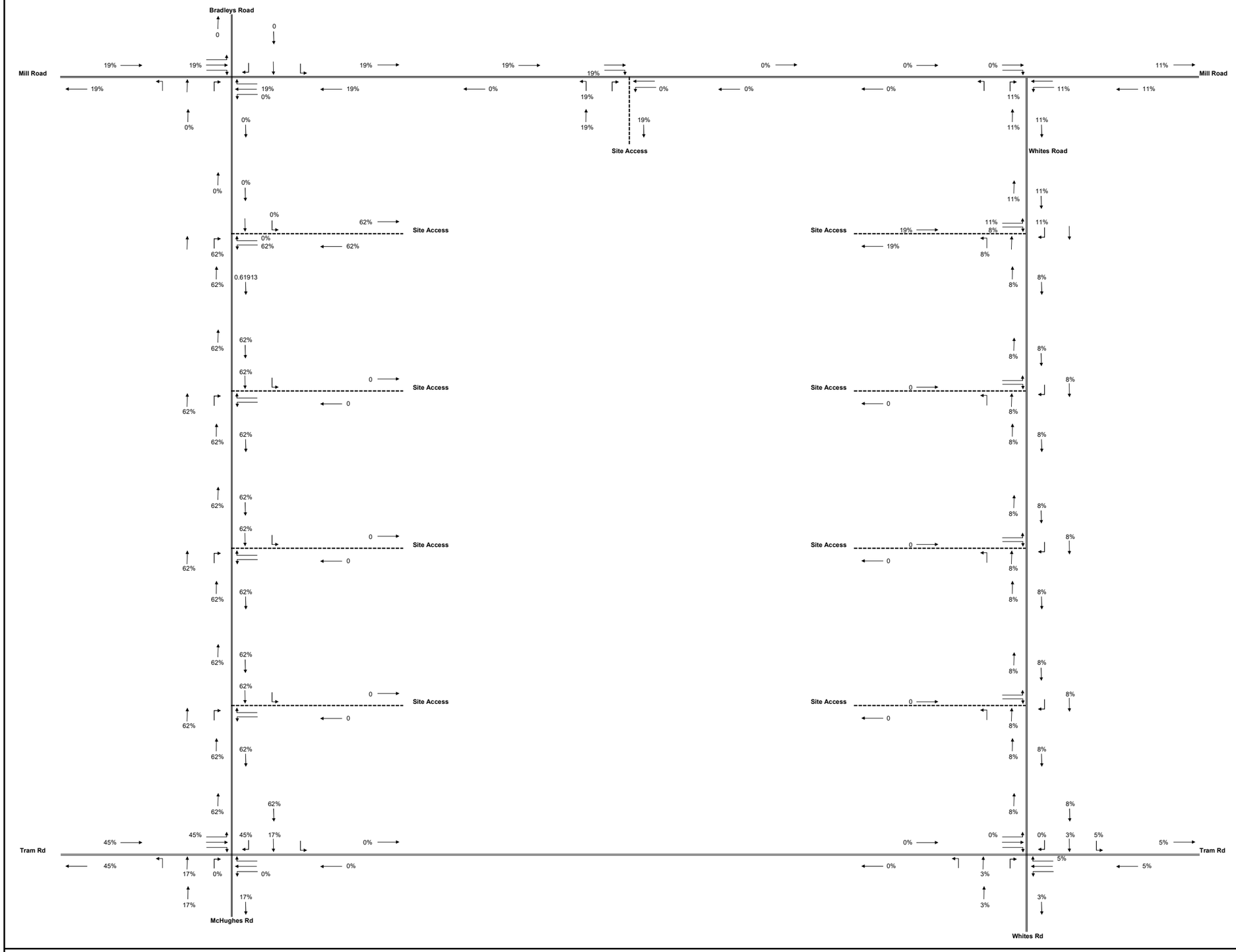
Appendix 9

School Traffic Distribution

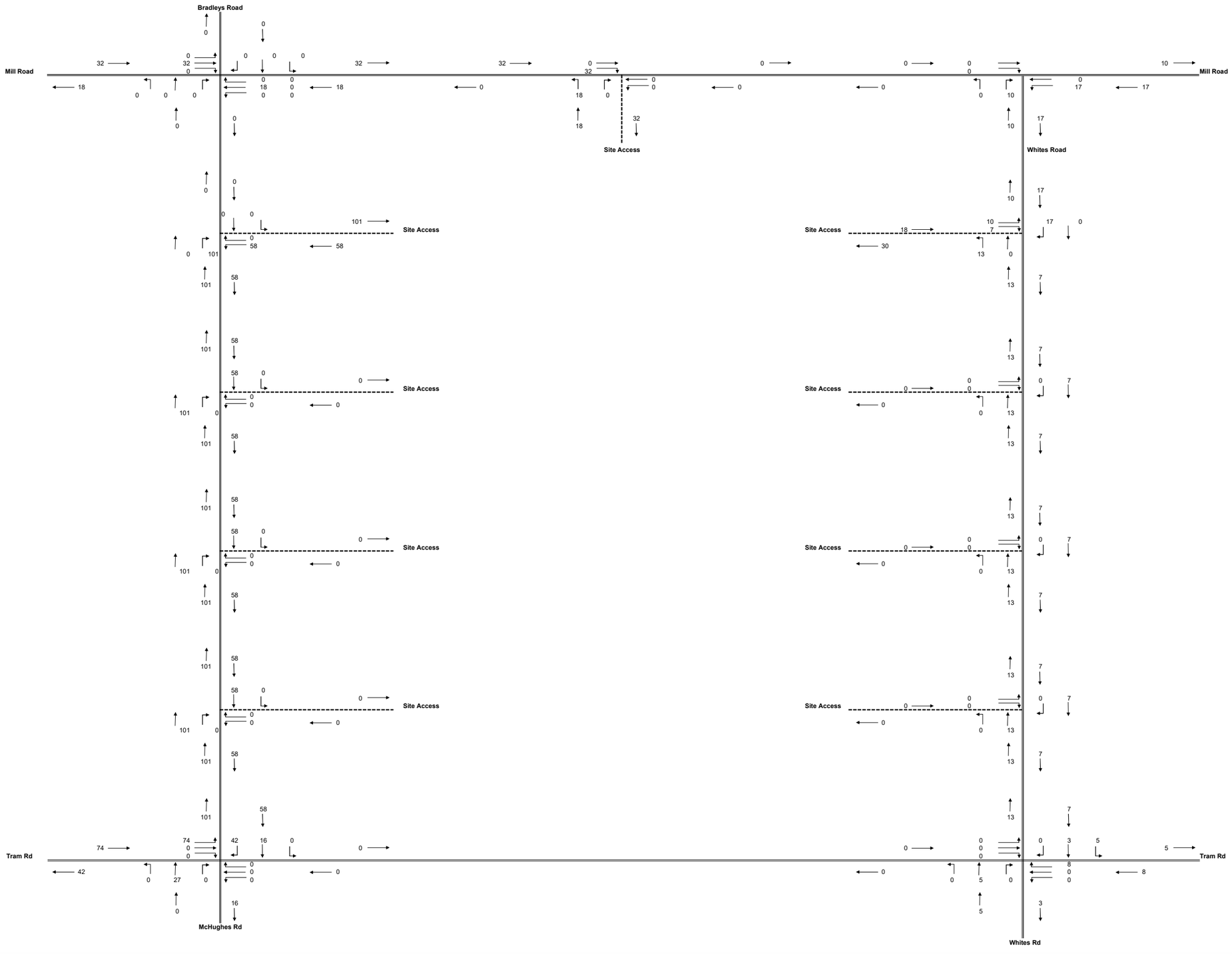
Origin	Resident Students	%	Distribution	%
Cust	543	17%	Mill Road (W)	8.5%
			Tram Rd (W)	8.5%
West Eyreton	375	12%	Tram Rd (W)	12%
Eyrewell	441	14%	Tram Rd (W)	14%
Swannanoa	270	8%	McHughs Rd	6%
			Whites Rd	3%
Clarkville	327	10%	Mill Rd (E)	5%
			Tram Rd (E)	5%
Ohoka	879	28%	Tram Rd (W)	11%
			McHughs Rd	11%
			Mill Rd (E)	6%
Fernside	348	11%	Mill Road (W)	11%
Total	3183	100%		100.0%

Appendix 10

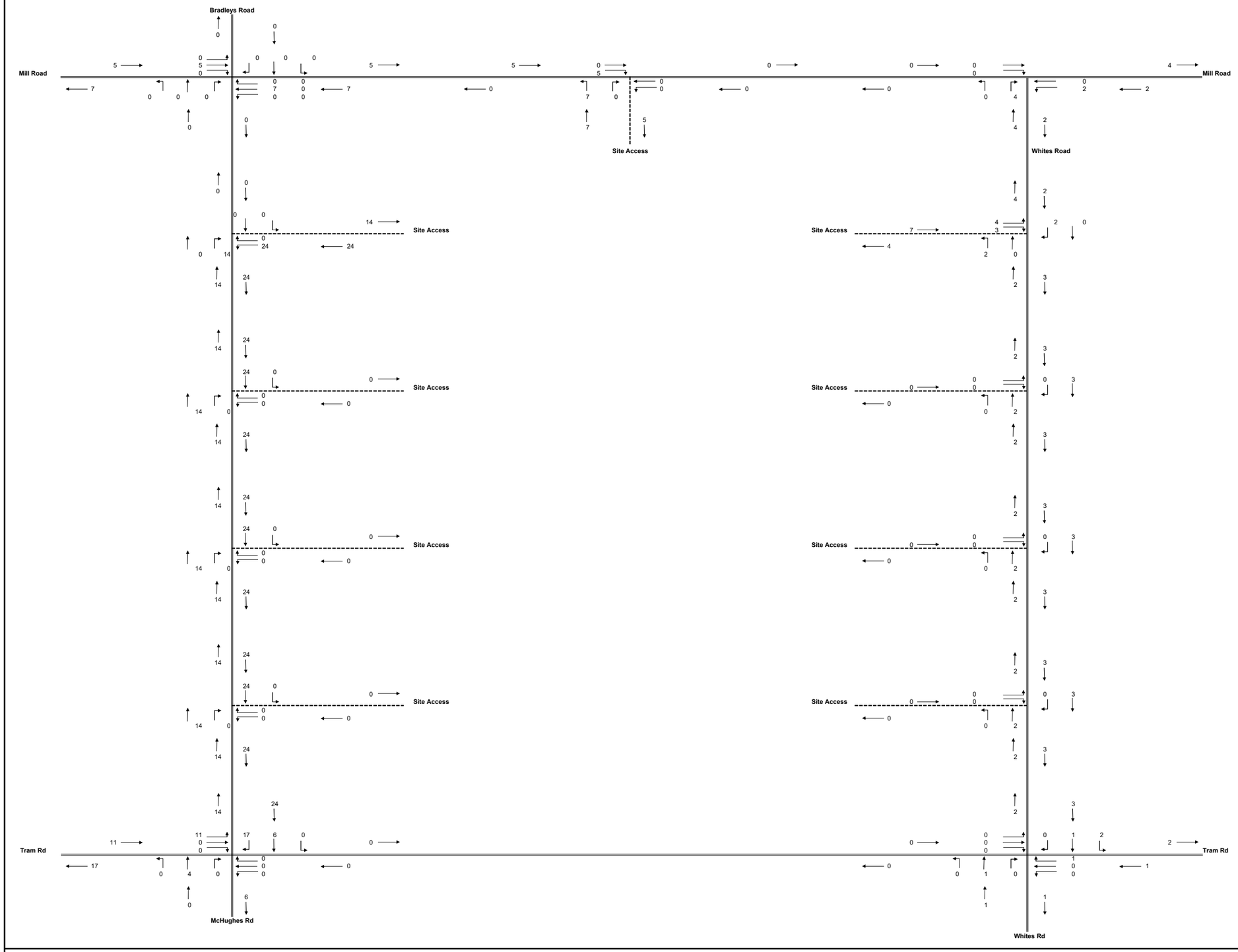
School Traffic Distribution & Assignment



021-034: Ohoka Plan Change
School Distribution



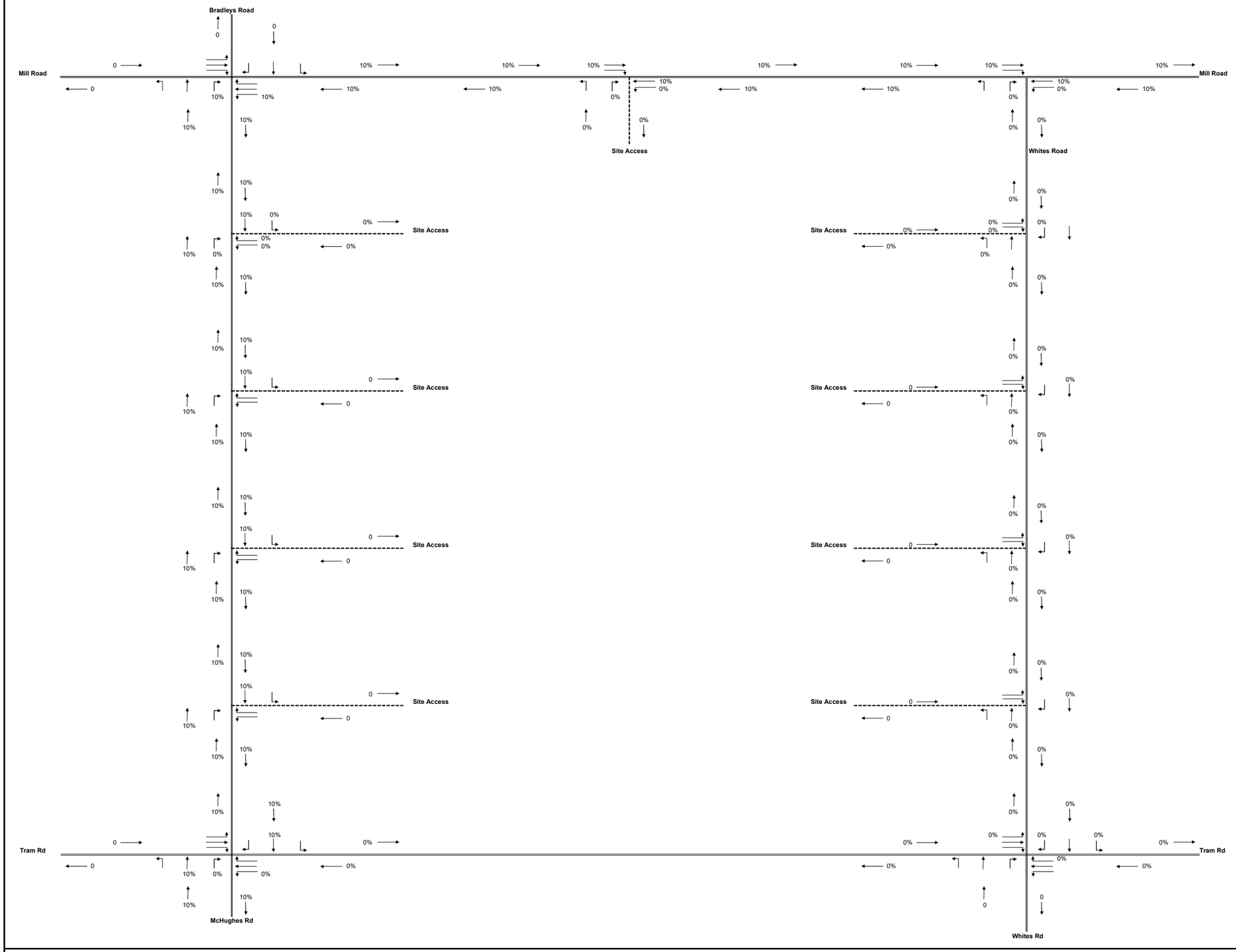
021-034: Ohoka Plan Change
School Traffic - AM



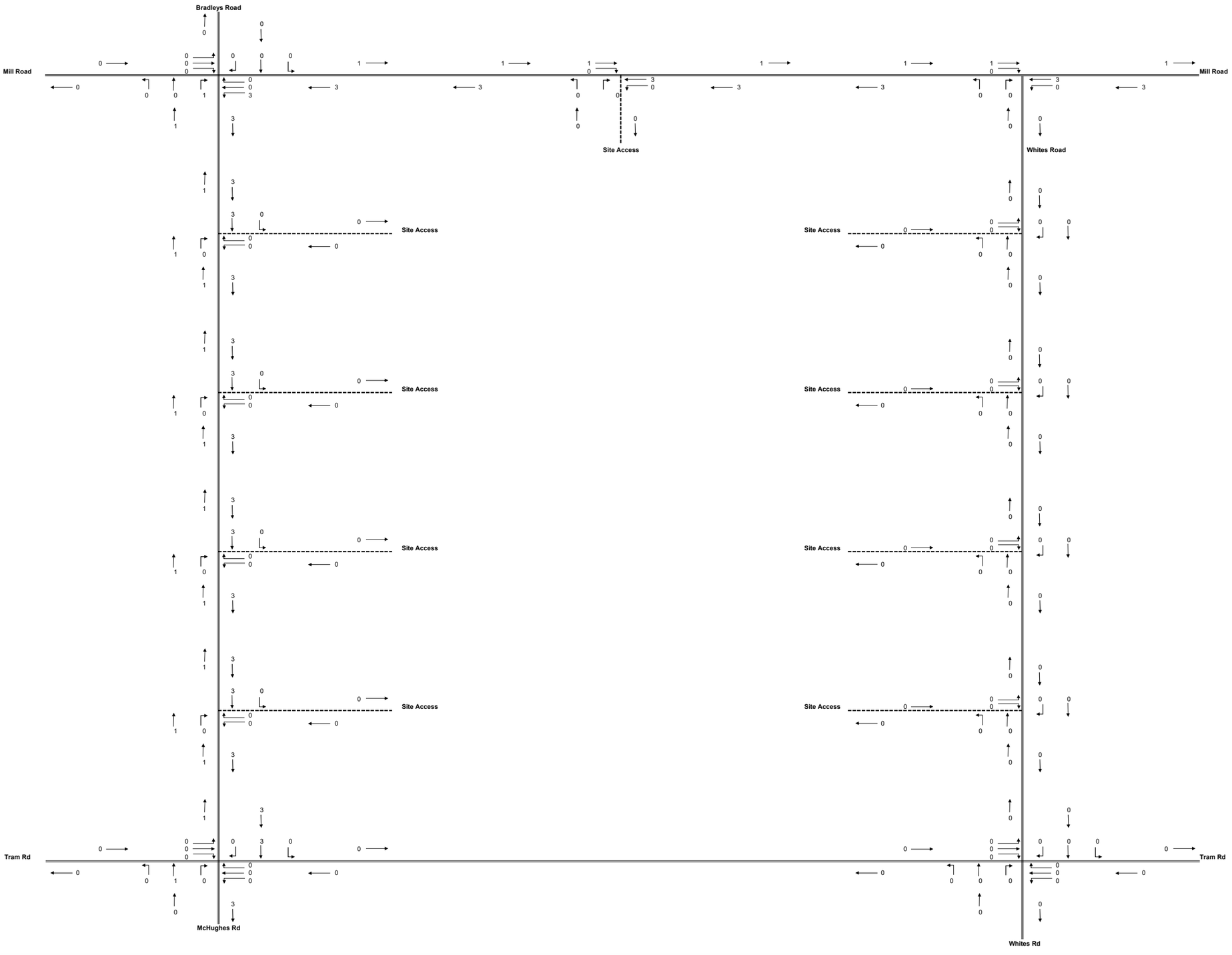
021-034: Ohoka Plan Change
School Traffic - PM

Appendix 11

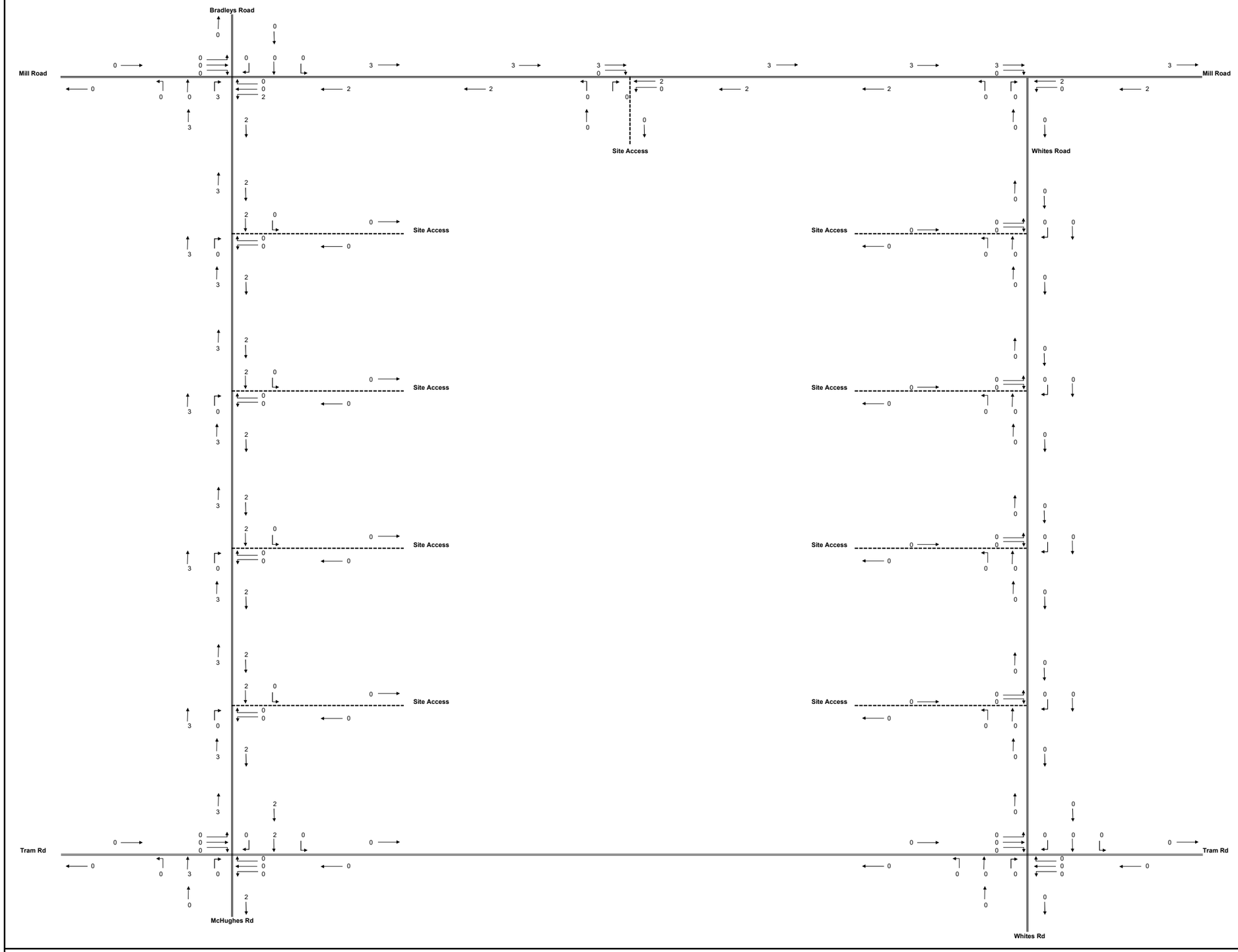
Traffic Growth



021-034: Ohoka Plan Change
Northern Site Distribution



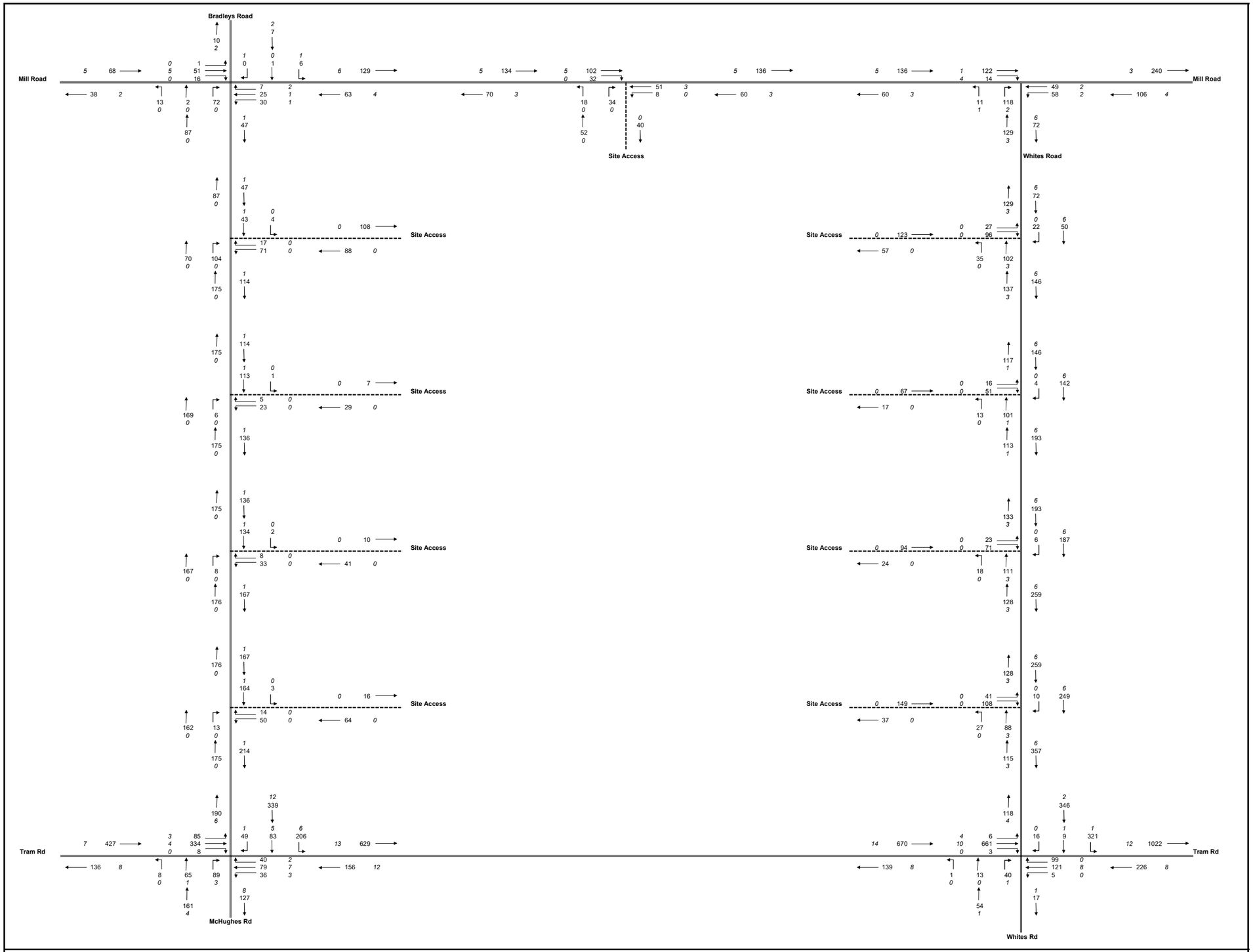
021-034: Ohoka Plan Change
Traffic Growth - AM



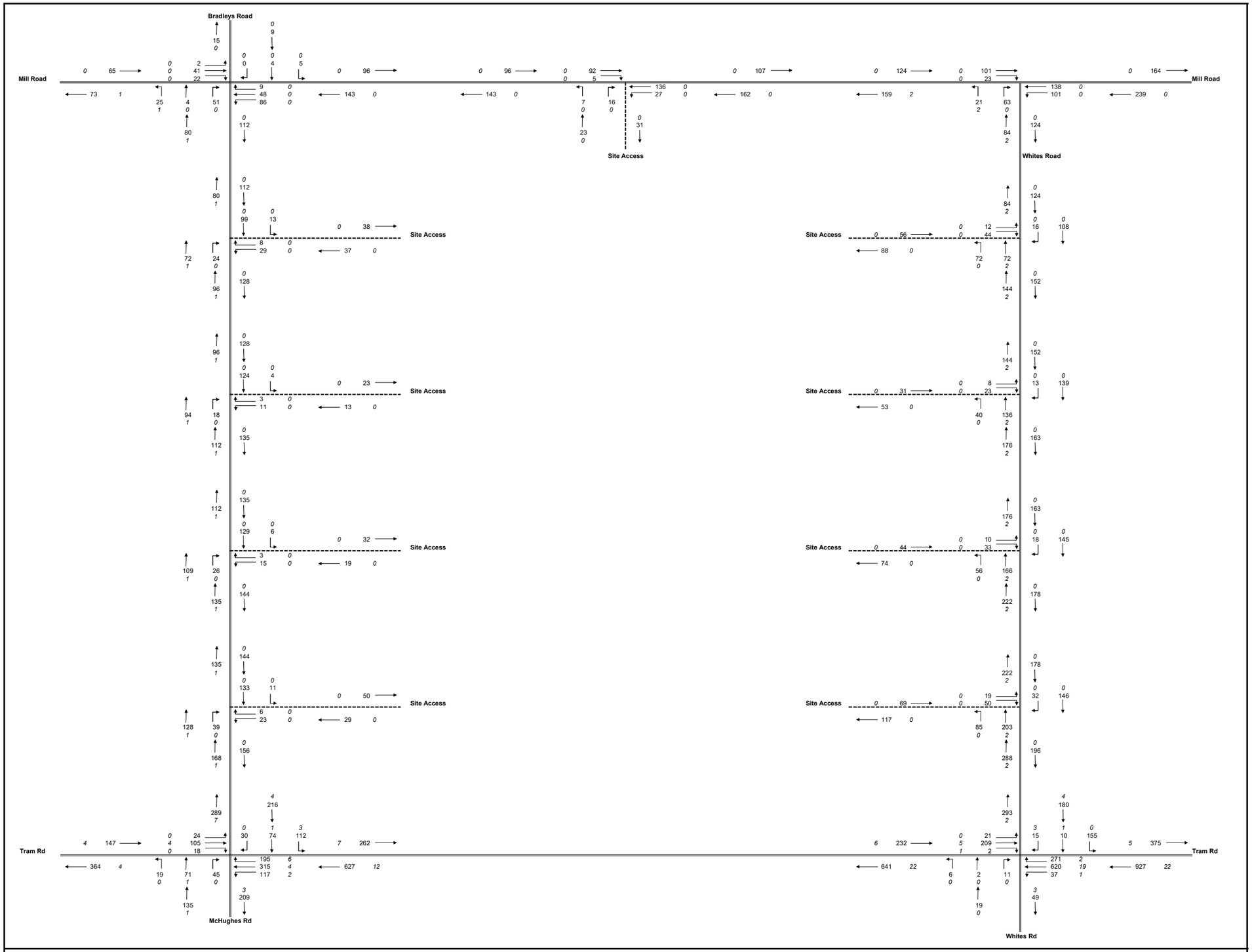
021-034: Ohoka Plan Change
Traffic Growth - PM

Appendix 12

Existing plus Growth & Plan Change Traffic



021-034: Ohoka Plan Change
2021 Existing plus Development + School Volumes - AM Peak



021-034: Ohoka Plan Change
2021 Existing plus Development + School Volumes - PM Peak

Appendix 13

Tram Rd / Bradleys Rd Intersection – With Plan Change Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Bradleys Rd - 2021 AM Peak + 850 Dev + Sch (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	0.007	9.2	LOS A	0.0	0.2	0.18	0.88	0.18	63.2
2	T1	66	1	69	1.5	0.646	29.3	LOS D	3.6	25.5	0.86	1.16	1.58	46.2
3	R2	92	3	97	3.3	0.646	33.7	LOS D	3.6	25.5	0.86	1.16	1.58	46.0
Approach		166	4	175	2.4	0.646	30.8	LOS D	3.6	25.5	0.83	1.14	1.51	46.7
East: Tram Rd														
4	L2	37	2	39	5.4	0.022	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	63.6
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	42	3	44	7.1	0.052	9.2	LOS A	0.2	1.5	0.48	0.70	0.48	60.5
Approach		165	12	174	7.3	0.052	3.9	NA	0.2	1.5	0.12	0.32	0.12	70.2
North: Bradleys Rd														
7	L2	212	6	223	2.8	0.247	11.0	LOS B	1.0	7.1	0.46	0.94	0.46	61.2
8	T1	88	5	93	5.7	0.539	26.5	LOS D	2.8	20.1	0.81	1.11	1.28	48.0
9	R2	50	1	53	2.0	0.539	29.2	LOS D	2.8	20.1	0.81	1.11	1.28	48.7
Approach		350	12	368	3.4	0.539	17.5	LOS C	2.8	20.1	0.60	1.00	0.78	55.4
West: Tram Rd														
10	L2	88	3	93	3.4	0.052	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	64.2
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	7.6	LOS A	0.0	0.2	0.23	0.57	0.23	64.4
Approach		434	7	457	1.6	0.182	1.6	NA	0.0	0.2	0.00	0.14	0.00	75.8
All Vehicles		1115	35	1174	3.1	0.646	11.3	NA	3.6	25.5	0.33	0.59	0.49	62.1

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 [Tram Rd & Bradleys Rd - 2021 PM Peak + 850 Dev + Sch (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	0.021	10.3	LOS B	0.1	0.5	0.38	0.87	0.38	62.6
2	T1	72	1	76	1.4	0.577	33.6	LOS D	2.7	19.2	0.88	1.11	1.41	44.9
3	R2	45	0	47	0.0	0.577	35.0	LOS D	2.7	19.2	0.88	1.11	1.41	45.2
Approach		136	1	143	0.7	0.577	30.8	LOS D	2.7	19.2	0.81	1.08	1.26	46.8
East: Tram Rd														
4	L2	119	2	125	1.7	0.070	7.0	LOS A	0.0	0.0	0.00	0.63	0.00	64.8
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	201	6	212	3.0	0.171	7.5	LOS A	0.8	5.4	0.28	0.61	0.28	63.1
Approach		639	12	673	1.9	0.173	3.7	NA	0.8	5.4	0.09	0.31	0.09	70.9
North: Bradleys Rd														
7	L2	115	3	121	2.6	0.103	9.5	LOS A	0.4	2.8	0.22	0.89	0.22	62.4
8	T1	75	1	79	1.3	0.576	36.6	LOS E	2.7	18.8	0.88	1.11	1.41	43.3
9	R2	30	0	32	0.0	0.576	38.0	LOS E	2.7	18.8	0.88	1.11	1.41	43.5
Approach		220	4	232	1.8	0.576	22.6	LOS C	2.7	18.8	0.54	1.00	0.79	51.6
West: Tram Rd														
10	L2	24	0	25	0.0	0.014	6.9	LOS A	0.0	0.0	0.00	0.63	0.00	65.4
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	9.2	LOS A	0.1	0.6	0.47	0.66	0.47	63.2
Approach		151	4	159	2.6	0.060	2.2	NA	0.1	0.6	0.06	0.18	0.06	74.9
All Vehicles		1146	21	1206	1.8	0.577	10.3	NA	2.7	19.2	0.25	0.52	0.36	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 14

Tram Rd / Whites Rd Intersection – With Plan Change Operation

MOVEMENT SUMMARY

Site: 101 [Tram Rd & Whites Rd - 2021 AM Existing + 850 Dev + Sch (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	0.380	15.3	LOS C	1.4	9.7	0.89	1.03	1.10	46.4
2	T1	13	0	14	0.0	0.380	32.7	LOS D	1.4	9.7	0.89	1.03	1.10	46.4
3	R2	41	1	43	2.4	0.380	42.1	LOS E	1.4	9.7	0.89	1.03	1.10	46.0
Approach		55	1	58	1.8	0.380	39.4	LOS E	1.4	9.7	0.89	1.03	1.10	46.1
East: Tram Rd														
4	L2	5	0	5	0.0	0.075	7.8	LOS A	0.0	0.0	0.00	0.03	0.00	88.0
5	T1	129	8	136	6.2	0.075	0.0	LOS A	0.0	0.0	0.00	0.03	0.00	99.1
6	R2	99	0	104	0.0	0.132	11.3	LOS B	0.5	3.7	0.61	0.85	0.61	70.0
Approach		233	8	245	3.4	0.132	5.0	NA	0.5	3.7	0.26	0.38	0.26	84.0
North: Whites Rd														
7	L2	321	0	338	0.0	0.604	18.6	LOS C	3.6	25.1	0.78	1.12	1.36	63.3
8	T1	10	1	11	10.0	0.118	30.3	LOS D	0.4	2.9	0.80	1.00	0.80	55.5
9	R2	17	1	18	5.9	0.118	20.4	LOS C	0.4	2.9	0.80	1.00	0.80	56.3
Approach		348	2	366	0.6	0.604	19.1	LOS C	3.6	25.1	0.78	1.11	1.32	62.7
West: Tram Rd														
10	L2	10	4	11	40.0	0.369	8.9	LOS A	0.0	0.0	0.00	0.01	0.00	71.0
11	T1	671	10	706	1.5	0.369	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	99.6
12	R2	3	0	3	0.0	0.002	7.8	LOS A	0.0	0.1	0.24	0.59	0.24	74.0
Approach		684	14	720	2.0	0.369	0.2	NA	0.0	0.1	0.00	0.01	0.00	98.9
All Vehicles		1320	25	1389	1.9	0.604	7.6	NA	3.6	25.1	0.29	0.41	0.44	80.3

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 - 2021 PM Existing + 850 Dev + Sch (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	0.122	13.7	LOS B	0.4	2.6	0.86	1.00	0.86	52.5
2	T1	2	0	2	0.0	0.122	38.5	LOS E	0.4	2.6	0.86	1.00	0.86	52.5
3	R2	11	0	12	0.0	0.122	38.4	LOS E	0.4	2.6	0.86	1.00	0.86	52.4
Approach		19	0	20	0.0	0.122	30.6	LOS D	0.4	2.6	0.86	1.00	0.86	52.5
East: Tram Rd														
4	L2	38	1	40	2.6	0.372	7.9	LOS A	0.0	0.0	0.00	0.04	0.00	86.2
5	T1	639	19	673	3.0	0.372	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	98.6
6	R2	273	2	287	0.7	0.202	8.5	LOS A	1.0	7.0	0.39	0.66	0.39	72.2
Approach		950	22	1000	2.3	0.372	2.8	NA	1.0	7.0	0.11	0.22	0.11	88.8
North: Whites Rd														
7	L2	155	0	163	0.0	0.152	10.6	LOS B	0.6	4.1	0.33	0.89	0.33	72.3
8	T1	11	1	12	9.1	0.236	49.1	LOS E	0.8	6.1	0.90	1.02	0.98	44.6
9	R2	18	3	19	16.7	0.236	35.9	LOS E	0.8	6.1	0.90	1.02	0.98	43.5
Approach		184	4	194	2.2	0.236	15.3	LOS C	0.8	6.1	0.42	0.91	0.44	65.6
West: Tram Rd														
10	L2	21	0	22	0.0	0.128	7.8	LOS A	0.0	0.0	0.00	0.06	0.00	87.1
11	T1	214	5	225	2.3	0.128	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	98.0
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		238	6	251	2.5	0.128	0.9	NA	0.0	0.2	0.01	0.07	0.01	96.1
All Vehicles		1391	32	1464	2.3	0.372	4.5	NA	1.0	7.0	0.14	0.29	0.15	85.1

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.

Appendix 15

Mill Rd / Bradleys Rd Intersection – With Plan Change Operation

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Bradleys Rd - 2021 AM Existing + 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	0.098	8.6	LOS A	0.3	2.4	0.18	0.92	0.18	57.8
2	T1	2	0	2	0.0	0.098	8.7	LOS A	0.3	2.4	0.18	0.92	0.18	57.5
3	R2	72	0	76	0.0	0.098	8.7	LOS A	0.3	2.4	0.18	0.92	0.18	57.3
Approach		87	0	92	0.0	0.098	8.7	LOS A	0.3	2.4	0.18	0.92	0.18	57.4
East: Mill Rd														
4	L2	31	1	33	3.2	0.039	6.5	LOS A	0.1	0.6	0.07	0.36	0.07	61.0
5	T1	26	1	27	3.8	0.039	0.1	LOS A	0.1	0.6	0.07	0.36	0.07	65.0
6	R2	9	2	9	22.2	0.039	6.7	LOS A	0.1	0.6	0.07	0.36	0.07	55.0
Approach		66	4	69	6.1	0.039	4.0	NA	0.1	0.6	0.07	0.36	0.07	61.6
North: Bradleys Rd														
7	L2	7	1	7	14.3	0.009	9.4	LOS A	0.0	0.3	0.16	0.93	0.16	53.6
8	T1	1	0	1	0.0	0.009	8.7	LOS A	0.0	0.3	0.16	0.93	0.16	57.0
9	R2	1	1	1	100.0	0.009	13.9	LOS B	0.0	0.3	0.16	0.93	0.16	38.1
Approach		9	2	9	22.2	0.009	9.8	LOS A	0.0	0.3	0.16	0.93	0.16	51.6
West: Mill Rd														
10	L2	1	0	1	0.0	0.043	6.5	LOS A	0.1	0.7	0.07	0.15	0.07	64.5
11	T1	56	5	59	8.9	0.043	0.1	LOS A	0.1	0.7	0.07	0.15	0.07	67.6
12	R2	16	0	17	0.0	0.043	6.3	LOS A	0.1	0.7	0.07	0.15	0.07	63.8
Approach		73	5	77	6.8	0.043	1.5	NA	0.1	0.7	0.07	0.15	0.07	66.7
All Vehicles		235	11	247	4.7	0.098	5.2	NA	0.3	2.4	0.11	0.52	0.11	60.9

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 & Bradleys Rd - 2021 PM Existing + 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	0.088	8.8	LOS A	0.3	2.3	0.19	0.92	0.19	56.6
2	T1	4	0	4	0.0	0.088	8.9	LOS A	0.3	2.3	0.19	0.92	0.19	57.4
3	R2	51	0	54	0.0	0.088	8.9	LOS A	0.3	2.3	0.19	0.92	0.19	57.2
Approach		81	1	85	1.2	0.088	8.9	LOS A	0.3	2.3	0.19	0.92	0.19	57.0
East: Mill Rd														
4	L2	86	0	91	0.0	0.081	6.4	LOS A	0.1	0.5	0.02	0.41	0.02	61.8
5	T1	48	0	51	0.0	0.081	0.0	LOS A	0.1	0.5	0.02	0.41	0.02	64.7
6	R2	9	0	9	0.0	0.081	6.2	LOS A	0.1	0.5	0.02	0.41	0.02	61.2
Approach		143	0	151	0.0	0.081	4.2	NA	0.1	0.5	0.02	0.41	0.02	62.7
North: Bradleys Rd														
7	L2	5	0	5	0.0	0.009	8.6	LOS A	0.0	0.2	0.13	0.95	0.13	57.7
8	T1	4	0	4	0.0	0.009	9.1	LOS A	0.0	0.2	0.13	0.95	0.13	57.4
9	R2	1	0	1	0.0	0.009	8.7	LOS A	0.0	0.2	0.13	0.95	0.13	57.2
Approach		10	0	11	0.0	0.009	8.8	LOS A	0.0	0.2	0.13	0.95	0.13	57.5
West: Mill Rd														
10	L2	2	0	2	0.0	0.038	6.8	LOS A	0.1	0.9	0.17	0.22	0.17	63.2
11	T1	41	0	43	0.0	0.038	0.2	LOS A	0.1	0.9	0.17	0.22	0.17	66.2
12	R2	22	0	23	0.0	0.038	6.5	LOS A	0.1	0.9	0.17	0.22	0.17	62.6
Approach		65	0	68	0.0	0.038	2.6	NA	0.1	0.9	0.17	0.22	0.17	64.8
All Vehicles		299	1	315	0.3	0.088	5.3	NA	0.3	2.3	0.11	0.52	0.11	61.3

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.

Appendix 16

Mill Rd / Whites Rd Intersection – With Plan Change Operation

MOVEMENT SUMMARY

Site: 101 [Mill Rd & Whites Rd - 2021 AM Existing + 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	9.1	LOS A	0.0	0.3	0.14	0.91	0.14	55.5
3	R2	120	2	126	1.7	0.139	9.1	LOS A	0.5	3.4	0.33	0.91	0.33	56.7
Approach		132	3	139	2.3	0.139	9.1	LOS A	0.5	3.4	0.31	0.91	0.31	56.6
East: Mill Rd														
4	L2	60	2	63	3.3	0.063	6.4	LOS A	0.0	0.0	0.00	0.34	0.00	61.6
5	T1	51	2	54	3.9	0.063	0.0	LOS A	0.0	0.0	0.00	0.34	0.00	65.6
Approach		111	4	117	3.6	0.063	3.5	NA	0.0	0.0	0.00	0.34	0.00	63.4
West: Mill Rd														
11	T1	123	1	129	0.8	0.082	0.1	LOS A	0.1	1.0	0.07	0.08	0.07	68.7
12	R2	18	4	19	22.2	0.082	7.0	LOS A	0.1	1.0	0.07	0.08	0.07	57.9
Approach		141	5	148	3.5	0.082	1.0	NA	0.1	1.0	0.07	0.08	0.07	67.1
All Vehicles		384	12	404	3.1	0.139	4.5	NA	0.5	3.4	0.14	0.44	0.14	62.1

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 + 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	0.020	9.5	LOS A	0.1	0.6	0.25	0.87	0.25	55.3
3	R2	63	0	66	0.0	0.079	9.5	LOS A	0.3	1.8	0.38	0.91	0.38	56.9
Approach		86	2	91	2.3	0.079	9.5	LOS A	0.3	1.8	0.34	0.90	0.34	56.5
East: Mill Rd														
4	L2	101	0	106	0.0	0.132	6.4	LOS A	0.0	0.0	0.00	0.27	0.00	63.5
5	T1	138	0	145	0.0	0.132	0.0	LOS A	0.0	0.0	0.00	0.27	0.00	66.5
Approach		239	0	252	0.0	0.132	2.7	NA	0.0	0.0	0.00	0.27	0.00	65.2
West: Mill Rd														
11	T1	101	0	106	0.0	0.072	0.2	LOS A	0.2	1.2	0.15	0.12	0.15	67.6
12	R2	23	0	24	0.0	0.072	7.0	LOS A	0.2	1.2	0.15	0.12	0.15	64.1
Approach		124	0	131	0.0	0.072	1.5	NA	0.2	1.2	0.15	0.12	0.15	66.9
All Vehicles		449	2	473	0.4	0.132	3.7	NA	0.3	1.8	0.11	0.35	0.11	63.8

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.