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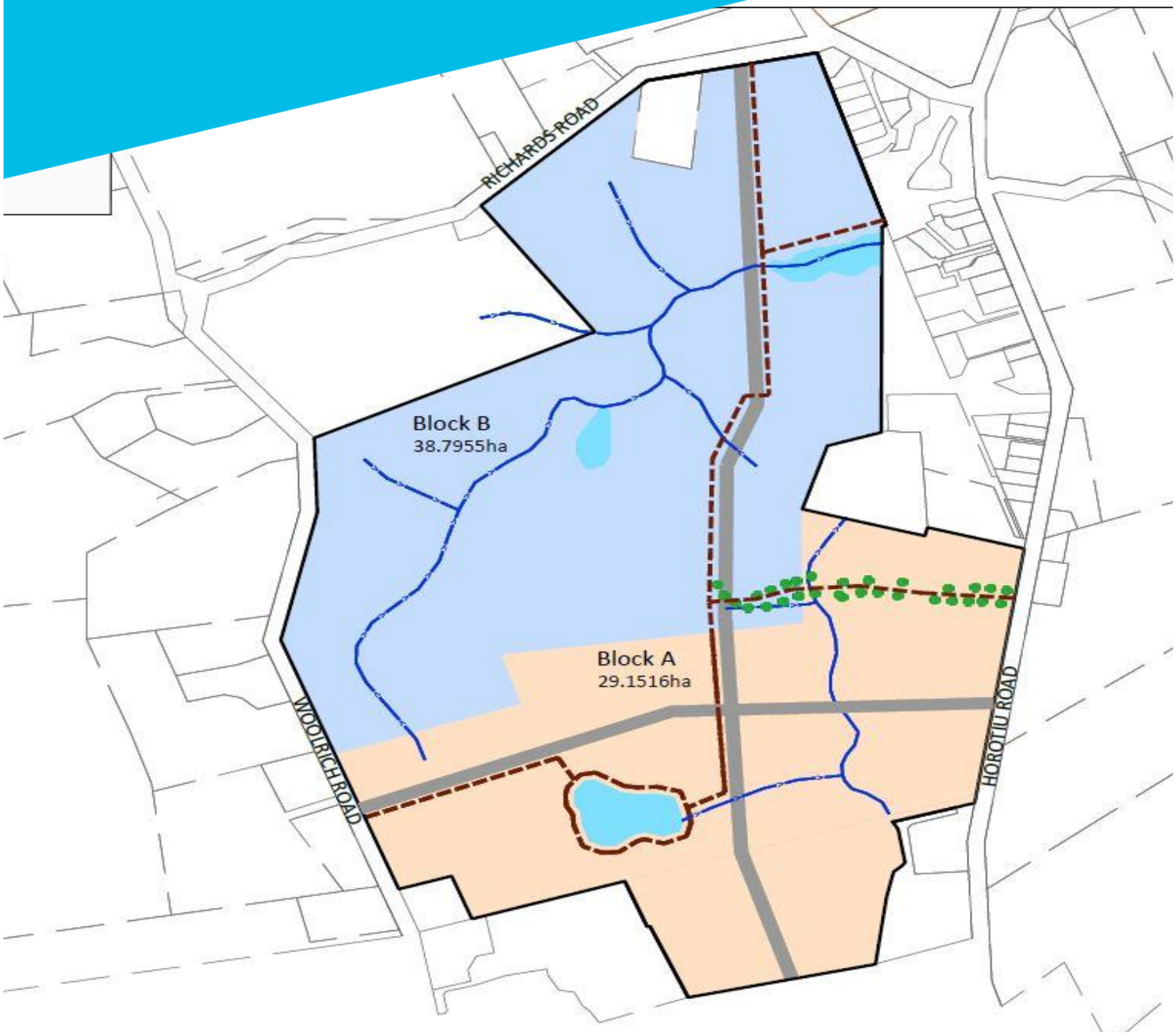
Greig Metcalfe
09-Jan-2018

Integrated Transport Assessment

Horotiu Road Development



Integrated Transport Assessment

Horotiu Road Development

Client: Greig Metcalfe

Co No.: N/A

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0	18-Dec-2017	Draft	Shaun Lion-Cachet Civil Infrastructure Manager Waikato	
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1.0 Introduction

Greig Metcalfe is seeking the re-zoning of approximately 68 hectares of land in Te Kowhai to facilitate residential subdivision. The subdivision is expected to create between 159 and 476 lots depending on the ratio of serviced and un-serviced lots.

AECOM has been appointed to carry out a Broad Integrated Transport Assessment which has been required by the Waikato District Council (WDC) to support the re-zoning.

The proposed development will generate additional traffic onto the road network. The purpose of this report is to assess and discuss the expected impact that this additional traffic will have on the safety, efficiency and accessibility of the local road network and to propose, where appropriate, any interventions to mitigate these effects.

2.0 Background

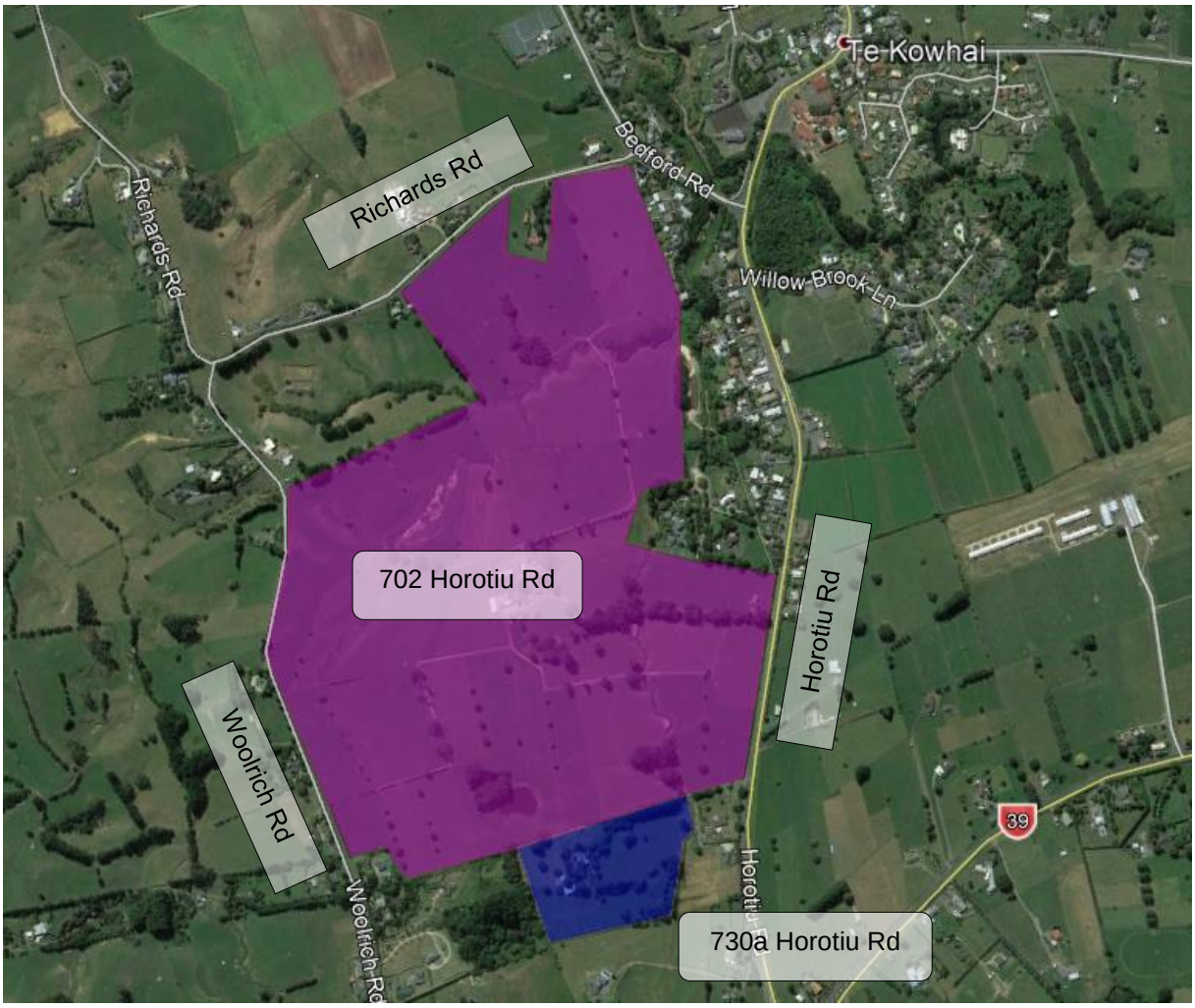
2.1 Location

The proposed development, which is for the purposes of this report referred to as Horotiu Road Development, is located at 702 and 730a Horotiu Road in Te Kowhai.

The site is located directly to the south and west of Te Kowhai village and covers approximately 68 hectares of predominately rural farmland. The land use for the site is pastoral farmland with dairy farming currently operating.

The site, as indicated in Figure 1 below, is bound by Horotiu Road to the south east, rural properties to the south, Woolrich Road to the west and Richards Road to the north.

Figure 1 Location Plan



3.0 Existing Traffic Environment

3.1 Road Classification

Horotiu Road, which runs through the village of Te Kowhai, and passes the eastern boundary of the proposed development, is classified in the Waikato District Plan as an Arterial Road with the function of being a milk haul road to Te Rapa.

State Highway 39 (SH39) is classified as a Regional Arterial as it provides the inter-regional mobility function and serves as a western bypass of Hamilton.

Horotiu Road intersects with SH39 about 400 m to the south of the proposed development. To the northeast of the development, Horotiu Road forms a T intersection with Bedford Road, with Bedford Road being subject to 'Give Way' control.

3.2 Link volumes

Indicative Annual Average Daily Traffic volumes for road links in the immediate vicinity of the development were extracted from the WDC Road Assessment and Maintenance Management (RAMM) database.

The volumes extracted for these links are as follows:

- Bedford Road (between Horotiu Road and Richards Road) – 727 vehicles per day (2016 count) and 6 percent heavy vehicles.
- Richards Road (between Bedford Road and Woolrich Road) – 50 vehicles per day (2015 estimate) and 10 percent heavy vehicles.
- Woolrich Road (between Richards Road and Marwood Road) – 70 vehicles per day (2015 estimate) and 3 percent heavy vehicles (2007 & 2012 count percentages).
- Horotiu Road (between SH39 and Bedford Road) – 890 vehicles per day (2014 estimate) and 10 percent heavy vehicles.
- SH39 (between Laxon Road and Te Kowhai Road) – 4770 vehicles per day (2016 estimate from adjacent count locations) and 15.8 percent heavy vehicles.

3.3 Intersection Traffic Volumes

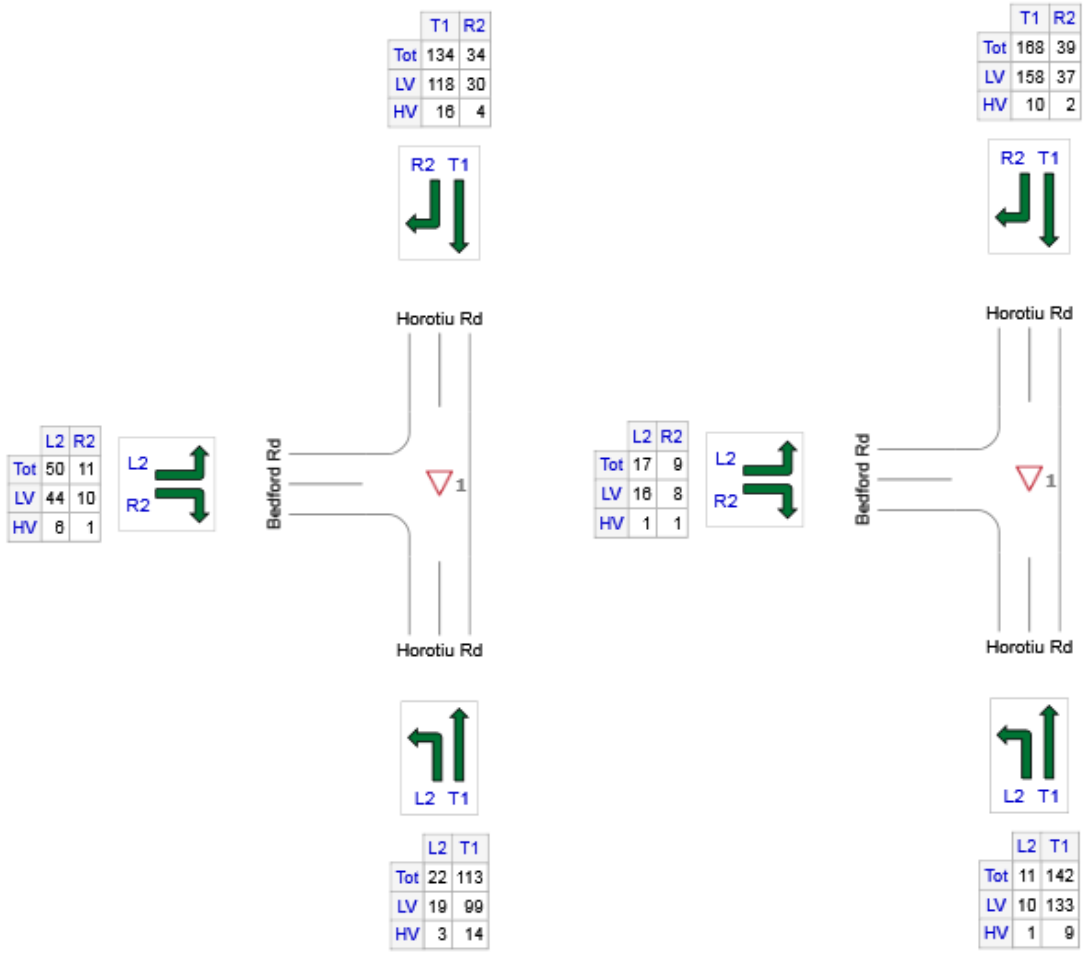
Traffic counts were carried out at the aforementioned intersections during the month of November 2017. Traffic counts were limited to these two intersections as the bulk of the traffic that will be generated by the proposed development is expected to route via these two intersections.

3.3.1 Horotiu Road / Bedford Road Intersection Traffic Volumes

Morning and afternoon peak period traffic counts were carried out on Wednesday 22 November 2017. The morning counts were carried out from 7–9 am while the afternoon counts were carried out from 4–6 pm.

Figure 2 below shows the peak hour intersection movement volumes counted for the AM and PM peak hour with the AM volumes on the left and PM volumes on the right.

Figure 2 Horotiu Road / Bedford Road Intersection AM and PM Peak hour volumes.



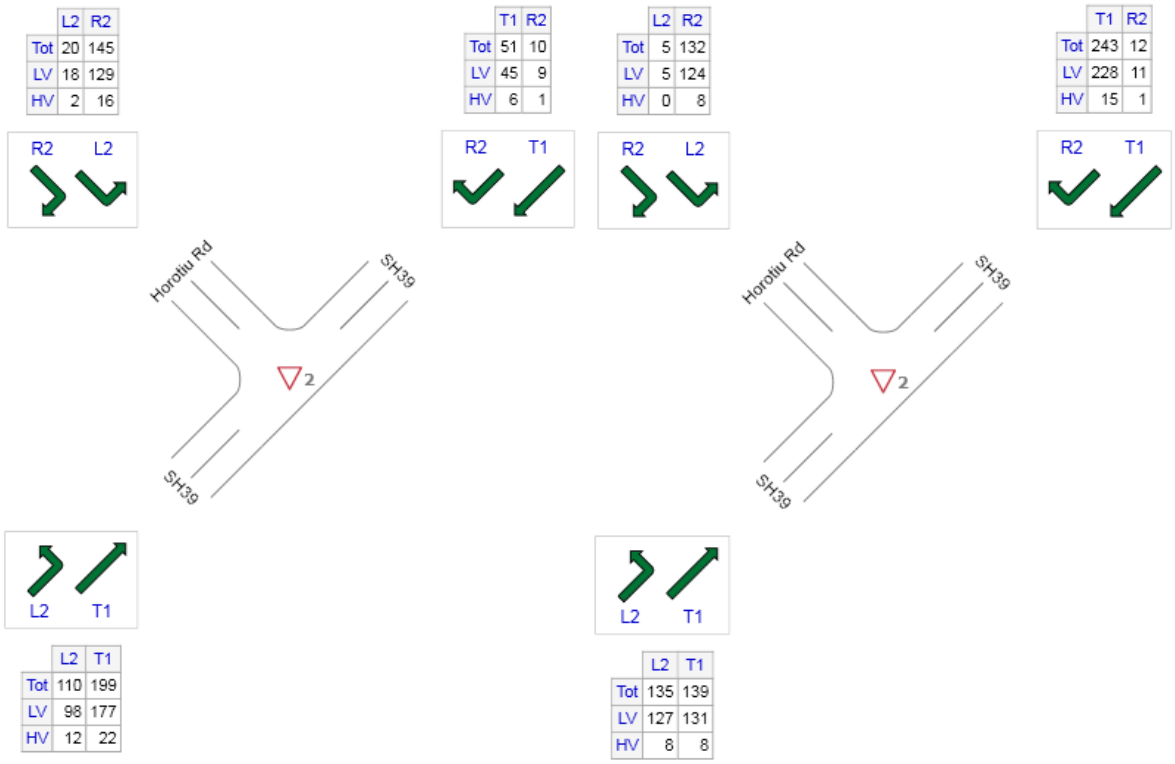
The total intersection volume counted during the AM peak hour, from 7.45–8.45 am, was 364 vehicles with an average heavy vehicle percentage of 12 percent.

The PM peak hour, 4.45–5.45 pm volumes counted were 386 vehicles with an average heavy vehicle percentage of 6 percent.

3.3.2 Horotiu Road / Limmer Road (SH39)

Traffic counts were conducted on 16 November 2017 between 7–9 am and 4–6 pm. The AM and PM peak hours were found to be 7.30–8.30 am and 5–6 pm respectively.

Figure 3 Horotiu Road / Sh29 Intersection AM and PM peak hour volumes



The total intersection volumes counted for the respective AM and PM peak hours are 535 and 666 with heavy vehicle percentages of 11 percent and 6 percent respectively.

3.4 Cycling Traffic

Bicycle volumes were also counted at the two intersections discussed above. The following bicycle volumes were counted:

- Horotiu / Bedford: Four (4) bicycles during the AM peak period (7–9 am) and five (5) during the PM peak period (4–6 pm).
- Horotiu / SH39: Three (3) bicycles were counted during both the AM and PM peak periods.

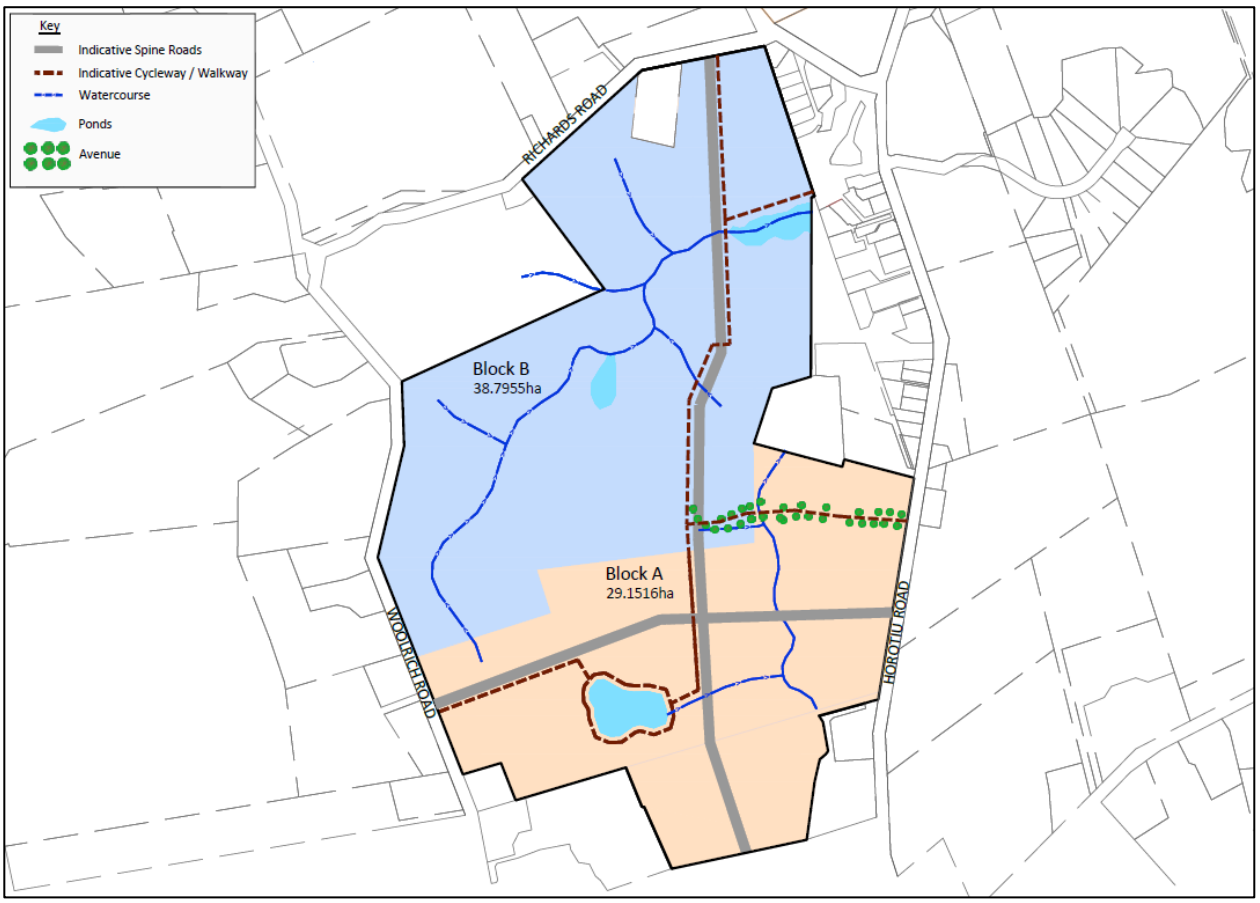
No predominant cycling direction of flow was identifiable from the count data.

4.0 Development Details

4.1 Block Layout

Figure 4 below provides an overview of the basic layout of the proposed development in two separate development blocks – Block A and Block B.

Figure 4 Development Block Layout Overview (source: CKL)



The development is expected to consist of 1,000 m² serviced lots and 3,000 m² un-serviced lots.

70 percent of the land has been assumed to be available for development after roads, reserves, stormwater infrastructure and topography have been accounted for. Based on this assumption, Table 1 below indicates the development area available per block.

Table 1 Development Block Details

Block	Gross (ha)	70% Net (ha)
Block A	29.2	20.4
Block B	38.8	27.2
Total	**67.9**	**47.5**

Proposed accesses to the development will be from Horotiu Road approximately 600 m north of the Horotiu Road and SH39 intersection, from Richards Road approximately 120 m west of Bedford Road and from Woolrich Road on the western side of the development with an internal spine road connecting the accesses.

4.2 Development Staging

Development of Block A is expected to be completed separately to Block B.

Block A, as indicated above has approximately 20 hectares available for development – about 43 percent of the total land area. Depending on the ratio of serviced to un-serviced lots, Block A would consist of between 68 (all un-serviced) and 204 lots (all serviced).

Block B, with approximately 27.1 hectares available for development, would, when fully developed, consist of between 91 lots (all un-serviced) and 272 lots (all serviced).

4.3 Development Scenarios

For the sole purpose of analysis the effect that the traffic generated by the development will have on the road network, four hypothetical development scenarios were tested. The four scenarios vary according to the area of serviced lots to the area of un-serviced ratio in order to obtain a range of probable trips generated by the total household numbers comprising the development.

- Scenario 1: 50 percent serviced, 50 percent un-serviced
  - 317 lots in total
- Scenario 2: 80 percent serviced, 20 percent un-serviced
  - 412 lots in total
- Scenario 3: 100 percent serviced
  - 476 lots in total
- Scenario 4: 0 percent serviced
  - 159 lots in total.

Scenario 3 is considered the ‘worst-case scenario’ but is unlikely to be implemented.

Since Block A is expected to be developed before Block B, the four scenarios mentioned above were tested for the development including Block A only and including both Block A and Block B.

5.0 Future Traffic Environment

5.1 Trip Generation

The four scenarios discussed above, coupled with the staged development of Block A before Block B will, based on this approach, result in six different trip generation scenarios.

The table below indicates the number of trips that will be generated by each development block under each one of the aforementioned scenarios.

The trip rates used for the trip generation per lot were based on the 85th percentile rates for *Dwelling (Rural)* as recommended by the *New Zealand trip generation and parking demand* report (NZ Transport Agency research report 453).

These rates suggest that a rural dwelling will generate 10.1 trips per day and 1.4 trips per peak hour which includes inbound and outbound trips.

Table 2 below indicates the range of trips expected given the scenarios discussed above.

Table 2 Trips Generated per Scenario

Scenario	Block A (Peak hour)	Block B (Peak Hour)	Total Peak Hour Trips	Total trips per day
50% serviced, Block A Only	191	0	191	1373
50% serviced, Block A & B	191	253	444	3202
80% serviced, Block A Only	248	0	248	1787
80% serviced, Block A & B	248	329	577	4161
100% serviced, Block A Only	286	0	286	2060
100% serviced, Block A & B	286	381	667	4807
0% serviced Block A Only	95	0	95	687
0% serviced Block A & B	95	127	222	1606

5.2 Trip Distribution

Assumptions have been made as to the proportions of traffic expected to route via the three accesses as shown in Figure 5 below as well as the directional split at each one of the access. The in/out proportions are assumed to be the same at the respective exit/entrance.

Figure 5 Development Blocks and Accesses (source: Google Earth)

Furthermore, since Block A is expected to be developed before Block B, it is not anticipated that “Exit B”, as indicated above will be used until Block B has been developed.

The proportion of traffic that have been assumed will route via each of one of the accesses are shown in Table 3 below.

Table 3 Access Traffic Proportions

Access Point	Block A Only	Block A & B Developed
Horotiu Road	90%	60%
Richards Road	0%	30%
Woolrich Road	10%	10%

Further assumptions have been made on the directional split of traffic exiting and entering each one of the access points. The exit and entry proportions have been assumed to be the same.

Table 4 Access Directional Flow Proportions

Access Point	Direction	Proportion
Horotiu Road	Southern leg	65%
	Northern leg	35%
Richards Road	Eastern leg	80%
	Western leg	20%
Woolrich Road	Southern leg	80%
	Northern leg	20%

Lastly, the proportion of trips leaving and arriving during the respective AM and PM peak hours was based on recent surveys carried out at the St James sub-division in Rototuna of more than 500 dwellings.

Table 5 Development In/Out Trip Generation Proportions

Peak Hour	Out	In
AM Peak	75%	25%
PM Peak	27%	73%

Applying the proportions in the three tables above to the trips generated per peak hour results in the number of trips estimated to enter and exit from/to each direction at each one of the access points for the respective scenario.

5.3 Effect on the Existing Intersections

Since the bulk of the generated traffic is expected to route via the two intersections discussed in Section 3.3, it has been assumed that the generated traffic flow proportions would be similar to the background traffic flow proportions.

Given this assumption the total number of vehicles per hour expected at the two intersections for each one of the scenarios is given by below.

Table 6 Intersection Peak Hour Traffic Volumes per Scenario

Intersection	Horotiu Road / Bedford Road		Horotiu Road / SH39	
Scenario	AM (veh/h)	PM (veh/h)	AM (veh/h)	PM (veh/h)
Background	364	386	535	666
50% serviced, Block A Only	424	446	647	778
50% serviced, Block A & B	564	586	720	861
80% serviced, Block A Only	442	464	680	811
80% serviced, Block A & B	624	646	775	919
100% serviced, Block A Only	454	476	702	833
100% serviced, Block A & B	664	686	813	958
0% serviced, Block A Only	394	416	591	722
0% serviced, Block A & B	464	486	628	763

While the percentage increase in traffic volumes is fairly high (about 60 percent for the worst-case scenario), the absolute increase in traffic is still a relatively low number at about 300 vehicles per peak hour per intersection. It should also be noted that these are 85th percentile values for design purposes rather than typical average daily values which would be lower.

The worst-case scenario in terms of traffic generated by the development is expected when both Block A and Block B have been developed and all lots are of the smaller (1,000 m²) and serviced variation. Even with this scenario, the movements at both these intersections are expected to operate at LOS B or better – that is, the average vehicle will not be delayed for more than 15 seconds.

In order to determine if these intersections will need upgrading to accommodate growth in traffic over the next 10 and 20 years, the background traffic volumes were escalated at 1.5 percent per annum while the generated traffic volumes were kept constant. The worst performing movement given these assumptions is the right-turn from Horotiu Road southbound to SH39 westbound during the PM peak hour which is expected to operate at LOS D – average delays of 35 seconds – in year 2037. All other movements will operate at LOS C or better.

Since this scenario is an unrealistic worst-case scenario just presented to indicate the robustness of the capacity of the intersection; no upgrades to the existing intersections are recommended.

5.4 New Intersections

As discussed in Section 4.1, three new intersections are proposed to service the new development. These intersections are all expected to be T-intersections with right and left turn access and egress allowed.

5.4.1 Operational Capacity

Intersection capacity is not expected to be the dictating factor in terms of the geometry required at either of the intersections. The proposed Horotiu Road Intersection, about 600 m north of SH39, is expected to be the busiest with maximum volumes around 900 vehicles per hour (worst-case scenario) and the majority of the traffic bypassing the intersection.

5.4.2 Safety Considerations

Safety should, however, be the determinant for what the proposed intersection geometry, especially the right-turns, should be and is discussed below under recommendations.

The additional turning movements introduced along Horotiu Road, Richards Road and Woolrich Road should, however, be addressed by introducing turning bays and bypass lanes where appropriate, especially for the right-turn movements.

5.4.3 Recommended Geometry

5.4.3.1 Horotiu Road Intersection

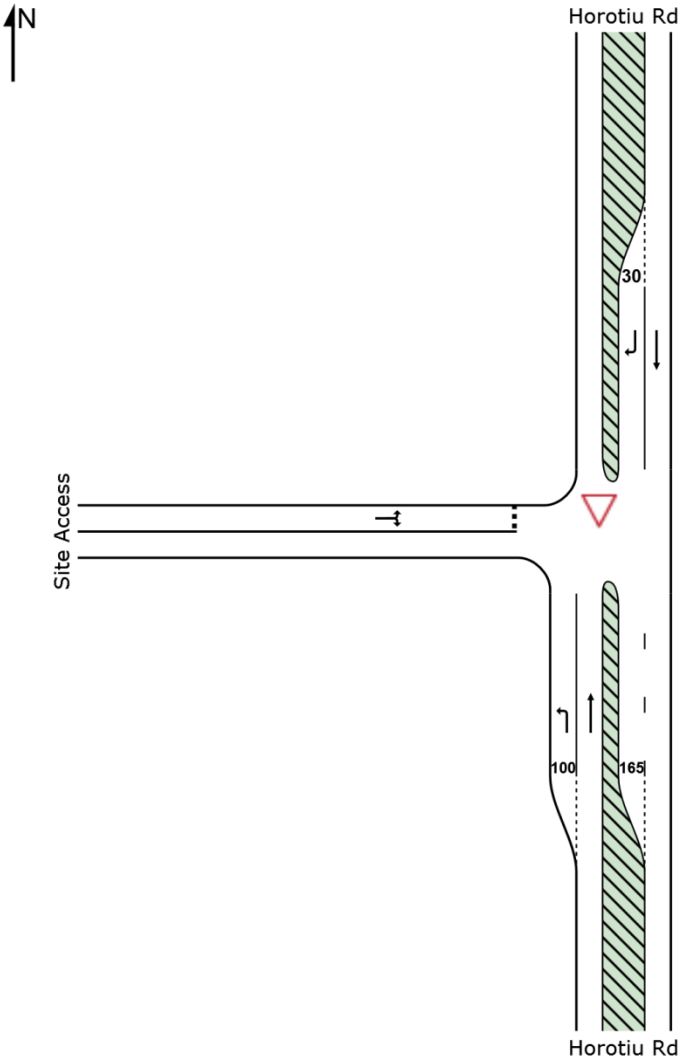
The access to the development at the proposed intersection on Horotiu Road is expected to, given the assumptions discussed previously, service the bulk of the traffic generated by the development. Depending on the ratio of serviced to un-serviced lots and whether Block B is developed or not, this demand could range between 700 and 3,200 vehicles per day.

The peak hour volumes, AM and PM, at the intersection, excluding the through traffic on Horotiu Road bypassing the development, could range between about 190 and 440 vehicles. In order to safely accommodate vehicles turning in and out of the development, geometry that separates turning movements from the through movements on Horotiu Road are proposed.

Given the relatively low flows in both directions (approximately 150veh/h), the probability of more than one right-turning vehicle arriving in a 5 second interval (assumed critical gap) is less than 1 percent. Minimal storage space is, therefore, required for queueing right-turning vehicles from Horotiu Road into the development.

Figure 6 below is a schematic representation of the proposed geometry at the Horotiu Road intersection.

Figure 6 Schematic Plan – Horotiu Road Intersection



Horotiu Road will require local widening to accommodate the turning bays indicated in the figure above.

5.4.3.2 Richards Road Intersection

The largest movements at this intersection are expected to be the right-turn out onto Richards Road in the morning and the left-turn into the development from Richards Road in the afternoon. The hourly flows expected for these movements are in the order of about 100 vehicles during both the morning and afternoon peak hours.

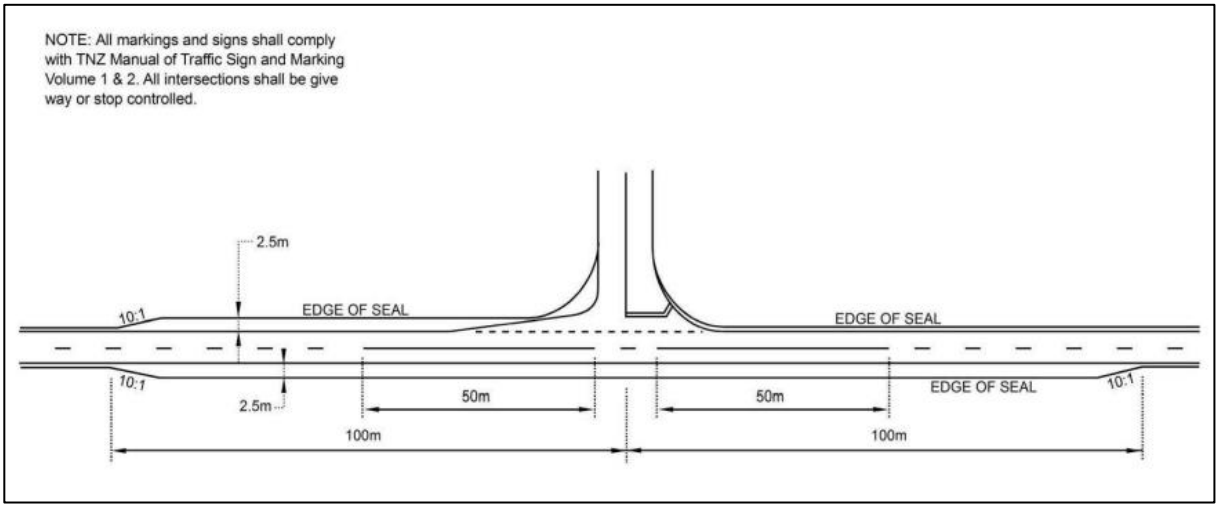
Due to the subdivision changing the function of Richards Road (from rural to urban), and its proximity to Bedford Road, it is recommended that Richards Road is upgraded to an urban standard with the 50 km/h speed limit extended to west of the new intersection. Under this scenario, the intersection would be formed as an urban intersection without any widening of Richards Road beyond that recommended for its upgraded cross-section (refer 5.6.2 of this report).

5.4.3.3 Woolrich Road Intersection

The existing traffic volumes on Woolrich Road are low – in the order of 70 vehicles per day as per 2015 WDC estimates. The traffic generated by the development is expected to add about 60 vehicles per day to the north of the proposed intersection position (approximately 1 km from the Woolrich / Marwood Intersection) and about 280 vehicles per day to the south of the intersection.

It is recommended that the Woolrich Road access also be designed to the standard WDC Appendix A3 Figure 5 layout as indicated in Figure 7 below.

Figure 7 Type A Austroads Local Intersection Widening (Source: WDC District Plan)



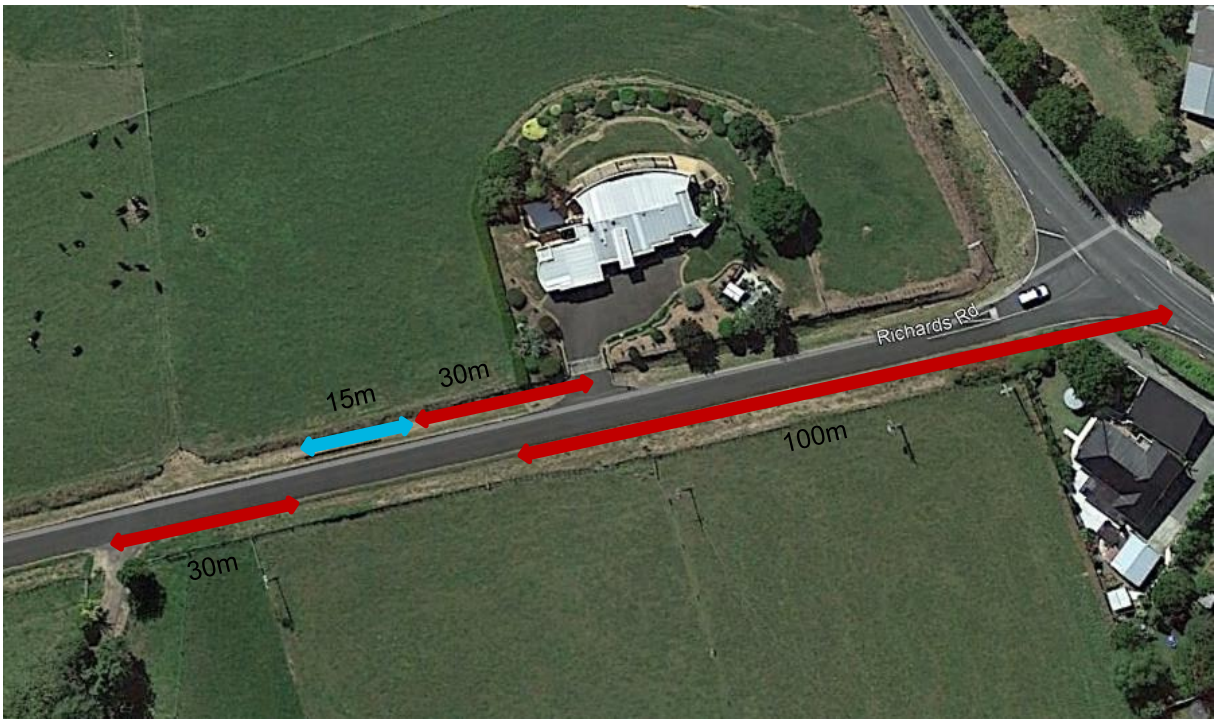
5.5 Intersection Spacing

Acceptable and safe intersection locations are based on adequate sight distances and separations from other vehicle crossings. The WDC District Plan provides recommended distances between intersections and accesses for different road classes.

The existing local accesses on Richards Road are spaced adequately for the 80 km/h speed environment. With the implementation of the proposed development, it is recommended that the speed environment be changed to 50 km/h as is appropriate for an urban subdivision. The position of the proposed Richards Road access to the development is, therefore, dependent on acceptable sight distances and separations for a 50km/h speed environment.

Figure 8 below indicates the constraining distances (red arrows) and the resultant allowable range (blue arrow) the intersection's position is subject to.

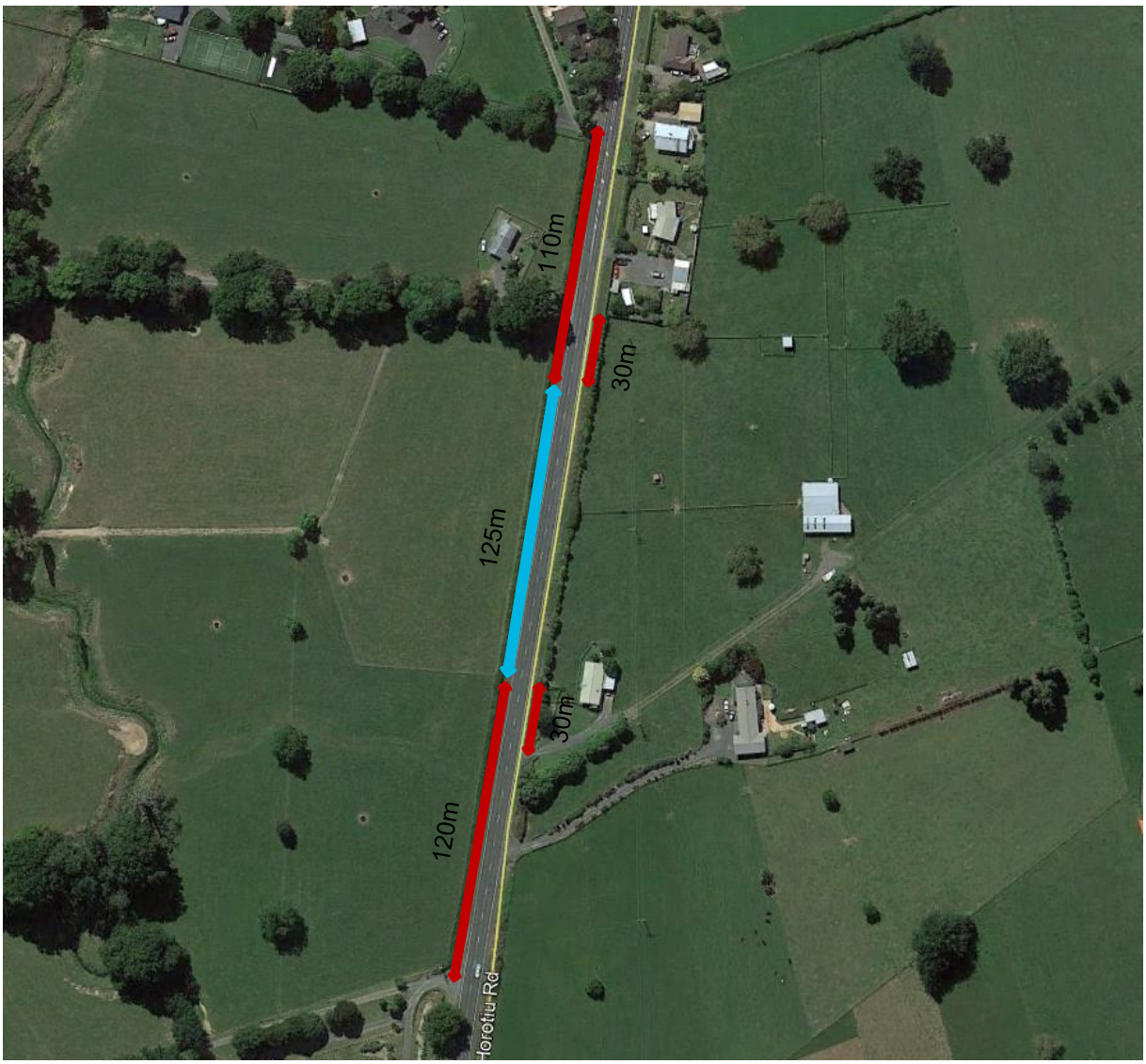
Figure 8 Richards Road Access Spacing



Given the introduction of an intersection along this section of Richards Road, the only point at which it will be permissible in accordance with WDC District Plan guidelines is approximately 105m from Bedford Road, at 50km/h posted speed limit. It should also be noted that without the change in speed limit to 50km/h, the introduction of an intersection would not comply with the recommended spacing and sight distances.

The range within which an intersection would be allowed given the same set of recommended distances for a 50 km/h speed environment for the Horotiu Road access is indicated in Figure 9 below.

Figure 9 Horotiu Road Access Spacing

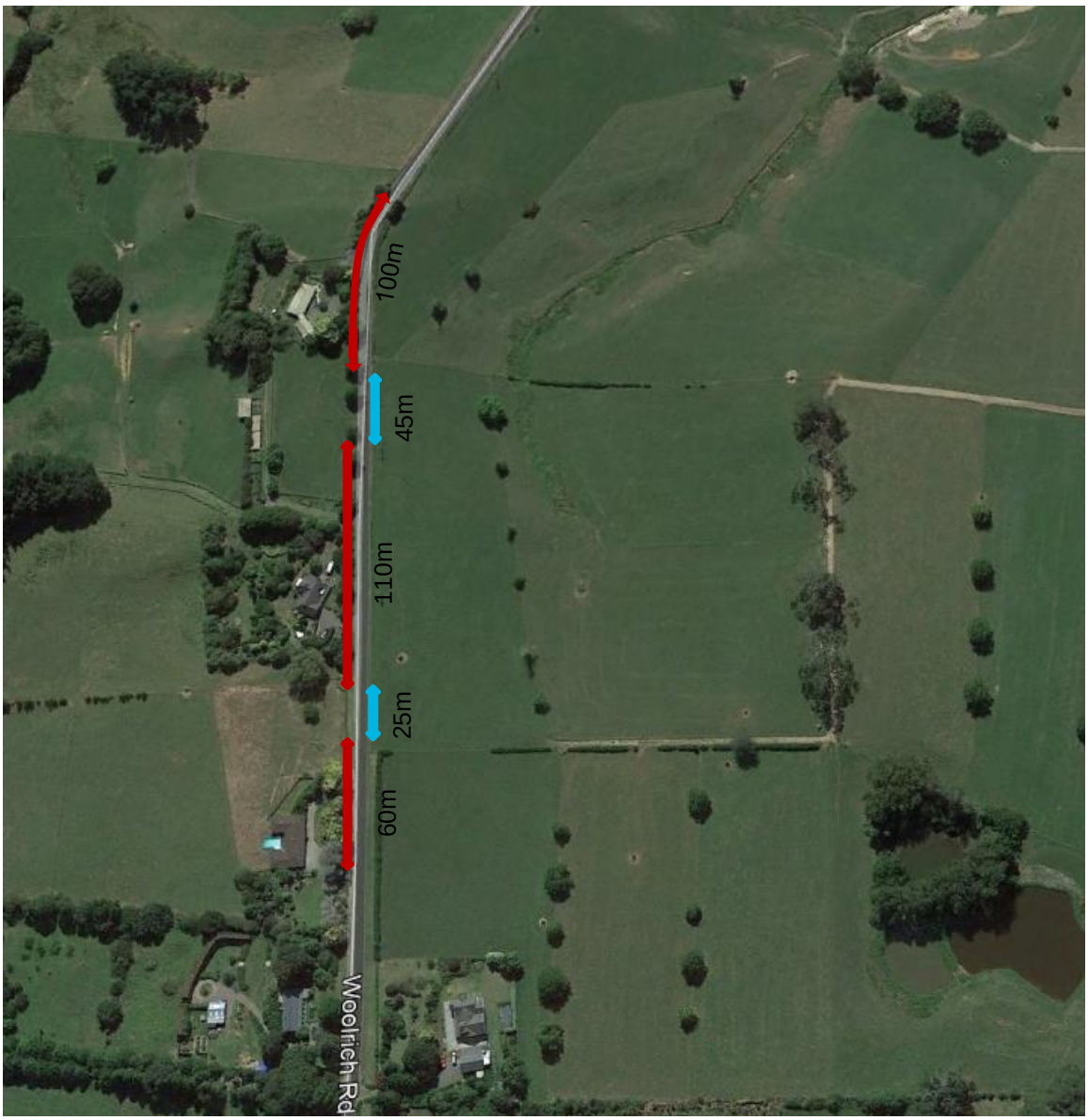


An intersection, with the geometry discussed in 5.4.3.1 above is only permissible within the 125m band indicated in the figure above, of which the northern bound is approximately 90m from the existing speed limit sign posts.

The subdivision would effectively shift the urban boundary of the Te Kowhai village about 330m to the south. It is therefore recommended that the posted speed limit be changed to 50km/h up to beyond the southern limit of the subdivision.

Given the topography, the location of existing accesses and the proposed change to a 50 km/h speed environment adjacent to the development, the allowable intersection positions for the Woolrich Road access is shown in Figure 10 below.

Figure 10 Woolrich Road Access Spacing



It is not envisaged that access will be preferred further to the north than indicated in the figure above as Block A has been identified to be developed earlier than Block B. The topography to the north and east of this location does also not provide adequate sight distances for this type of intersection.

5.6 Road Standards

5.6.1 Traffic Volumes

Based on the aforementioned traffic distribution ratio assumptions, the “worst-case” approximate resultant daily traffic volumes expected on the road links serving the development are summarised as follows:

- Horotiu Road
  - 1,900 vehicles per day north of the site access (existing 890)

  - 3,200 vehicles per day south of the site access (existing 890)
- Richards Road
  - 300 vehicles per day west of the site access (existing 90)
  - 800 vehicles per day east of the site access (existing 90)
- Woolrich Road
  - 120 vehicles per day north of the site access (existing 70)
  - 280 vehicles per day south of the site access (existing 70)

5.6.2 Recommended Road Cross Sections

The existing road cross-sections of the three roads that will front on and provide access to the development are as follows:

- Horotiu Road: Two 3.5 m lanes and 0.5 m sealed shoulders
- Richards Road: 4.5 m wide single carriageway with no shoulders
- Woolrich Road: 5 m wide single carriageway with no shoulders

With the increased traffic volumes and potential higher number of cyclists expected, it is recommended that the Horotiu Road shoulders be widened to 1.5 m on each side between the subdivision intersection and the existing urban area of Te Kowhai. It is also recommended that the point at which the posted speed limit changes from 50km/h to 100km/h be moved to a point south of the Horotiu Road subdivision intersection (approximately 300m). Horotiu road should also be widened sufficiently in the vicinity of the new intersection to accommodate the turning bays.

The appropriate cross-section for Richards Road and Woolrich Road will depend, in part, on whether there is frontage access and if so, how much. That will in turn influence the speed limit which is applied and whether these roads are upgraded to an urban form or a more rural form. The latter seems probable for Woolrich Road but Richards Road may be more suitable in an urban form given its proximity to the centre of Te Kowhai village. It would however be recommended that both these roads be upgraded given the higher traffic volumes and possibility of cyclists.

The minimum recommended cross-sections for these two roads should, therefore, be as follows:

- Richards Road: Two 3.5 m lanes and 0.5 m sealed shoulders
- Woolrich Road: Two 3.1 m lanes and 0.5 m sealed shoulders

5.6.3 Internal Road Network

The form of the internal road network would effectively consist of a central spine, which should be constructed to a Collector Road Standard, and local roads serving the housing lots. The design standard of these roads should comply with the Regional Infrastructure Technical Specifications (RITS) which are currently being developed.

If the RITS does not specify cross-sections then it is recommended that the District Plan Appendix 3 Figure 4A cross-sections the Tamahere Country Living Zone (see Appendix C) be applied for the un-serviced areas of the development. Subject to stormwater design the standards in Table 4 would apply to the local roads although it is recommended that the detailed design includes indented, or partially indented parking bays so as to avoid continuous 11 m wide carriageways. These details will be subject to the normal subdivision engineering plan approval process.

5.6.4 Cycling Infrastructure

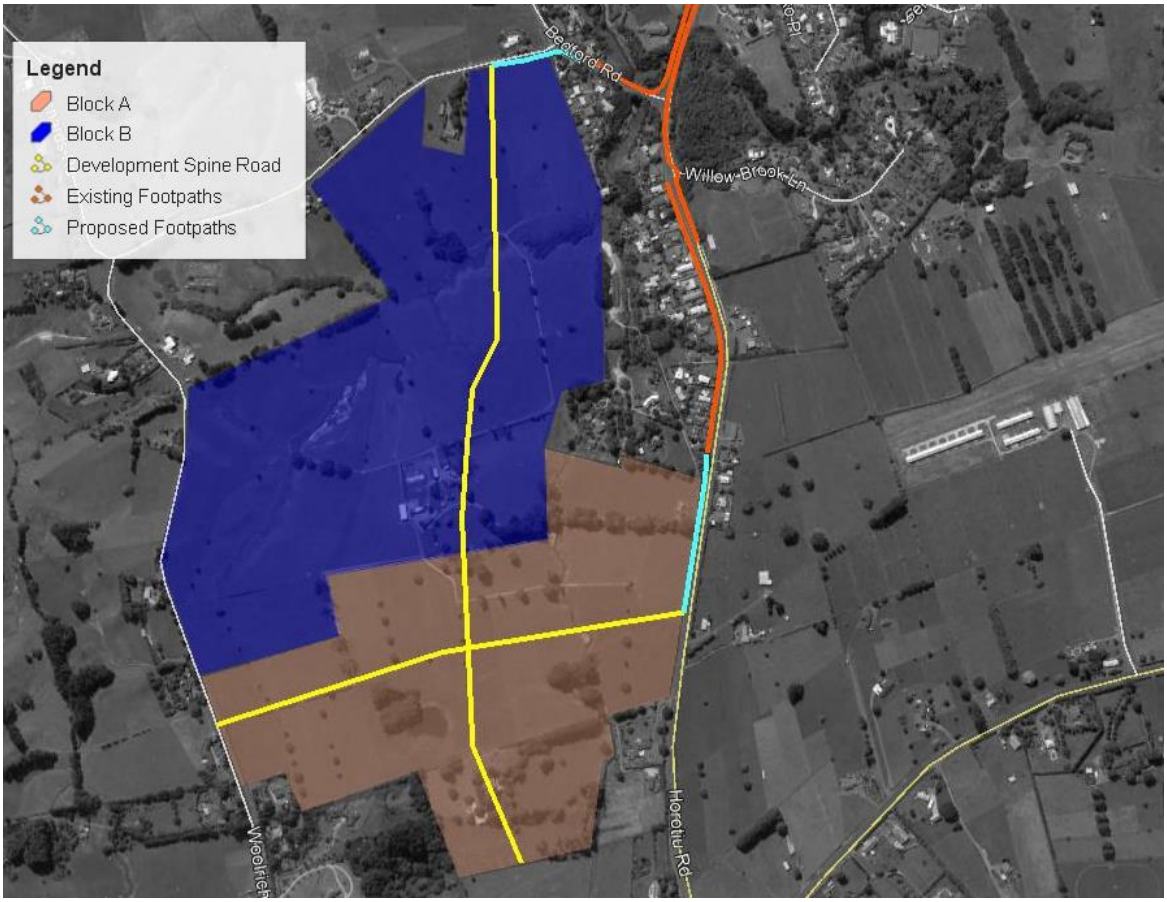
Notwithstanding the private vehicle traffic generated by the development, the development is also expected to generate cycling and pedestrian traffic on the road network near the development. The cycling trips generated by the development are expected to be mainly recreational and possibly schoolchildren with only a small percentage of commuting trips to Hamilton or elsewhere.

Provision should, therefore, be made for wide shoulders and/or designated cycle-paths where they do not exist.

5.6.5 Pedestrian Transport Infrastructure

The existing pedestrian footpath network in the vicinity of the development site is indicated in Figure 11 below.

Figure 11 Footpaths



As the development will effectively move the urban boundary, it is recommended that the existing footpath network is extended to connect with the proposed development accesses along Horotiu Road and Richards Road. Pedestrian facilities along Woolrich Road are not proposed as it is envisaged that pedestrian traffic would filter through the development along the internal network and connect with the proposed links as depicted in Figure 11 above.

5.6.6 Public Transport Infrastructure

There are currently no public transport (PT) routes serving Te Kowhai and the Waikato Regional Public Transport Plan does not indicate any plans for introducing any services in the future.

The development is envisaged to be occupied by relatively affluent households who historically have not made use of PT services for commuting purposes. Investing in PT services to serve this area does not appear viable with current attitudes to mode choice, even with the addition of 360 to 520 additional dwellings.

Provision should, however, be made for facilities to cater for school bus transport services with a logical pickup point on Horotiu Road near the site access.

6.0 Recommendations & Conclusion

As detailed above, operational capacity is not expected to be an issue with the additional traffic that is expected to be generated by the proposed development.

The increased traffic volumes on the roads adjacent to the development, and the turning movements in and out of the development, are however expected to pose a risk to motorists, cyclists and pedestrians.

No improvements are required in terms of efficiency to the existing road infrastructure. The existing intersections will continue to operate at acceptable levels of service for the foreseeable future despite the additional traffic added to the network.

Access has been proposed on Horotiu Road, Richards Road and Woolrich Road. It is, however, envisaged that Block A would be developed first and Block B would be deferred to a later stage. The access on Richards Road will only be required if and when Block B is developed.

Providing access off these roads will, however, imply that the road cross-sections need to be improved to a suitable standard to accommodate the increased traffic volumes, turning movements and number of cyclists expected on the affected road network.

Given these changes to the road and speed environment, the positions of the proposed intersections are limited to a specific range to conform to the district plan standards in terms of access separation and sight distances.

In summary, the following recommendations are made:

- Upgrade of Richards Road and Woolrich Road to two 3.1 m lanes and 0.5 m sealed shoulders;
    - For Richards Road, the minimum length of upgrade recommended is the section of road between the proposed intersection and the Bedford Road intersection;
    - For Woolrich Road, the minimum section of upgrade recommended is the length of road directly adjacent to the development.
- Provision of local intersection Austroads Type A at both the Woolrich and Richard Road Intersections;
- The Richards Road Intersection should be introduced at 120–130 m from Bedford Road;
- The Woolrich Road Intersection should be introduced at 950–1,000 m from Marwood Road with an alternative position at about 1,075 m from Marwood Road;
- The intersection on Horotiu Road should be provided with turning lanes to separate the through movements on Horotiu Road from the movements turning in and out of the development;
- The Horotiu Road intersection should be introduced between 600 m and 700 m from SH39;
- Pedestrian facilities should be introduced from the Horotiu Road and Richards Road intersections to link up with the existing footpaths to the north and east of the proposed development; and
- Provision should be made for school bus transport facilities along Horotiu Road near the development access intersection.

Appendix A

Traffic Counts

Unit Type:	MICROTALLY V3.08
Serial Number:	7100101
ID:	Bedford Road
Location:	Te Kowhai Bedford Rd Inter
Comments:	22-Nov-17
Measurements:	English
Start Date:	11/22/2017
Start Time:	06:59

CARS

Time	SB Thru	SB Right	NB Left	NB Thru	EB Left	EB Right	Total
11/22/17 07:00							
11/22/17 07:15	30	2	1	20	7	0	60
11/22/17 07:30	15	0	0	25	4	2	46
11/22/17 07:45	24	3	1	19	10	2	59
11/22/17 08:00	25	7	3	26	7	1	69
11/22/17 08:15	21	1	3	20	13	1	59
11/22/17 08:30	35	7	5	29	11	2	89
11/22/17 08:45	35	9	8	21	18	4	95
11/22/17 09:00	22	8	1	24	12	3	70
Total	207	37	22	184	82	15	547
HEAVYS	SB Thru	SB Right	NB Left	NB Thru	EB Left	EB Right	
11/22/17 07:00							
11/22/17 07:15	5	0	0	3	0	0	8
11/22/17 07:30	1	0	0	1	0	1	3
11/22/17 07:45	2	3	0	3	0	0	8
11/22/17 08:00	5	6	0	5	0	2	18
11/22/17 08:15	3	2	0	3	0	0	8
11/22/17 08:30	6	1	1	6	0	0	14
11/22/17 08:45	3	0	2	2	0	1	8
11/22/17 09:00	5	1	0	2	0	0	8
Total	30	13	3	25	0	4	75
BIKES	SB Thru	SB Right	NB Left	NB Thru	EB Left	EB Right	
11/22/17 07:00							
11/22/17 07:15	0	0	0	0	0	0	0
11/22/17 07:30	0	0	0	0	0	0	0
11/22/17 07:45	0	0	0	0	0	0	0
11/22/17 08:00	1	1	0	0	1	0	3
11/22/17 08:15	0	0	0	0	0	0	0
11/22/17 08:30	0	0	0	1	0	0	1
11/22/17 08:45	0	0	0	0	0	0	0
11/22/17 09:00	0	0	0	0	0	0	0
Total	1	1	0	1	1	0	4
AFTERNOON							
CARS	SB Thru	SB Right	NB Left	NB Thru	EB Left	EB Right	
11/22/17 16:00							
11/22/17 16:15	32	1	3	28	4	0	68
11/22/17 16:30	34	7	1	22	2	0	66
11/22/17 16:45	38	7	1	24	4	4	78
11/22/17 17:00	37	7	2	33	1	0	80
11/22/17 17:15	47	11	2	37	7	5	109
11/22/17 17:30	37	13	3	30	1	3	87
11/22/17 17:45	38	8	1	30	8	1	86
11/22/17 18:00	16	8	1	15	4	0	44
Total	279	62	14	219	31	13	618
HEAVYS	SB Thru	SB Right	NB Left	NB Thru	EB Left	EB Right	
11/22/17 16:00							
11/22/17 16:15	4	0	0	1	0	1	6
11/22/17 16:30	2	0	0	6	1	0	9
11/22/17 16:45	2	0	0	3	0	0	5
11/22/17 17:00	2	0	0	5	0	0	7
11/22/17 17:15	2	0	1	3	0	0	6
11/22/17 17:30	1	0	2	1	0	0	4
11/22/17 17:45	0	0	0	3	1	0	4
11/22/17 18:00	0	0	0	2	0	0	2
Total	13	0	3	24	2	1	43
BIKES	SB Thru	SB Right	NB Left	NB Thru	EB Left	EB Right	
11/22/17 16:00							
11/22/17 16:15	0	0	0	0	0	0	0
11/22/17 16:30	0	0	0	0	0	0	0
11/22/17 16:45	0	0	0	0	0	0	0
11/22/17 17:00	2	0	0	0	0	0	2
11/22/17 17:15	0	0	0	0	0	0	0
11/22/17 17:30	0	0	0	0	0	0	0
11/22/17 17:45	1	0	0	2	0	0	3
11/22/17 18:00	0	0	0	0	0	0	0
Total	3	0	0	2	0	0	5

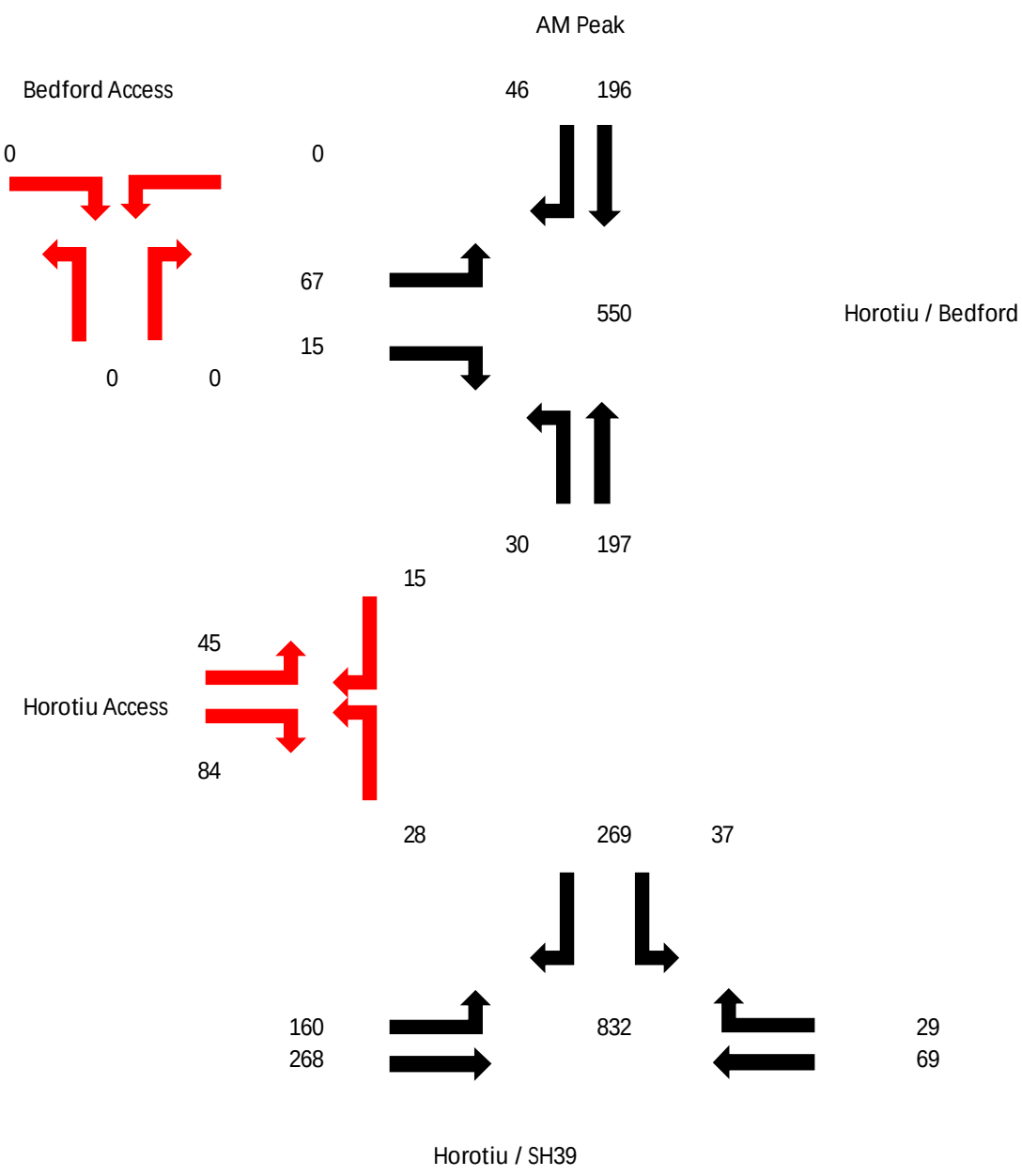
Unit Type:	MICROTALLY V3.08
Serial Number:	7100101
ID:	Horotiu - Limmer SH39
Location:	
Comments:	Thursday 16 November 2017
Measurements:	English
Start Date:	11/16/2017
Start Time:	06:58
Title:	Standard Export

Time	SB LEFT	SB Right	WB Thru	WB Right	EB Left	EB Thru	Total
Cars							
11/16/17 07:15	4	18	5	3	11	42	83
11/16/17 07:30	5	23	12	1	19	48	108
11/16/17 07:45	4	29	14	2	21	63	133
11/16/17 08:00	4	27	6	4	22	43	106
11/16/17 08:15	3	27	12	2	32	40	116
11/16/17 08:30	7	45	11	1	21	35	120
11/16/17 08:45	5	35	13	4	25	39	121
11/16/17 09:00	6	20	10	7	19	26	88
Total	38	224	83	24	170	336	875
Heavys							
Time	SB Left	SB Right	WB Thru	WB Right	EB Left	EB Thru	
11/16/17 07:15	0	7	2	0	1	3	13
11/16/17 07:30	0	6	5	0	2	2	15
11/16/17 07:45	0	5	2	0	3	6	16
11/16/17 08:00	0	6	1	0	3	2	12
11/16/17 08:15	1	2	1	0	5	7	16
11/16/17 08:30	0	4	4	1	2	3	14
11/16/17 08:45	0	2	0	0	2	4	8
11/16/17 09:00	0	2	6	0	1	2	11
Total	1	34	21	1	19	29	105
Bikes	SB Left	SB Right	WB Thru	WB Right	EB Left	EB Thru	
11/16/17 07:15	0	0	0	0	0	0	0
11/16/17 07:30	0	0	0	0	0	0	0
11/16/17 07:45	0	0	0	0	0	0	0
11/16/17 08:00	0	0	0	0	0	0	0
11/16/17 08:15	1	0	0	0	0	0	1
11/16/17 08:30	0	0	0	0	1	0	1
11/16/17 08:45	0	0	0	0	0	0	0
11/16/17 09:00	0	1	0	0	0	0	1
Total	1	1	0	0	1	0	3
Cars	SB Left	SB Right	WB Thru	WB Right	EB Left	EB Thru	
11/16/17 16:15	2	38	44	4	14	27	129
11/16/17 16:30	3	40	43	4	15	25	130
11/16/17 16:45	2	30	41	3	29	19	124
11/16/17 17:00	0	28	48	2	22	12	112
11/16/17 17:15	2	47	68	4	43	29	193
11/16/17 17:30	1	34	76	6	28	43	188
11/16/17 17:45	1	25	51	1	30	25	133
11/16/17 18:00	1	19	42	1	24	27	114
Total	12	261	413	25	205	207	1123
Heavys	SB Left	SB Right	WB Thru	WB Right	EB Left	EB Thru	
11/16/17 16:15	2	1	3	0	1	4	11
11/16/17 16:30	0	3	0	0	1	2	6
11/16/17 16:45	0	5	1	1	2	3	12
11/16/17 17:00	0	1	5	0	2	2	10
11/16/17 17:15	0	2	2	0	1	3	8
11/16/17 17:30	0	0	0	0	1	4	5
11/16/17 17:45	0	1	1	0	3	4	9
11/16/17 18:00	0	2	2	0	5	4	13
Total	2	15	14	1	16	26	74
Bikes	SB Left	SB Right	WB Thru	WB Right	EB Left	EB Thru	
11/16/17 16:15	0	0	0	0	0	0	0
11/16/17 16:30	0	0	0	0	0	0	0
11/16/17 16:45	0	0	0	0	0	0	0
11/16/17 17:00	0	0	0	0	0	0	0
11/16/17 17:15	0	0	1	0	0	0	1
11/16/17 17:30	0	0	0	0	0	0	0
11/16/17 17:45	0	2	0	0	0	0	2
11/16/17 18:00	0	0	0	0	0	0	0
Total	0	2	1	0	0	0	3

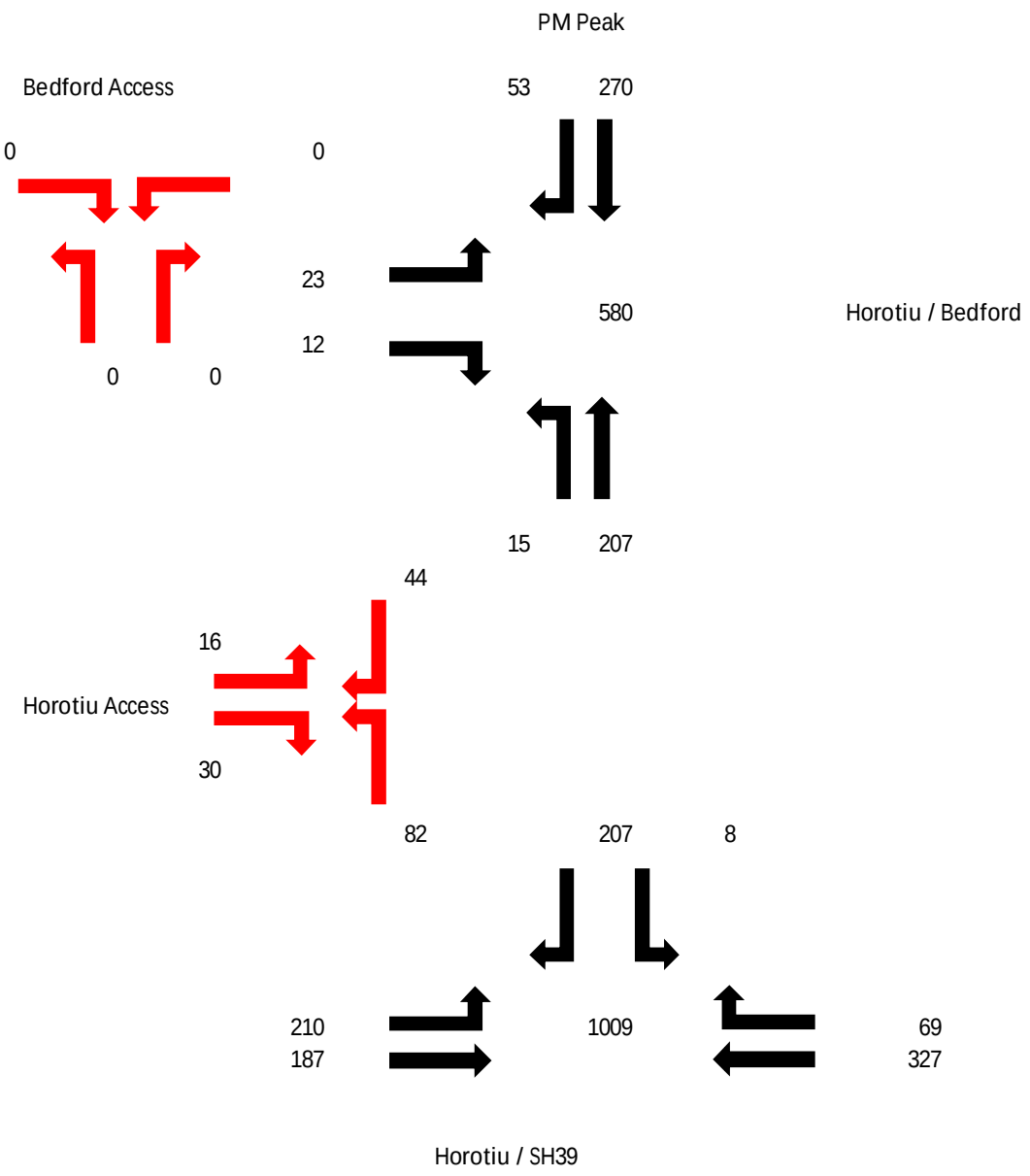
Appendix B

Trips Generated

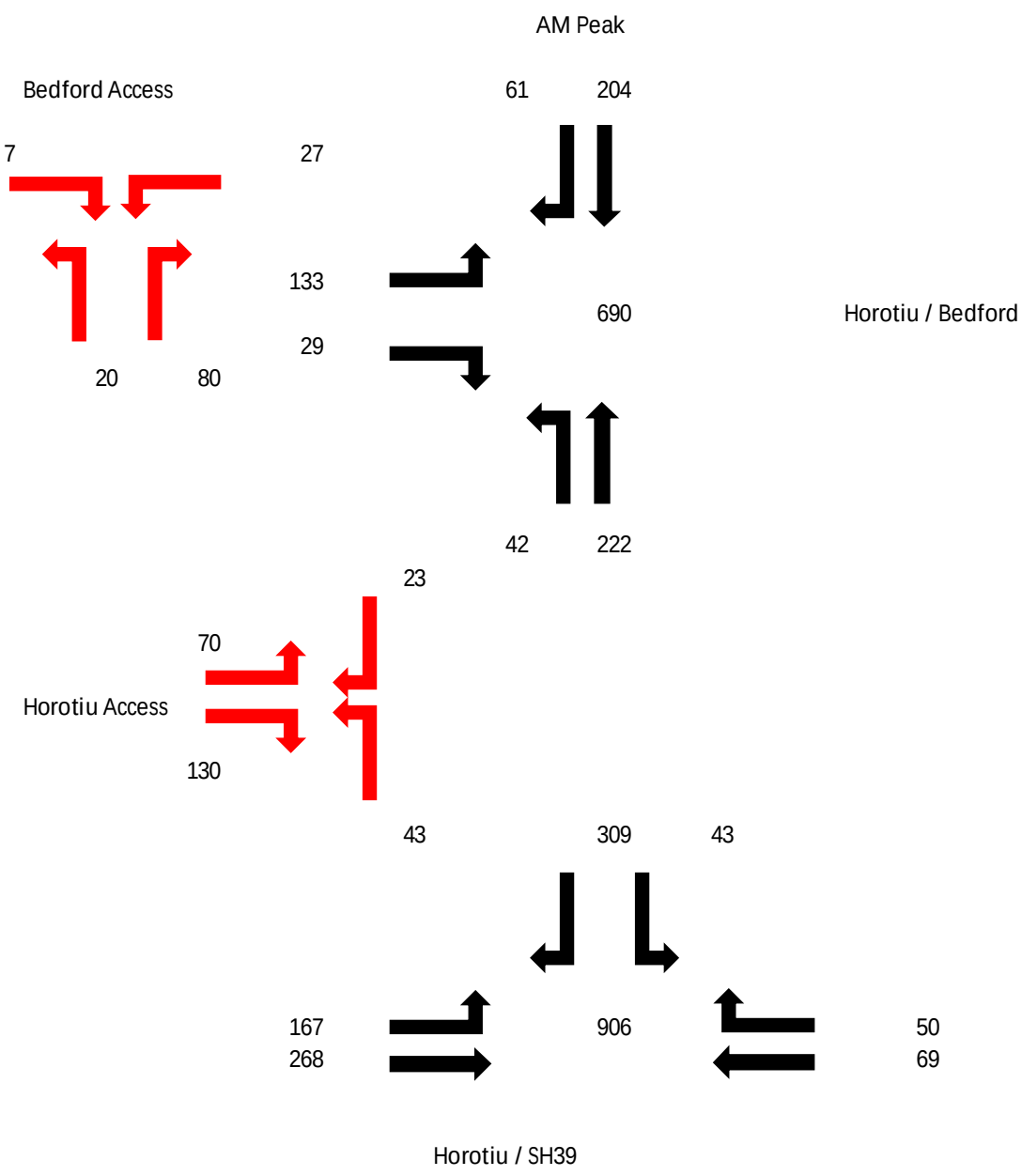
Scenario 1 , Block A only Generated Traffic + Background Traffic



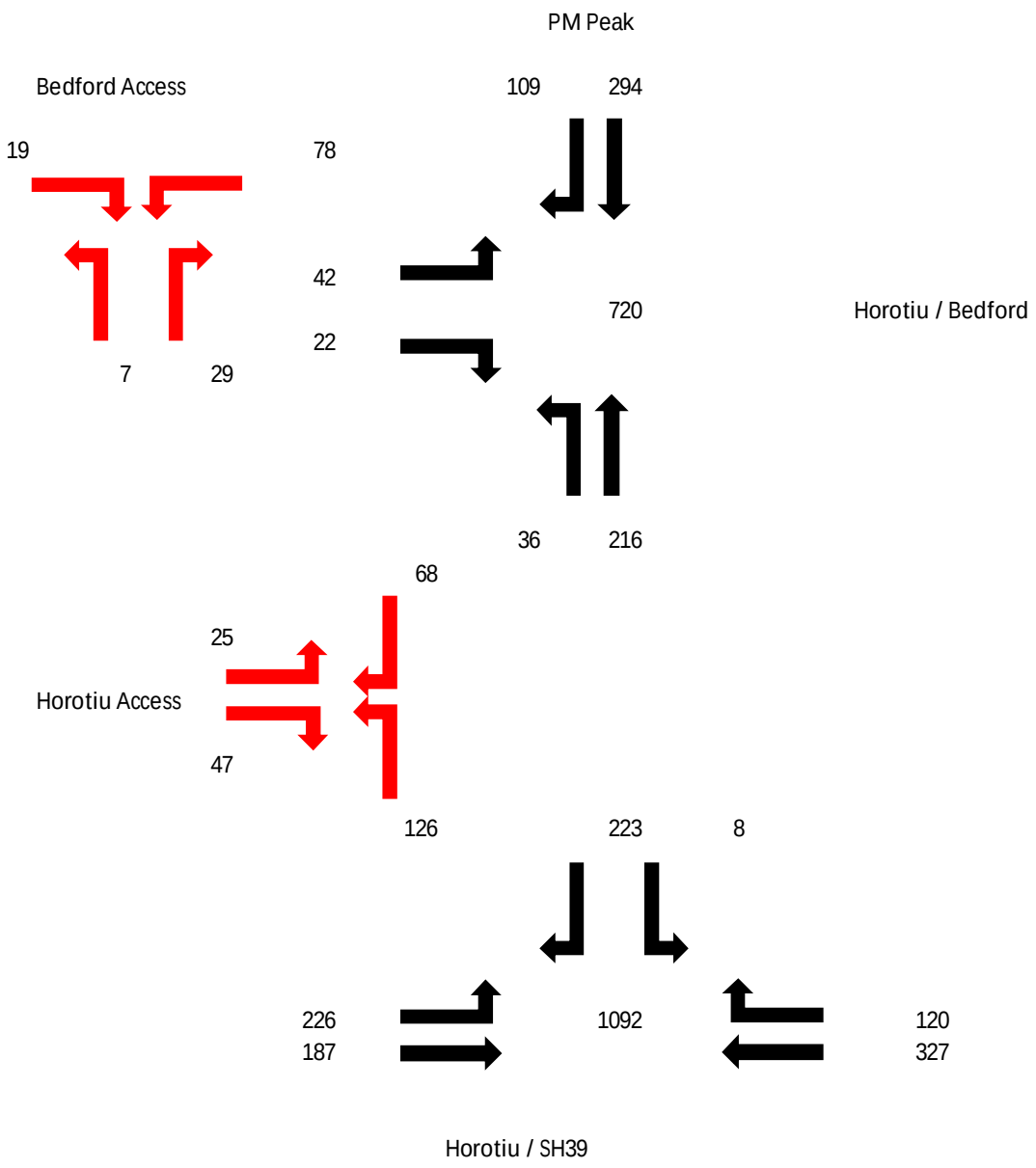
Scenario 1 , Block A only Generated Traffic + Background Traffic



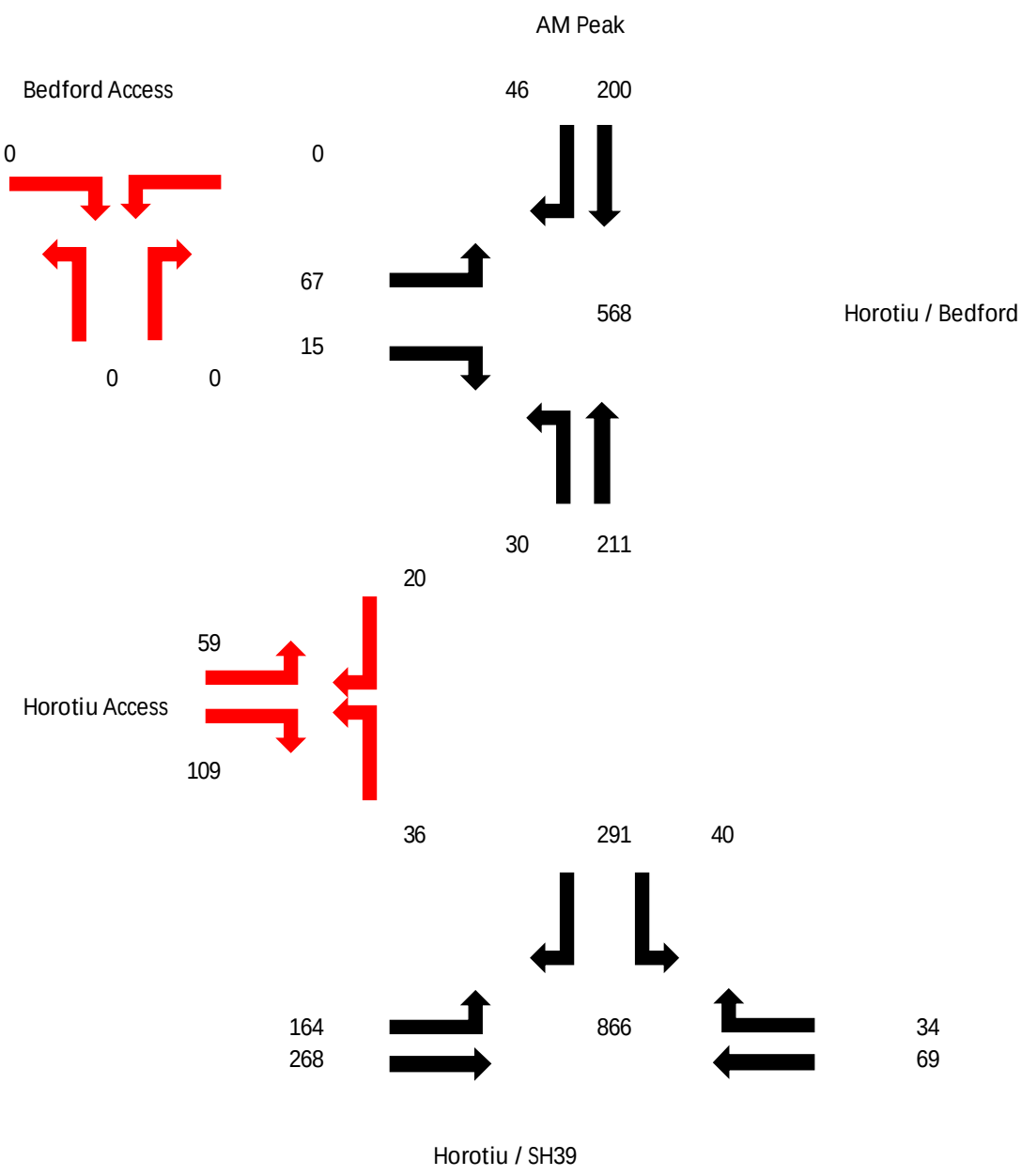
Scenario 1 , Block A & B Generated Traffic + Background Traffic



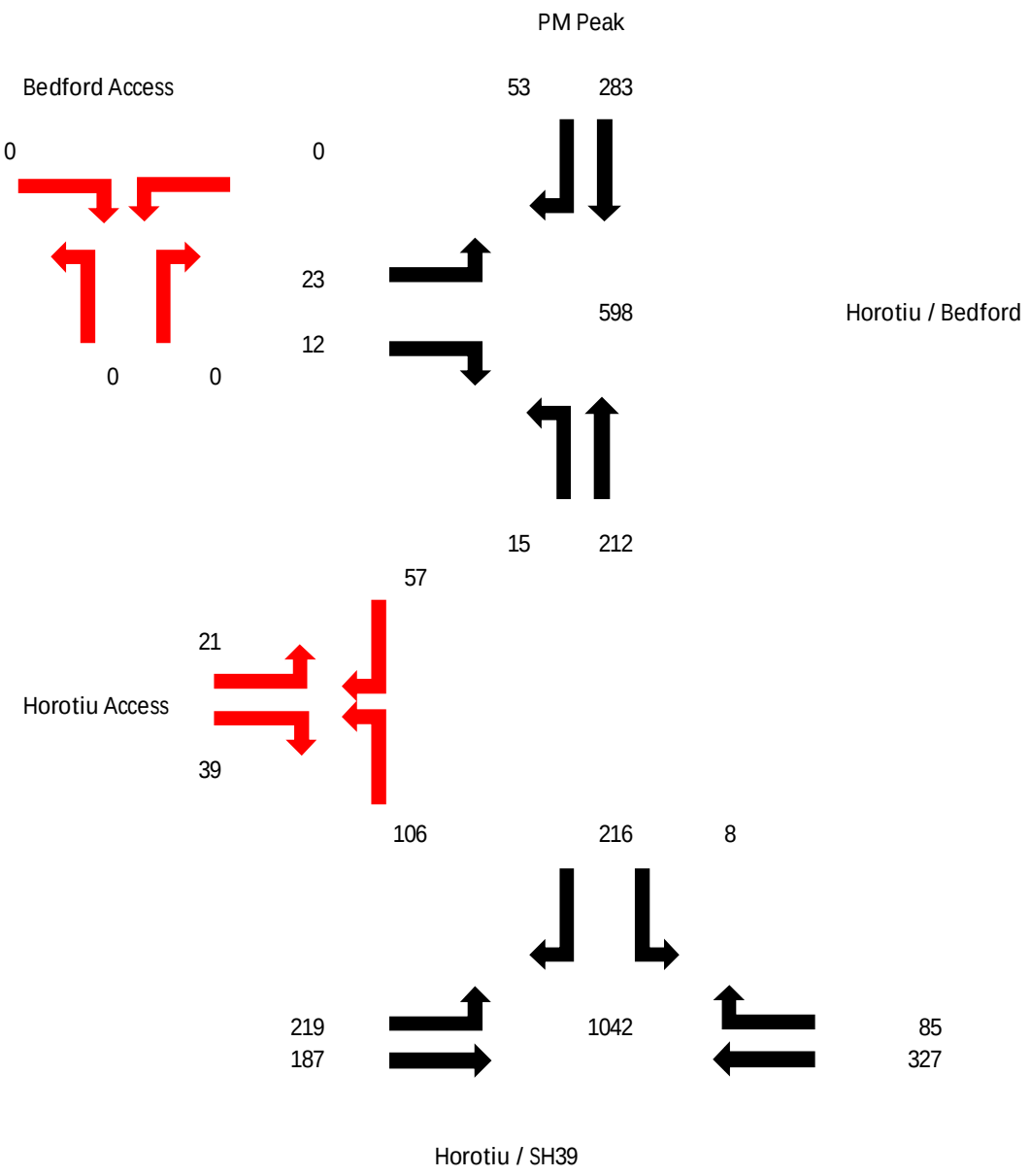
Scenario 1 , Block A & B Generated Traffic + Background Traffic



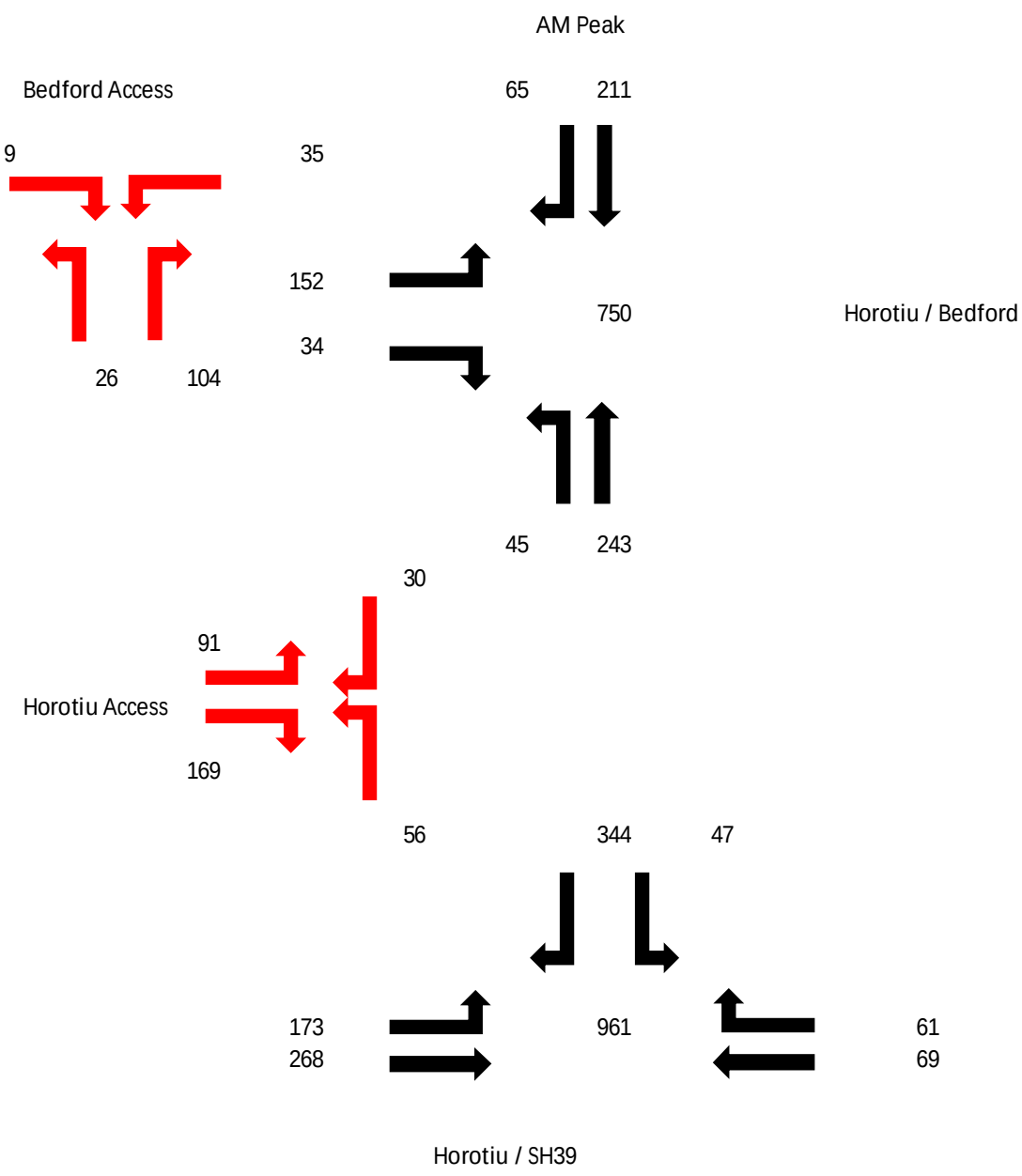
Scenario 2 , Block A only Generated Traffic + Background Traffic



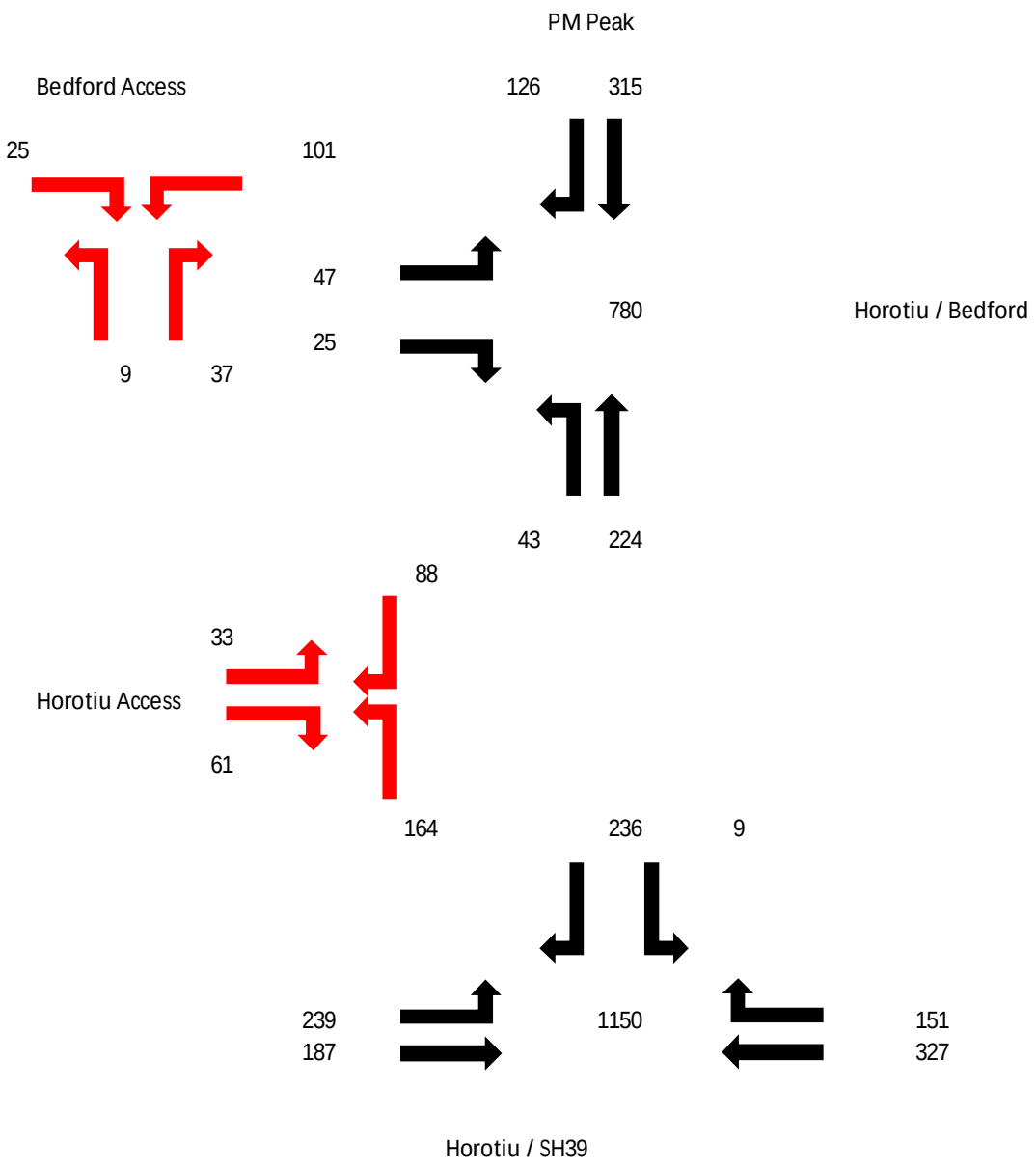
Scenario 2 , Block A only Generated Traffic + Background Traffic



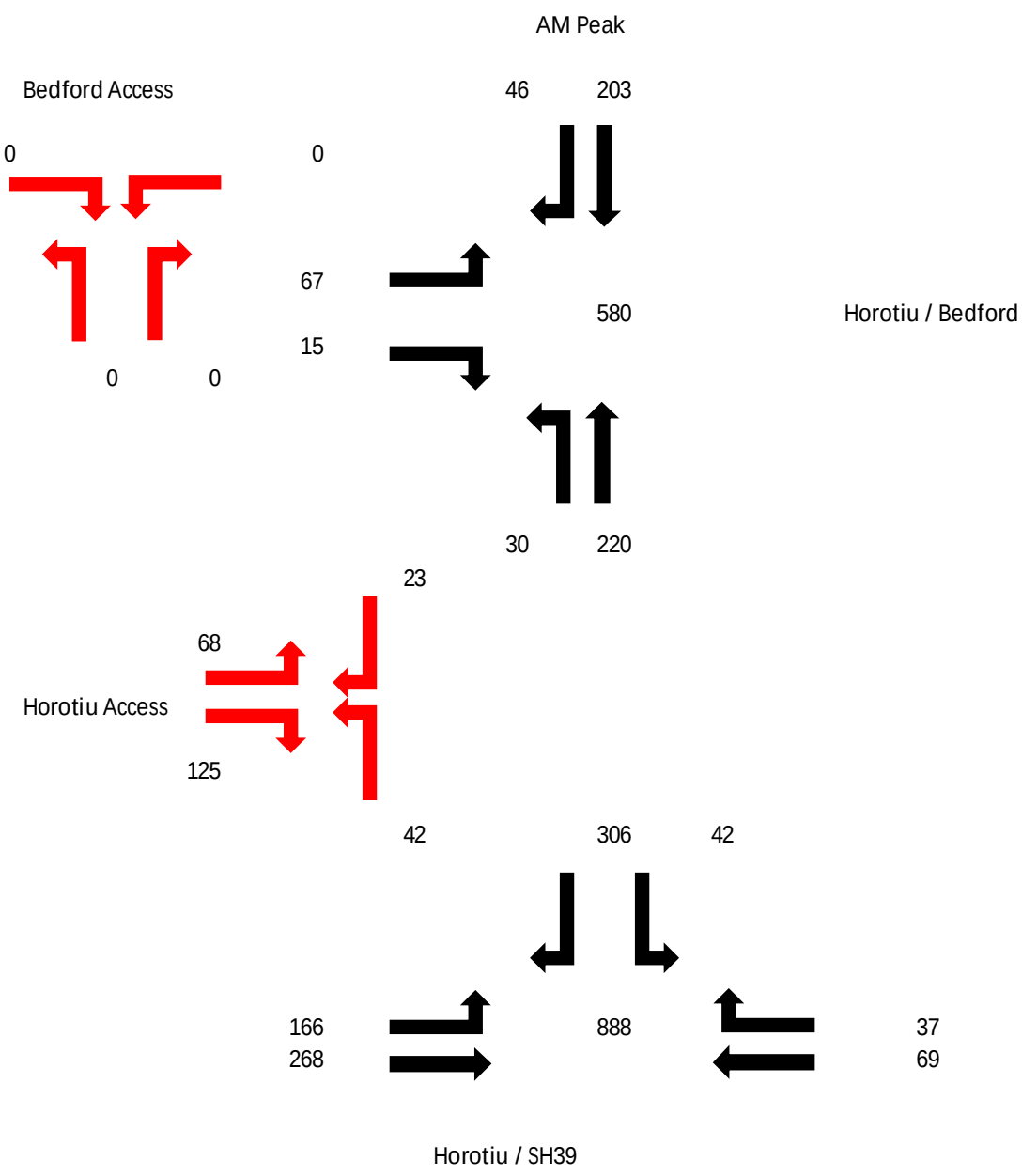
Scenario 2 , Block A & B Generated Traffic + Background Traffic



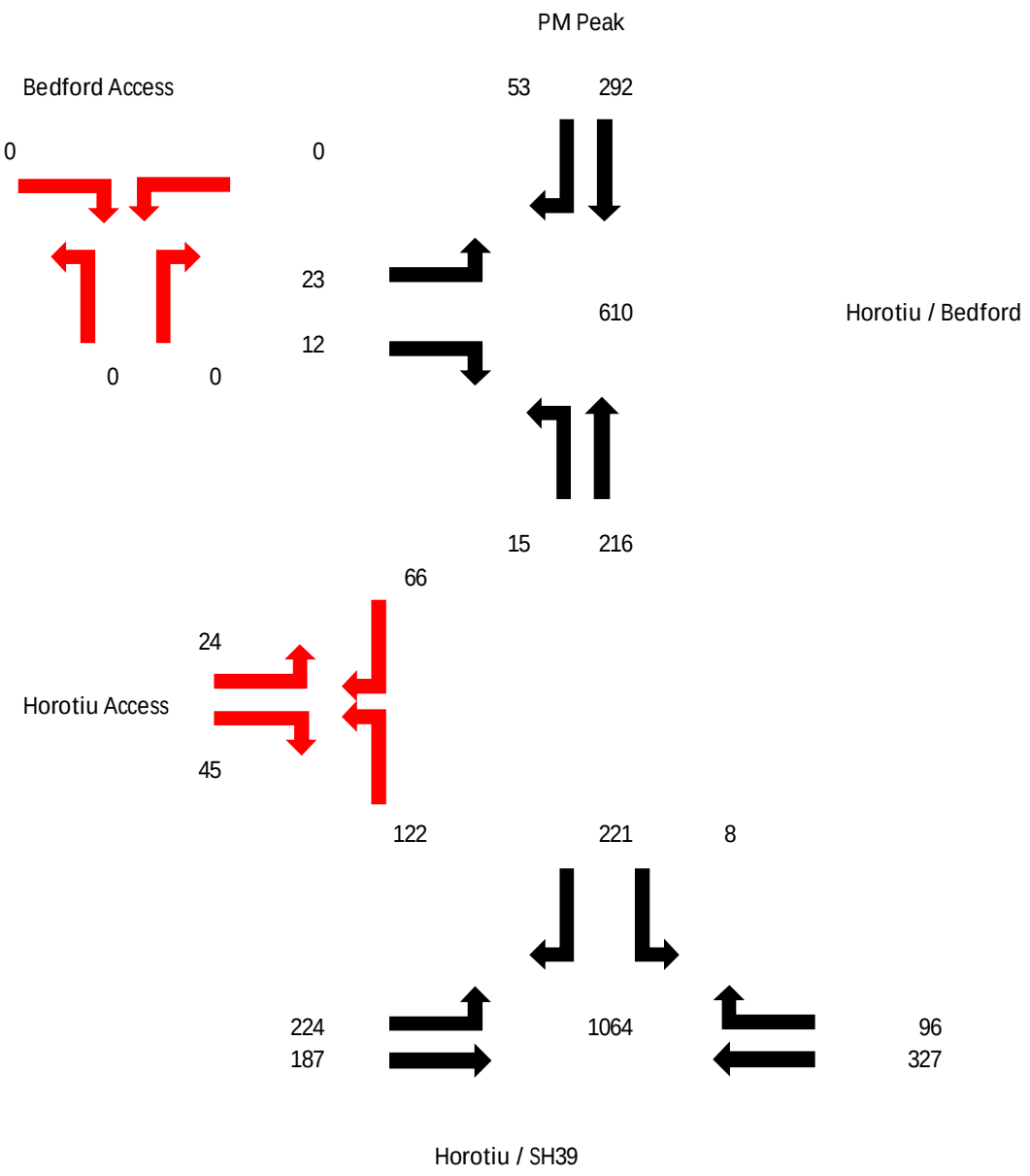
Scenario 2 , Block A & B Generated Traffic + Background Traffic



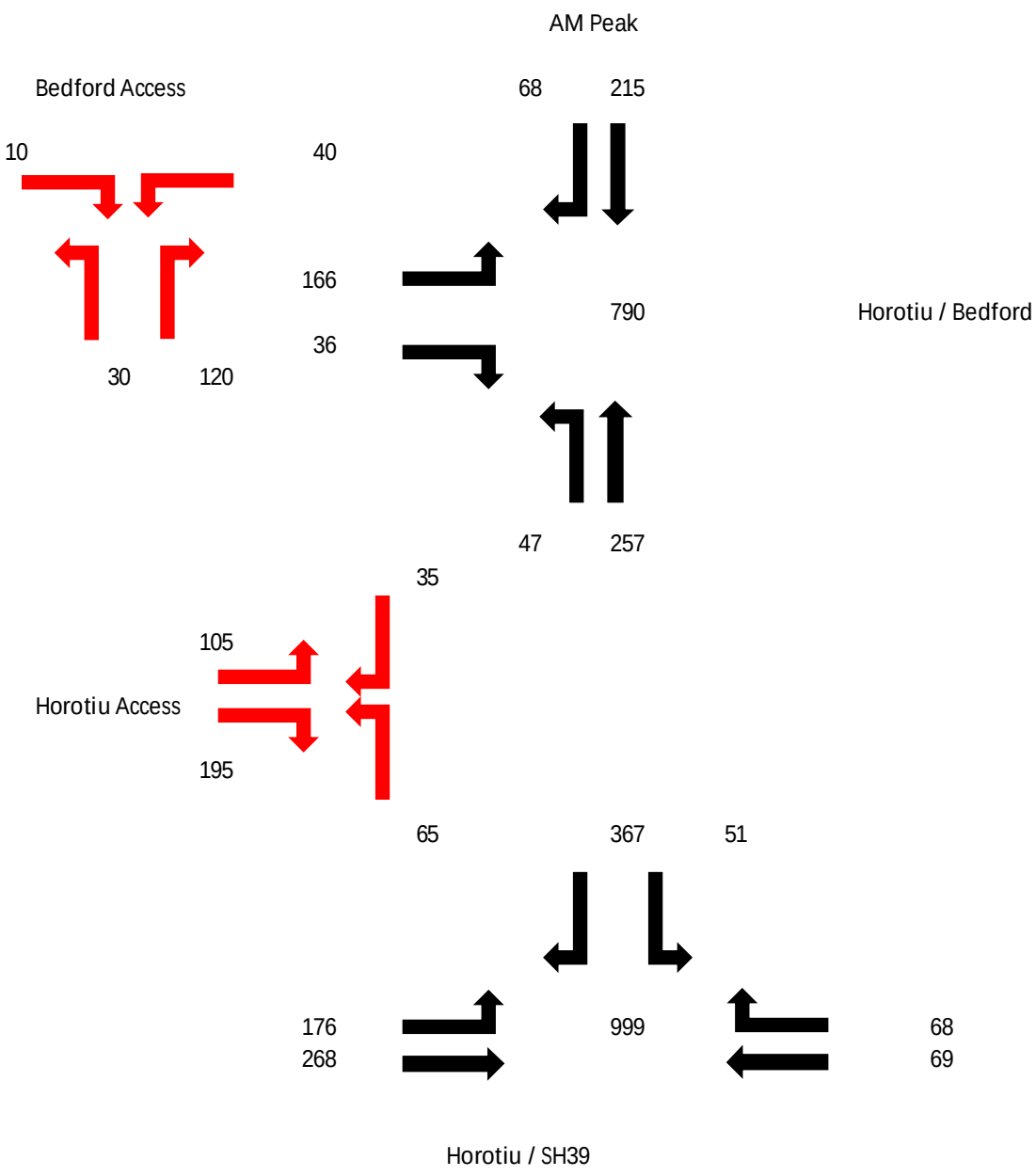
Scenario 3 , Block A only Generated Traffic + Background Traffic



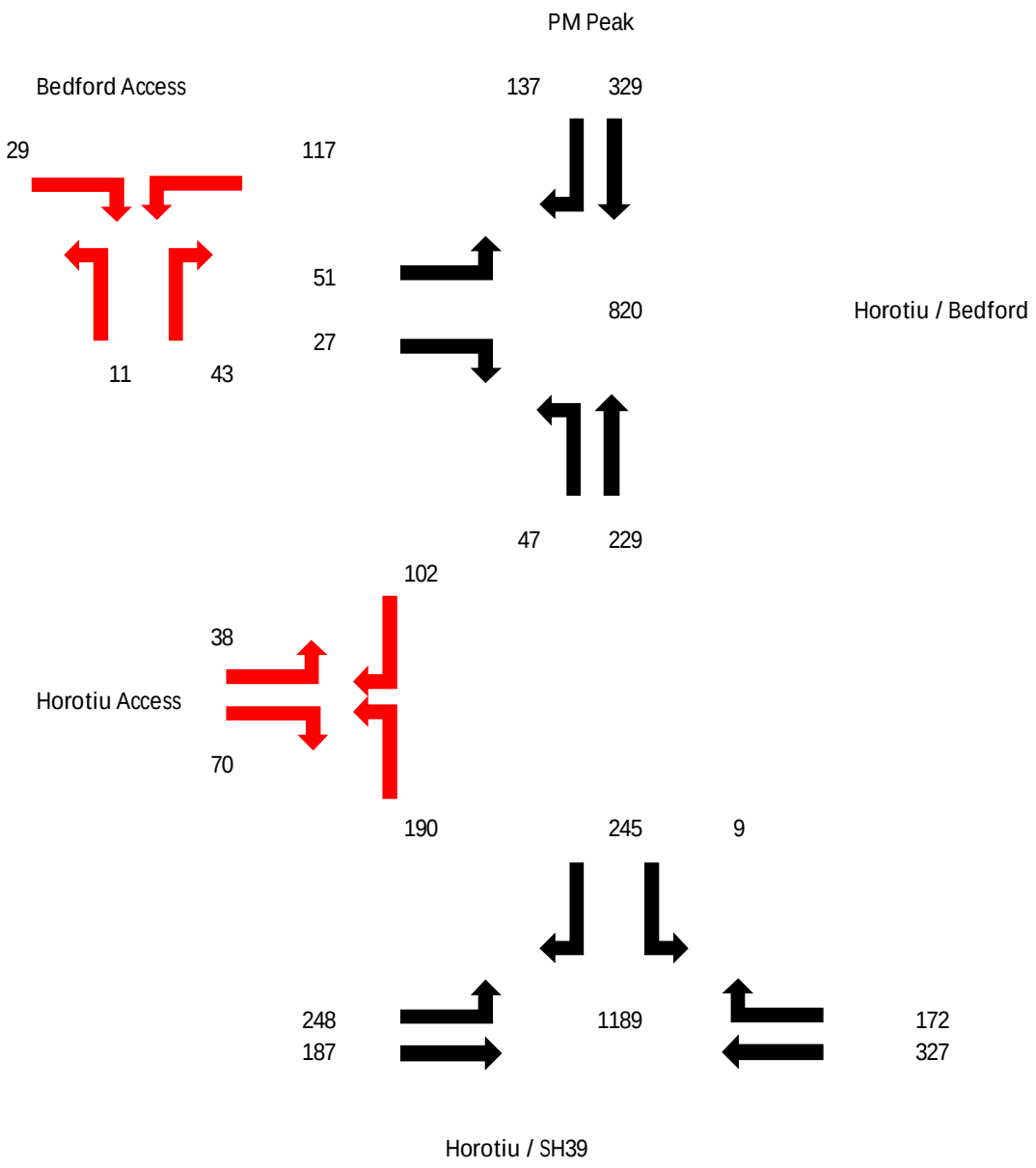
Scenario 3 , Block A only Generated Traffic + Background Traffic



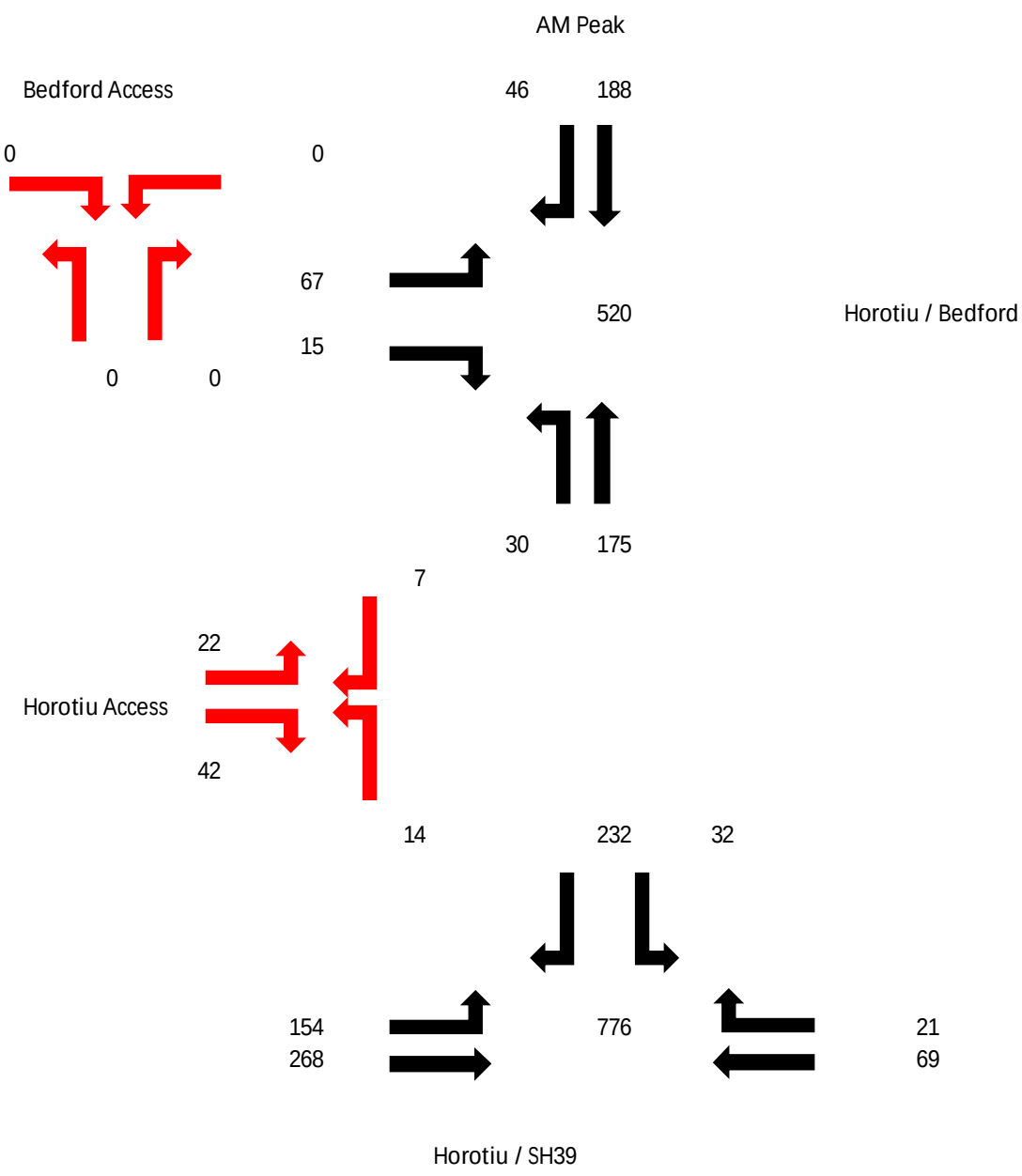
Scenario 3 , Block A & B Generated Traffic + Background Traffic



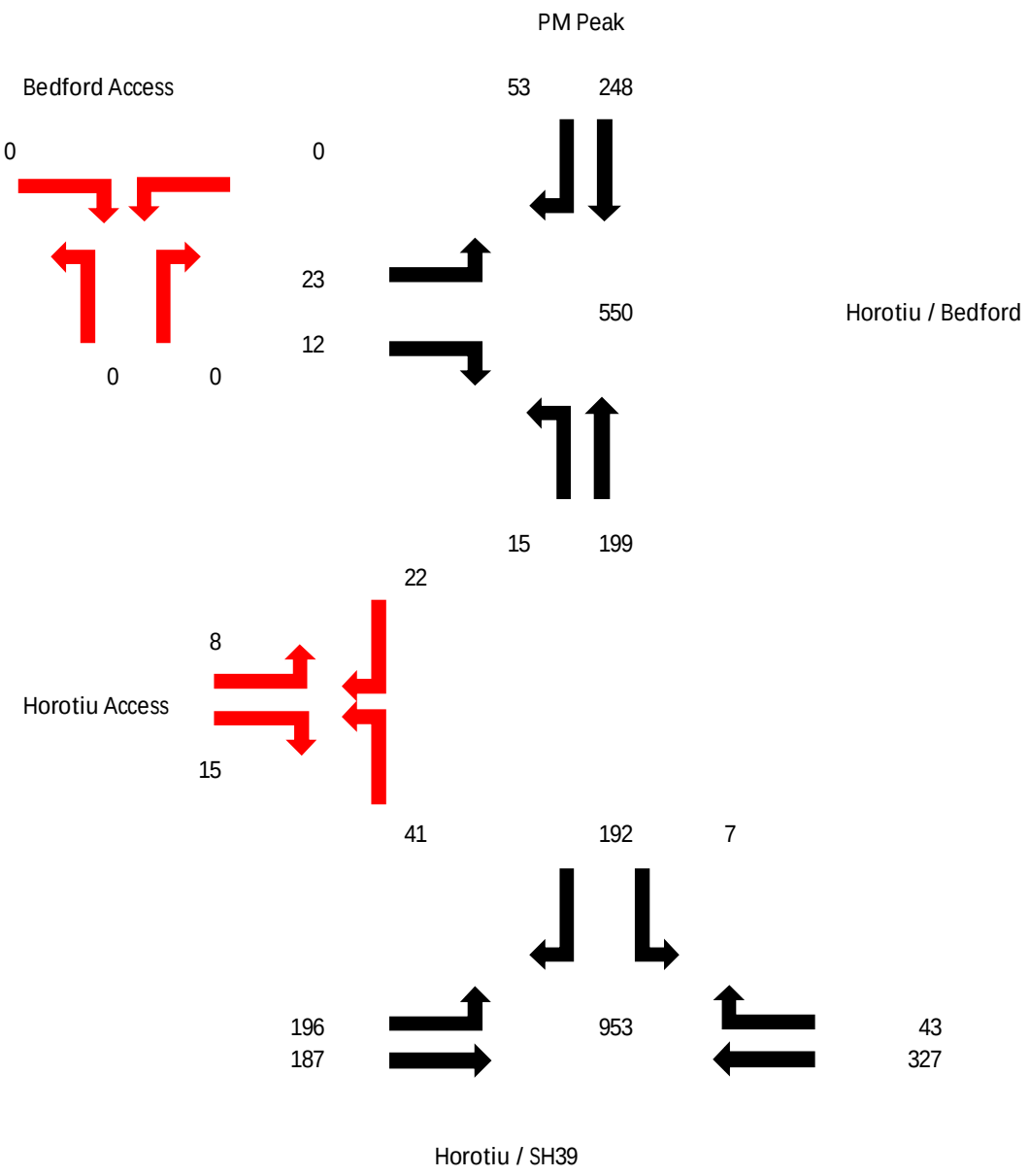
Scenario 3 , Block A & B Generated Traffic + Background Traffic



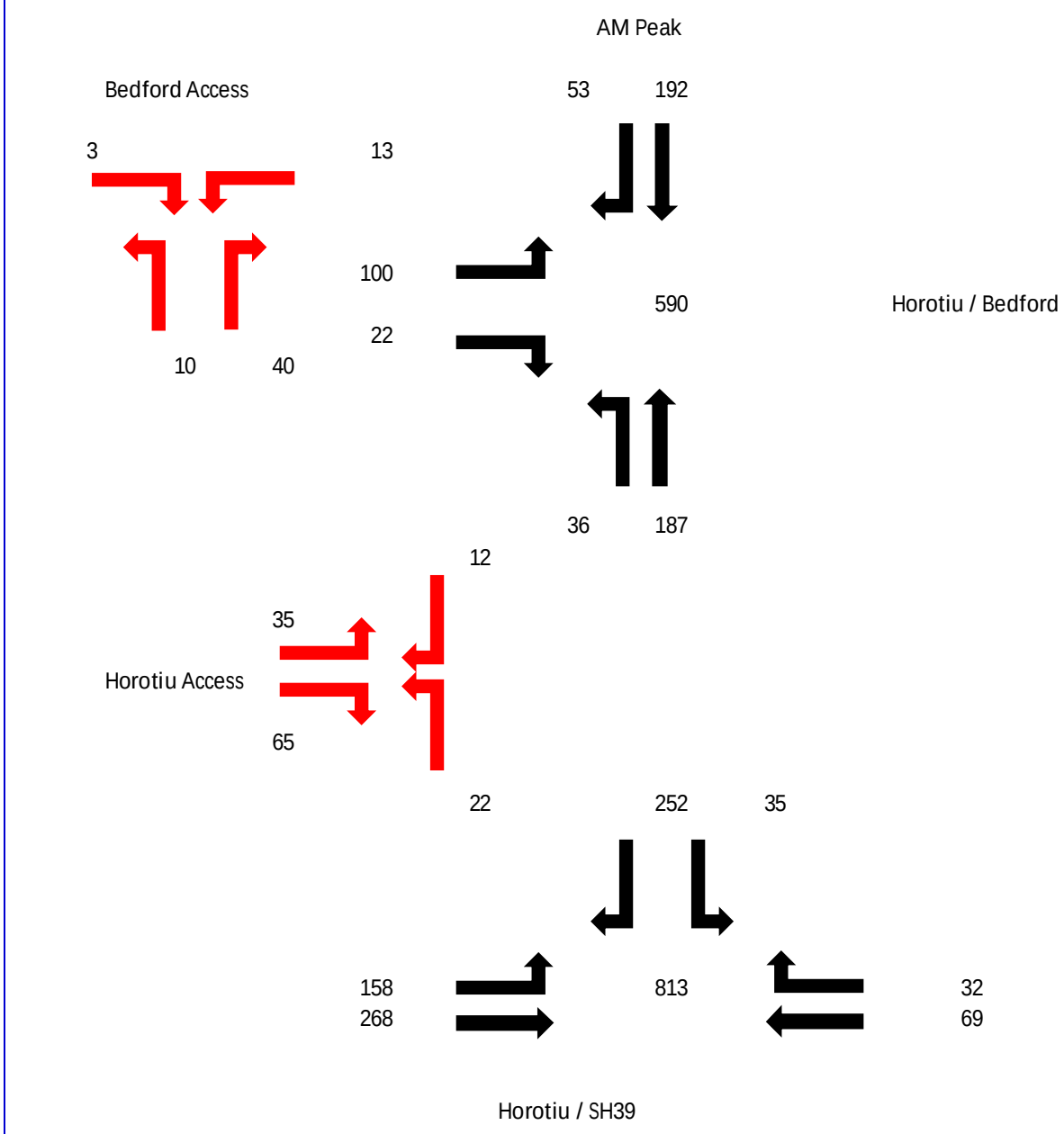
Scenario 4 , Block A only Generated Traffic + Background Traffic



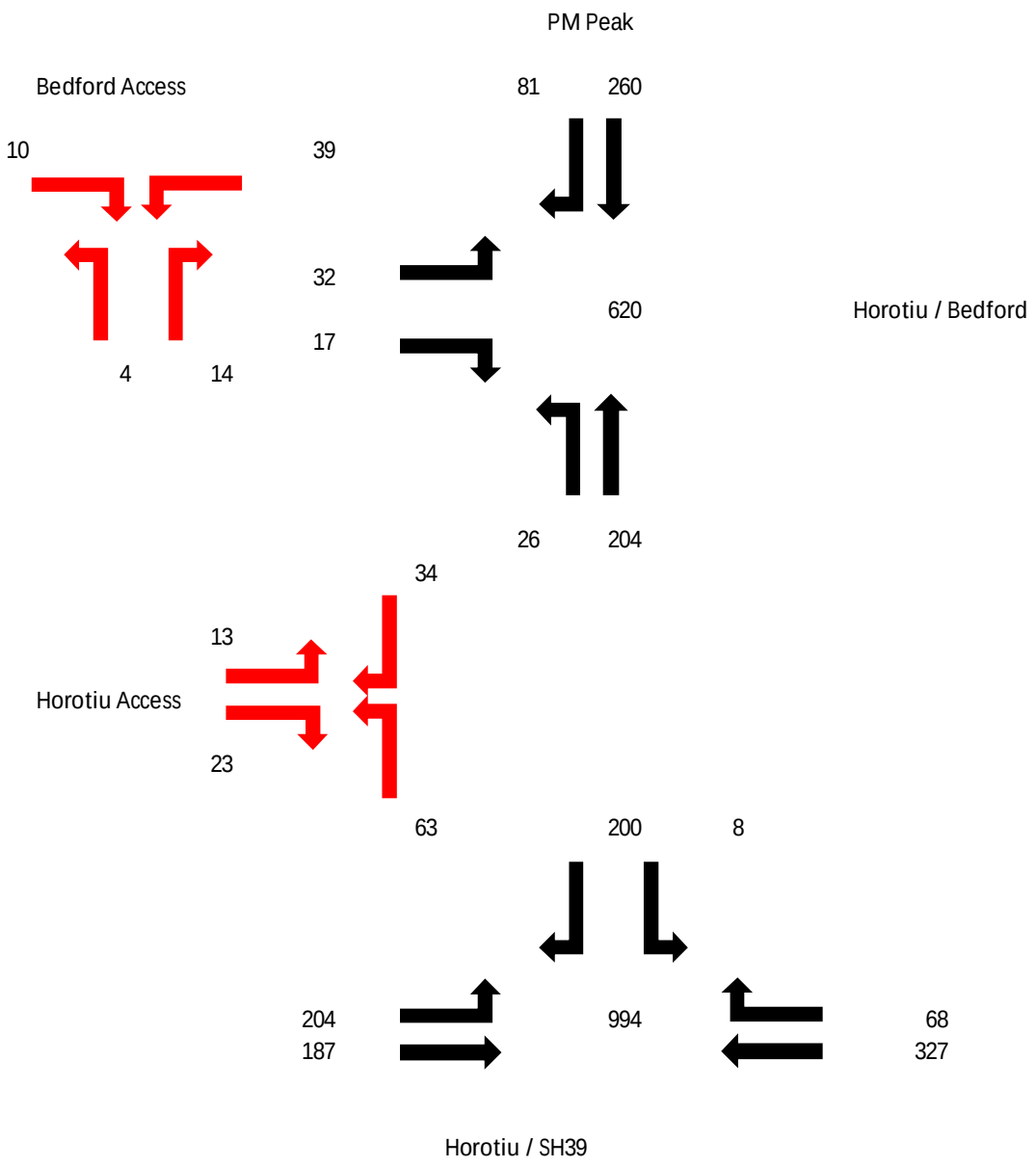
Scenario 4 , Block A only Generated Traffic + Background Traffic



Scenario 4 , Block A & B Generated Traffic + Background Traffic



Scenario 4 , Block A & B Generated Traffic + Background Traffic



Appendix C

Typical Road Cross Sections Tamahere Country Living Zone

Figure 4A Typical Road Cross Sections Tamahere Country Living Zone