TRANSPORTATION IMPACT STUDY

IDA STREET DEVELOPMENT

TOWNSHIP OF SOUTHGATE
GREY COUNTY

PREPARED FOR:

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PREPARED BY:

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CONSULTING ENGINEERS

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Rev.0	April 2023	Issued for Client Review
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1.0 Executive Summary

C. F. Crozier and Associates Inc. (Crozier) was retained by Flato Ida Dundalk Inc. (Client) to undertake a Transportation Impact Study (TIS) to support a Draft Plan of Subdivision Application for the Ida Street Development (Subject Development) located in the northwest end of the Community of Dundalk, Township of Southgate (Township), County of Grey (County).

The proposed Draft Plan prepared by MHBC dated April 30, 2024 consists of 269 single detached dwelling units, 52 townhouse units, and lands to be occupied by future Township land uses. At this time, it was indicated to Crozier to assume the Township lands would be occupied by 68,000 sq.ft. Gross Floor Area (GFA) of office land uses and a 68,000 sq.ft. GFA of recreational centre land uses. Access to the Subject Development is proposed by two accesses to Grey Road 9 and one access to Ida Street.

The TIS analyzes the following intersections:

- Ida Street and Main Street/Grey Road 9
- Proposed Site Accesses

Per the agreed upon Terms of Reference, horizon years of 2027 and 2032 were assessed which represent five and ten years from the study commencement.

The detailed analysis contained within this report resulted in the following key findings:

- Under existing conditions, the Ida Street and Main Street/Grey Road 9 intersection is operating at a Level of Service (LOS) B during the weekday a.m. and p.m. peak hours.

- Several background developments have been considered for the assessment of the background conditions. These developments include Glenelg Phase 1, Glenelg Phase 2, the unoccupied Edgewood Greens units, and White Rose Phase 3. Consideration was also given to the development of the industrial lands surrounding the proposed Eco Parkway extension in an alternative scenario which will be summarized later in the conclusions.

- Under future background conditions, the Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at an LOS A during the weekday a.m. and p.m. peak hours. It is noted as discussed with the Township, a roundabout is the preferred future form of traffic control at this location to accommodate future traffic demand.

- The Subject Development is estimated to generate 471 and 616 two-way trips during the weekday a.m. and p.m. peak hours, respectively. Based on the currently assumed office and recreational centre land uses for the Township lands, the Township lands are estimated to account for approximately 50% of the traffic generated by the Subject Development.

- The left-turn lane warrant analysis indicates that an eastbound left-turn lane is warranted at Site Access A for a posted speed limit of 80 km/h and at Access B for a posted speed of 60 km/h under 2032 total conditions. It is noted that the warrant analysis is based on the current expected land uses for the Township block which accounts for approximately 50% of the estimated traffic generated by the Subject Development. Further, the proposed development is adjacent to the built-up area of Dundalk and will extend the built-up area to the west, it is expected that the 40 km/h posted speed limit could be extended to the western limits of the Subject Development's frontage on Grey Road 9.

- Under future total conditions, the roundabout at Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at LOS A during the weekday a.m. and p.m. peak hour. The site accesses are forecast to operate at LOS D or better during the weekday a.m. and p.m. peak hours. No critical movements are noted.

- As requested in the Terms of Reference, a scenario analyzing the impacts of the Eco Parkway extension and development of surrounding industrial lands was completed under 2032 future total conditions. The Scenario with the Eco Parkway extension and the proposed industrial development lands are estimated to generate 1,376 and 1,266 external two-way trips in the a.m. and p.m. peak hours, respectively. The Eco Parkway extension is also anticipated to detour 30% of the existing traffic volumes on Main Street around downtown Dundalk.

  In the scenario with the Eco Parkway extension that excludes the Subject Development site-generated traffic:

  - An eastbound left-turn lane is warranted at Access A for a posted speed limit of 80 km/h and at Access B for all assessed design speeds. It is noted that the warrant analysis is based on the current expected land uses for the Township block which accounts for approximately 50% of the estimated traffic generated by the Subject Development.

  - The Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at LOS A during the weekday a.m. and p.m. peak hours.

  - The southbound movement on Access A at Grey Road 9 is forecast to operate at LOS F. It is noted that these poor operations are primarily caused by the traffic generated by the current expected land uses for the Township block.

  - The Access 1 and Access B approaches are forecast to operate at LOS D or better during the weekday a.m. and p.m. peak hours and no critical movements are noted.

Based on the key finding, it is recommended that:

- The 40 km/h posted speed limit is extended to the western limits of the Subject Development's frontage on Grey Road 9 to be consistent with the built-up area of Dundalk.

- The need for left-turn lanes or other mitigation measures at the proposed site accesses are reevaluated once the uses of Township lands become known.

The analysis contained within this report was prepared using the Draft Plan prepared by MHBC (April 30, 2024). Any minor revisions to the Draft Plan is not expected to affect the conclusions contained in this report.

In conclusion, the proposed development can be supported from a transportation perspective with the noted recommendations.

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2.1 Background

C. F. Crozier and Associates Inc. (Crozier) was retained by Flato Ida Dundalk Inc. (Client) to undertake a Transportation Impact Study (TIS) to support a Draft Plan of Subdivision Application for the Ida Street Development (Subject Development) located in the northwest end of the Community of Dundalk, Township of Southgate (Township), County of Grey (County).

2.2 Development Proposal

The proposed Draft Plan prepared by MHBC dated April 30, 2024 consists of 269 single detached dwelling units, 52 townhouse units, and lands to be occupied by future Township land uses. At this time, it was indicated to Crozier to assume the Township lands would be occupied by 68,000 sq.ft. Gross Floor Area (GFA) of office land uses and a 68,000 sq.ft. GFA of recreational centre land uses.

Access to the Subject Development is proposed by two accesses to Grey Road 9 and one access to Ida Street.

The proposed Draft Plan prepared by MHBC (April 30, 2024) has been included as **Figure 1**.

2.3 Purpose and Scope

The purpose of the study is to assess the impacts of the proposed development on the study area road network and to recommend mitigation measures, if required.

The study reviewed the following aspects of the proposed residential development from a transportation engineering perspective:

- Existing, future background, and future total traffic operations on the study area road network
- Forecast trip generation and assignment of the Subject Development
- Auxiliary turning lane warrants

The scope and assumptions contained within this report were confirmed through consultation with the Township and the County. **Appendix A** contains the Terms of Reference correspondence.

3.0 Existing Traffic Conditions

3.1 Development Lands

The subject property is approximately 35.94 ha and currently consists of vacant, agricultural, and residential land uses. The subject property is bound by Grey Road 9 and agricultural land uses to the south, agricultural land uses to the north and west, and Ida Street to the east.

Figure 2 illustrates the site's location.

3.2 Study Intersections

The following key intersections within the study area have been analyzed under existing, future background, and future total volume conditions:

- Ida Street and Main Street/Grey Road 9
- Proposed site accesses

3.3 Study Area Road Network

Table 1 describes the study area road network. For the purposes of this report, Ida Street has been given a north-south orientation while Main Street (Grey Road 9) has been given an east-west orientation. The information included below was obtained from the Township of Southgate "Official Plan. **Figure 3** illustrates the existing traffic controls in lane configurations at the study intersections.

Table 1: Study Area Road Network

Road	Main Street / Grey Road 9	Ida Street
Direction	East - West	North - South
Posted Speed Limit	80 km/h when130 m west of Ida Street 40 km/h to east	40 km/h
Classification	County Arterial	Municipal Road
Jurisdiction	County of Grey	Township of Southgate
Sidewalk	Asphalt sidewalk with mountable curb to the East of Ida Street	None
Cycling Facilities	None	None
Transit	Grey Bruce Regional Transit stop at Arena (2.1 km from site)	None

Grey Transit Route 1 & 2 is a bus route that operates between Owen Sound and Orangeville. There is approximately one The closest bus stop is at the Ruth Hargrave Memorial Library in Dundalk, which is approximately 1 kilometre to the east of the Subject Development.

3.4 Traffic Data

Turning movement counts at the study intersections were undertaken by Spectrum Traffic Data Inc. staff from 6:00 a.m. to 10:00 a.m. and from 3:00 p.m. to 7:00 p.m. on Tuesday June 7th, 2022. The turning movement count data is included in **Appendix B**. **Figure 4** illustrates the 2022 existing traffic volumes.

3.5 Intersection Operations

The operations of the study intersections were analyzed using Synchro 11 modelling software.

The operations were assessed based on the 2022 existing traffic volumes and existing lane configurations. **Table 2** summarizes the 2022 existing traffic operations. Level of Service (LOS)

definitions have been included in **Appendix C**. Detailed capacity analysis worksheets are included in **Appendix D**.

Table 2: 2022 Existing Traffic Operations

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay (seconds)	Critical v/c ratio [2]
Ida Street and Main Street/ Grey Road 9	Stop (Two-way)	A.M.	B	11.7 s	0.06 (NB)
		P.M.	B	11.2 s	0.11 (NB)

Note [1]: The LOS of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM2000).
Note [2]: The critical v/c ratio is the maximum v/c ratio for movements at the intersection.

The Ida Street and Main Street / Grey Road 9 intersection operates at a LOS B under existing conditions. The maximum control delay is 11.7 seconds and the largest volume-to-capacity (v/c) ratio is 0.11. These metrics show that the study intersections have reserve capacity for future increases in traffic volumes.

4.0 Future Background Conditions

4.1 Horizon Years

As confirmed with County Staff and the Township peer reviewer (Triton) during pre-study consultations, horizon years of 2027 and 2032 were assessed which represent five and ten years from the study commencement.

4.2 Growth Rate

To remain consistent with the Glenelg Phase 1 TIS, the Glenelg Phase 2 TIS, and the Edgewood Greens TIS, a growth rate of 1.5 percent was used to forecast future background traffic volumes on Main Street/Grey Road 9 and Ida Street.

It is acknowledged that Grey County Transportation Master Plan (Cole Engineering Group and C.C. Tatham & Associates, 2014) used a growth rate of 1.0 percent.

4.3 Study Area Road Network Improvements

Based on a review of Southgate's Development Charges Background Study and published planned roadworks, mostly minor roadworks are planned which are not expected to impact the findings of this report (ie. no changes to lane configurations or traffic control). The exception is the development of Eco-Parkway and the Associated Development Lands, which is assessed as an alternative scenario in this study.

Based on a review of Grey County's Development Charges, Capital Works Schedule and Transportation Master Plan, no road improvements were identified that may impact the study area road network.

Given the anticipated future capacity constraints at the Ida Street and Main Street/Grey Road 9 intersection with the inclusion of nearby future developments, the Township has confirmed that a roundabout is the preferred future form of traffic control at this location to accommodate future traffic demand. It is assumed that the roundabout will be constructed by 2027. **Appendix E** contains an overlay of the proposed roundabout over the existing Ida Street and Main Street/Grey Road 9

intersection. It is noted that the design is still conceptual as additional land will need to be acquired to accommodate the roundabout.

4.4 Background Developments

The background developments identified for inclusion in this study by Township peer reviewer during pre-study consultation are summarized in **Table 3**. **Figure 5** to **Figure 11** illustrate the background development forecast traffic volumes.

Table 3: Background Developments

Background Development	Number of Units	Opening Horizon Year of Analysis	Reference
Edgewood Greens	275[1] Single Detached Dwelling Units and 157[1] Townhouse Dwelling Units	Assumed 2027	C. F. Crozier & Associates Inc. (February 2021)
Glenelg Phase 1	118 Single Detached dwelling Units and 65 Townhouse Dwelling Units	Assumed 2027	C. F. Crozier & Associates Inc. (September 2020)
Glenelg Phase 2	89 Single detached dwelling units and 66 Townhouse Dwelling Units	2025	C. F. Crozier & Associates Inc. (September 2020)
White Rose Phase 3	33[1] Single Detached Dwelling Units 24[1] Townhouse Dwelling Units 34 Senior Adult Housing Units	Assumed 2027	C. F. Crozier & Associates Inc. (February 2021)
Glenelg Phase 3	369 Single Detached Dwelling Units, 90 Townhouse Dwelling Units	Assumed 2027	C.F. Crozier & Associates Inc. (August 2022)

Note[1]: Determined the number of closed units in consultation with development team to avoid accounting for occupied units.

4.4.1 Edgewood Greens

The Edgewood Greens Development is a mixed-use development located southeast of the Ida Street Development. The development is still under construction; however, many of the residential units are currently occupied. Updated residential trip generation rates were estimated using the Institute of Transportation Engineers (ITE) Trip Generation Manual 11th Edition. The commercial trip generation estimates were adopted from the Edgewood Greens TIS update (Crozier, February 2021). It is noted that the size and composition of each land use may change as the development proceeds. The development is assumed to be built-out prior to the 2027 horizon year. **Table 4** summarizes the trip generation estimates.

Table 4: Edgewood Greens Trip Generation

Land Use	Units/GFA	Peak Hour	Trip Type	Trips Generated		
				Inbound	Outbound	Total
LUC 210: Single Family Detached Housing[1]	272 Units	A.M.	Primary	48	137	185
		P.M.		160	94	257
LUC 215: Attached Multifamily Housing [1]	157 Units	A.M.	Primary	24	52	76
		P.M.		51	39	90
LUC 820: Shopping Centre[2]	15,586 ft[2]	A.M.	Primary	10	7	17
			Pass-by	0	0	0
		P.M.	Primary	21	23	44
			Pass-by	11	12	23
Total		**A.M.**	**Primary**	**82**	**196**	**278**
			Pass-by	**0**	**0**	**0**
		P.M.	**Primary**	**55**	**82**	**134**
			Pass-by	**11**	**11**	**12**

Note [1]: The trip generation for the residential units was updated with the fitted curve equations noted in the ITE Trip Generation Manual 11th Edition for the unoccupied unit count.

Note [2]: The trip generation for the commercial block was adopted from the fitted curve equation given in ITE Trip Generation Manual 10th Edition as per the Edgewood Greens, Transportation Impact Study Update (Crozier, January 2020).

The trips generated by the Edgewood Greens development were assigned to the study area road network based on the distribution described in the Edgewood Greens TIS update (Crozier, February 2021). Most trips were assigned to/from Highway 10 with some trips assigned to the west of Dundalk at the intersection of Osprey and Main Street. To extend the trip distribution past Ida Street it was assumed that the trips assigned to Main Street would continue straight on Main Street at the intersection with Ida Street.

Relevant excerpts from the Edgewood Greens TIS update (Crozier, February 2021) have been included in **Appendix F**. The trip assignment for Edgewood Greens development is illustrated in **Figure 5** and **Figure 6**.

4.4.2 Glenelg Phase 1

Glenelg Phase 1 is a residential development located on to the northeast of the Ida Street Development. The development is proposed to consist of 118 single detached dwelling units and 65 townhouse dwelling units. Access is proposed though two all-move accesses to Glenelg Street but it is noted that the traffic study was analyzed with only one full move access. It was assumed the development would be completed prior to the 2027 horizon year. **Table 5** summarizes the trip generation estimates noted in the Glenelg Phase 2 TIS Study (Crozier, September 2020).

Table 5: Glenelg Phase 1 Trip Generation

Development	Unit Type	Number of Units	Roadway Peak Hour	Number of Trips		
				Inbound	Outbound	Total
Glenelg Phase 1	LUC 210: Single Family Detached Housing	118	Weekday A.M.	22	67	89
			Weekday P.M.	75	44	119
	LUC 220: Multifamily Housing (Low-Rise)	65	Weekday A.M.	7	25	32
			Weekday P.M.	25	15	40
Total			**Weekday A.M.**	**29**	**92**	**121**
			Weekday P.M.	**100**	**59**	**159**

The trips generated by the Glenelg Phase 1 were assigned to the study area road network based on the distribution used in the Glenelg Phase 2 TIS (Crozier, September 2020). **Appendix F** contains the Glenelg Phase 2 TIS. The trip assignment for Glenelg Phase 1 is illustrated in **Figure 7**.

4.4.3 Glenelg Phase 2

The Glenelg Phase 2 development is located to the northeast of the Ida Street Development. Glenelg Phase 2 connects to Glenelg Street through Glenelg Phase 1. Based on the Glenelg Phase 2 Transportation Impact Study (Crozier, September 2020), the development is proposed to include 89 single detached dwelling units and 66 townhouse dwelling units. It is noted that the trip generation estimates are conservative as the number of units may be a reduced to provide access to the Glenelg Phase 3. **Table 6** summarizes the trip generation estimates.

Table 6: Glenelg Phase 2 Trip Generation

Use	Trip Type	Peak Hour	Number of Trips		
			Inbound	Outbound	Total
LUC 210: Single Family Detached Housing (89 Units)	Primary	Weekday A.M.	17	51	68
	Primary	Weekday P.M.	57	34	91
LUC 220: Multifamily Housing (Low-Rise) (66 Units)	Primary	Weekday A.M.	7	25	32
	Primary	Weekday P.M.	26	15	41
Total	**Primary**	**Weekday A.M.**	**24**	**76**	**100**
	Primary	**Weekday P.M.**	**83**	**49**	**132**

Note: The trip generation above was adopted from the fitted curve equation given in ITE Trip Generation Manual 10th Edition as per the Glenelg Phase 2 Transportation Impact Study (Crozier, September 2020). As the second roadway extending from Street B was not accounted for in the original draft plan, 2-3 units may be removed. This will not significantly impact the findings of the study as the original unit count and trip generation have been maintained.

The trips generated by Glenelg Phase 2 were assigned to the study area road similar to the Glenelg Phase 2 TIS. **Figure 8** illustrates the Glenelg Phase 2 trip assignment.

4.4.4 White Rose Park Phase 3

The White Rose Phase 3 development is located to the northeast of the Ida Street Development. Based on the White Rose Phase 3 Transportation Impact Study (Triton Engineering Services, September 2020), the development is proposed to consist of 33 single detached dwelling units, 24 townhouse dwelling units, and 34 senior dwelling units. **Table 7** summarizes the trip generation estimates.

Table 7: White Rose Phase 3 Trip Generation

Use	Trip Type	Peak Hour	Number of Trips		
			Inbound	Outbound	Total
LUC 210: Single Family Detached Housing (33 Units)	Primary	Weekday A.M.	8	23	31
	Primary	Weekday P.M.	23	13	36
LUC 230: Residential Condominium/ Townhouse (24 Units)	Primary	Weekday A.M.	3	14	17
	Primary	Weekday P.M.	13	6	19
LUC 252: Senior Adult Housing (Attached) (34 Units)	Primary	Weekday A.M.	2	3	5
	Primary	Weekday P.M.	5	1	6
Total	**Primary**	**Weekday A.M.**	**13**	**40**	**53**
	Primary	**Weekday P.M.**	**41**	**20**	**61**

Note: The trip generation above was adopted from the fitted curve equation given in ITE Trip Generation Manual 10th Edition as per the White Rose Phase 3 TIS (Triton, September 2020).

The trips generated by White Rose Phase 3 were assigned to the study area road consistent with the transportation impact study. **Figure 9** illustrates the White Rose Phase 3 trip assignment, and **Appendix F** contains White Rose TIS Excerpts.

4.4.5 Glenelg Phase 3

Glenelg Phase 3 is located to the northeast of the Ida Street Development. Based on the Glenelg Phase 3 Transportation Impact Study (Crozier, August 2022) the development is proposed to have 369 single family detached units and 90 townhouse units. **Table 8** summarizes the trip generation estimates. The trip assignment is illustrated in **Figure 10.**

Table 8: Glenelg Phase 3 Trip Generation

	Trip Type	Peak Hour	Number of Trips		
			Inbound	Outbound	Total
LUC 210 'Single Family Homes' (369 Units)	Primary	Weekday A.M.	64	181	304
	Primary	Weekday P.M.	214	125	339
LUC 215 'Single Family Attached housing ' (90 Units)	Primary	Weekday A.M.	13	28	41
	Primary	Weekday P.M.	28	22	50
TOTAL	**Primary**	**Weekday A.M.**	**76**	**209**	**285**
	Primary	**Weekday P.M.**	**242**	**147**	**389**

The trips generated by Glenelg Phase 3 impact the traffic volumes at the Ida Street and Main Street/Grey Road 9 intersection and thus were assigned to the study area network similarly to the Glenelg Phase 3 TIS.

Figure 11 illustrates the total trip assignment of all the background developments.

4.5 Intersection Operations

The operations of the study intersections were analyzed based on the 2027 and 2032 future background traffic volumes. The background volumes, which include the generalized background growth and the noted background developments, are illustrated in **Figure 12** and **Figure 13** for the 2027 and 2032 horizons, respectively. **Appendix C** contains the LOS definitions and **Appendix D** contains the detailed capacity analysis worksheets. **Table 9** and **Table 10** summarize the 2027 and 2032 future background traffic operations, respectively.

Table 9: 2027 Future Background Traffic Operations

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay[1]
Ida Street and Main Street/Grey Road 9	Roundabout	A.M.	A	1.4 s
		P.M.	A	1.3 s

Note [1]: Applies to the overall Intersection.

Table 10: 2032 Future Background Traffic Operations

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay
Ida Street and Main Street/Grey Road 9	Roundabout	A.M.	A	1.4 s
		P.M.	A	1.4 s

Note [1]: Applies to the overall Intersection.

The implementation of the roundabout at the Ida Street and Main Street/Grey Road 9 intersection is forecast to result in operations of LOS A under future background conditions and no critical movements are noted. This is an improvement over the existing two-way stop control configuration, which is operating at LOS B under existing conditions during the weekday a.m. and p.m. peak hours. The maximum control delay of 1.4 seconds indicate that the intersection has capacity for increases in traffic volumes.

5.0 Site Generated Traffic

The proposed development will result in additional vehicles on the study area road network that previously did not exist.

5.1 Trip Generation

The trip generation of the proposed development was forecast using the fitted curve equations from the ITE Trip Generation Manual 11th Edition for Land Use Code (LUC) 210 "Single Family Detached Housing", LUC 220 "Multifamily Housing (Low-Rise)", LUC 730 "Government Office Building" and LUC 495 "Recreation Center". **Table 11** summarizes the estimated trip generation of the Subject Development. **Appendix G** contains ITE Trip Generation Manual Excerpts.

Table 11: Subject Development Trip Generation

Use	Trip Type	Peak Hour	Number of Trips		
			Inbound	Outbound	Total
LUC 210: Single Family Detached Housing (266 Units)	Primary	Weekday A.M.	45	136	181
	Primary	Weekday P.M.	157	92	249
LUC 220: Multifamily Housing (Low-Rise) (55 Units)	Primary	Weekday A.M.	10	30	40
	Primary	Weekday P.M.	28	16	44
Residential Total	**Primary**	**Weekday A.M.**	**55**	**166**	**221**
	Primary	**Weekday P.M.**	**185**	**108**	**293**
LUC 730: Government Office Building (68,000 sq. ft.)	Primary	Weekday A.M.	106	14	120
	Primary	Weekday P.M.	20	101	121
LUC 495: Recreational Community Center (68,000 sq. ft.)	Primary	Weekday A.M.	86	44	130
	Primary	Weekday P.M.	95	107	202
Township Lands Total	**Primary**	**Weekday A.M.**	**192**	**58**	**250**
	Primary	**Weekday P.M.**	**115**	**208**	**323**
Subject Development Total	**Primary**	**Weekday A.M.**	**247**	**224**	**471**
	Primary	**Weekday P.M.**	**300**	**316**	**616**

The Subject Development is estimated to generate 471 and 616 two-way trips during the weekday a.m. and p.m. peak hours, respectively. Based on the currently assumed office and recreational centre land uses for the Township lands, the Township lands are estimated to account for approximately 50% of the traffic generated by the Subject Development.

5.2 Trip Distribution and Assignment

Trips generated by the Ida Street Development were distributed to the boundary road network similar to the distribution used in the Glenelg Phase 1 TIS and Glenelg Phase 2 TIS. The trip distribution was based on Transportation Tomorrow Survey (TTS) data. The TTS is a comprehensive survey of transportation characteristics which includes the Golden Horseshoe, Simcoe County, and Grey County. As TTS data is not available for the Community of Dundalk, the Township of Melancthon (adjacent Dundalk to the south and east) was selected as it is considered most representative of the subject area. The TTS Data used in the Glenelg studies have been included in **Appendix F**.

The trip distribution is as follows:

- 80% to/from the east on Main Street.
    - 20% to/from downtown Dundalk
    - 60% to/from Highway 10
- 10% to/from the west on Main Street/Grey Road 9
- 10% to/from the north on Ida Street

The trip assignment of the Subject Development is illustrated in **Figure 14**.

6.0 Future Total Conditions

6.1 Basis of Assessment

The total traffic volumes combine the background traffic volumes with the traffic volumes generated by the Subject Development. **Figure 15** and **Figure 16** illustrate the 2027 and 2032 future total traffic volumes for the weekday a.m. and p.m. peak hours.

6.2 Left-Turn Lane Warrant

Auxiliary left-turn lane warrants were assessed at the proposed site accesses to Grey Road 9 and Ida Street based on the methodology described in the MTO Design Supplement for the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR). As a roundabout is planned for the Ida Street and Main Street/Grey Road 9 intersection, left-turn lanes were not assessed at this location.

There is a 40 km/h posted speed limit throughout Dundalk. As the proposed development is adjacent to the built-up area of Dundalk and will extend the built-up area to the west, it is expected that the 40 km/h posted speed limit could be extended to the western limits of the Subject Development's frontage on Grey Road 9. If the 40 km/h posted speed limit is not extended, it is recommended that a speed transition area of 60 km/h is implemented between the posted 40 km/h and 80 km/h locations. It was assumed that the existing posted speed limit of 40 km/h on Ida Street would not be increased in the future.

Auxiliary left-turn lane warrants have been evaluated at the site access to Ida Street for a posted speed limit of 40 km/h, the easterly access to Grey Road 9 for posted speed limits of 40 km/h and 60 km/h, and the westerly access to Grey Road 9 for posted speed limits of 40 km/h, 60 km/hr, and 80 km/h which correspond to design speeds of 50 km/h, 80 km/h, and 100 km/h, respectively. As left-turn lane warrants for higher speeds are more likely to require a left-turn lane, warrants were not evaluated at the lower speed thresholds if they were not warranted at the higher design speeds.

Table 12 summarizes the results of the left-turn lane warrants and **Appendix H** contains the left-turn lane warrant nomographs. **Appendix I** contains excerpts from the TAC Manual.

Table 12: Left-Turn Lane Warrant Summary

Access	Peak Hour	Design Speed		
		50 km/h	80 km/h	100 km/h
Access A Eastbound-Left	A.M.	X	X	X
	P.M	X	X	15 m
Access B Eastbound-Left	A.M.	X	X	N/A
	P.M	X	15 m	N/A
Access 1 Northbound-Left	A.M.	X	N/A	N/A
	P.M	X	N/A	N/A

An eastbound left-turn lane is warranted at Site Access A for a posted speed limit of 80 km/h and at Access B for a posted speed of 60 km/h under 2032 total conditions.

Based on the 2032 total operations analysis discussed in **Section 6.3**, the eastbound movements on Grey Road 9 at the site accesses are forecast to operate at LOS A with delays of less than 2 seconds without the implementation of eastbound left-turn lanes on Grey Road 9. Further, there are 7 or fewer eastbound left-turning vehicles on Grey Road 9 at Access B forecast under 2032 total conditions, which is approximately one vehicle every 10 minutes.

If the speed limit is not reduced across the Subject Development's frontage to Grey Road 9, it is recommended an eastbound left-turn lane is implemented at Access A with 15 metres of storage. However, due to the low future volumes forecast to use Access B and due to the lower speed limit, it is recommended that the Township monitors Access B for the need of an eastbound left-turn.

It is noted that these recommendations are based on the current expected land uses for the Township block. The need for left-turn lanes should be reevaluated once the Township land uses become known as they currently account for approximately 50% of the estimated traffic generated by the Subject Development.

6.3 Intersection Operations

The operations of the study intersections were analyzed based on the 2027 and 2032 total traffic volumes. **Table 13** and **Table 14** outline the 2027 and 2032 horizon year future total traffic operations, respectively. It has been assumed that the 40 km/hr speed limit on Main Street has been extended westerly beyond Access A. LOS definitions have been included in **Appendix C** and detailed capacity analyses worksheets are included in **Appendix D.**

Table 13: 2027 Future Total Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Max v/c ratio
Ida Street and Main Street/Grey Road 9	Roundabout	A.M.	A	2.4 s	N/A
		P.M.	A	3.1 s	
Ida Street and Access 1	Stop (T-intersection)	A.M.	A	9.3 s	0.06 (EB)
		P.M.	A	9.4 s	0.04 (EB)
Grey Road 9 & Access A	Stop (T-intersection)	A.M.	B	14.0 s	0.20 (SB)
		P.M.	D	25.3 S	0.59 (SB)
Grey Road 9 & Access B	Stop (T-intersection)	A.M.	C	16.6 s	0.24 (SB)
		P.M.	C	21.4 s	0.23 (SB)

Note [1]: The LOS of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000). The LOS for the roundabout is the overall intersection delay.

Table 14: 2032 Future Total Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Max v/c ratio
Ida Street and Main Street/Grey Road 9	Roundabout	A.M.	A	2.5 s	N/A
		P.M.	A	3.3 s	
Ida Street and Access 1	Stop (T-intersection)	A.M.	A	9.4 s	0.06 (EB)
		P.M.	A	9.5 s	0.04 (EB)
Grey Road 9 & Access A	Stop (T-intersection)	A.M.	B	14.3 s	0.20 (SB)
		P.M.	D	26.9 s	0.62 (SB)
Grey Road 9 & Access B	Stop (T-intersection)	A.M.	C	17.0 s	0.25 (SB)
		P.M.	C	22.2 s	0.23 (SB)

Note [1]: The LOS of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000). The LOS for the roundabout is the overall intersection delay.

No critical movements are forecast at the study intersections. The roundabout at Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at LOS A during the weekday a.m. and p.m. peak hour.

The site accesses are forecast to operate at LOS D or better during the weekday a.m. and p.m. peak hours.

The study intersections have reserve capacity for increases in traffic volumes.

7.0 Eco Parkway Scenario

The Eco Parkway extension is an industrial access road running east-west and parallel to Main Street from Highway 10 to Ida Street. The industrial access road will be classified as an arterial roadway and the lands on both sides of the road have been designated for industrial use. A Traffic Impact Study for the Eco Parkway (formally Industrial Access Road) was completed by Triton Engineering as

part of the environmental assessment ("Eco Parkway TIS", September 2017). **Appendix F** contains the Eco Parkway TIS excerpts. It is recognized that the TIS referred to the proposed roadway as Industrial Access Road, however the most recent naming is Eco Parkway.

7.1 Eco Parkway Site Generated Trips

Construction of the Eco Parkway extension will provide a bypass to Dundalk and is expected to reroute existing traffic. For the purposes of their study and to remain consistent with the Eco Parkway TIS, it was assumed that 30% of the existing traffic on Grey Road 9 through Dundalk would use Eco Parkway to bypass the community. The Eco Parkway TIS also assumed that existing truck traffic would use Eco Parkway to bypass Main Street or to access the industrial lands.

To remain consistent with the Eco Parkway TIS, existing traffic volumes, which includes background traffic growth, were redistributed as follows:

- 30% of southbound left vehicles will complete southbound through movements
- 30% of eastbound through vehicles will complete eastbound right movements
- 30% of westbound through vehicles will complete northbound left movements
- 30% of westbound right vehicles will complete northbound through movements

Trips from the background developments were not re-distributed based on the Eco Parkway construction because most of the developments are located to the north of Eco Parkway and would have to detour to use Eco Parkway. It should be noted that most of the new developments are residential while the proposed site is industrial, therefore some synergies will likely occur, but this was not investigated in this study. Trips may have been counted in both the industrial site generated trips and other background development generated trips to ensure a conservative analysis. **Figure 17** illustrates the adjusted vehicular volumes that are forecast to bypass Main Street.

7.2 Eco Parkway Site Generated Trips

The development of the industrial area serviced by the Eco Parkway extension is anticipated to result in new trips to the study area road network. The full build-out of the Eco Parkway extension industrial lands was assumed to be completed prior to the 2032 horizon year, so the trip generation associated with full build-out has been used in this analysis.

The ITE Trip Generation Manual, 8th Edition was used in the Eco Parkway TIS to estimate the trip generation of the industrial lands. LUC 130 "Industrial Park" was applied to the 259.75 acre site as specific industrial land uses were unknown at that time. The Eco Parkway TIS assumed that all site-generate trips were primary trips. **Table 15** summarizes the estimated trip generation noted in the Eco Parkway TIS. **Appendix F** contains relevant excerpts from the Eco Parkway TIS.

Table 15: Eco Parkway Industrial Lands Trip Generation

Peak Hour	Number of Trips		
	Inbound	Outbound	Total
Weekday A.M.	1,142	234	1,376
Weekday P.M.	266	1,000	1,266

The development of the industrial lands surrounding the Eco Parkway extension is estimated to generate approximately 1,376 and 1,266 two-way trips in the a.m. and p.m. peak hours, respectively. The trips were assigned to the road network consistent with the Eco Parkway TIS. The Eco Parkway TIS assumed 70% of trips would travel towards Highway 10 on the Eco Parkway

extension and the remainder would travel into Dundalk. **Figure 18** contains the Eco Parkway Industrial Lands trip assignment as noted in the Eco Parkway TIS.

7.3 Eco Parkway Future Total Scenario

Based on the proximity of the Subject Development to Eco Parkway, it is anticipated that the bypass will provide an alternative path for site-generated trips. The revised trip distribution is as follows:

- 20% to/from the east on Main Street to/from downtown Dundalk
- 60% to/from the south to access Highway 10 via Eco Parkway
- 10% to/from the west on Main Street/Grey Road 9
- 10% to/from the north on Ida Street

The alternative site trip assignment is illustrated in **Figure 19** and the 2032 Eco Parkway Scenario total traffic volumes are illustrated in **Figure 20.**

7.3.1 Left Turn Lane Warrant

The need for left-turn lanes were evaluated using TAC GDGCR methodology, similar to **Section 6.2** of this study.

Table 16 summarizes the results of the left-turn lane warrants for the site accesses under the 2032 Eco Parkway Scenario total traffic conditions. **Appendix H** contains the left-turn lane warrant nomographs and **Appendix I** contains excerpts from the TAC Manual.

Table 16: Left-Turn Lane Warrant Summary – Eco Parkway

Access	Peak Hour	Design Speed		
		50 km/h	80 km/h	100 km/h
Access A Eastbound-Left	A.M.	X	X	15 m
	P.M	X	X	15 m
Access B Eastbound-Left	A.M.	X	15 m	N/A
	P.M	15 m	15 m	N/A
Access 1 Northbound-Left	A.M.	X	N/A	N/A
	P.M	X	N/A	N/A

An eastbound left-turn lane is warranted at Access A for a posted speed limit of 80 km/h and at Access B for all assessed design speeds under 2032 total conditions.

It is noted that based on the 2032 total operations, the eastbound movements on Grey Road 9 at the site accesses are forecast to operate at LOS A with delays of less than 2 seconds without the implementation of eastbound left-turn lanes. Further, there are 7 or fewer eastbound left-turning vehicles on Grey Road 9 at Access B forecast under 2032 total conditions, which is approximately one vehicle every 10 minutes.

If the speed limit is not reduced across the Subject Development's frontage to Grey Road 9, it is recommended an eastbound left-turn lane is implemented at Access A with 15 metres of storage. However, due to the low future volumes forecast to use Access B and due to the lower speed limit, it is recommended that the Township monitors Access B for the need of an eastbound left-turn.

It is noted that these recommendations are based on the current expected land uses for the Township block. The need for left-turn lanes should be reevaluated once the Township land uses become known as they currently account for approximately 50% of the estimated traffic generated by the Subject Development.

7.3.2 Future Total Operations Eco Parkway Scenario

The operations of the study intersections were analyzed based on the 2032 Eco Parkway Scenario total traffic volumes and are summarized in

Table 17. LOS definitions have been included in **Appendix C** and detailed capacity analyses worksheets are included in **Appendix D.**

Table 17: Eco Parkway Scenario - 2032 Future Total Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Max v/c ratio
Ida Street and Main Street/Grey Road 9	Roundabout	A.M.	A	7.6 s	N/A
		P.M.	A	6.5 s	N/A
Ida Street and Access 1	Stop (T-intersection)	A.M.	B	10.1 s	0.06 (EB)
		P.M.	A	9.8 s	0.04 (EB)
Grey Road 9 & Access A	Stop (T-intersection)	A.M.	C	18.2 s	0.27 (SB)
		P.M.	**F (SB)**	**56.1 s (SB)**	0.83 (SB)
Grey Road 9 & Access B	Stop (T-intersection)	A.M.	C	23.0 s	0.33 (SB)
		P.M.	D	31.2 s	0.32 (SB)

Note [1]: The LOS of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000). The LOS of a signalized intersection is based on the average control delay per vehicle.
Note [2]: The critical v/c ratio is the maximum v/c ratio for movements at the intersection.

The analysis indicates that the inclusion of Eco Parkway traffic is forecast to increase the intersection delay by approximately 4 seconds at the Ida Street and Main Street/Grey Road 9 intersection compared to 2032 total operations without Eco Parkway. The 95th percentile queue is forecast to be 101 metres or less on all approaches.

The southbound movement on Access A at Grey Road 9 is forecast to operate at LOS F under 2032 Eco Parkway Scenario total traffic conditions. It is noted that these poor operations are primarily caused by the traffic generated by the current expected land uses for the Township block. The traffic operations at this location should be reevaluated once the Township land uses become known to determine if mitigation measures are required to improve traffic operations.

The Access 1 and Access B approaches are forecast to operate at LOS D or better during the weekday a.m. and p.m. peak hours and no critical movements are noted.

8.0 Conclusions and Recommendations

The detailed analysis contained within this report resulted in the following key findings:

- The Subject Development is proposed to consist of 269 single detached dwelling units, 52 townhouse units, and lands to be occupied by future Township land uses. At this time, it was

indicated to Crozier to assume the Township lands would be occupied by 68,000 sq.ft. Gross Floor Area (GFA) of office land uses and a 68,000 sq.ft. GFA of recreational centre land uses. Access to the Subject Development is proposed by two accesses to Grey Road 9 and one access to Ida Street.

- Under existing conditions, the Ida Street and Main Street/Grey Road 9 intersection is operating at a Level of Service (LOS) B during the weekday a.m. and p.m. peak hours.

- Several background developments have been considered for the assessment of the background conditions. These developments include Glenelg Phase 1, Glenelg Phase 2, the unoccupied Edgewood Greens units, and White Rose Phase 3. Consideration was also given to the development of the industrial lands surrounding the proposed Eco Parkway extension in an alternative scenario which will be summarized later in the conclusions.

- Under future background conditions, the Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at an LOS A during the weekday a.m. and p.m. peak hours. It is noted as discussed with the Township, a roundabout is the preferred future form of traffic control at this location to accommodate future traffic demand.

- The Subject Development is estimated to generate 471 and 616 two-way trips during the weekday a.m. and p.m. peak hours, respectively. Based on the currently assumed office and recreational centre land uses for the Township lands, the Township lands are estimated to account for approximately 50% of the traffic generated by the Subject Development.

- The left-turn lane warrant analysis indicates that an eastbound left-turn lane is warranted at Site Access A for a posted speed limit of 80 km/h and at Access B for a posted speed of 60 km/h under 2032 total conditions. It is noted that the warrant analysis is based on the current expected land uses for the Township block which accounts for approximately 50% of the estimated traffic generated by the Subject Development. Further, the proposed development is adjacent to the built-up area of Dundalk and will extend the built-up area to the west, it is expected that the 40 km/h posted speed limit could be extended to the western limits of the Subject Development's frontage on Grey Road 9.

- Under future total conditions, the roundabout at Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at LOS A during the weekday a.m. and p.m. peak hour. The site accesses are forecast to operate at LOS D or better during the weekday a.m. and p.m. peak hours. No critical movements are noted.

- As requested in the Terms of Reference, a scenario analyzing the impacts of the Eco Parkway extension and development of surrounding industrial lands was completed under 2032 future total conditions. The Scenario with the Eco Parkway extension and the proposed industrial development lands are estimated to generate 1,376 and 1,266 external two-way trips in the a.m. and p.m. peak hours, respectively. The Eco Parkway extension is also anticipated to detour 30% of the existing traffic volumes on Main Street around downtown Dundalk.

  In the scenario with the Eco Parkway extension that excludes the Subject Development site-generated traffic:

  - An eastbound left-turn lane is warranted at Access A for a posted speed limit of 80 km/h and at Access B for all assessed design speeds. It is noted that the warrant analysis is based on the current expected land uses for the Township block which

accounts for approximately 50% of the estimated traffic generated by the Subject Development.

- The Ida Street and Main Street/Grey Road 9 intersection is forecast to operate at LOS A during the weekday a.m. and p.m. peak hours.
- The southbound movement on Access A at Grey Road 9 is forecast to operate at LOS F. It is noted that these poor operations are primarily caused by the traffic generated by the current expected land uses for the Township block.
- The Access 1 and Access B approaches are forecast to operate at LOS D or better during the weekday a.m. and p.m. peak hours and no critical movements are noted.

Based on the key finding, it is recommended that:

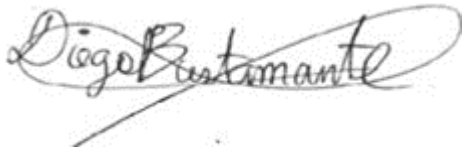
- The 40 km/h posted speed limit is extended to the western limits of the Subject Development's frontage on Grey Road 9 to be consistent with the built-up area of Dundalk.
- The need for left-turn lanes or other mitigation measures at the proposed site accesses are reevaluated once the uses of Township lands become known.

The analysis contained within this report was prepared using the Draft Plan prepared by MHBC (April 30, 2024). Any minor revisions to the Draft Plan is not expected to affect the conclusions contained in this report.

In conclusion, the proposed development can be supported from a transportation perspective with the noted recommendations.

Respectfully submitted,

C.F. CROZIER & ASSOCIATES INC.



Diego Bustamante, EIT
Engineering Intern, Transportation

C.F. CROZIER & ASSOCIATES INC.

Stefan Hajgato, P.Eng.
Project Engineer, Transportation

SH/db

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APPENDIX A

Terms of Reference

Emma Howlett

From: Dustin Lyttle <dlyttle@tritoneng.on.ca>
Sent: August 8, 2022 3:38 PM
To: Emma Howlett
Cc: Jim Ellis
Subject: RE: Ida Street (Dundalk Northwest)- Terms of Reference for Review

Categories: Filed to Sharepoint

Hi Emma,

Generally, we do not have any concerns with the proposed Terms of Reference however the scenario which assesses the traffic with the Eco Parkway extension completed should also include the development of that area as well.

Thanks,
Dustin Lyttle

From: Emma Howlett
Sent: July 27, 2022 12:45 PM
To: Dustin Lyttle <dlyttle@tritoneng.on.ca>; 'Jim.stevenson@grey.ca' <Jim.stevenson@grey.ca>
Cc: Alexander Fleming <afleming@cfcrozier.ca>
Subject: Ida Street (Dundalk Northwest)- Terms of Reference for Review

Hello Dustin and Jim,

C.F. Crozier & Associates has been retained to prepare a Traffic Impact Study (TIS) to review the traffic impacts and potential mitigation measures required to support the Ida Street (Dundalk Northwest) Subdivision in the Village of Dundalk, Township of Southgate, County of Grey. The site is proposed to connect to Ida Street and County Road 9. As per the MZO application documents the development is anticipated to generate 440 and 427 two-way trips in the a.m. and p.m. peak hours, respectively.

Please advise if the Terms of Reference (TOR) outlined below are acceptable. If you are not the correct person for correspondence, I would appreciate it if you could direct me to the correct contact.

The Transportation Impact Report will follow Grey County TIS Guidelines. The Terms of Reference are as follows:

Traffic Data/Study Intersections

- Ida Street and Main Street
- Proposed site accesses

Analysis Periods and Scenarios

Analysis of weekday a.m. and p.m. peak hours will be used to capture the peak hours associated with the residential development. It has been assumed that the proposed development will be completed within 5 years. Accordingly, the horizon years of 2027 and 2032 will be analyzed, representing 5 and 10 years from the study date**.**

- Proposed site accesses

Analysis Periods and Scenarios

Analysis of weekday a.m. and p.m. peak hours will be used to capture the peak hours associated with the residential development. It has been assumed that the proposed development will be completed within 5 years. Accordingly, the horizon years of 2027 and 2032 will be analyzed, representing 5 and 10 years from the study date**.**

Background Growth

A growth rate of 1.5% per year will be applied to the boundary road network as consistent with previous studies undertaken in Dundalk.

Background Developments

There are several ongoing developments within the Village of Dundalk. Unoccupied units from Flato's developments of Dundalk North and East ("Edgewood Greens"), Glenelg Phase 1 and 2, White Rose Phase 3, and the Glenelg Expansion lands will be considered as background developments.

Trip Distribution

Trips will be distributed to the boundary road network based on a review of the Transportation Tomorrow Survey data from 2016 from the abutting Township of Melancthon, a review of existing travel patterns, and a review of previously assumed distributions. Similar to the terms of reference for Glenelg Phase 3 a scenario will be completed for the construction of Eco-Parkway.

We trust that the above is acceptable.

Should you have any questions or concerns, please feel free to contact us.

Thank you,

Emma Howlett, EIT | Engineering Intern
1 First Street, Suite 200 | Collingwood, ON L9Y 1A1
T: 705.446.3510

CROZIER
CONSULTING ENGINEERS

Crozier Connections:

Emma Howlett

From: Jim Stevenson <Jim.Stevenson@grey.ca>
Sent: August 9, 2022 7:01 AM
To: Emma Howlett
Subject: RE: Ida Street (Dundalk Northwest)- Terms of Reference for Review

Categories: Filed to Sharepoint

Looks good, please proceed!

Jim Stevenson
Corridor Control Technologist
Phone: +1 519-372-0219 ext. 1285

From: Emma Howlett <ehowlett@cfcrozier.ca>
Sent: Wednesday, July 27, 2022 12:45 PM
To: Dustin Lyttle <dlyttle@tritoneng.on.ca>; Jim Stevenson <Jim.stevenson@grey.ca>
Cc: Alexander Fleming <afleming@cfcrozier.ca>
Subject: Ida Street (Dundalk Northwest)- Terms of Reference for Review

[EXTERNAL EMAIL]

Hello Dustin and Jim,

C.F. Crozier & Associates has been retained to prepare a Traffic Impact Study (TIS) to review the traffic impacts and potential mitigation measures required to support the Ida Street (Dundalk Northwest) Subdivision in the Village of Dundalk, Township of Southgate, County of Grey. The site is proposed to connect to Ida Street and County Road 9. As per the MZO application documents the development is anticipated to generate 440 and 427 two-way trips in the a.m. and p.m. peak hours, respectively.

Please advise if the Terms of Reference (TOR) outlined below are acceptable. If you are not the correct person for correspondence, I would appreciate it if you could direct me to the correct contact.

The Transportation Impact Report will follow Grey County TIS Guidelines. The Terms of Reference are as follows:

Traffic Data/Study Intersections

- Ida Street and Main Street

Background Growth

A growth rate of 1.5% per year will be applied to the boundary road network as consistent with previous studies undertaken in Dundalk.

Background Developments

There are several ongoing developments within the Village of Dundalk. Unoccupied units from Flato's developments of Dundalk North and East ("Edgewood Greens"), Glenelg Phase 1 and 2, White Rose Phase 3, and the Glenelg Expansion lands will be considered as background developments.

Trip Distribution

Trips will be distributed to the boundary road network based on a review of the Transportation Tomorrow Survey data from 2016 from the abutting Township of Melancthon, a review of existing travel patterns, and a review of previously assumed distributions. Similar to the terms of reference for Glenelg Phase 3 a scenario will be completed for the construction of Eco-Parkway.

We trust that the above is acceptable.

Should you have any questions or concerns, please feel free to contact us.

Thank you,

Read our latest news and announcements here.

APPENDIX B

Traffic Data

Crozier & Associates
SUITE 301 40 HURON STREET
COLLINGWOOD ONTARIO, L9Y 4R3
CANADA

Turning Movement Count (3 . IDA ST & MAIN ST)

Start Time	N Approach IDA ST						E Approach MAIN ST (GREY RD 9						S Approach IDA ST						W Approach MAIN ST (GREY RD 9						Int. Total (15 min)	Int. Total (1 hr)
	Right N:W	Thru N:S	Left N:E	UTurn N:N	Peds N:	Approach Total	Right E:N	Thru E:W	Left E:S	UTurn E:E	Peds E:	Approach Total	Right S:E	Thru S:N	Left S:W	UTurn S:S	Peds S:	Approach Total	Right W:S	Thru W:E	Left W:N	UTurn W:W	Peds W:	Approach Total		
06:00:00	0	2	1	0	0	3	0	13	1	0	0	14	1	0	2	0	0	3	8	16	1	0	0	25	45	
06:15:00	0	2	0	0	0	2	0	20	5	0	0	25	0	0	3	0	0	3	5	9	0	0	0	14	44	
06:30:00	0	0	1	0	0	1	0	22	3	0	0	25	2	0	3	0	0	5	2	16	1	0	0	19	50	
06:45:00	1	1	1	0	0	3	4	12	5	0	6	21	6	3	5	0	0	14	3	15	0	0	0	18	56	195
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07:45:00	4	2	5	0	0	11	1	16	3	0	0	20	3	2	3	0	0	8	7	26	2	0	0	35	74	264
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08:15:00	2	5	2	0	0	9	0	12	8	0	0	20	4	0	1	0	0	5	4	31	2	0	0	37	71	283
08:30:00	0	2	4	0	0	6	7	21	13	0	0	41	7	1	3	0	0	11	6	29	1	0	1	36	94	309
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BREAK																										
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17:00:00	2	3	3	0	1	8	4	28	9	0	0	41	10	3	8	0	0	21	6	26	1	0	0	33	103	387
17:15:00	3	4	1	0	0	8	3	35	3	0	0	41	11	4	7	0	0	22	0	33	3	0	0	36	107	394
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18:30:00	2	0	0	0	0	2	1	16	4	0	0	21	8	4	1	0	0	13	1	19	1	0	0	21	57	253
18:45:00	0	0	3	0	0	3	3	13	2	0	0	18	1	4	2	0	0	7	0	24	1	0	0	25	53	236
Grand Total	37	65	69	0	5	171	67	671	186	0	12	924	199	76	121	0	1	396	120	749	35	0	1	904	**2395**	-
Approach%	21.6%	38%	40.4%	0%		-	7.3%	72.6%	20.1%	0%		-	50.3%	19.2%	30.6%	0%		-	13.3%	82.9%	3.9%	0%		-	-	-
Totals %	1.5%	2.7%	2.9%	0%		7.1%	2.8%	28%	7.8%	0%		38.6%	8.3%	3.2%	5.1%	0%		16.5%	5%	31.3%	1.5%	0%		37.7%	-	-
Heavy	5	3	2	0		-	4	67	61	0		-	39	4	20	0		-	19	75	9	0		-	-	-
Heavy %	13.5%	4.6%	2.9%	0%		-	6%	10%	32.8%	0%		-	19.6%	5.3%	16.5%	0%		-	15.8%	10%	25.7%	0%		-	-	-
Bicycles	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-
Bicycle %	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-	-	-		-	-	-

Crozier & Associates
SUITE 301 40 HURON STREET
COLLINGWOOD ONTARIO, L9Y 4R3
CANADA

Peak Hour: 08:00 AM - 09:00 AM Weather: Overcast Clouds (16.73 °C)

Start Time	N Approach IDA ST						E Approach MAIN ST (GREY RD 9						S Approach IDA ST						W Approach MAIN ST (GREY RD 9						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
08:00:00	0	1	2	0	0	3	0	15	7	0	1	22	7	1	4	0	0	12	2	30	1	0	0	33	70
08:15:00	2	5	2	0	0	9	0	12	8	0	0	20	4	0	1	0	0	5	4	31	2	0	0	37	71
08:30:00	0	2	4	0	0	6	7	21	13	0	0	41	7	1	3	0	0	11	6	29	1	0	1	36	94
08:45:00	1	3	4	0	0	8	3	16	8	0	1	27	6	0	3	0	0	9	5	24	1	0	0	30	74
Grand Total	3	11	12	0	0	26	10	64	36	0	2	110	24	2	11	0	0	37	17	114	5	0	1	136	**309**
Approach%	11.5%	42.3%	46.2%	0%		-	9.1%	58.2%	32.7%	0%		-	64.9%	5.4%	29.7%	0%		-	12.5%	83.8%	3.7%	0%		-	**-**
Totals %	1%	3.6%	3.9%	0%		8.4%	3.2%	20.7%	11.7%	0%		35.6%	7.8%	0.6%	3.6%	0%		12%	5.5%	36.9%	1.6%	0%		44%	**-**
PHF	0.38	0.55	0.75	0		0.72	0.36	0.76	0.69	0		0.67	0.86	0.5	0.69	0		0.77	0.71	0.92	0.63	0		0.92	**-**
Heavy	0	1	1	0		2	1	9	19	0		29	6	0	1	0		7	6	20	1	0		27	**-**
Heavy %	0%	9.1%	8.3%	0%		7.7%	10%	14.1%	52.8%	0%		26.4%	25%	0%	9.1%	0%		18.9%	35.3%	17.5%	20%	0%		19.9%	**-**
Lights	3	10	11	0		24	9	55	17	0		81	18	2	10	0		30	11	94	4	0		109	**-**
Lights %	100%	90.9%	91.7%	0%		92.3%	90%	85.9%	47.2%	0%		73.6%	75%	100%	90.9%	0%		81.1%	64.7%	82.5%	80%	0%		80.1%	**-**
Single-Unit Trucks	0	0	1	0		1	0	3	5	0		8	4	0	0	0		4	0	15	0	0		15	**-**
Single-Unit Trucks %	0%	0%	8.3%	0%		3.8%	0%	4.7%	13.9%	0%		7.3%	16.7%	0%	0%	0%		10.8%	0%	13.2%	0%	0%		11%	**-**
Buses	0	1	0	0		1	1	1	11	0		13	1	0	0	0		1	2	2	1	0		5	**-**
Buses %	0%	9.1%	0%	0%		3.8%	10%	1.6%	30.6%	0%		11.8%	4.2%	0%	0%	0%		2.7%	11.8%	1.8%	20%	0%		3.7%	**-**
Articulated Trucks	0	0	0	0		0	0	5	3	0		8	1	0	1	0		2	4	3	0	0		7	**-**
Articulated Trucks %	0%	0%	0%	0%		0%	0%	7.8%	8.3%	0%		7.3%	4.2%	0%	9.1%	0%		5.4%	23.5%	2.6%	0%	0%		5.1%	**-**
Pedestrians	-	-	-	-	0	-	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	1	-	**-**
Pedestrians%	-	-	-	-	0%		-	-	-	-	66.7%		-	-	-	-	0%		-	-	-	-	33.3%		**-**
Bicycles on Crosswalk	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		**-**

Spectrum

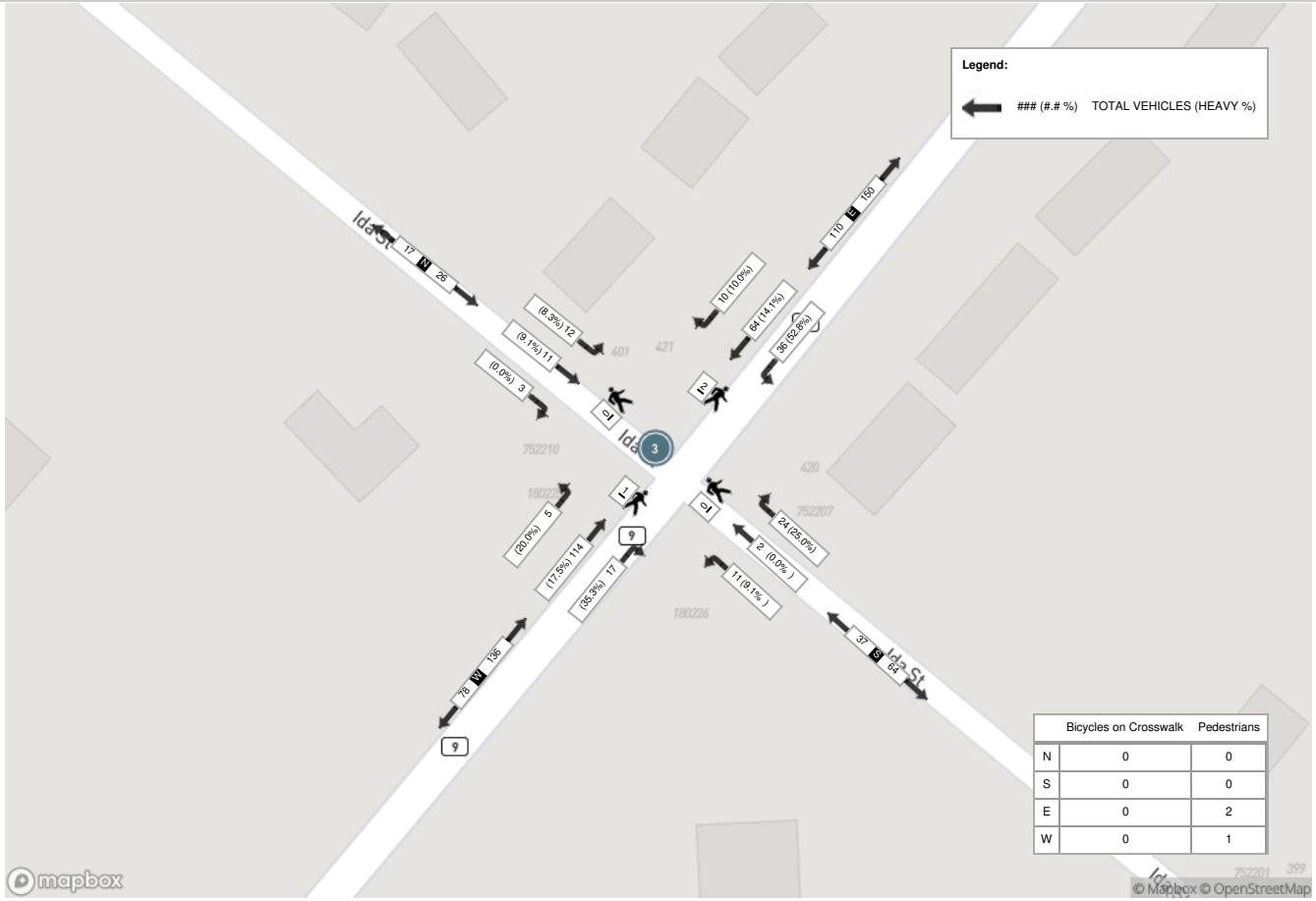
Turning Movement Count
Location Name: IDA ST & MAIN ST
Date: Tue, Jun 07, 2022 Deployment Lead: Tasos Issaaakidis

Crozier & Associates
SUITE 301 40 HURON STREET
COLLINGWOOD ONTARIO, L9Y 4R3
CANADA

Peak Hour: 03:45 PM - 04:45 PM Weather: Overcast Clouds (12.76 °C)

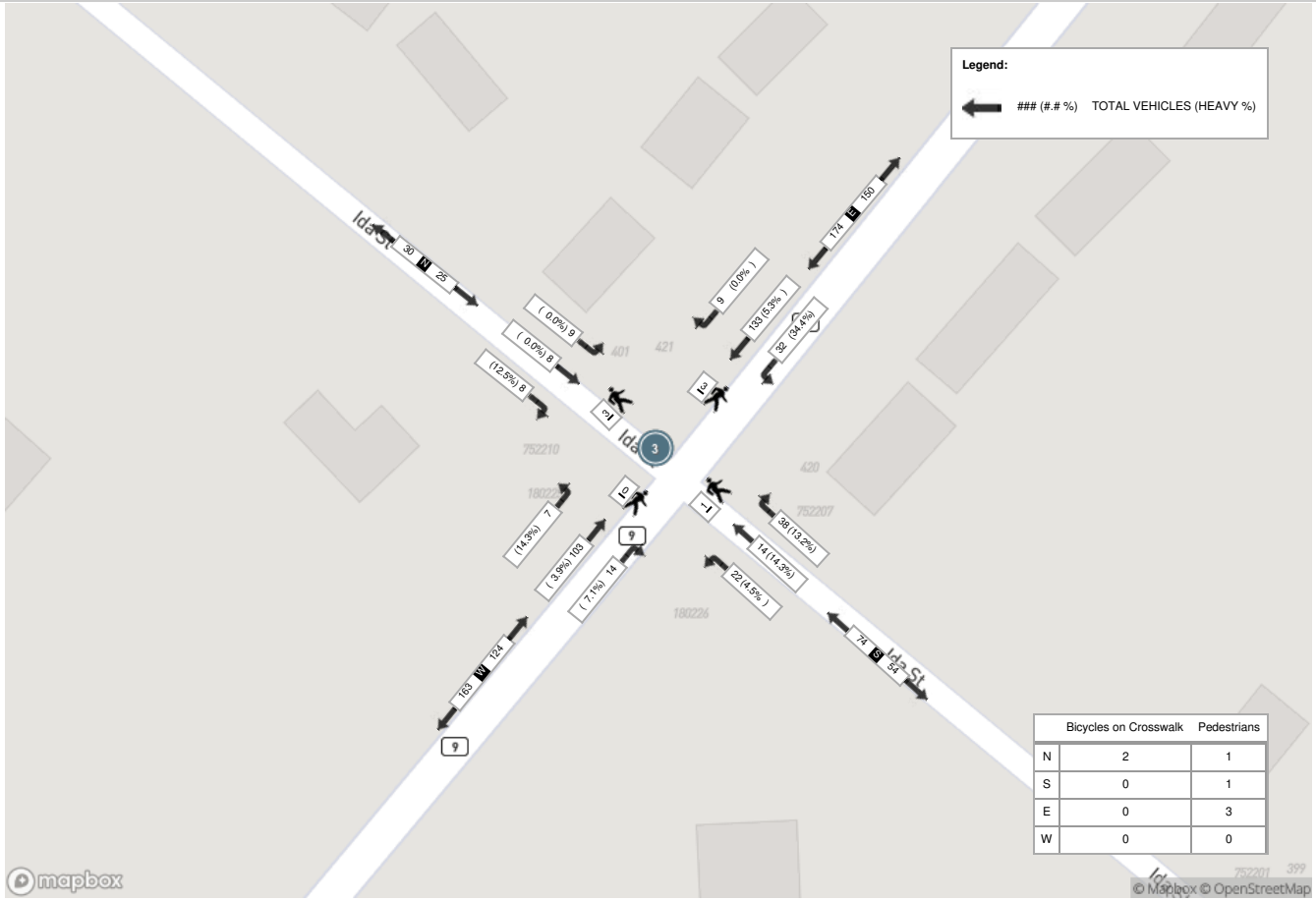
Start Time	N Approach IDA ST						E Approach MAIN ST (GREY RD 9						S Approach IDA ST						W Approach MAIN ST (GREY RD 9						Int. Total (15 min)
	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	Right	Thru	Left	UTurn	Peds	Approach Total	
15:45:00	5	3	1	0	0	9	1	31	8	0	0	40	11	1	8	0	0	20	3	24	0	0	0	27	96
16:00:00	1	1	1	0	2	3	3	31	7	0	0	41	6	3	5	0	0	14	5	32	1	0	0	38	96
16:15:00	0	3	4	0	0	7	2	37	10	0	1	49	8	3	5	0	0	16	2	24	2	0	0	28	100
16:30:00	2	1	3	0	1	6	3	34	7	0	2	44	13	7	4	0	1	24	4	23	4	0	0	31	105
Grand Total	8	8	9	0	3	25	9	133	32	0	3	174	38	14	22	0	1	74	14	103	7	0	0	124	**397**
Approach%	32%	32%	36%	0%		-	5.2%	76.4%	18.4%	0%		-	51.4%	18.9%	29.7%	0%		-	11.3%	83.1%	5.6%	0%		-	**-**
Totals %	2%	2%	2.3%	0%		6.3%	2.3%	33.5%	8.1%	0%		43.8%	9.6%	3.5%	5.5%	0%		18.6%	3.5%	25.9%	1.8%	0%		31.2%	**-**
PHF	0.4	0.67	0.56	0		0.69	0.75	0.9	0.8	0		0.89	0.73	0.5	0.69	0		0.77	0.7	0.8	0.44	0		0.82	**-**
Heavy	1	0	0	0		1	0	7	11	0		18	5	2	1	0		8	1	4	1	0		6	**-**
Heavy %	12.5%	0%	0%	0%		4%	0%	5.3%	34.4%	0%		10.3%	13.2%	14.3%	4.5%	0%		10.8%	7.1%	3.9%	14.3%	0%		4.8%	**-**
Lights	7	8	9	0		24	9	126	21	0		156	33	12	21	0		66	13	99	6	0		118	**-**
Lights %	87.5%	100%	100%	0%		96%	100%	94.7%	65.6%	0%		89.7%	86.8%	85.7%	95.5%	0%		89.2%	92.9%	96.1%	85.7%	0%		95.2%	**-**
Single-Unit Trucks	0	0	0	0		0	0	3	6	0		9	2	1	0	0		3	0	1	1	0		2	**-**
Single-Unit Trucks %	0%	0%	0%	0%		0%	0%	2.3%	18.8%	0%		5.2%	5.3%	7.1%	0%	0%		4.1%	0%	1%	14.3%	0%		1.6%	**-**
Buses	1	0	0	0		1	0	2	0	0		2	0	1	0	0		1	0	3	0	0		3	**-**
Buses %	12.5%	0%	0%	0%		4%	0%	1.5%	0%	0%		1.1%	0%	7.1%	0%	0%		1.4%	0%	2.9%	0%	0%		2.4%	**-**
Articulated Trucks	0	0	0	0		0	0	2	5	0		7	3	0	1	0		4	1	0	0	0		1	**-**
Articulated Trucks %	0%	0%	0%	0%		0%	0%	1.5%	15.6%	0%		4%	7.9%	0%	4.5%	0%		5.4%	7.1%	0%	0%	0%		0.8%	**-**
Pedestrians	-	-	-	-	1	-	-	-	-	-	3	-	-	-	-	-	1	-	-	-	-	-	0	-	**-**
Pedestrians%	-	-	-	-	14.3%		-	-	-	-	42.9%		-	-	-	-	14.3%		-	-	-	-	0%		**-**
Bicycles on Crosswalk	-	-	-	-	2	-	-	-	-	-	0	-	-	-	-	-	0	-	-	-	-	-	0	-	**-**
Bicycles on Crosswalk%	-	-	-	-	28.6%		-	-	-	-	0%		-	-	-	-	0%		-	-	-	-	0%		**-**

Peak Hour: 08:00 AM - 09:00 AM **Weather: Overcast Clouds (16.73 °C)**



	Bicycles on Crosswalk	Pedestrians
N	0	0
S	0	0
E	0	2
W	0	1

Peak Hour: 03:45 PM - 04:45 PM Weather: Overcast Clouds (12.76 °C)



	Bicycles on Crosswalk	Pedestrians
N	2	1
S	0	1
E	0	3
W	0	0

APPENDIX C

Levels of Service Definitions

Level of Service Definitions

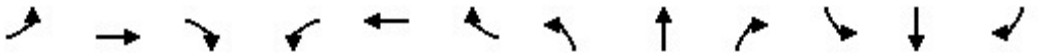
Stop Controlled Intersections

Level of Service	Control Delay per Vehicle (seconds)	Interpretation
A	≤ 10	EXCELLENT. Large and frequent gaps in traffic on the main roadway. Queuing on the minor street is rare.
B	> 10 and ≤ 15	VERY GOOD. Many gaps exist in traffic on the main roadway. Queuing on the minor street is minimal.
C	> 15 and ≤ 25	GOOD. Fewer gaps exist in traffic on the main roadway. Delay on minor approach becomes more noticeable.
D	> 25 and ≤ 35	FAIR. Infrequent and shorter gaps in traffic on the main roadway. Queue lengths develop on the minor street.
E	> 35 and ≤ 50	POOR. Very infrequent gaps in traffic on the main roadway. Queue lengths become noticeable.
F	> 50	UNSATISFACTORY. Very few gaps in traffic on the main roadway. Excessive delay with significant queue lengths on the minor street.

Adapted from Highway Capacity Manual 2000, Transportation Research Board

APPENDIX D

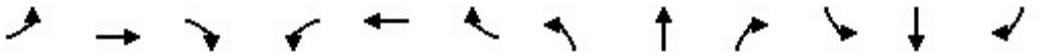
Capacity Analysis Worksheets



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	5	114	17	36	64	10	11	2	24	12	11	3
Future Volume (Veh/h)	5	114	17	36	64	10	11	2	24	12	11	3
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82	0.82
Hourly flow rate (vph)	6	139	21	44	78	12	13	2	29	15	13	4
Pedestrians		1			2							
Lane Width (m)		4.8			4.8							
Walking Speed (m/s)		1.1			1.1							
Percent Blockage		0			0							
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	90			160			345	340	152	366	344	85
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	90			160			345	340	152	366	344	85
tC, single (s)	4.3			4.6			7.2	6.5	6.5	7.2	6.6	6.2
tC, 2 stage (s)												
tF (s)	2.4			2.7			3.6	4.0	3.5	3.6	4.1	3.3
p0 queue free %	100			96			98	100	97	97	98	100
cM capacity (veh/h)	1399			1161			564	561	836	539	544	978

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	166	134	44	32
Volume Left	6	44	13	15
Volume Right	21	12	29	4
cSH	1399	1161	717	573
Volume to Capacity	0.00	0.04	0.06	0.06
Queue Length 95th (m)	0.1	0.9	1.5	1.3
Control Delay (s)	0.3	2.9	10.3	11.7
Lane LOS	A	A	B	B
Approach Delay (s)	0.3	2.9	10.3	11.7
Approach LOS			B	B

Intersection Summary			
Average Delay	3.4		
Intersection Capacity Utilization	27.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	7	103	14	32	133	9	22	14	38	9	8	8
Future Volume (Veh/h)	7	103	14	32	133	9	22	14	38	9	8	8
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95	0.95
Hourly flow rate (vph)	7	108	15	34	140	9	23	15	40	9	8	8
Pedestrians					3			1			3	
Lane Width (m)					4.8			4.8			4.8	
Walking Speed (m/s)					1.1			1.1			1.1	
Percent Blockage					0			0			0	
Right turn flare (veh)												
Median type		None			None							
Median storage veh)												
Upstream signal (m)												
pX, platoon unblocked												
vC, conflicting volume	152			124			355	350	120	396	354	148
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	152			124			355	350	120	396	354	148
tC, single (s)	4.2			4.4			7.1	6.6	6.3	7.1	6.5	6.3
tC, 2 stage (s)												
tF (s)	2.3			2.5			3.5	4.1	3.4	3.5	4.0	3.4
p0 queue free %	99			97			96	97	96	98	99	99
cM capacity (veh/h)	1354			1285			566	535	899	513	554	868

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	130	183	78	25
Volume Left	7	34	23	9
Volume Right	15	9	40	8
cSH	1354	1285	689	607
Volume to Capacity	0.01	0.03	0.11	0.04
Queue Length 95th (m)	0.1	0.6	2.9	1.0
Control Delay (s)	0.5	1.6	10.9	11.2
Lane LOS	A	A	B	B
Approach Delay (s)	0.5	1.6	10.9	11.2
Approach LOS			B	B

Intersection Summary				
Average Delay	3.6			
Intersection Capacity Utilization	28.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk

Filename: 2027 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\Arcady\2027
Report generation date: 2023-01-17 1:41:55 PM

Summary of intersection performance

	AM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2027 [Entry Lane Simulation] - Future Background 2027						
Leg 1	0.12	0.62	1.45	N/A	A	1.36	A
Leg 2	0.02	~1	0.77	N/A	A		
Leg 3	0.14	0.83	1.51	N/A	A		
Leg 4	0.02	~1	0.97	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Future Background 2027, AM " model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2027, PM" model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2027, AM" model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2027, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2023-01-17 1:41:55 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	2102662377	2627

2027 - Future Background 2027, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2027 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2027	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Background 2027, AM	Future Background 2027	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Intersection Delay (s)	Intersection LOS
1	untitled	Roundabout	1,2,3,4			1.36	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Leg options

Leg	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Leg	Lane Level	Lane	Has Limited Storage	Storage (PCE)	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Leg	Slope	Intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Intersection	Leg	Lane Level	Lane	Leg			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	188.00	100.000
2	ONE HOUR	✓	67.00	100.000
3	ONE HOUR	✓	196.00	100.000
4	ONE HOUR	✓	41.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	11.000	138.000	39.000
	2	13.000	0.000	42.000	12.000
	3	157.000	20.000	0.000	19.000
	4	26.000	3.000	12.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.06	0.73	0.21
	2	0.19	0.00	0.63	0.18
	3	0.80	0.10	0.00	0.10
	4	0.63	0.07	0.29	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.100	1.141	1.528
	2	1.083	1.000	1.000	1.091
	3	1.175	1.200	1.000	1.353
	4	1.250	1.000	1.091	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	10.0	14.1	52.8
	2	8.3	0.0	0.0	9.1
	3	17.5	20.0	0.0	35.3
	4	25.0	0.0	9.1	0.0

Results

Results Summary for whole modelled period

Leg	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	1.45	0.12	0.62	A	212.79	319.19	7.84	1.47	0.09
2	0.77	0.02	~1	A	63.10	94.65	1.18	0.75	0.01
3	1.51	0.14	0.83	A	215.74	323.62	8.25	1.53	0.09
4	0.97	0.02	~1	A	44.35	66.53	1.22	1.10	0.01

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

Filename: 2027 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\Arcady\2027
Report generation date: 2023-01-17 1:39:02 PM

Summary of intersection performance

	PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2027 [Entry Lane Simulation] - Future Background 2027						
Leg 1	0.15	0.82	1.46	N/A	A	1.33	A
Leg 2	0.02	~1	0.92	N/A	A		
Leg 3	0.13	0.64	1.36	N/A	A		
Leg 4	0.03	~1	1.06	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Future Background 2027, AM" model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2027, PM " model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2027, AM" model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2027, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2023-01-17 1:39:02 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	349762622	2478

2027 - Future Background 2027, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2027 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2027	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Background 2027, PM	Future Background 2027	PM		ONE HOUR	17:00	18:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Intersection Delay (s)	Intersection LOS
1	untitled	Roundabout	1,2,3,4			1.33	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Leg options

Leg	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Leg	Lane Level	Lane	Has Limited Storage	Storage (PCE)	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Leg	Slope	Intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Intersection	Leg	Lane Level	Lane	Leg			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	243.00	100.000
2	ONE HOUR	✓	53.00	100.000
3	ONE HOUR	✓	258.00	100.000
4	ONE HOUR	✓	81.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	10.000	198.000	35.000
	2	10.000	0.000	34.000	9.000
	3	191.000	51.000	0.000	16.000
	4	41.000	16.000	24.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.04	0.81	0.14
	2	0.19	0.00	0.64	0.17
	3	0.74	0.20	0.00	0.06
	4	0.51	0.20	0.30	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.000	1.053	1.344
	2	1.000	1.000	1.125	1.000
	3	1.039	1.143	1.000	1.071
	4	1.132	1.143	1.045	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	0.0	5.3	34.4
	2	0.0	0.0	12.5	0.0
	3	3.9	14.3	0.0	7.1
	4	13.2	14.3	4.5	0.0

Results

Results Summary for whole modelled period

Leg	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	1.46	0.15	0.82	A	245.51	368.26	8.40	1.37	0.09
2	0.92	0.02	~1	A	51.93	77.90	1.20	0.93	0.01
3	1.36	0.13	0.64	A	251.27	376.91	7.85	1.25	0.09
4	1.06	0.03	~1	A	82.03	123.04	2.22	1.08	0.02

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk

Filename: 2032 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\Arcady\2032
Report generation date: 2023-01-12 11:52:34 AM

Summary of intersection performance

	AM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2032 [Entry Lane Simulation] - Future Background 2032						
Leg 1	0.14	0.75	1.48	N/A	A	1.42	A
Leg 2	0.02	~1	0.80	N/A	A		
Leg 3	0.14	0.82	1.64	N/A	A		
Leg 4	0.02	~1	0.99	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Future Background 2032, AM " model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2032, PM" model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2032, AM" model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2032, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2023-01-12 11:52:34 AM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	602990736	3266

2032 - Future Background 2032, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2032 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2032	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Background 2032, AM	Future Background 2032	AM		ONE HOUR	08:00	09:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Intersection Delay (s)	Intersection LOS
1	untitled	Roundabout	1,2,3,4			1.42	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Leg options

Leg	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Leg	Lane Level	Lane	Has Limited Storage	Storage (PCE)	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Leg	Slope	Intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Intersection	Leg	Lane Level	Lane	Leg			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	198.00	100.000
2	ONE HOUR	✓	69.00	100.000
3	ONE HOUR	✓	207.00	100.000
4	ONE HOUR	✓	44.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	12.000	144.000	42.000
	2	14.000	0.000	42.000	13.000
	3	167.000	20.000	0.000	20.000
	4	28.000	3.000	13.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.06	0.73	0.21
	2	0.20	0.00	0.61	0.19
	3	0.81	0.10	0.00	0.10
	4	0.64	0.07	0.30	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.100	1.141	1.528
	2	1.083	1.000	1.000	1.091
	3	1.175	1.200	1.000	1.353
	4	1.250	1.000	1.091	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	10.0	14.1	52.8
	2	8.3	0.0	0.0	9.1
	3	17.5	20.0	0.0	35.3
	4	25.0	0.0	9.1	0.0

Results

Results Summary for whole modelled period

Leg	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	1.48	0.14	0.75	A	221.70	332.55	8.52	1.54	0.09
2	0.80	0.02	~1	A	64.91	97.37	1.26	0.78	0.01
3	1.64	0.14	0.82	A	226.78	340.17	9.23	1.63	0.10
4	0.99	0.02	~1	A	48.10	72.15	1.33	1.10	0.01

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

Filename: 2032 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\Arcady\2032
Report generation date: 2023-01-12 12:15:42 PM

Summary of intersection performance

	PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	V/C Ratio	LOS	Intersection Delay (s)	Intersection LOS
	2032 [Entry Lane Simulation] - Future Background 2032						
Leg 1	0.15	0.85	1.59	N/A	A	1.41	A
Leg 2	0.02	~1	0.92	N/A	A		
Leg 3	0.13	0.67	1.44	N/A	A		
Leg 4	0.04	~1	1.10	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Intersection LOS and Intersection Delay are demand-weighted averages.

"D1 - Future Background 2032, AM" model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2032, PM " model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2032, AM" model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2032, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2023-01-12 12:15:42 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Analyst	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	V/C Ratio Threshold	Average Delay Threshold (s)	Queue Threshold (PCE)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	2045526176	5245

2032 - Future Background 2032, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2032 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2032	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Background 2032, PM	Future Background 2032	PM		ONE HOUR	17:00	18:30	90	15				✓		

Intersection Network

Intersections

Intersection	Name	Intersection Type	Leg Order	Grade Separated	Large Roundabout	Intersection Delay (s)	Intersection LOS
1	untitled	Roundabout	1,2,3,4			1.41	A

Intersection Network Options

Driving Side	Lighting
Right	Normal/unknown

Legs

Legs

Leg	Leg	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Leg	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Leg	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Leg	Enter slope and intercept directly	Entered slope	Entered intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Leg options

Leg	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Leg	Lane Level	Lane	Has Limited Storage	Storage (PCE)	Minimum Capacity (PCE/hr)	Maximum Capacity (PCE/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Leg	Slope	Intercept (PCE/hr)	Final Slope	Final Intercept (PCE/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Intersection	Leg	Lane Level	Lane	Leg			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCE Factor for a Truck (PCE)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	Truck Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Leg	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	258.00	100.000
2	ONE HOUR	✓	56.00	100.000
3	ONE HOUR	✓	269.00	100.000
4	ONE HOUR	✓	88.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	11.000	209.000	38.000
	2	11.000	0.000	35.000	10.000
	3	200.000	52.000	0.000	17.000
	4	45.000	17.000	26.000	0.000

Turning Proportions (Veh) - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.04	0.81	0.15
	2	0.20	0.00	0.63	0.18
	3	0.74	0.19	0.00	0.06
	4	0.51	0.19	0.30	0.00

Vehicle Mix

Average PCE Per Vehicle - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.000	1.053	1.344
	2	1.000	1.000	1.125	1.000
	3	1.039	1.143	1.000	1.071
	4	1.132	1.143	1.045	1.000

Truck Percentages - Intersection 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	0.0	5.3	34.4
	2	0.0	0.0	12.5	0.0
	3	3.9	14.3	0.0	7.1
	4	13.2	14.3	4.5	0.0

Results

Results Summary for whole modelled period

Leg	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Intersection Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	1.59	0.15	0.85	A	258.05	387.07	9.55	1.48	0.11
2	0.92	0.02	~1	A	55.21	82.82	1.30	0.94	0.01
3	1.44	0.13	0.67	A	262.40	393.60	8.57	1.31	0.10
4	1.10	0.04	~1	A	90.13	135.19	2.51	1.11	0.03

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

For sales and distribution information, program advice and maintenance, contact TRL:
Tel: +44 (0)1344 770758 email: software@trl.co.uk Web: http://www.trlsoftware.co.uk

Filename: 2027 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\2024\Arcady\2027
Report generation date: 2024-05-27 1:38:53 PM

Summary of junction performance

	AM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS
	2027 [Entry Lane Simulation] - Future Total 2027						
Arm 1	0.34	2.01	2.48	N/A	A	2.41	A
Arm 2	0.07	~1	1.47	N/A	A		
Arm 3	0.44	2.41	2.85	N/A	A		
Arm 4	0.05	~1	1.46	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

"D1 - Future Background 2027, AM" model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2027, PM" model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2027, AM " model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2027, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2024-05-27 1:38:53 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	1099725843	2768

2027 - Future Total 2027, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2027 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2027	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Total 2027, AM	Future Total 2027	AM		ONE HOUR	08:00	09:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	untitled	Roundabout	1,2,3,4			2.41	A

Junction Network Options

Driving Side	Lighting
Right	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Arm options

Arm	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane Level	Lane	Has Limited Storage	Storage (PCU)	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Arm	Slope	Intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Junction	Arm	Lane Level	Lane	Arm			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	328.00	100.000
2	ONE HOUR	✓	136.00	100.000
3	ONE HOUR	✓	355.00	100.000
4	ONE HOUR	✓	79.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	20.000	269.000	39.000
	2	42.000	0.000	82.000	12.000
	3	291.000	33.000	0.000	31.000
	4	26.000	3.000	50.000	0.000

Turning Proportions (Veh) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.06	0.82	0.12
	2	0.31	0.00	0.60	0.09
	3	0.82	0.09	0.00	0.09
	4	0.33	0.04	0.63	0.00

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.100	1.141	1.528
	2	1.083	1.000	1.000	1.091
	3	1.175	1.200	1.000	1.353
	4	1.250	1.000	1.091	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	10.0	14.1	52.8
	2	8.3	0.0	0.0	9.1
	3	17.5	20.0	0.0	35.3
	4	25.0	0.0	9.1	0.0

Results

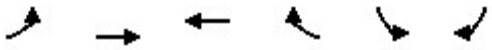
Results Summary for whole modelled period

Arm	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	2.48	0.34	2.01	A	356.78	535.18	20.30	2.28	0.23
2	1.47	0.07	~1	A	127.63	191.44	4.11	1.29	0.05
3	2.85	0.44	2.41	A	388.84	583.27	25.04	2.58	0.28
4	1.46	0.05	~1	A	81.85	122.77	3.03	1.48	0.03

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	29	10	46	107	6
Future Volume (Veh/h)	16	29	10	46	107	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	32	11	50	116	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	192	120	123			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	192	120	123			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	97	99			
cM capacity (veh/h)	791	932	1464			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	49	61	123
Volume Left	17	11	0
Volume Right	32	0	7
cSH	878	1464	1700
Volume to Capacity	0.06	0.01	0.07
Queue Length 95th (m)	1.3	0.2	0.0
Control Delay (s)	9.3	1.4	0.0
Lane LOS	A	A	
Approach Delay (s)	9.3	1.4	0.0
Approach LOS	A		

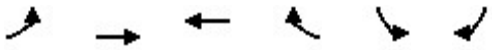
Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	19.6%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	197	198	181	75	17
Future Volume (Veh/h)	23	197	198	181	75	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	214	215	197	82	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	412				578	314
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	412				578	314
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				82	98
cM capacity (veh/h)	1147				468	727

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	239	412	100
Volume Left	25	0	82
Volume Right	0	197	18
cSH	1147	1700	500
Volume to Capacity	0.02	0.24	0.20
Queue Length 95th (m)	0.5	0.0	5.6
Control Delay (s)	1.0	0.0	14.0
Lane LOS	A		B
Approach Delay (s)	1.0	0.0	14.0
Approach LOS			B

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	41.5%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	270	373	28	84	6
Future Volume (Veh/h)	2	270	373	28	84	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	293	405	30	91	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	435				717	420
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	435				717	420
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				77	99
cM capacity (veh/h)	1125				396	633

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	295	435	98
Volume Left	2	0	91
Volume Right	0	30	7
cSH	1125	1700	406
Volume to Capacity	0.00	0.26	0.24
Queue Length 95th (m)	0.0	0.0	7.1
Control Delay (s)	0.1	0.0	16.6
Lane LOS	A		C
Approach Delay (s)	0.1	0.0	16.6
Approach LOS			C

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	33.0%	ICU Level of Service	A
Analysis Period (min)	15		

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

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Filename: 2027 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\2024\Arcady\2027
Report generation date: 2024-05-27 1:39:55 PM

Summary of junction performance

	PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS
	2027 [Entry Lane Simulation] - Future Total 2027						
Arm 1	0.51	2.60	3.27	N/A	A	3.10	A
Arm 2	0.06	~1	1.54	N/A	A		
Arm 3	0.61	3.20	3.53	N/A	A		
Arm 4	0.07	~1	1.77	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

"D1 - Future Background 2027, AM" model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2027, PM" model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2027, AM" model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2027, PM " model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2024-05-27 1:39:55 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	1873332158	3004

2027 - Future Total 2027, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2027 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2027	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Total 2027, PM	Future Total 2027	PM		ONE HOUR	17:00	18:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	untitled	Roundabout	1,2,3,4			3.10	A

Junction Network Options

Driving Side	Lighting
Right	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Arm options

Arm	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane Level	Lane	Has Limited Storage	Storage (PCU)	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Arm	Slope	Intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Junction	Arm	Lane Level	Lane	Arm			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	449.00	100.000
2	ONE HOUR	✓	97.00	100.000
3	ONE HOUR	✓	516.00	100.000
4	ONE HOUR	✓	104.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	41.000	373.000	35.000
	2	29.000	0.000	59.000	9.000
	3	364.000	94.000	0.000	58.000
	4	41.000	16.000	47.000	0.000

Turning Proportions (Veh) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.09	0.83	0.08
	2	0.30	0.00	0.61	0.09
	3	0.71	0.18	0.00	0.11
	4	0.39	0.15	0.45	0.00

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.000	1.053	1.344
	2	1.000	1.000	1.125	1.000
	3	1.039	1.143	1.000	1.071
	4	1.132	1.143	1.045	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	0.0	5.3	34.4
	2	0.0	0.0	12.5	0.0
	3	3.9	14.3	0.0	7.1
	4	13.2	14.3	4.5	0.0

Results

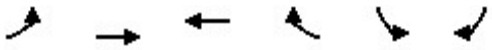
Results Summary for whole modelled period

Arm	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	3.27	0.51	2.60	A	440.82	661.22	29.75	2.70	0.33
2	1.54	0.06	~1	A	96.69	145.03	3.42	1.41	0.04
3	3.53	0.61	3.20	A	502.80	754.19	35.35	2.81	0.39
4	1.77	0.07	~1	A	103.88	155.83	4.23	1.63	0.05

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	20	33	119	77	18
Future Volume (Veh/h)	10	20	33	119	77	18
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	22	36	129	84	20
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	295	94	104			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	295	94	104			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	98			
cM capacity (veh/h)	679	963	1488			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	33	165	104
Volume Left	11	36	0
Volume Right	22	0	20
cSH	845	1488	1700
Volume to Capacity	0.04	0.02	0.06
Queue Length 95th (m)	0.9	0.6	0.0
Control Delay (s)	9.4	1.8	0.0
Lane LOS	A	A	
Approach Delay (s)	9.4	1.8	0.0
Approach LOS	A		

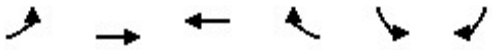
Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	24.8%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	264	259	129	203	28
Future Volume (Veh/h)	24	264	259	129	203	28
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	287	282	140	221	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	422				691	352
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	422				691	352
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				45	96
cM capacity (veh/h)	1137				401	692

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	313	422	251
Volume Left	26	0	221
Volume Right	0	140	30
cSH	1137	1700	422
Volume to Capacity	0.02	0.25	0.59
Queue Length 95th (m)	0.5	0.0	28.4
Control Delay (s)	0.9	0.0	25.3
Lane LOS	A		D
Approach Delay (s)	0.9	0.0	25.3
Approach LOS			D

Intersection Summary			
Average Delay	6.7		
Intersection Capacity Utilization	53.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	460	385	93	55	4
Future Volume (Veh/h)	7	460	385	93	55	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	500	418	101	60	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	519				984	468
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	519				984	468
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				78	99
cM capacity (veh/h)	1047				273	595

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	508	519	64
Volume Left	8	0	60
Volume Right	0	101	4
cSH	1047	1700	283
Volume to Capacity	0.01	0.31	0.23
Queue Length 95th (m)	0.2	0.0	6.5
Control Delay (s)	0.2	0.0	21.4
Lane LOS	A		C
Approach Delay (s)	0.2	0.0	21.4
Approach LOS			C

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	39.8%	ICU Level of Service	A
Analysis Period (min)	15		

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

For sales and distribution information, program advice and maintenance, contact TRL:
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Filename: 2032 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\2024\Arcady\2032
Report generation date: 2024-05-27 1:42:54 PM

Summary of junction performance

	AM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS
2032 [Entry Lane Simulation] - Future Total 2032							
Arm 1	0.34	2.01	2.60	N/A	A	2.53	A
Arm 2	0.07	0.05	1.50	N/A	A		
Arm 3	0.46	2.55	3.02	N/A	A		
Arm 4	0.06	~1	1.54	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

"D1 - Future Background 2032, AM" model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2032, PM" model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2032, AM " model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2032, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2024-05-27 1:42:54 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	1540822910	2748

2032 - Future Total 2032, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2032 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2032	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Total 2032, AM	Future Total 2032	AM		ONE HOUR	08:00	09:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	untitled	Roundabout	1,2,3,4			2.53	A

Junction Network Options

Driving Side	Lighting
Right	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Arm options

Arm	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane Level	Lane	Has Limited Storage	Storage (PCU)	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Arm	Slope	Intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Junction	Arm	Lane Level	Lane	Arm			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	338.00	100.000
2	ONE HOUR	✓	138.00	100.000
3	ONE HOUR	✓	366.00	100.000
4	ONE HOUR	✓	82.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	21.000	275.000	42.000
	2	43.000	0.000	82.000	13.000
	3	301.000	33.000	0.000	32.000
	4	28.000	3.000	51.000	0.000

Turning Proportions (Veh) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.06	0.81	0.12
	2	0.31	0.00	0.59	0.09
	3	0.82	0.09	0.00	0.09
	4	0.34	0.04	0.62	0.00

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.100	1.141	1.528
	2	1.083	1.000	1.000	1.091
	3	1.175	1.200	1.000	1.353
	4	1.250	1.000	1.091	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	10.0	14.1	52.8
	2	8.3	0.0	0.0	9.1
	3	17.5	20.0	0.0	35.3
	4	25.0	0.0	9.1	0.0

Results

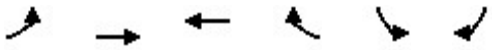
Results Summary for whole modelled period

Arm	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	2.60	0.34	2.01	A	367.20	550.80	21.82	2.38	0.24
2	1.50	0.07	0.05	A	131.83	197.75	4.29	1.30	0.05
3	3.02	0.46	2.55	A	399.70	599.55	27.21	2.72	0.30
4	1.54	0.06	~1	A	85.48	128.22	3.31	1.55	0.04

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	29	10	47	109	6
Future Volume (Veh/h)	16	29	10	47	109	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	32	11	51	118	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	194	122	125			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	194	122	125			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	97	99			
cM capacity (veh/h)	788	930	1462			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	49	62	125
Volume Left	17	11	0
Volume Right	32	0	7
cSH	875	1462	1700
Volume to Capacity	0.06	0.01	0.07
Queue Length 95th (m)	1.3	0.2	0.0
Control Delay (s)	9.4	1.4	0.0
Lane LOS	A	A	
Approach Delay (s)	9.4	1.4	0.0
Approach LOS	A		

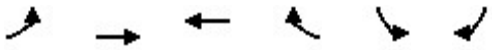
Intersection Summary			
Average Delay	2.3		
Intersection Capacity Utilization	19.7%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	208	204	181	75	17
Future Volume (Veh/h)	23	208	204	181	75	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	226	222	197	82	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	419				596	320
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	419				596	320
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				82	98
cM capacity (veh/h)	1140				456	720

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	251	419	100
Volume Left	25	0	82
Volume Right	0	197	18
cSH	1140	1700	488
Volume to Capacity	0.02	0.25	0.20
Queue Length 95th (m)	0.5	0.0	5.8
Control Delay (s)	1.0	0.0	14.3
Lane LOS	A		B
Approach Delay (s)	1.0	0.0	14.3
Approach LOS			B

Intersection Summary			
Average Delay	2.2		
Intersection Capacity Utilization	42.0%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	281	379	28	84	6
Future Volume (Veh/h)	2	281	379	28	84	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	305	412	30	91	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	442				736	427
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	442				736	427
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				76	99
cM capacity (veh/h)	1118				386	628

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	307	442	98
Volume Left	2	0	91
Volume Right	0	30	7
cSH	1118	1700	396
Volume to Capacity	0.00	0.26	0.25
Queue Length 95th (m)	0.0	0.0	7.3
Control Delay (s)	0.1	0.0	17.0
Lane LOS	A		C
Approach Delay (s)	0.1	0.0	17.0
Approach LOS			C

Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	33.3%	ICU Level of Service	A
Analysis Period (min)	15		

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

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Filename: 2032 Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\2024\Arcady\2032
Report generation date: 2024-05-27 1:43:39 PM

Summary of junction performance

	PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS
	2032 [Entry Lane Simulation] - Future Total 2032						
Arm 1	0.55	2.76	3.48	N/A	A	3.27	A
Arm 2	0.06	~1	1.67	N/A	A		
Arm 3	0.63	2.98	3.70	N/A	A		
Arm 4	0.06	~1	1.78	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

"D1 - Future Background 2032, AM" model duration: 8:00 AM - 9:30 AM
"D2 - Future Background 2032, PM" model duration: 5:00 PM - 6:30 PM
"D3 - Future Total 2032, AM" model duration: 8:00 AM - 9:30 AM
"D4 - Future Total 2032, PM " model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2024-05-27 1:43:39 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	2128646183	1671

2032 - Future Total 2032, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - 2032 [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set(s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
2032	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
Future Total 2032, PM	Future Total 2032	PM		ONE HOUR	17:00	18:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	untitled	Roundabout	1,2,3,4			3.27	A

Junction Network Options

Driving Side	Lighting
Right	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Arm options

Arm	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane Level	Lane	Has Limited Storage	Storage (PCU)	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Arm	Slope	Intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Junction	Arm	Lane Level	Lane	Arm			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	464.00	100.000
2	ONE HOUR	✓	100.00	100.000
3	ONE HOUR	✓	527.00	100.000
4	ONE HOUR	✓	107.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	42.000	384.000	38.000
	2	30.000	0.000	60.000	10.000
	3	373.000	95.000	0.000	59.000
	4	45.000	17.000	45.000	0.000

Turning Proportions (Veh) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.09	0.83	0.08
	2	0.30	0.00	0.60	0.10
	3	0.71	0.18	0.00	0.11
	4	0.42	0.16	0.42	0.00

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.000	1.053	1.344
	2	1.000	1.000	1.125	1.000
	3	1.039	1.143	1.000	1.071
	4	1.132	1.143	1.045	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	0.0	5.3	34.4
	2	0.0	0.0	12.5	0.0
	3	3.9	14.3	0.0	7.1
	4	13.2	14.3	4.5	0.0

Results

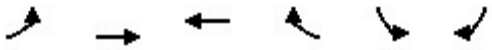
Results Summary for whole modelled period

Arm	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	3.48	0.55	2.76	A	454.40	681.60	32.18	2.83	0.36
2	1.67	0.06	~1	A	98.12	147.18	3.67	1.50	0.04
3	3.70	0.63	2.98	A	510.74	766.11	37.61	2.95	0.42
4	1.78	0.06	~1	A	106.19	159.28	4.46	1.68	0.05

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	20	33	121	80	18
Future Volume (Veh/h)	10	20	33	121	80	18
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	22	36	132	87	20
Pedestrians					3	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	304	97	107			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	304	97	107			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	98			
cM capacity (veh/h)	669	959	1484			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	33	168	107
Volume Left	11	36	0
Volume Right	22	0	20
cSH	838	1484	1700
Volume to Capacity	0.04	0.02	0.06
Queue Length 95th (m)	0.9	0.6	0.0
Control Delay (s)	9.5	1.8	0.0
Lane LOS	A	A	
Approach Delay (s)	9.5	1.8	0.0
Approach LOS	A		

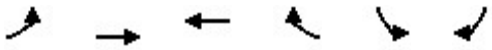
Intersection Summary			
Average Delay	2.0		
Intersection Capacity Utilization	24.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	274	273	129	203	28
Future Volume (Veh/h)	24	274	273	129	203	28
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	298	297	140	221	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	437				717	367
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	437				717	367
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				43	96
cM capacity (veh/h)	1123				387	678

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	324	437	251
Volume Left	26	0	221
Volume Right	0	140	30
cSH	1123	1700	408
Volume to Capacity	0.02	0.26	0.62
Queue Length 95th (m)	0.5	0.0	30.3
Control Delay (s)	0.9	0.0	26.9
Lane LOS	A		D
Approach Delay (s)	0.9	0.0	26.9
Approach LOS			D

Intersection Summary			
Average Delay	7.0		
Intersection Capacity Utilization	53.9%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	470	399	93	55	4
Future Volume (Veh/h)	7	470	399	93	55	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	511	434	101	60	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	535				1012	484
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	535				1012	484
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				77	99
cM capacity (veh/h)	1033				263	582

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	519	535	64
Volume Left	8	0	60
Volume Right	0	101	4
cSH	1033	1700	273
Volume to Capacity	0.01	0.31	0.23
Queue Length 95th (m)	0.2	0.0	6.8
Control Delay (s)	0.2	0.0	22.2
Lane LOS	A		C
Approach Delay (s)	0.2	0.0	22.2
Approach LOS			C

Intersection Summary			
Average Delay	1.4		
Intersection Capacity Utilization	40.3%	ICU Level of Service	A
Analysis Period (min)	15		

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

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Filename: Future Total 2032 Eco-Park Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\2024\Arcady\Eco-Park 2032
Report generation date: 2024-05-27 1:47:47 PM

Summary of junction performance

	AM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS
	Future Total 2032 (Eco Park) [Entry Lane Simulation] - 2032						
Arm 1	0.58	3.16	4.11	N/A	A	7.58	A
Arm 2	0.27	1.53	3.32	N/A	A		
Arm 3	2.81	10.70	13.45	N/A	B		
Arm 4	0.15	0.81	1.84	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

"D1 - 2032, AM " model duration: 8:00 AM - 9:30 AM
"D2 - 2032, PM" model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2024-05-27 1:47:47 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	125290088	1640

Future Total 2032 (Eco Park) - 2032, AM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - Future Total 2032 (Eco Park) [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
Future Total 2032 (Eco Park)	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2032, AM	2032	AM		ONE HOUR	08:00	09:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	untitled	Roundabout	1,2,3,4			7.58	A

Junction Network Options

Driving Side	Lighting
Right	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Arm options

Arm	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane Level	Lane	Has Limited Storage	Storage (PCU)	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Arm	Slope	Intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Junction	Arm	Lane Level	Lane	Arm			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	358.00	100.000
2	ONE HOUR	✓	239.00	100.000
3	ONE HOUR	✓	531.00	100.000
4	ONE HOUR	✓	211.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	10.000	227.000	121.000
	2	18.000	0.000	82.000	139.000
	3	183.000	33.000	0.000	315.000
	4	45.000	30.000	136.000	0.000

Turning Proportions (Veh) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.03	0.63	0.34
	2	0.08	0.00	0.34	0.58
	3	0.34	0.06	0.00	0.59
	4	0.21	0.14	0.64	0.00

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.100	1.141	1.528
	2	1.083	1.000	1.000	1.091
	3	1.175	1.200	1.000	1.353
	4	1.250	1.000	1.091	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	10.0	14.1	52.8
	2	8.3	0.0	0.0	9.1
	3	17.5	20.0	0.0	35.3
	4	25.0	0.0	9.1	0.0

Results

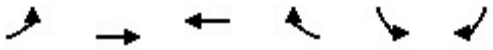
Results Summary for whole modelled period

Arm	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	4.11	0.58	3.16	A	415.10	622.66	36.97	3.56	0.41
2	3.32	0.27	1.53	A	232.22	348.33	15.20	2.62	0.17
3	13.45	2.81	10.70	B	623.13	934.69	141.66	9.09	1.57
4	1.84	0.15	0.81	A	213.82	320.73	9.17	1.72	0.10

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	16	29	9	63	208	6
Future Volume (Veh/h)	16	29	9	63	208	6
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	17	32	10	68	226	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	318	230	233			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	318	230	233			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	97	96	99			
cM capacity (veh/h)	671	810	1335			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	49	78	233
Volume Left	17	10	0
Volume Right	32	0	7
cSH	755	1335	1700
Volume to Capacity	0.06	0.01	0.14
Queue Length 95th (m)	1.6	0.2	0.0
Control Delay (s)	10.1	1.0	0.0
Lane LOS	B	A	
Approach Delay (s)	10.1	1.0	0.0
Approach LOS	B		

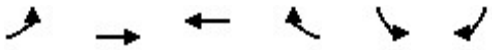
Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	21.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	23	373	241	181	75	17
Future Volume (Veh/h)	23	373	241	181	75	17
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	25	405	262	197	82	18
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	459				816	360
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	459				816	360
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				76	97
cM capacity (veh/h)	1102				339	684

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	430	459	100
Volume Left	25	0	82
Volume Right	0	197	18
cSH	1102	1700	373
Volume to Capacity	0.02	0.27	0.27
Queue Length 95th (m)	0.5	0.0	8.1
Control Delay (s)	0.7	0.0	18.2
Lane LOS	A		C
Approach Delay (s)	0.7	0.0	18.2
Approach LOS			C

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	50.3%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	2	446	416	28	84	6
Future Volume (Veh/h)	2	446	416	28	84	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	485	452	30	91	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	482				956	467
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	482				956	467
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				68	99
cM capacity (veh/h)	1081				286	596

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	487	482	98
Volume Left	2	0	91
Volume Right	0	30	7
cSH	1081	1700	297
Volume to Capacity	0.00	0.28	0.33
Queue Length 95th (m)	0.0	0.0	10.6
Control Delay (s)	0.1	0.0	23.0
Lane LOS	A		C
Approach Delay (s)	0.1	0.0	23.0
Approach LOS			C

Intersection Summary			
Average Delay	2.1		
Intersection Capacity Utilization	36.7%	ICU Level of Service	A
Analysis Period (min)	15		

Junctions 8

ARCADY 8 - Roundabout Module

Version: 8.0.6.541 [19821,26/11/2015]

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Filename: Future Total 2032 Eco-Park Traffic Volumes.arc8
Path: J:\1000\1060-Flato Dev\5590_Ida Street\Design\Traffic\Working\2024\Arcady\Eco-Park 2032
Report generation date: 2024-05-27 1:48:31 PM

Summary of junction performance

	PM						
	Queue (Veh)	95% Queue (Veh)	Delay (s)	RFC	LOS	Junction Delay (s)	Junction LOS
	Future Total 2032 (Eco Park) [Entry Lane Simulation] - 2032						
Arm 1	0.64	2.93	5.33	N/A	A	6.53	A
Arm 2	0.09	0.30	2.39	N/A	A		
Arm 3	0.92	3.94	4.80	N/A	A		
Arm 4	2.05	7.78	9.75	N/A	A		

Values shown are the maximum values over all time segments. Delay is the maximum value of average delay per arriving vehicle. Junction LOS and Junction Delay are demand-weighted averages.

"D1 - 2032, AM" model duration: 8:00 AM - 9:30 AM
"D2 - 2032, PM " model duration: 5:00 PM - 6:30 PM

Run using Junctions 8.0.6.541 at 2024-05-27 1:48:31 PM

File summary

Title	(untitled)
Location	
Site Number	
Date	2022-08-12
Version	
Status	(new file)
Identifier	
Client	
Jobnumber	
Enumerator	khagan
Description	

Analysis Options

Vehicle Length (m)	Do Queue Variations	Calculate Residual Capacity	Residual Capacity Criteria Type	RFC Threshold	Average Delay Threshold (s)	Queue Threshold (PCU)
5.75	✓		N/A	0.85	36.00	20.00

Units

Distance Units	Speed Units	Traffic Units Input	Traffic Units Results	Flow Units	Average Delay Units	Total Delay Units	Rate Of Delay Units
m	kph	Veh	Veh	perHour	s	-Min	perMin

Entry Lane Analysis Options

Stop Criteria (%)	Random Seed	Results Refresh Speed (s)	Individual Vehicle Animation Number Of Trials	Time Step Size (s)	Last Run Random Seed	Last Run Number Of Trials
1.00	-1	3	1	10	759076392	1529

Future Total 2032 (Eco Park) - 2032, PM

Data Errors and Warnings

Severity	Area	Item	Description
Warning	Entry Lane Analysis	A1 - Future Total 2032 (Eco Park) [Entry Lane Simulation]	This analysis set uses entry lane simulation mode. This is provided as an investigative tool and the user should apply judgement when interpreting the results.

Analysis Set Details

Name	Roundabout Capacity Model	Description	Include In Report	Use Specific Demand Set(s)	Specific Demand Set (s)	Locked	Network Flow Scaling Factor (%)	Network Capacity Scaling Factor (%)	Reason For Scaling Factors
Future Total 2032 (Eco Park)	Entry Lane Simulation		✓				100.000	100.000	

Demand Set Details

Name	Scenario Name	Time Period Name	Description	Traffic Profile Type	Model Start Time (HH:mm)	Model Finish Time (HH:mm)	Model Time Period Length (min)	Time Segment Length (min)	Results For Central Hour Only	Single Time Segment Only	Locked	Run Automatically	Use Relationship	Relationship
2032, PM	2032	PM		ONE HOUR	17:00	18:30	90	15				✓		

Junction Network

Junctions

Junction	Name	Junction Type	Arm Order	Grade Separated	Large Roundabout	Junction Delay (s)	Junction LOS
1	untitled	Roundabout	1,2,3,4			6.53	A

Junction Network Options

Driving Side	Lighting
Right	Normal/unknown

Arms

Arms

Arm	Arm	Name	Description
1	1	Main Street W	
2	2	Ida Street	
3	3	Grey Road 9	
4	4	Ida Street	

Capacity Options

Arm	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	0.00	99999.00
2	0.00	99999.00
3	0.00	99999.00
4	0.00	99999.00

Roundabout Geometry

Arm	V - Approach road half-width (m)	E - Entry width (m)	l' - Effective flare length (m)	R - Entry radius (m)	D - Inscribed circle diameter (m)	PHI - Conflict (entry) angle (deg)	Exit Only
1	3.80	4.25	5.00	20.00	35.00	32.50	
2	3.80	4.25	5.00	20.00	35.00	32.50	
3	3.80	4.25	5.00	20.00	35.00	32.50	
4	3.80	4.25	5.00	20.00	35.00	32.50	

Slope / Intercept / Capacity

Roundabout Slope and Intercept used in model

Arm	Enter slope and intercept directly	Entered slope	Entered intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1		(calculated)	(calculated)	0.557	1246.355
2		(calculated)	(calculated)	0.557	1246.355
3		(calculated)	(calculated)	0.557	1246.355
4		(calculated)	(calculated)	0.557	1246.355

The slope and intercept shown above include any corrections and adjustments.

Entry Lane Analysis: Arm options

Arm	Lane Capacity Source	Traffic Considering Secondary Lanes (%)
1	Evenly split	10.00
2	Evenly split	10.00
3	Evenly split	10.00
4	Evenly split	10.00

Lanes

Arm	Lane Level	Lane	Has Limited Storage	Storage (PCU)	Minimum Capacity (PCU/hr)	Maximum Capacity (PCU/hr)
1	1	1		Infinity	0.00	99999.00
2	1	1		Infinity	0.00	99999.00
3	1	1		Infinity	0.00	99999.00
4	1	1		Infinity	0.00	99999.00

Entry Lane slope and intercept

Arm	Slope	Intercept (PCU/hr)	Final Slope	Final Intercept (PCU/hr)
1	(calculated)	(calculated)	0.557	1246.355
2	(calculated)	(calculated)	0.557	1246.355
3	(calculated)	(calculated)	0.557	1246.355
4	(calculated)	(calculated)	0.557	1246.355

Lane Movements

Junction	Arm	Lane Level	Lane	Arm			
				1	2	3	4
1	1	1	1	✓	✓	✓	✓
1	2	1	1	✓	✓	✓	✓
1	3	1	1	✓	✓	✓	✓
1	4	1	1	✓	✓	✓	✓

Traffic Flows

Demand Set Data Options

Default Vehicle Mix	Vehicle Mix Varies Over Time	Vehicle Mix Varies Over Turn	Vehicle Mix Varies Over Entry	Vehicle Mix Source	PCU Factor for a HV (PCU)	Default Turning Proportions	Estimate from entry/exit counts	Turning Proportions Vary Over Time	Turning Proportions Vary Over Turn	Turning Proportions Vary Over Entry
		✓	✓	HV Percentages	2.00				✓	✓

Entry Flows

General Flows Data

Arm	Profile Type	Use Turning Counts	Average Demand Flow (Veh/hr)	Flow Scaling Factor (%)
1	ONE HOUR	✓	323.00	100.000
2	ONE HOUR	✓	115.00	100.000
3	ONE HOUR	✓	571.00	100.000
4	ONE HOUR	✓	571.00	100.000

Turning Proportions

Turning Counts / Proportions (Veh/hr) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.000	15.000	249.000	59.000
	2	12.000	0.000	60.000	43.000
	3	286.000	95.000	0.000	190.000
	4	96.000	130.000	345.000	0.000

Turning Proportions (Veh) - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.00	0.05	0.77	0.18
	2	0.10	0.00	0.52	0.37
	3	0.50	0.17	0.00	0.33
	4	0.17	0.23	0.60	0.00

Vehicle Mix

Average PCU Per Vehicle - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	1.000	1.000	1.053	1.344
	2	1.000	1.000	1.125	1.000
	3	1.039	1.143	1.000	1.071
	4	1.132	1.143	1.045	1.000

Heavy Vehicle Percentages - Junction 1 (for whole period)

		To			
		1	2	3	4
From	1	0.0	0.0	5.3	34.4
	2	0.0	0.0	12.5	0.0
	3	3.9	14.3	0.0	7.1
	4	13.2	14.3	4.5	0.0

Results

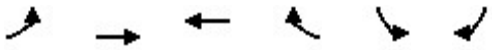
Results Summary for whole modelled period

Arm	Max Delay (s)	Max Queue (Veh)	Max 95th percentile Queue (Veh)	Max LOS	Average Demand (Veh/hr)	Total Junction Arrivals (Veh)	Total Queueing Delay (Veh-min)	Average Queueing Delay (s)	Rate Of Queueing Delay (Veh-min/min)
1	5.33	0.64	2.93	A	328.86	493.28	33.02	4.02	0.37
2	2.39	0.09	0.30	A	113.24	169.87	5.68	2.01	0.06
3	4.80	0.92	3.94	A	559.69	839.53	51.12	3.65	0.57
4	9.75	2.05	7.78	A	568.08	852.13	93.16	6.56	1.04

Movement	EBL	EBR	NBL	NBT	SBT	SBR
Lane Configurations						
Traffic Volume (veh/h)	10	20	32	208	95	18
Future Volume (Veh/h)	10	20	32	208	95	18
Sign Control	Stop			Free	Free	
Grade	0%			0%	0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	11	22	35	226	103	20
Pedestrians					3	
Lane Width (m)					3.5	
Walking Speed (m/s)					1.1	
Percent Blockage					0	
Right turn flare (veh)						
Median type				None	None	
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	412	113	123			
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	412	113	123			
tC, single (s)	6.4	6.2	4.1			
tC, 2 stage (s)						
tF (s)	3.5	3.3	2.2			
p0 queue free %	98	98	98			
cM capacity (veh/h)	580	940	1464			

Direction, Lane #	EB 1	NB 1	SB 1
Volume Total	33	261	123
Volume Left	11	35	0
Volume Right	22	0	20
cSH	779	1464	1700
Volume to Capacity	0.04	0.02	0.07
Queue Length 95th (m)	1.0	0.6	0.0
Control Delay (s)	9.8	1.2	0.0
Lane LOS	A	A	
Approach Delay (s)	9.8	1.2	0.0
Approach LOS	A		

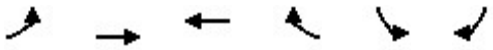
Intersection Summary			
Average Delay	1.5		
Intersection Capacity Utilization	29.4%	ICU Level of Service	A
Analysis Period (min)	15		



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	24	318	435	129	203	28
Future Volume (Veh/h)	24	318	435	129	203	28
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	26	346	473	140	221	30
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	613				941	543
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	613				941	543
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				22	94
cM capacity (veh/h)	966				284	540

Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	372	613	251
Volume Left	26	0	221
Volume Right	0	140	30
cSH	966	1700	301
Volume to Capacity	0.03	0.36	0.83
Queue Length 95th (m)	0.6	0.0	53.6
Control Delay (s)	0.9	0.0	56.1
Lane LOS	A		F
Approach Delay (s)	0.9	0.0	56.1
Approach LOS			F

Intersection Summary			
Average Delay	11.7		
Intersection Capacity Utilization	56.1%	ICU Level of Service	B
Analysis Period (min)	15		



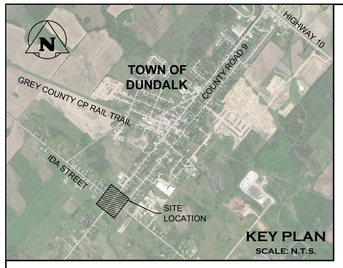
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	514	560	93	55	4
Future Volume (Veh/h)	7	514	560	93	55	4
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	559	609	101	60	4
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	710				1234	660
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	710				1234	660
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				69	99
cM capacity (veh/h)	889				193	463

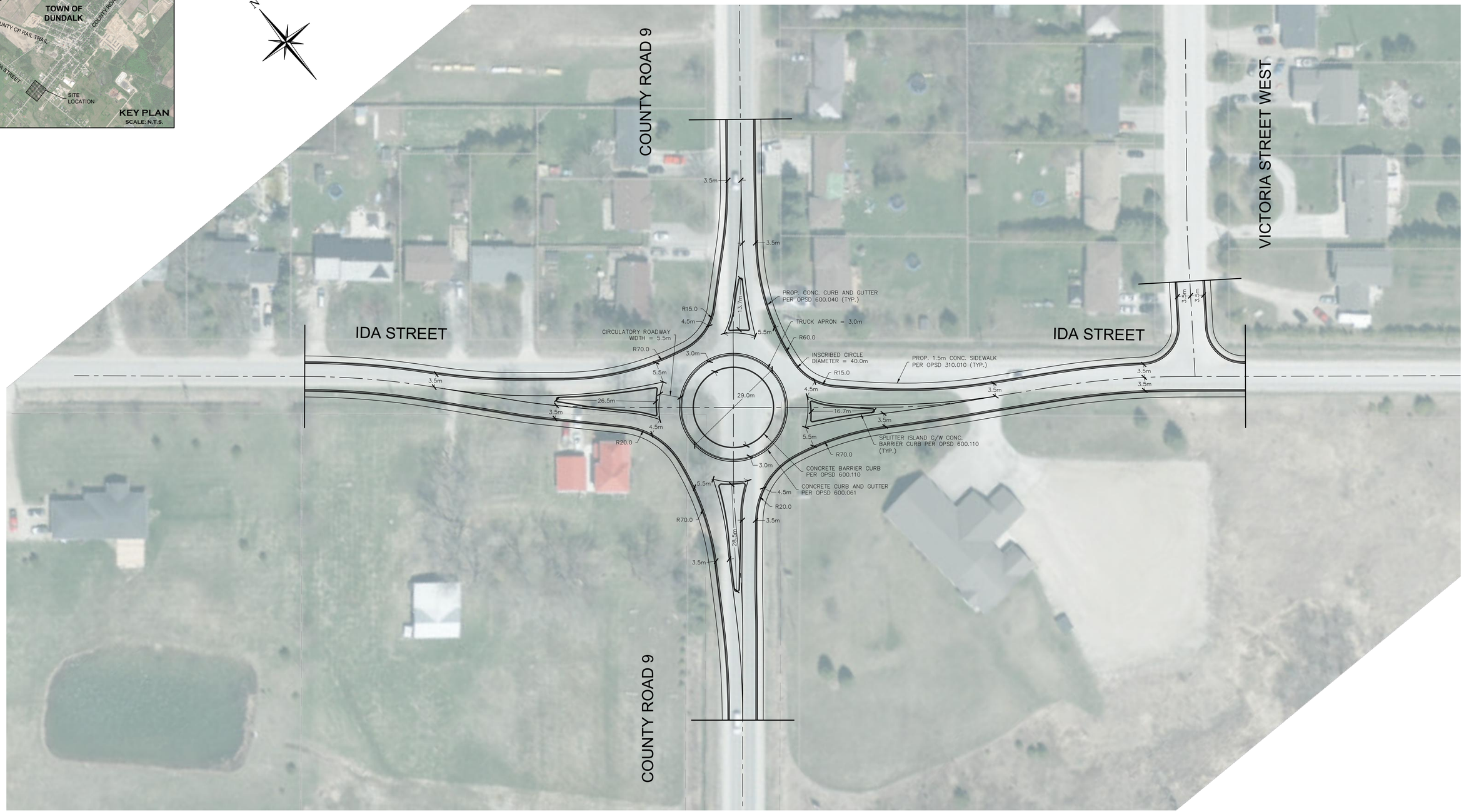
Direction, Lane #	EB 1	WB 1	SB 1
Volume Total	567	710	64
Volume Left	8	0	60
Volume Right	0	101	4
cSH	889	1700	200
Volume to Capacity	0.01	0.42	0.32
Queue Length 95th (m)	0.2	0.0	9.9
Control Delay (s)	0.2	0.0	31.2
Lane LOS	A		D
Approach Delay (s)	0.2	0.0	31.2
Approach LOS			D

Intersection Summary			
Average Delay	1.6		
Intersection Capacity Utilization	45.1%	ICU Level of Service	A
Analysis Period (min)	15		

APPENDIX E

Roundabout Overlay





10 0m 10 20 30 40
SCALE: 1:500

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3. THIS DRAWING IS TO BE READ AND UNDERSTOOD IN CONJUNCTION WITH ALL OTHER PLANS AND DOCUMENTS APPLICABLE TO THIS PROJECT.
4. DO NOT SCALE THE DRAWINGS.
5. ALL EXISTING UNDERGROUND UTILITIES TO BE VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO CONSTRUCTION.

TEMPORARY BENCHMARKS

TBM#1–
TBM#2–
TBM#3–

•••ADD REFERENCE TO SURVEY/SOURCE

Town

No.	ISSUE	DATE: MMM/DD/YYYY
1.	ISSUED FOR TOWN REVIEW	08/22/2022

Engineer

PROFESSIONAL ENGINEERS ONTARIO — PRELIMINARY — NOT TO BE USED FOR CONSTRUCTION

Engineer

PROFESSIONAL ENGINEERS ONTARIO — PROVINCE OF ONTARIO

Project

GLENELG EXPANSION LANDS
TOWN OF DUNDALK

Drawing

CONCEPTUAL ROUNDABOUT PLAN

CROZIER CONSULTING ENGINEERS
ADMIRAL BUILDING
1 FIRST STREET, SUITE 200
COLLINGWOOD, ON, L9Y 1A1
705-446-3510 T
705-446-3520 F
WWW.CFCROZIER.CA
INFO@CFCROZIER.CA

Drawn By	Design By	Project	
DE	DE		1060–5590
Check By	Check By	Scale	Drawing
SH	MF	1: 500	FIG.1

APPENDIX F

Background Development Traffic Study Excerpts

FEBRUARY 25, 2021

PROJECT NO: 1060-5384

Ministry of Transportation – West Region
Corridor Management Section
659 Exeter Road
London, Ontario N6E 1L3

Attention: Martin Leyton
Corridor Management Planner, West Region

RE: EDGEWOOD GREENS
TRAFFIC IMPACT STUDY UPDATE COVER LETTER
TOWNSHIP OF SOUTHGATE

Dear Martin,

Please find enclosed our updated Transportation Impact Study, prepared to support the proposed neighbourhood commercial block located within the Dundalk Meadows development (now referred to as Edgewood Greens) in Dundalk, Township of Southgate.

The original TIS was submitted in December 2015 to the Ontario Ministry of Transportation (MTO) and Township of Southgate. The first update was prepared in response to discussions with MTO and to reflect the additional lands acquired by Flato (Flato North). Subsequent updates were completed in February 2016 and June 2016 in response to comments provided by the MTO. Since these updates, Flato North, East and West have been Draft Plan Approved. Flato West has been constructed and occupied, Flato North is currently under construction, a portion of Flato East has been constructed and the remaining lands are Draft Plan Approved and undergoing detailed design.

A subsequent TIS Update was submitted in January 2020 to support the addition of a neighbourhood commercial block in the south east corner of the property. Since the January 2020 submission, the change has been approved from an Official Plan Amendment, Zoning By-law Amendment and Redline Draft Plan Application perspective, and is now undergoing detailed design as part of the Site Plan Application process.

Additional comments were provided by the MTO in January 2021 and are addressed in the enclosed TIS Update. We have transcribed the comments received on January 6, 2021, followed by our response.

1. **Comment**: Use the peak hour of the generator fitted equation to estimate the trips for the Shopping Centre (LUC 820)
   Response: Acknowledged, the fitted curve of peak hour of generator has now been used. The updated trip generation forecasts are summarized in **Section 5.1**.

2. **Comment**: Include a Saturday peak hour
   Response: The proposed development as a whole is residential in nature, and the proposed commercial block is expected to primarily service the residential development. Accordingly, the Saturday peak hour is not expected to reflect a worst-case scenario for

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CROZIER CONSULTING ENGINEERS

traffic operations. Additionally, the COVID-19 pandemic and subsequent lockdown prevents accurate traffic data from being collected. Based on further discussions with MTO staff, it was agreed that the Saturday peak hour would not need to be assessed.

3. **Comment**: MTO agrees with a pass-by trip percentage of 34% as recommended in the report. However, the pass-by trip percentage used on Table 8: Trip Generation was 52%
   Response: A 34% pass-by percentage was utilized for both the a.m. and p.m. peak hours. It is highlighted that the 34% pass-by is not a fraction of the primary trips, rather the total trip generation. The total commercial trip generation in the previous version of the TIS was 67 trips in the p.m. peak hour. 23 trips reflect 34% of the 67 total trips. The primary trips represent the remainder which was 44 trips.

4. **Comment**: Provide a left turn warrant assessment with the updated numbers for the 5- and 10-year horizon.
   Response: Acknowledged, left turn warrants are included for all future horizon years.

The total outstanding unit breakdown is as follows:

- 477 Single-detached Units
- 62 Semi-detached Units
- 157 Townhouse Units
- Commercial Building with a GFA of 1,448 m^2 (15,586 ft^2)

It is noted that since the previous submission, Phases 11-13 of the development have been consolidated and are now referred to only as Phase 11.

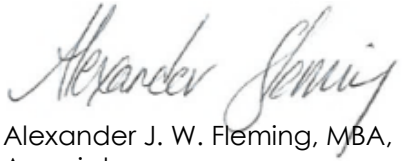
Details pertaining to the trip generation are provided in **Section 5.1.** The future total traffic volumes for the 2025, 2030 and 2035 horizon years are illustrated in **Figures 13, 14 and 15**, respectively, with auxiliary turn-lane warrant information included in **Section 5.3** and levels of service summarized in **Section 5.4.** Based on the weekday p.m. future total volumes, a northbound left-turn lane with a minimum storage of 50 metres is warranted at the proposed Highway 10 entrance. This is an increase in 10 metres compared to the January 2020 TIS Update which recommended 40 metres.

Overall, the TIS Update concluded that the proposed development is supportable, with the noted improvements. The boundary road network is expected to operate well under future total traffic volume conditions. Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

The enclosed TIS Update was prepared using the most recent Draft Plan and Site Plan. Any minor changes to the Plan will not materially affect the conclusions contained within this report.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.



Alexander J. W. Fleming, MBA, P.Eng.
Associate

C.F. CROZIER & ASSOCIATES INC.

Madeleine Ferguson, P.Eng.
Project Engineer, Transportation

/kh

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TRAFFIC IMPACT STUDY

EDGEWOOD GREENS
TOWNSHIP OF SOUTHGATE

PREPARED FOR:
FLATO DEVELOPMENTS INC.

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
40 HURON STREET, SUITE 301
COLLINGWOOD, ONTARIO
L9T 6P4

ORIGINAL – DECEMBER 2015
UPDATE – FEBRUARY 2016
UPDATE – JUNE 2016
UPDATE – JANUARY 2020
UPDATE – FEBURARY 2021

CFCA FILE NO. 1060-5384

CROZIER
CONSULTING ENGINEERS

LIST OF FIGURES

Trips generated by Glenelg Phase 1 and Glenelg Phase 2 were assigned to the boundary road network based on the distributions described in the original TIS (Crozier, September 2018 and September 2020, respectively). While the intersection Highway 10 and County Road 9 was not analyzed fully in those reports, 10 percent of trips were assumed to continue east on County Road 9 and 50 percent of trips were assumed to travel south on Highway 10.

The trip assignment for the Glenelg Development is illustrated in **Figure 6** and relevant excerpts from the Glenelg Phase 1 TIS and Phase 2 TIS, as well as the most recent Draft Plan have been included in **Appendix E**.

4.5 Intersection Operations

The future background operations at the study intersections were analyzed using the 2025, 2030 and 2035 future background traffic volumes illustrated in **Figures 7, 8 and 9**, respectively. Detailed capacity analysis worksheets are included in **Appendix C**. **Table 6, Table 7 and Table 8** outline the 2025, 2030 and 2035 future background traffic operations, respectively.

Table 6: 2025 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Maximum v/c ratio [2]	95th Percentile Queues > Storage
Highway 10 and Main Street	Signal	A.M.	B	10.3 s	0.49 (EBT)	None
		P.M.	B	12.5 s	0.51 (EBT)	None
Main Street and Russell Street	Two-way Stop	A.M.	B	10.5 s	0.07 (NB)	None
		P.M.	B	11.3 s	0.06(NB)	None
Main Street and Alice Street/Mill Street	Two-way Stop	A.M.	B	11.3 s	0.05 (NB)	None
		P.M.	B	14.5 s	0.06 (NB)	None
Main Street and Osprey Street	Two-way Stop	A.M.	B	11.9 s	0.04 (SB)	None
		P.M.	B	14.4 s	0.05 (SB)	None
Elm Street and Victoria Street	Two-way Stop	A.M.	A	9.1 s	0.06 (NB)	None
		P.M.	A	9.0 s	0.03 (NB)	None

Note[1]: The Level of Service of a signalized intersection is based on the average control delay per vehicle (Synchro/ICU). The Level of Service of a two-way stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000).

Note[2]: The maximum v/c ratio for two-way stop-controlled intersections represents the maximum v/c for the minor road approach movements at the intersection. Any movements that experience a v/c ratio in excess of 0.85 are considered critical per the MTO TIS Guidelines.

Table 7: 2030 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Maximum v/c ratio [2]	95th Percentile Queues > Storage
Highway 10 and Main Street	Signal	A.M.	B	10.6 s	0.50 (EBT)	None
		P.M.	B	13.1 s	0.54 (EBT)	None
Main Street and Russell Street	Two-way Stop	A.M.	B	10.7 s	0.07 (NB)	None
		P.M.	B	11.5 s	0.06 (NB)	None
Main Street and Alice Street/Mill Street	Two-way Stop	A.M.	B	11.5 s	0.06 (NB)	None
		P.M.	C	15.1 s	0.07 (NB)	None
Main Street and Osprey Street	Two-way Stop	A.M.	B	11.9 s	0.04 (SB)	None
		P.M.	B	14.8 s	0.05 (SB)	None
Elm Street and Victoria Street	Two-way Stop	A.M.	A	9.1 s	0.07 (NB)	None
		P.M.	A	9.1 s	0.04 (NB)	None

Note[1]: The Level of Service of a signalized intersection is based on the average control delay per vehicle (Synchro/ICU). The Level of Service of a two-way stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000).

Note[2]: The maximum v/c ratio for two-way stop-controlled intersections represents the maximum v/c for the minor road approach movements at the intersection. Any movements that experience a v/c ratio in excess of 0.85 are considered critical per the MTO TIS Guidelines.

Table 8: 2035 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Maximum v/c ratio [2]	95th Percentile Queues > Storage
Highway 10 and Main Street	Signal	A.M.	B	10.9 s	0.52 (EBT)	None
		P.M.	B	13.6 s	0.56 (EBT)	None
Main Street and Russell Street	Two-way Stop	A.M.	B	11.0 s	0.08 (NB)	None
		P.M.	B	11.9 s	0.07 (NB)	None
Main Street and Alice Street/Mill Street	Two-way Stop	A.M.	B	11.9 s	0.07 (NB)	None
		P.M.	C	16.6 s	0.08 (NB)	None
Main Street and Osprey Street	Two-way Stop	A.M.	B	12.3 s	0.05 (SB)	None
		P.M.	C	15.5 s	0.06 (SB)	None
Elm Street and Victoria Street	Two-way Stop	A.M.	A	9.2 s	0.07 (NB)	None
		P.M.	A	9.2 s	0.04 (NB)	None

Note[1]: The Level of Service of a signalized intersection is based on the average control delay per vehicle (Synchro/ICU). The Level of Service of a two-way stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000).

Note[2]: The maximum v/c ratio for two-way stop-controlled intersections represents the maximum v/c for the minor road approach movements at the intersection. Any movements that experience a v/c ratio in excess of 0.85 are considered critical per the MTO TIS Guidelines.

The metrics summarized above indicate that the study intersections are expected to continue operating with a LOS "B" or better, with the exception of Main Street and Alice Street/Mill Street and Main Street and Osprey Street, which are expected to operate with a LOS "C" in the weekday p.m. peak hour. The maximum volume-to-capacity ratio of 0.56 (Highway 10 and Main Street, EBT, p.m.) indicates that the intersections have reserve capacity for increases in traffic volumes. The 95th percentile queues through all horizon years and peak hours can be contained within their available storage lengths.

5.0 Future Total Conditions

5.1 Site Generated Traffic

The proposed mixed-use development will result in additional vehicles on the boundary road network that would otherwise not exist. The proposed development will also result in additional turning movements at the study intersections.

As noted, the remainder of the development is proposed to consist of the following:

- 477 Single-detached Units
- 62 Semi-detached Units
- 157 Townhouse Units
- Commercial Building with a GFA of 1,448 m^2 (15,586 ft^2)

The trip generation of the proposed residential dwelling and commercial units was forecasted using published data from the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. The ITE Trip Generation Manual is a compendium of industry collected trip generation data across North America for a variety of land uses and is used industry wide as a source for trip generation forecasts.

The applicable average rates and fitted curve equations for Land Use Category (LUC) 210 "Single Family Detached Housing" and LUC 220 "Multifamily Housing (Low-Rise)" were applied to the proposed residential dwelling units. The fitted curve for the peak hour of generator for LUC 820 "Shopping Centre" was applied to the proposed commercial GFA, per the January 2021 MTO comments.

As defined by the ITE Trip Generation Handbook, 3rd Edition, primary trips are made for the specific purpose of visiting the generator. Pass-by trips are made as intermediate stops on the way from an origin to a primary destination without a route diversion. Accordingly, these vehicles do not increase the volume of vehicles on the roadway.

The pass-by trip percentage of the commercial retail pass-by trips was forecasted using the rates provided by the ITE Trip Generation Handbook. LUC 820 was used to establish a pass-by percentage of 34 percent for the p.m. peak period. A pass-by percentage was not applied to the a.m. peak period as this trip generation generally captures employees of the commercial uses.

Relevant excerpts from the ITE Trip Generation Manual, 10th Edition and ITE Trip Generation Handbook, 3rd Edition have been included in **Appendix I**. The forecasted trip generation of the mixed-use development is summarized in **Table 9**.

Table 9: Trip Generation

Land Use	Units/GFA	Peak Hour	Trip Type	Trips Generated		
				Inbound	Outbound	Total
LUC 210: Single Family Detached Housing	477 Units	A.M.	Primary	85	258	343
		P.M.		287	168	455
LUC 220: Multifamily Housing (Low-Rise)	219 Units	A.M.	Primary	23	77	100
		P.M.		75	44	119
LUC 820: Shopping Centre	15,586 ft^2	A.M.	Primary	43	36	79
			Pass-by	22	19	41
		P.M.	Primary	49	49	98
			Pass-by	25	25	50
Total		**A.M.**	**Primary**	**151**	**371**	**522**
			Pass-by	**22**	**19**	**41**
		P.M.	**Primary**	**411**	**261**	**672**
			Pass-by	**25**	**25**	**50**

5.2 Trip Distribution and Assignment

5.2.1. Residential Trips

The trips generated by the proposed residential portion of the development were distributed to the boundary road network using the distribution described in the June 2016 TIS Update, which was completed using Transportation Tomorrow Survey (TTS) data. Excerpts from the June 2016 TIS as well as the TTS data have been included in **Appendix G.**

The following residential trip distribution was established:

- 50% to and from the south on Highway 10 via the Highway 10 Access
- 5% to and from the north on Highway 10 via the Highway 10 Access
- 5% to and from the east on Main Street via the Highway 10 Access
- 15% travelling to and from the west on Main Street via Elm Street and Osprey Street
- 15% to and from the west on Main Street via Russell Street
- 5% to and from the east on Main Street via Russell Street
- 5% to and from the north on Highway 10 via Russell Street

Figure 10 outlines the residential trip distribution for the development. The associated primary trip assignment is illustrated in **Figure 13**.

5.2.2. Commercial Primary Trips

The primary trips generated by the commercial component of the proposed development were distributed to the boundary road network based on the expected catchment areas in the community. The main catchment area is expected to be comprised of the surrounding residential dwellings in the urban area of the Community of Dundalk.

Given the scale of the Edgewood Greens development, it is assumed that the commercial development will primarily service residents from within the development. As such, half the primary

commercial trips were assumed to remain within Edgewood Greens. The remaining trips were distributed to the west on Main Street and Victoria Street via Russell Street and Elm Street, respectively.

Figure 11 outlines the residential trip distribution for the development. The associated primary trip assignment is illustrated in **Figure 14**.

5.2.3. Commercial Pass-By Trips

The pass-by trips generated by the proposed development are expected to utilize the proposed site access to Highway 10. Existing turning movement counts were used to establish the pass-by trip distribution. In the weekday a.m. peak hour, 50 percent of trips were observed to be travelling to the north and south on Highway 10. In the weekday p.m. peak hour, 35 percent of trips were observed travelling south on Highway 10, with the remaining 65 percent travelling north on Highway 10.

Figure 12 outlines the pass-by trip distribution for the site, and **Figure 15** outlines the corresponding pass-by trip assignment.

5.3 Auxiliary Turn-Lane Assessment

Auxiliary left-turn lane warrants were undertaken for a northbound left-turn lane on Highway 10 at the proposed site access. The warrants were completed using the MTO Design Supplement for TAC Geometric Design Guide for Canadian Roads. Highway 10 has a posted speed limit of 80 km/h fronting the site access. Accordingly, a design speed of 100 km/h was selected, reflecting the engineering convention of a 20 km/h increase on higher speed roadways. **Table 10** summarizes the results of the northbound left-turn lane analyses.

Table 10: 2035 Future Total Auxiliary Lane Analysis

Intersection	Peak Hour	V_A	% Left Turns in V_A	V_O	Warranted	Minimum Storage	MTO GDSOH Figure
Highway 10 and Site Access	A.M.	285	23%	318	Yes	15 m	Ex. 9A-25
	P.M.	731	27%	341	Yes	50 m	Ex. 9A-25

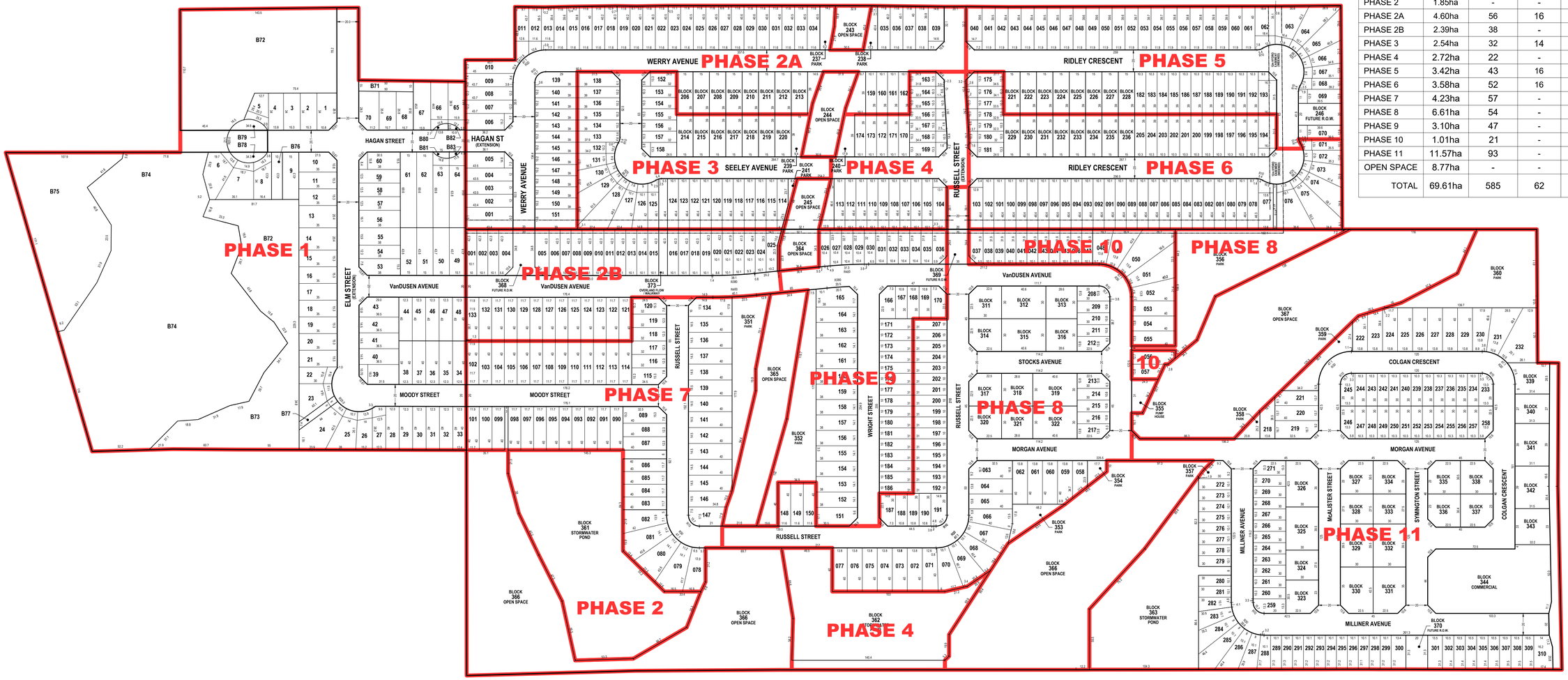
It can be seen that the volumes on Highway 10 exceed the minimum threshold for an auxiliary left-turn lane in the weekday a.m. and p.m. peak hours. The weekday a.m. peak hour volumes warrant a left-turn lane with a minimum storage length of 15 metres, while the weekday p.m. peak hour volumes warrant a left-turn lane with a minimum storage length of 50 metres. A left-turn lane with 50 metres of storage was also warranted under 2030 future total conditions, while a left-turn lane with 40 metres of storage was warranted under 2025 future total conditions.

The auxiliary left-turn lane warrant charts for the 2025, 2030 and 2035 horizon years have been included in **Appendix H** for reference. As discussed in **Section 5.4**, the northbound left-turn movement is forecasted to experience a 95th percentile queue of 22.0 metres, which can be accommodated within the warranted 50 metres of storage.

A southbound right-turn lane was considered on Highway 10 at the proposed site access. Per the Transportation Association of Canada (TAC) Geometric Design Guide for Canadian Roads (GDGCR), a right-turn lane is required when the volume of right-turns causes a large delay to the through movements. The projected volume of right-turning vehicles at the site accesses is forecasted to be a maximum of 45 vehicles (p.m.), which represents approximately 13 percent of southbound volumes. This volume of right-turning vehicles is not expected to cause a delay to the southbound through

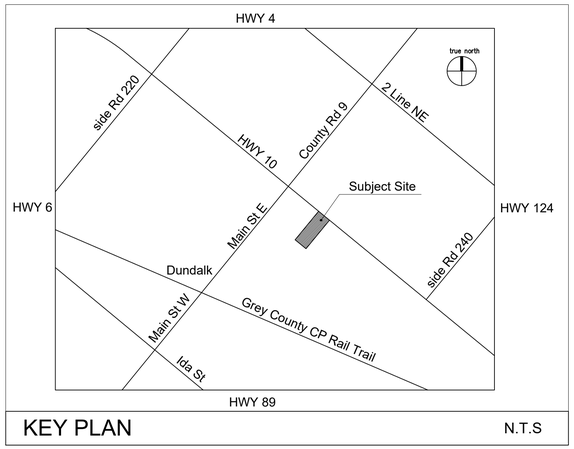
EDGEWOOD GREENS

COMPOSITE PHASING PLAN

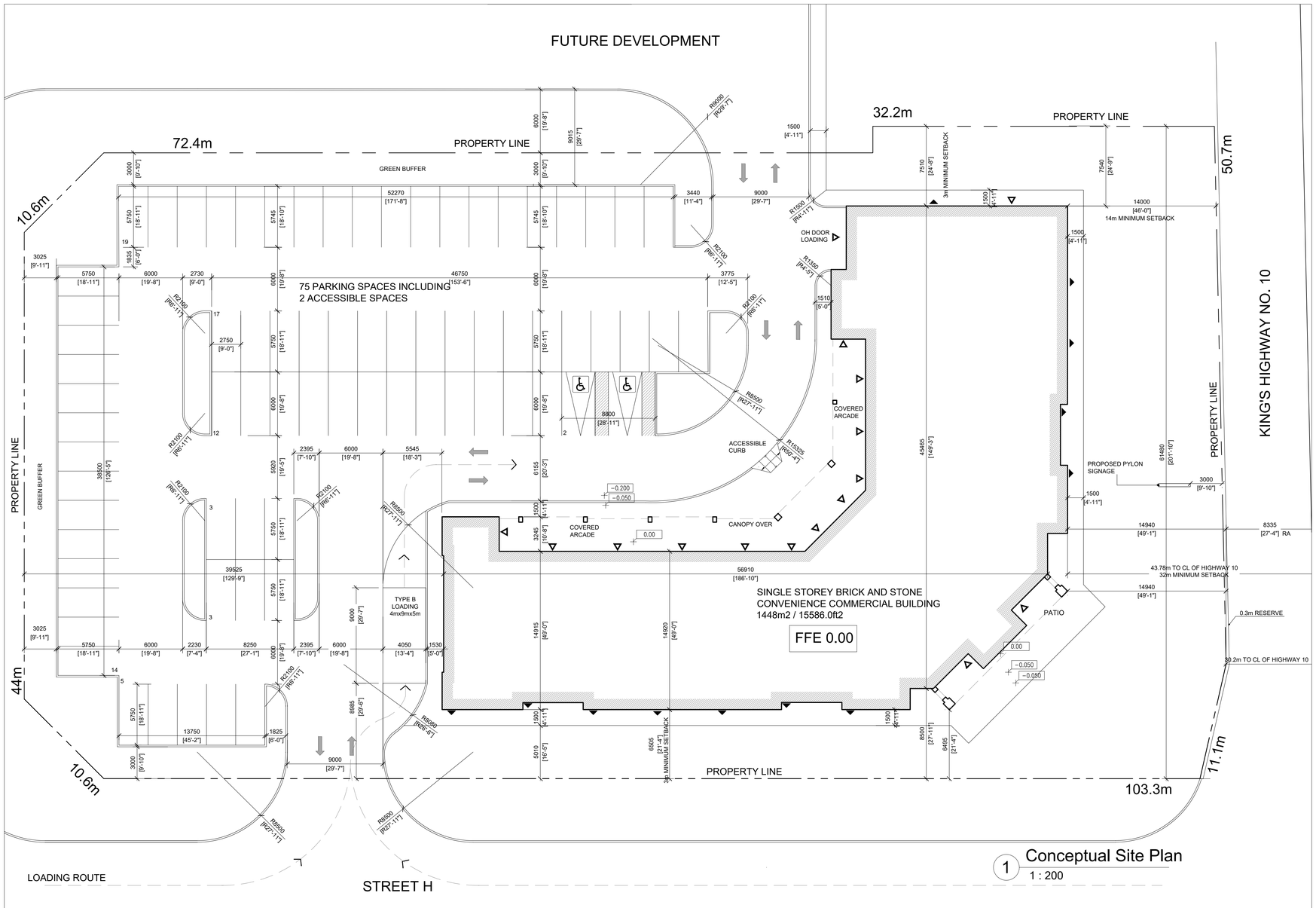


PHASE	AREA	SINGLES	SEMIS	TOWNS	TOTAL
PHASE 1	13.22ha	70	-	-	70
PHASE 2	1.85ha	-	-	-	-
PHASE 2A	4.60ha	56	16	-	72
PHASE 2B	2.39ha	38	-	-	38
PHASE 3	2.54ha	32	14	-	46
PHASE 4	2.72ha	22	-	-	22
PHASE 5	3.42ha	43	16	-	59
PHASE 6	3.58ha	52	16	-	68
PHASE 7	4.23ha	57	-	-	57
PHASE 8	6.61ha	54	-	56	110
PHASE 9	3.10ha	47	-	-	47
PHASE 10	1.01ha	21	-	-	21
PHASE 11	11.57ha	93	-	101	194
OPEN SPACE	8.77ha	-	-	-	-
TOTAL	69.61ha	585	62	157	804

January 19, 2021



KEY PLAN N.T.S



SITE STATISTICS

1. SITE AREA BREAKDOWN	AREA ft2	AREA m2
LOT AREA	71,730.0	6664.0
NET LOT AREA	71,730.0	6664.0
2. BUILDING AREA (FOOTPRINT)	15,586.0	1448.0
3. PROPOSED BUILDING HEIGHT		
1 STOREY (MEASURED FROM FFE 0.0)		8.94m2 (29'-0")
4. F.S.I (FLOOR SPACE INDEX)		
GROSS FLOOR AREA (m2) / SITE AREA (m2)	(GFA) 1448.0 / (SITE) 6664.0	0.21

5. PARKING (TYPICAL PARKING SPACE SIZE = 2.75m X 5.75m)	
REQUIRED PARKING	
COMMERCIAL PARKING (1 PARKING SPACE / 20m2 OF NFA (1369/20)	68 SPACES
TOTAL REQUIRED PARKING	68 SPACES
PROVIDED PARKING	75 SPACES
* OF WHICH 2 SPACES ARE BARRIER-FREE (4.4m X 6m)	

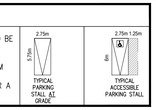
6.LOADING	
REQUIRED	1 TYPE B (4m X 9m X 5m ht)
PROVIDED	1 TYPE B (4m X 9m X 5m ht)

7. FLOOR AREA BREAKDOWN	GROSS FLOOR AREA (GFA)		DEDUCTIONS			NET FLOOR AREA (NFA)	
	ft2	m2		ft2	m2	ft2	m2
GROUND FLOOR (COMMERCIAL, GROUP E CLASSIFICATION)	15586.0	1448.0	LOADING	624.3	58.0	14735.7	1369.0
			MECH	226.0	21.0		
TOTAL	15586.0	1448.0	FLOOR DEDUCTIONS	850.3	79.0	14735.7	1369.0

8. SETBACKS	REQUIRED	PROVIDED
NORTH INTERIOR SIDE SETBACK	3.0m	7.5m
SOUTH EXTERIOR SIDE SETBACK	3.0m	6.5m
EAST FRONT SETBACK	14.0m	14.0m
WEST REAR SETBACK	7.5m	39.5

PARKING LEGEND

GENERAL NOTE – FIRE ROUTE TO BE POSTED AND DESIGNATED UNDER MUNICIPAL BY-LAW. TO BE MINIMUM 6.0m WIDE WITH MINIMUM 12.0m CENTER-LINE TURNING RADIUS MAXIMUM 8% SLOPE OVER A MINIMUM DISTANCE OF 15m



SURVEY DATA

LEGEND

UNIT ENTRANCE	CB	CATCH BASIN	
SERVICE DOOR	H.P.	HYDRO POLE	
GEODETIC ELEVATION	MH	MANHOLE	
EXISTING ELEVATION	F.H.	FIRE HYDRANT	
PROPOSED ELEVATION	B.B.	BOLLARD LIGHT REFER TO ELEC DWGS.	
HANDICAPPED PARKING			

Firm Name:	architecture unfolded
Certificate of Practice Number:	4647
	219 Dufferin St. Suite 201B
	Toronto. ON M6K 1Y9

The Certificate of Practice Number of the holder is the holder's BCIN.

Name of Project: EDGEWOOD PLAZA

Location: DUNDALK, ONTARIO

ONTARIO ASSOCIATION OF ARCHITECTS — EDUARDO A. ORTIZ LICENCE 6919

The architect noted above has exercised responsible control with respect to design activities.

Item	Ontario Building Code Data Matrix Part 3				OBC Reference
1.	Project Description:	■ New ☐ Addition ☐ Alteration	☐ Part 11 11.1 to 11.4	■ Part 3	☐ Part 9
		☐ Change of Use		1.1.2 [A]	1.1.2 [A] 9.10.1.3
2.	Major Occupancy(s) Group C, RESIDENTIAL OCCUPANCY			3.1.2.1 (1)	9.10.2
3.	Building Area (m2)	Existing	New 1490.4 m2 Total 1490.4 m2	1.4.1.2 [A]	1.4.1.2 [A]
4.	Gross Area (m2)	Existing	New 1494 m2 Total 9488.8 m2	1.4.1.2 [A]	1.4.1.2 [A]
5.	Number of Storeys	Above grade: 1	Below grade: 0	1.4.1.2 [A] & 3.2.1.1	1.4.1.2 [A] & 9.10.1
6.	Number of Streets/Fire Fighter Access: 1			3.2.2.10 & 3.2.5	9.10.20
7.	Building Classification: GROUP C (up to 6-Storey, Sprinklered)			3.2.2.43A	9.10.4
8.	Sprinkler System Proposed		■ entire building ☐ basement & ground floor only ☐ in lieu of roof rating ☐ not required	3.2.2.20 – 3.2.2.83 3.2.2.15 3.2.2.17	9.10.8
9.	Standpipe required		☐ Yes ■ No	3.2.9	N/A
10.	Fire Alarm required		☐ Yes ■ No	3.2.4	9.10.18.2
11.	Water Service/Supply is Adequate		■ Yes ☐ No	3.2.5.7	N/A
12.	High Building		☐ Yes ■ No	3.2.6	N/A
13.	Permitted Construction / Actual Construction	■ Combustible / ■ Combustible	☐ Non-combustible / ☐ Non-combustible	■ Both / ■ Both	3.2.2.20 – 3.2.2.83 9.10.6
14.	Mezzanine(s) Area m2 N/A			3.2.1.1 (3) – 3.2.1.1 (8)	9.10.4.1
15.	Occupant load based on	☐ m2/person	■ design of building	3.1.17	9.9.1.3
16.	Barrier-free Design	■ Yes ☐ No(Explain)		3.8	9.5.2
17.	Hazardous Substances	☐ Yes ■ No		3.3.1.2 & 3.3.1.19	9.10.1.3 (4)
18.	Required Fire Resistance Rating (FRR)	Horizontal Assemblies FRR (Hours)	Listed Design No. Description (SB-2)	3.2.2.20–.83 & 3.2.1.4	9.10.8 9.10.9
		Floors ____N/A____ Hours (below grade)			
		Floors ____N/A____ Hours (above grade)			
		Roof _____0_____ Hours			
		Mezzanine _N/A_ Hours	N/A		
		FRR of Supporting Members	Listed Design No. Or Description (SB-2)		
		Floors _____1_____ Hours	min.200mm POURED CONCRETE SLAB		
		Roof _____0_____ Hours			
		Mezzanine _N/A_ Hours	N/A		
19.	Spatial Separation – Construction of Exterior Walls			3.2.3	9.10.14

	Wall Area of EBF (m2)	L.D. (m)	L/H or H/L	Permitted Max. % of Openings	Proposed % of Openings	FRR (Hours)	Listed Design or Description	Comb Const	Comb. Constr. Nonc. Cladding	Non-comb. Constr.
North	NO WINDOWS TO NORTH .									
South	REFER TO PROPOSED METHOD OF BUILDING COMPLIANCE REPORT BY JENSEN HUGHES .									
East	REFER TO PROPOSED METHOD OF BUILDING COMPLIANCE REPORT BY JENSEN HUGHES .									
West	REFER TO PROPOSED METHOD OF BUILDING COMPLIANCE REPORT BY JENSEN HUGHES .									

20. Other – Describe

architecture**unfolded**
219 dufferin street, suite 201b, toronto, on, m6k 3j1 tel:(416)601.5416 info@unfolded.ca

4 ISSUED FOR OPA/ZBA	11.06.20
3 ISSUED FOR SPA/CO-ORDINATION	07.15.20
2 ISSUED FOR CONSULTANT REVIEW	05.08.20
1 ISSUED FOR CLIENT REVIEW	05.06.20
revisions:	m.d.yr

architectural team :

Eduardo Ortiz

ONTARIO ASSOCIATION OF ARCHITECTS — EDUARDO A. ORTIZ LICENCE 6919

construction managers:

structural:

electrical:

mechanical:

landscape:

site services:

project:

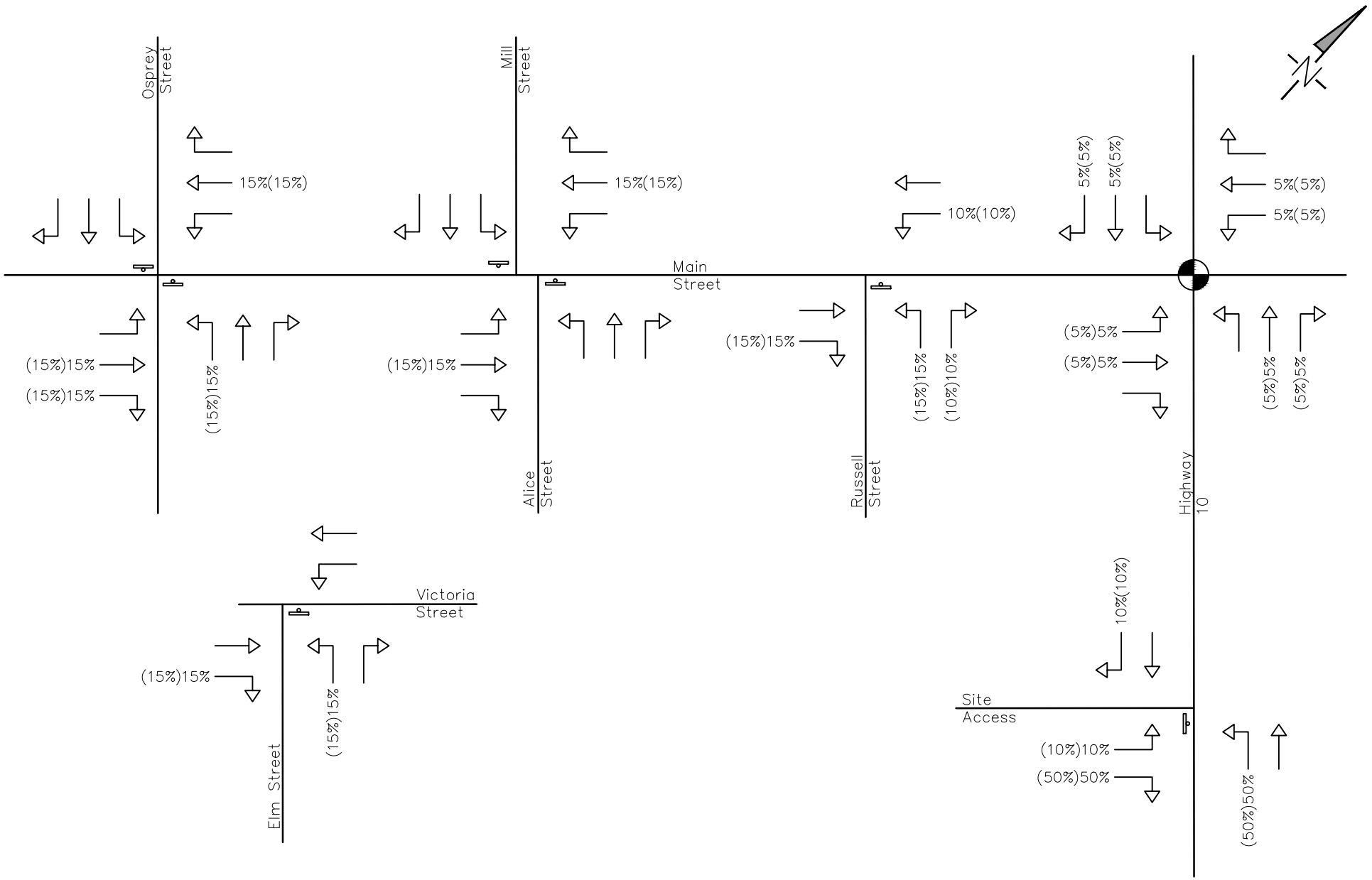
Dundalk Commercial
Dundalk, Ontario

Conceptual Site Plan & Statistics

November 6th, 2020 — date:
1:200 — scale:
20-07 — project
ep — drawn by:

north

drawing number: A102a



NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

- SIGNAL CONTROL
- STOP CONTROL
- XX(YY) A.M. (P.M.) PEAK HOUR TRAFFIC VOLUMES

Project

Edgewood Greens
Dundalk, Township of Southgate

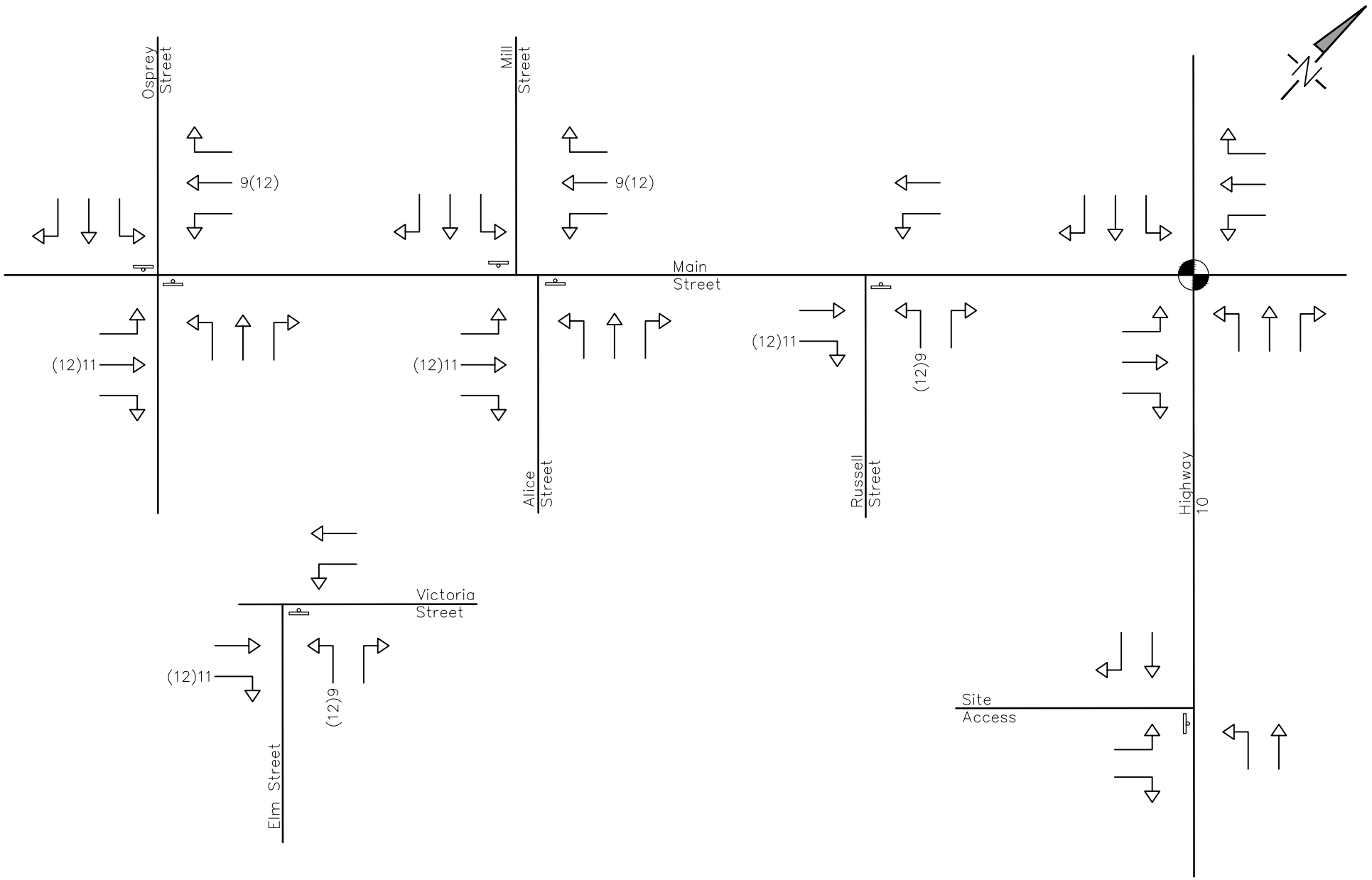
Drawing

Residential Trip Distribution

CROZIER CONSULTING ENGINEERS
The HarbourEdge Building,
40 Huron Street, Suite 301,
Collingwood, ON L9Y 4R3
705 446-3510 T
705 446-3520 F
www.cfcrozier.ca
info@cfcrozier.ca

Drawn By	Design By	Project
S.K.	S.K.	1060-5384

Scale	Date	Check By	Drawing
N.T.S.	JAN. 20, 2020	M.F.	FIG. 10



NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

- SIGNAL CONTROL
- STOP CONTROL
- XX(YY) A.M. (P.M.) PEAK HOUR TRAFFIC VOLUMES

Project

Edgewood Greens
Dundalk, Township of Southgate

Drawing

Commercial Primary Trip Assignment

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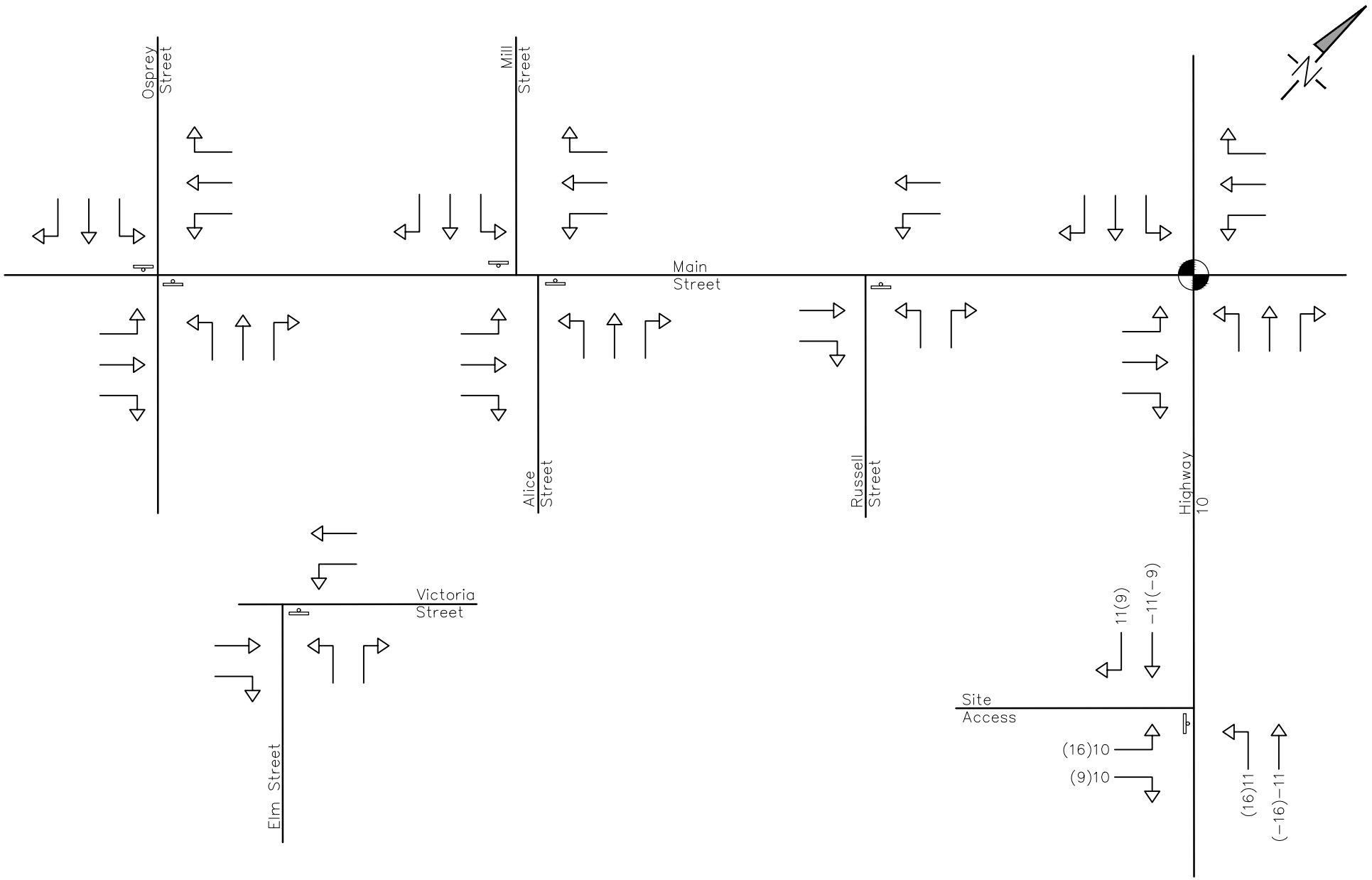
S.K.	S.K.	1060–5384

Scale	Date	Check By	Drawing
N.T.S.	FEB. 22, 2021	M.F.	FIG. 14



NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

SIGNAL CONTROL

STOP CONTROL

XX(YY) A.M. (P.M.) PEAK HOUR TRAFFIC VOLUMES

Project

Edgewood Greens
Dundalk, Township of Southgate

Drawing

Commercial Pass–by Trip Assignment

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Drawn By	Design By	Project
S.K.	S.K.	1060–5384

Scale	Date	Check By	Drawing
N.T.S.	FEB. 22, 2021	M.F.	FIG. 15

TRAFFIC IMPACT STUDY

SOUTHGATE MEADOWS INC.
TOWNSHIP OF SOUTHGATE

GLENELG RESIDENTIAL DEVELOPMENT
PHASE 2

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
40 HURON STREET
COLLINGWOOD, ONTARIO
L9Y 4R3

SEPTEMBER 2020

CFCA FILE NO. 1060-5545

CROZIER
CONSULTING ENGINEERS

2 INTRODUCTION

2.1 Background

C.F. Crozier & Associates Inc. (Crozier) was retained by Southgate Meadows Inc. ("the Developer") to complete a Traffic Impact Study (TIS) in support of a County Official Plan Amendment, Township Official Plan Amendment, Zoning By-law Amendment and Draft Plan of Subdivision Application for a Settlement Boundary Expansion for Phase 2 of the proposed Glenelg residential development located in the west end of the Community of Dundalk, Township of Southgate, County of Grey (the site).

In September 2018, Crozier completed a TIS to support Phase 1 of the Glenelg Residential Development. Phase 1 is located directly south of the Phase 2 lands fronting Glenelg Street. The Phase 1 Official Plan Amendment, Zoning By-law Amendment and Draft Plan Applications have been approved and a Redline Draft Plan Application has also recently been submitted and approved. Phase 1 of the development is currently undergoing detailed design and working towards registration. The scope of this TIS is consistent with that of the Phase 1 TIS.

2.2 Purpose

The purpose of the study was to assess the impacts of the proposed development on the boundary road network and to recommend any mitigation measures, if warranted.

The study reviews the following main aspects of the proposed residential development from a transportation engineering perspective:

- Existing, future background, and future total traffic operations at the study intersections
- Forecasted trip generation of the proposed development
- Auxiliary lane requirements at the proposed site accesses

2.3 Development Proposal

The site statistics proposed on the Draft Plan have been summarized in **Table 1** below. The Draft Plan prepared by MHBC Planning (September 24, 2020) has been included as **Figure 1.** It has been assumed that for the purposes of this analysis, the entire Phase 2 development will be built out concurrently.

Table 1: Development Site Statistics

Development Type	Unit Type	Draft Plan (September 24, 2020)
Residential	Single Detached	83
	Townhomes	66
	Partial Lots	6

For the purpose of this analysis, the six partial lots were assessed as single detached units. Access to the site will be provided by two accesses to Glenelg Street through the previous Glenelg Phase 1 lands and are spaced approximately 220 metres apart. The internal roads within Phase 2 are described as Corbett Street, Aitchison Avenue, Street "A" and Street "B". Street "A" and Aitchison Avenue provide connectivity to the Phase 1 lands.

4.4 Background Development Trip Generation

4.4.1 Industrial Access Road

It is noted that the Township of Southgate completed a Municipal Class Environmental Assessment for the Dundalk Industrial Access Road in September 2018. The Industrial Access Road would facilitate the development of industrial and commercial employment lands, south of the Community of Dundalk.

Triton Engineering completed a Traffic Impact Study to determine the impacts of the Access Road on the intersection of Main Street West (Grey County Road 9) and Ida Street. Since there are no current applications to develop these lands, the Traffic Impact Study (Triton, 2017) analyzed the intersection under the 2024 and 2029 horizon years assuming both 50 percent build-out and 100 percent build-out. The findings noted that if the development is 100 percent built-out by 2029, the northbound movements would operate at a LOS E in the p.m. peak hour.

Since there are no planning proposals at this time for development in this area, the following analysis did not account for traffic generated by the future industrial/commercial employment lands.

Relevant excerpts from the Industrial Access Traffic Impact Study have been included in **Appendix F** for reference.

4.4.2 Glenelg Phase 1

Glenelg Phase 1 is located south of the proposed Phase 2 lands and includes the two primary accesses to Glenelg Street. A Redline Draft Plan has recently been approved for Glenelg Phase 1. The Redline Draft Plan proposes 118 single detached units and 65 townhouse units. It has been assumed that the Phase 1 lands will be fully built-out and occupied prior to the 2025 horizon year. The Glenelg Phase 1 Redline Draft Plan as well as excerpts from the original Glenelg Phase 1 TIS have been included as **Appendix G**.

The trip generation of the Redline Phase 1 development was established using the Institute of Transportation Engineers (ITE) Trip Generation Manual 10th Edition using Land Use Categories (LUC) 210 "Single Family Detached Dwelling" and LUC 220 "Multifamily Housing (Low-Rise)". The Glenelg Phase 1 trip generation is summarized in **Table 5**.

Table 5: Glenelg Phase 1 Trip Generation

Development	Unit Type	Number of Units	Roadway Peak Hour	Number of Trips		
				Inbound	Outbound	Total
Glenelg Phase 1	LUC 210: Single Family Detached Housing	118	Weekday A.M.	22	67	89
			Weekday P.M.	75	44	119
	LUC 220: Multifamily Housing (Low-Rise)	65	Weekday A.M.	7	25	32
			Weekday P.M.	25	15	40
Total			**Weekday A.M.**	**29**	**92**	**121**
			Weekday P.M.	**100**	**59**	**159**

The trips generated by the Redline Glenelg Phase 1 Draft Plan were distributed to the boundary road network based on the trip distribution described in the original Glenelg Phase 1 TIS (Crozier, September 2018). The trips generated by the Glenelg Phase 1 residential development are illustrated in **Figure 5**.

Table 8: 2030 Future Background Level of Service

Intersection	Control	Peak Hour	Level of Service[1]	Control Delay	Maximum v/c ratio[2]
Glenelg Street and Ida Street	Stop (Two-way)	A.M.	A	8.8s (WB)	0.04 (WB)
		P.M.	A	8.9s (WB)	0.05 (WB)
Glenelg Street/Grey Street and Dundalk Street	Stop (Two-way)	A.M.	A	9.5s (NB)	0.04 (NB)
		P.M.	A	9.6s (NB)	0.11 (NB)
Main Street West (Grey County Road 9) and Dundalk Street	Stop (Two-way)	A.M.	B	13.3s (SB)	0.21 (SB)
		P.M.	B	14.2s (SB)	0.15 (SB)
Main Street West (Grey County Road 9) and Ida Street	Stop (Two-way)	A.M.	B	11.6s (SB)	0.10 (SB)
		P.M.	B	13.6s (SB)	0.18 (NB)
Glenelg Site Access	Stop (Two-way)	A.M.	A	9.2s (SB)	0.10 (SB)
		P.M.	A	9.5s (SB)	0.07 (SB)

Note[1]: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000).

Note[2]: The maximum v/c ratio for two-way stop-controlled intersections represents the maximum v/c for the minor road approach movements at the intersection.

The metrics listed above indicate that the boundary road network is expected to continue operating at a LOS "B" or better under 2025 and 2030 future background conditions, with minimal delays and reserve capacity for increases in traffic volumes.

5 SITE GENERATED TRAFFIC

The proposed development will result in additional vehicles on the boundary road network that previously did not exist. The proposed development will also result in additional turning movements at the boundary road intersections.

5.1 Trip Generation

The trip generation of the single detached residential lots was forecasted using the fitted curve equations provided in the ITE Trip Generation Manual, 10th Edition, under the Land Use Category 210 "Single Family Detached Dwelling".

The trip generation of the townhouse residential lots was forecasted using the fitted curve equations provided in the ITE Trip Generation Manual, 10th Edition, under the Land Use Category 220 "Multifamily Housing (Low-Rise)".

The trip generation of Glenelg Phase 2 is summarized in **Table 9**. Relevant excerpts from the ITE Trip Generation Manual, 10th Edition are included in **Appendix I**.

Table 9: Glenelg Phase 2 Trip Generation

Use	Trip Type	Peak Hour	Number of Trips		
			Inbound	Outbound	Total
L.U. 210: Single Family Detached Housing (89 Units)	Primary	Weekday A.M.	17	51	68
	Primary	Weekday P.M.	57	34	91
L.U. 220: Multifamily Housing (Low-Rise) (66 Units)	Primary	Weekday A.M.	7	25	32
	Primary	Weekday P.M.	26	15	41
Total	**Primary**	**Weekday A.M.**	**24**	**76**	**100**
	Primary	**Weekday P.M.**	**83**	**49**	**132**

5.2 Trip Distribution and Assignment

Trips generated by Phase 2 of the Glenelg residential development were distributed to the boundary road network maintaining the distribution described in the Glenelg Phase 1 TIS. The trip distribution was based on Transportation Tomorrow Survey (TTS) data. The TTS is a comprehensive survey of transportation characteristics in the Golden Horseshoe, Simcoe County and Grey County areas. TTS data is not available for the Community of Dundalk, accordingly, the Township of Melancthon (abutting the Dundalk to the south and east) was selected as it is considered most representative of the subject area.

TTS Data has been included in **Appendix J**. The trip distribution is as follows:

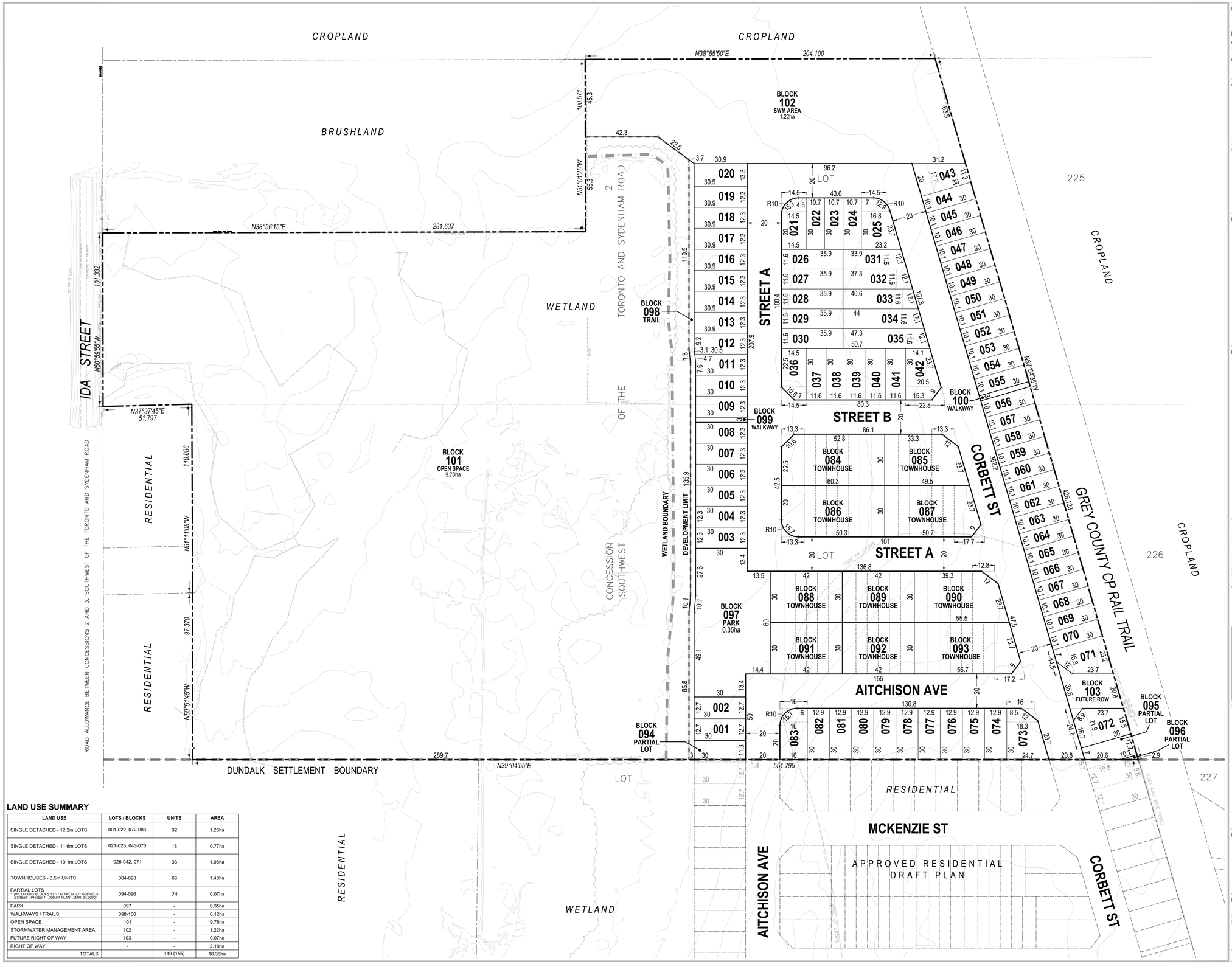
- 10% to/from the north on Ida Street
- 10% to/from the west on Ida Street
- 60% to/from the south on Highway 10
- 20% to/from Dundalk (downtown)
    - 15% to/from the east on Grey Road 9
    - 5% to/from the west on Main Street

Of the 20 percent remaining in Dundalk, five percent were assumed to travel south on Dundalk Street and then turn right to travel west on Main Street West. The remaining 15 percent were assumed to travel east on Grey Street South and use Proton Street North to access the main downtown commercial corridor.

The development was analyzed under a consolidated access configuration to provide a conservative analysis. The future operations of the site accesses to Glenelg Street are expected to be better than listed herein as traffic volumes will be dispersed across both accesses.

The trips generated by the proposed development were assigned to the boundary road network per the distributions illustrated in **Figure 9**. The corresponding trip assignment is illustrated in **Figure 10**.

FIGURES



LAND USE SUMMARY

LAND USE	LOTS / BLOCKS	UNITS	AREA
SINGLE DETACHED - 12.2m LOTS	001-022, 072-083	32	1.26ha
SINGLE DETACHED - 11.6m LOTS	021-025, 043-070	18	0.77ha
SINGLE DETACHED - 10.1m LOTS	026-042, 071	33	1.06ha
TOWNHOUSES - 6.5m UNITS	084-093	66	1.48ha
PARTIAL LOTS *(INCLUDING BLOCKS 131-132 FROM 231 GLENELG STREET - PHASE 1 - DRAFT PLAN - MAR. 24,2020)*	094-096	(6)	0.07ha
PARK	097	-	0.35ha
WALKWAYS / TRAILS	098-100	-	0.12ha
OPEN SPACE	101	-	9.78ha
STORMWATER MANAGEMENT AREA	102	-	1.22ha
FUTURE RIGHT OF WAY	103	-	0.07ha
RIGHT OF WAY	-	-	2.18ha
TOTALS		149 (155)	18.36ha

LEGAL DESCRIPTION

PART OF LOTS 225 AND 226
CONCESSION 2, SOUTHWEST OF THE TORONTO AND SYDENHAM ROAD
TOWNSHIP OF SOUTHGATE
COUNTY OF GREY

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE: _____

_____
SHAKIR REHMATULLAH - PRESIDENT
2358737 ONTARIO INC.

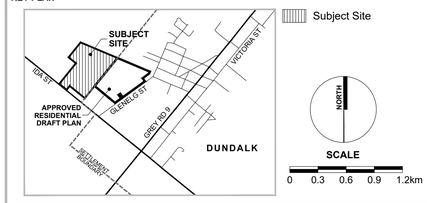
SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: _____

_____
DAN DZALDOV - OLS
SCHAEFFER DZALDOV BENNETT LTD.
P: 416-987-0101

KEY PLAN



LEGEND

- RIGHT OF WAY LINE
- BLOCK LINE
- LOT LINE
- PROJECT BOUNDARY LINE
- PARCEL FABRIC

REVISION No.	DATE	ISSUED / REVISION	BY

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990 C.P.13 AS AMENDED

- **A.** AS SHOWN
- **B.** AS SHOWN
- **C.** AS SHOWN
- **D.** 83 SINGLE DETACHED LOTS & 64 TOWNHOUSE UNITS
- **E.** AS SHOWN
- **F.** AS SHOWN
- **G.** AS SHOWN
- **H.** MUNICIPAL WATER SUPPLY
- **I.** LOAM/SILT LOAM
- **J.** AS SHOWN
- **K.** ALL MUNICIPAL SERVICES AS REQUIRED
- **L.** AS SHOWN

PLANNING
URBAN DESIGN
& LANDSCAPE
ARCHITECTURE
MHBC PLANNING
113 COLLIER STREET
BARRIE, ON, L4M 1H2
P: 705 728 0045 F: 705 728 2010
WWW.MHBCPLAN.COM

STAMP

DATE	SEPT. 24, 2020
FILE No.	15184H
SCALE	1:1,000 (ARCH D)
DRAWN BY	M.M.
CHECKED BY	K.M.
OTHER	

PROJECT
231 GLENELG STREET PHASE 2
2358737 ONTARIO INC.
3621 HIGHWAY 7 EAST, SUITE 503
MARKHAM, ON L3R 0G6
P:(905) 479-9292 F:(905) 429-9165
WWW.FLATOGROUP.COM

NORTH

FILE NAME
DRAFT PLAN OF SUBDIVISION

DWG No. 1 of 1

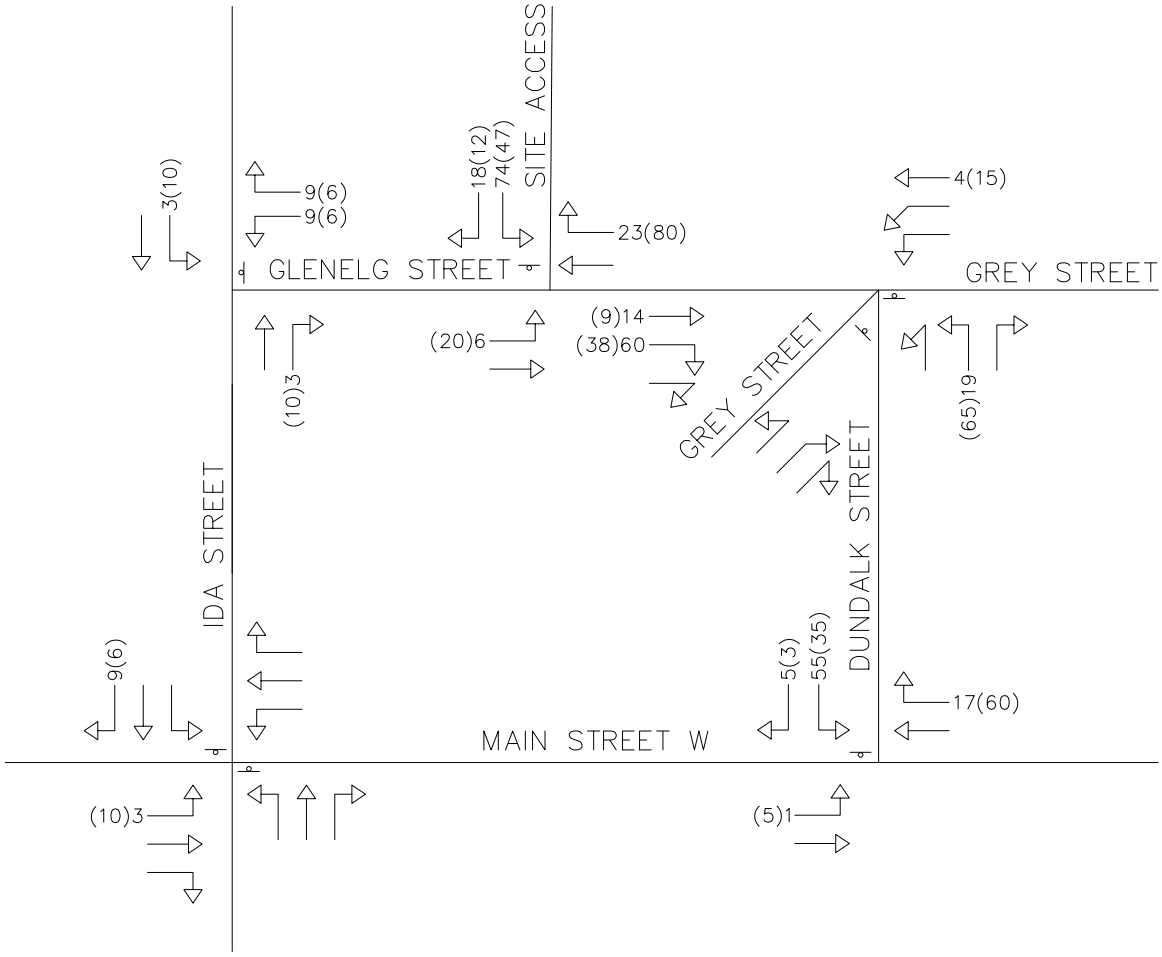
SCALE BAR

0 5 10 15 20 25 37.5 50 75 100m

MEASUREMENTS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

N:\Southgate\231 Glenelg Street – 15184H\Drawings\Draft Plan – Phase 2\CAD\15184H – Draft Plan – Phase 2 – 2020-09-24.dwg

NOTE:
THIS FIGURE IS SCHEMATIC ONLY AND IS NOT TO BE SCALED.



LEGEND:

⊲	STOP CONTROL
AM(PM)	WEEKDAY AM(PM) TRIP DISTRIBUTION

Project

GLENELG PHASE 2
TOWNSHIP OF SOUTHGATE

Title

GLENELG PHASE 1
BACKGROUND TRAFFIC VOLUMES

CROZIER
CONSULTING ENGINEERS

THE HARBOUREDGE BUILDING,
40 HURON STREET, SUITE 301,
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INFO@CFCROZIER.CA

Drawn	S.K.	Design		Project No.	1060–5545
Check	M.F.	Check		Scale	N.T.S
				Dwg.	FIG. 5

NOTE:
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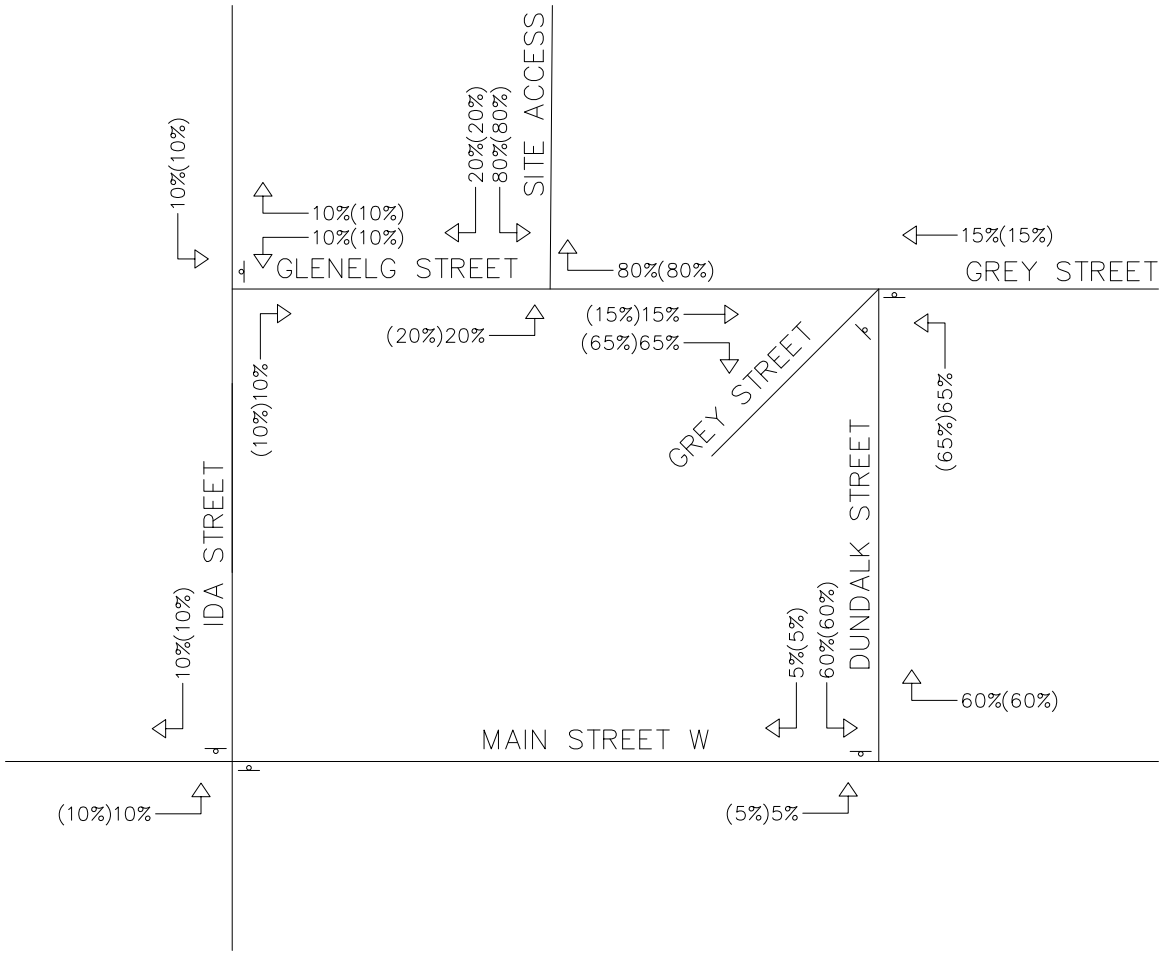

LEGEND:

⊲	STOP CONTROL
AM(PM)	WEEKDAY AM(PM) TRIP DISTRIBUTION

Project

GLENELG PHASE 2
TOWNSHIP OF SOUTHGATE

Title

TRIP DISTRIBUTION

CROZIER
CONSULTING ENGINEERS
THE HARBOUREDGE BUILDING,
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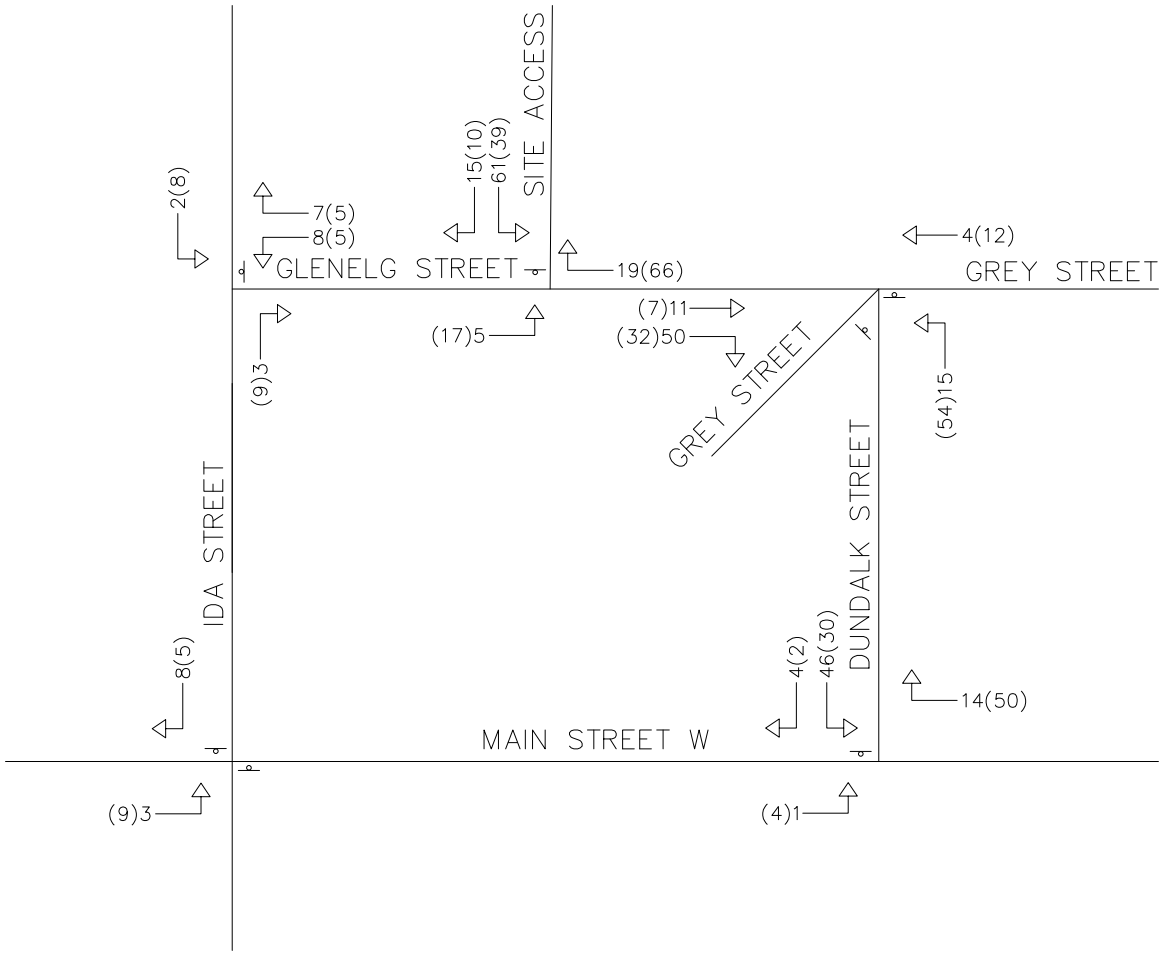
Drawn	Design	Project No.	
S.K.			1060–5545
Check	Check	Scale	Dwg.
M.F.		N.T.S	FIG. 9

NOTE:
THIS FIGURE IS SCHEMATIC ONLY AND IS NOT TO BE SCALED.



LEGEND:

⊲	STOP CONTROL
AM(PM)	WEEKDAY AM(PM) TRIP DISTRIBUTION

Project

GLENELG PHASE 2
TOWNSHIP OF SOUTHGATE

Title

TRIP ASSIGNMENT

CROZIER
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Drawn	S.K.	Design		Project No.	1060–5545
Check	M.F.	Check		Scale	N.T.S
				Dwg.	FIG. 10

WHITE ROSE (PHASE 3)

PLAN OF SUBDIVISION

TOWNSHIP OF SOUTHGATE (DUNDALK)

GREY COUNTY

TRAFFIC IMPACT STUDY

SEPTEMBER, 2020

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

18 Robb Boulevard, Unit 8
Orangeville, Ontario
L9W 3L2
Tel: (519) 941-0330
Fax: (519) 941-1830
ORANGEVILLE X FERGUS X GRAVENHURST X HARRISTON

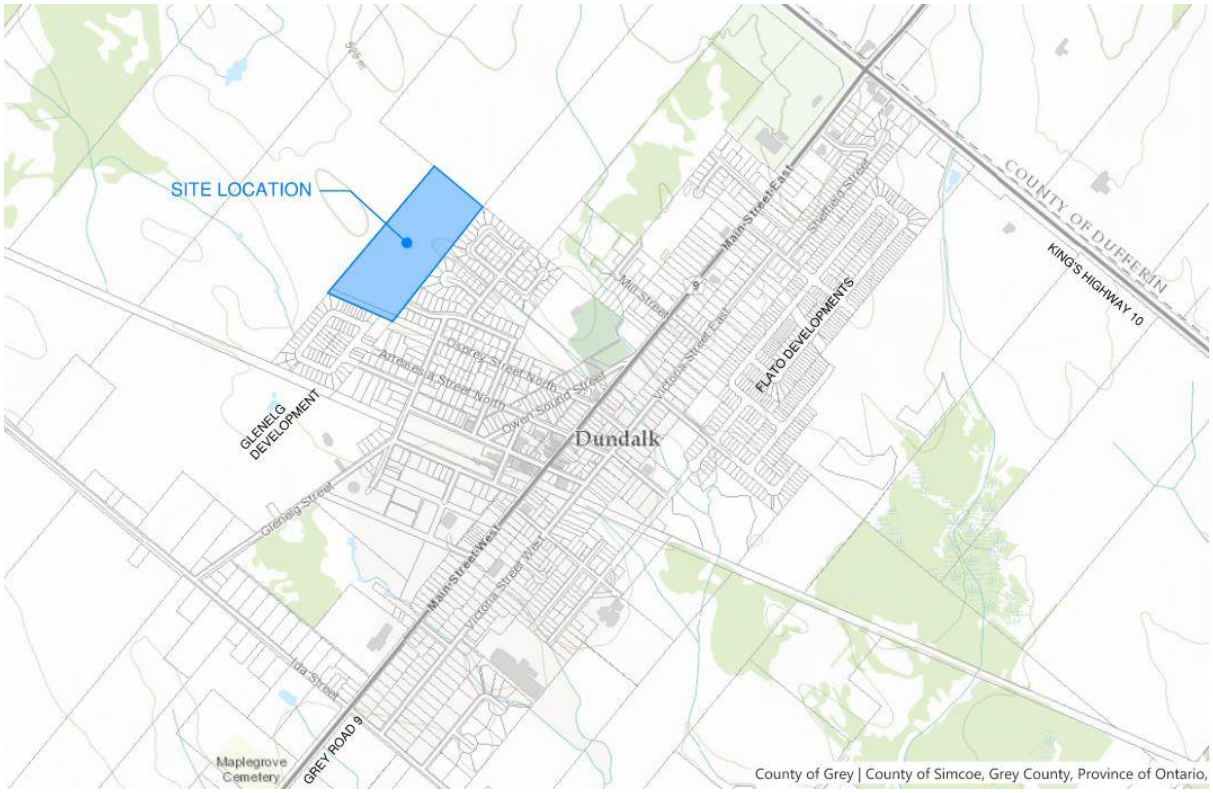
1.0 INTRODUCTION

Triton Engineering Services Limited (TESL) has been retained by White Rose Park to prepare a Traffic Impact Study (TIS) in support of a Draft Plan Application for a proposed residential development located in the Community of Dundalk, Township of Southgate. The purpose of this study is to address the impact of this development on Grey Road 9 (Main Street East) and to determine what road and intersection improvements may be required.

2.0 EXISTING CONDITIONS

2.1 Road Network

The proposed site is located on the northwest side of Dundalk at the end of Bradley Street. The location of the proposed site is shown on the Key Plan below.



Key Plan

The road network in Dundalk has a skewed orientation. To provide clarity throughout this study, King's Highway 10, Osprey Street, Artemesia Street, Proton Street, Dundalk Street, and Ida Street have been designated as north-south roads and Glenelg Street and Grey Road 9 (Main Street) have been designated as east-west roads.

3.0 PROPOSED DEVELOPMENT

MHBC have provided a draft plan of subdivision, enclosed in Appendix A.

The proposed development consists of 33 single-family dwellings, 24 townhouses, and 34 senior dwellings. The development has two proposed accesses, with 'Street A' connecting to Todd Crescent (Phase 1/2 of White Rose Park) and 'Street B' connecting to the north end of Bradley Street.

4.0 EXISTING TRAFFIC

Weekday morning and afternoon peak period traffic counts were undertaken as part of the Glenelg Residential Subdivision TIS in 2018 by C.F. Crozier & Associates Inc. (Crozier) at the intersection of Glenelg Street and Ida Street, the intersection of Grey Road 9 and Ida Street, and the intersection of Grey Road 9 and Dundalk Street. Since these counts were undertaken, there have been no major developments in the surrounding area and are considered acceptable. The traffic volumes were converted into 2020 existing traffic volumes by applying a 1.5% growth rate. This growth rate is consistent with the Glenelg development TIS and the Flato development TIS conducted in 2016 by Crozier.

A traffic count was undertaken at the intersection of Owen Sound Street and Grey Road 9 during the morning and afternoon peak periods on September 8, 2020. Traffic counts were not undertaken at the Proton Street and Artemesia Street intersections with Grey Road 9 as the increase to traffic volumes generated by White Rose Park at these intersections is expected to be very minor, as shown in Figure 5. It is assumed that if increased traffic volumes can be accommodated by the Dundalk Street and Grey Road 9 intersection, then the Proton Street and Artemesia Street intersections will also be able to accommodate the increased traffic volumes.

The existing peak hours for the four intersections and their respective traffic volumes are illustrated on Figure 1 and Table 1 lists the peak hours for each traffic count.

Table 1: Peak Hours

Intersection	Peak Hour
Ida Street and Glenelg Street	8:00-9:00 am
	4:15-5:15 pm
Grey Road 9 and Ida Street	7:45-8:45 am
	5:00-6:00 pm
Grey Road 9 and Dundalk Street	8:00-9:00 am
	5:00-6:00 pm
Grey Road 9 and Owen Sound Street	8:00-9:00 am
	4:15-5:15 pm

Intersection	Movement	Level of Service (Delay, s)	
		Weekday AM	Weekday PM
Grey Road 9 and Owen Sound Street (Unsignalized)	EB left-thru WB thru-right SB left-right	A (0.1) A (0.0) B (14.0)	A (0.1) A (0.0) C (17.4)

The levels of service remain consistent for most movements due to the increase in traffic volumes during the 2025 and 2030 years with slightly increased delays. The northbound movement at the Ida Street and Grey Road 9 intersection operates at a LOS 'B' during the 2025 AM peak hour, the southbound movement at the Grey Road 9 and Dundalk Street operates at a LOS 'B' during the 2025 AM and PM peak hours, and the southbound movement at the Grey Road 9 and Owen Sound Street intersection operates at a LOS 'C' during the 2025 PM peak hour. All movements are still operating with acceptable delays.

6.0 SITE GENERATED TRAFFIC

6.1 General

Trip generation is forecast for future developments from studies of similar developments. The *Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition* was used in this analysis. Trips generated from residential condominium/townhouse land uses are considered primary trips.

6.2 Trip Generation

The ITE Code and the calculated number of trips generated by the development are shown in Table 5.

Table 5: Trip Generation Codes and Distribution

Land Use	ITE Code	Description	Trips Generated per Unit					
			Weekday AM			Weekday PM		
			Total	Entering	Exiting	Total	Entering	Exiting
Residential	210	Single-Family Detached Housing	31	8	23	36	23	13
Residential	230	Residential Condominium/ Townhouse	17	3	14	19	13	6
Residential	252	Senior Adult Housing – Attached	5	2	3	6	5	1
Development Total			**53**	**13**	**40**	**61**	**41**	**20**

The trip distribution used by the Glenelg and Flato Developments was applied to the White Rose Phase 3 development and is described below:

- 60% to/from Highway 10 via the Owen Sound Street/Grey Road 9 intersection;
- 10% to/from the north via the Ida Street/Glenelg Street intersection;
- 10% to/from the west via Dundalk Street and Grey Road 9; and,
- 20% to/from downtown Dundalk via Dundalk Street, Proton Street, Artemesia Street, and Osprey Street.

This distribution is illustrated on Figure 4 and the trips assigned to the road network is illustrated on Figure 5.

7.0 FUTURE TRAFFIC

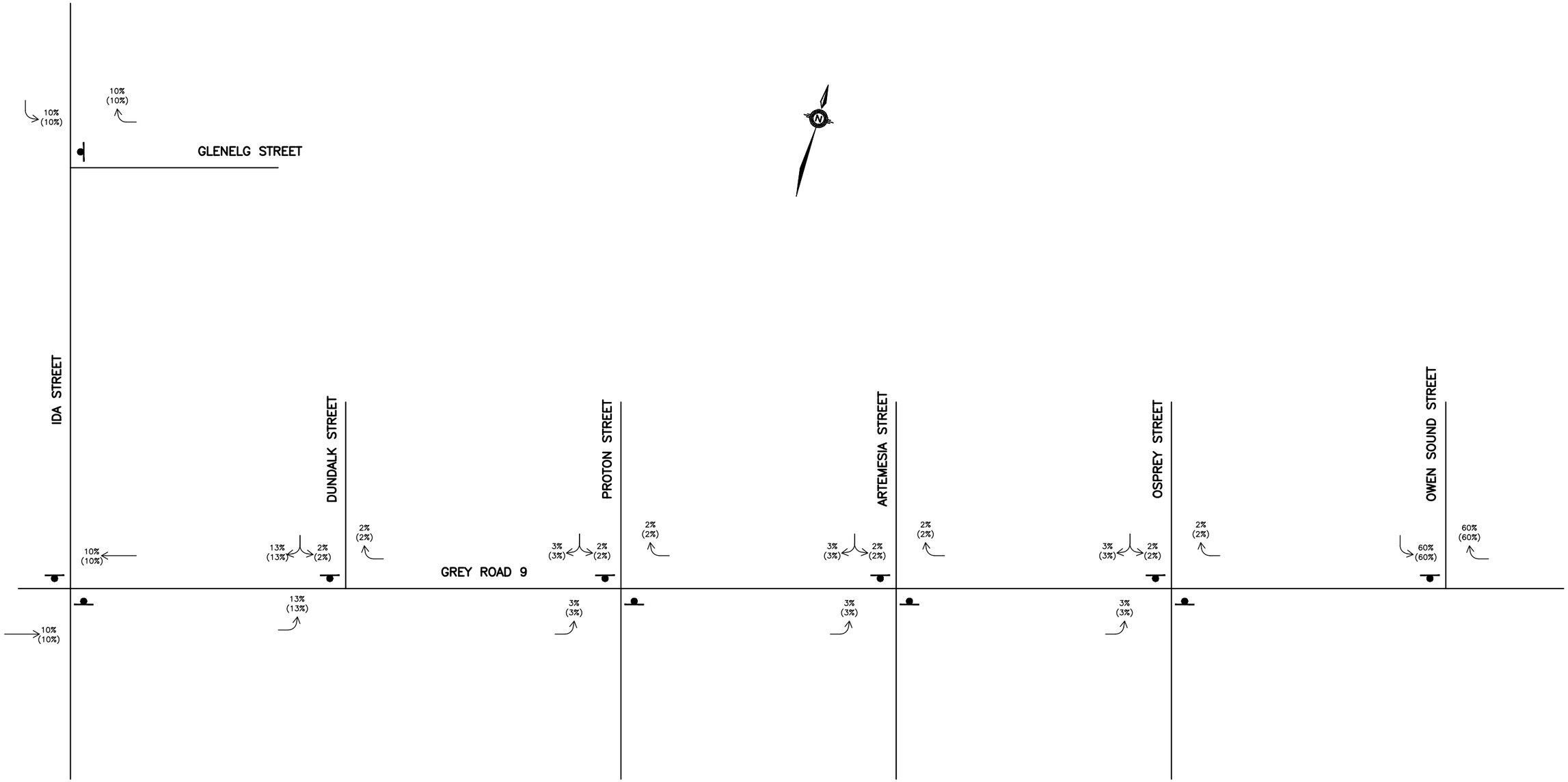
The total development generated traffic was added to the 2025 and 2030 background traffic volumes to determine the total 2025 and 2030 future peak hour traffic, as illustrated in Figures 6 and 7, respectively.

7.1 Level of Service Analysis

A level of service analysis was carried out to determine the impact of the trips generated by the development on the existing intersections during the Weekday AM and PM peak hours. The detailed capacity analyses are included in Appendix C. Table 6 and Table 7 summarize the future levels of service for 2025 and 2030 respectively.

Table 6: 2025 Future Traffic Level of Service

Intersection	Movement	Level of Service (Delay, s)	
		Weekday AM	Weekday PM
Ida Street and Glenelg Street (Unsignalized)	EB left-right NB thru-right SB thru-left	A (8.8) A (0.0) A (2.7)	A (8.9) A (0.0) A (3.2)
Ida Street and Grey Road 9 (Unsignalized)	EB left-thru-right WB left-thru-right NB left-thru-right SB left-thru-right	A (0.5) A (1.7) B (10.2) B (11.4)	A (0.9) A (0.7) B (12.9) B (13.3)
Grey Road 9 and Dundalk Street (Unsignalized)	EB left-thru WB thru-right SB left-right	A (0.7) A (0.0) B (12.6)	A (0.5) A (0.0) B (13.7)
Grey Road 9 and Owen Sound Street (Unsignalized)	EB left-thru WB thru-right SB left-right	A (0.1) A (0.0) B (14.2)	A (0.1) A (0.0) C (17.5)

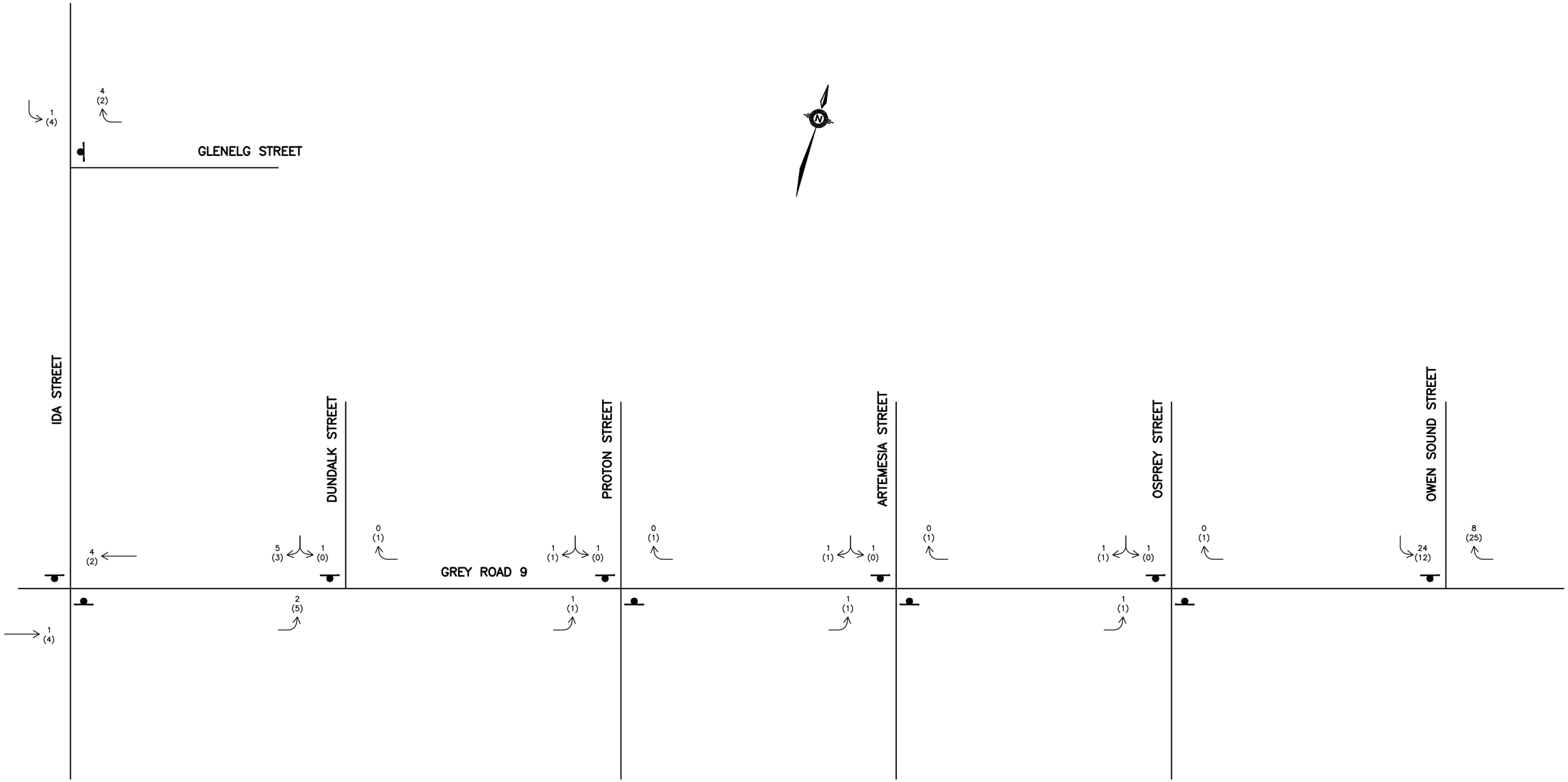


LEGEND:

- STOP CONTROL
- TRAFFIC FLOW
- 25 am Peak / (25) pm Peak TRAFFIC VOLUMES
- TRAFFIC SIGNALS
- EXISTING ROAD
- PROPOSED ENTRANCE

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

FIGURE 4:
DEVELOPMENT PEAK HOUR TRIP ASSIGNMENT
(NOT TO SCALE)



LEGEND:

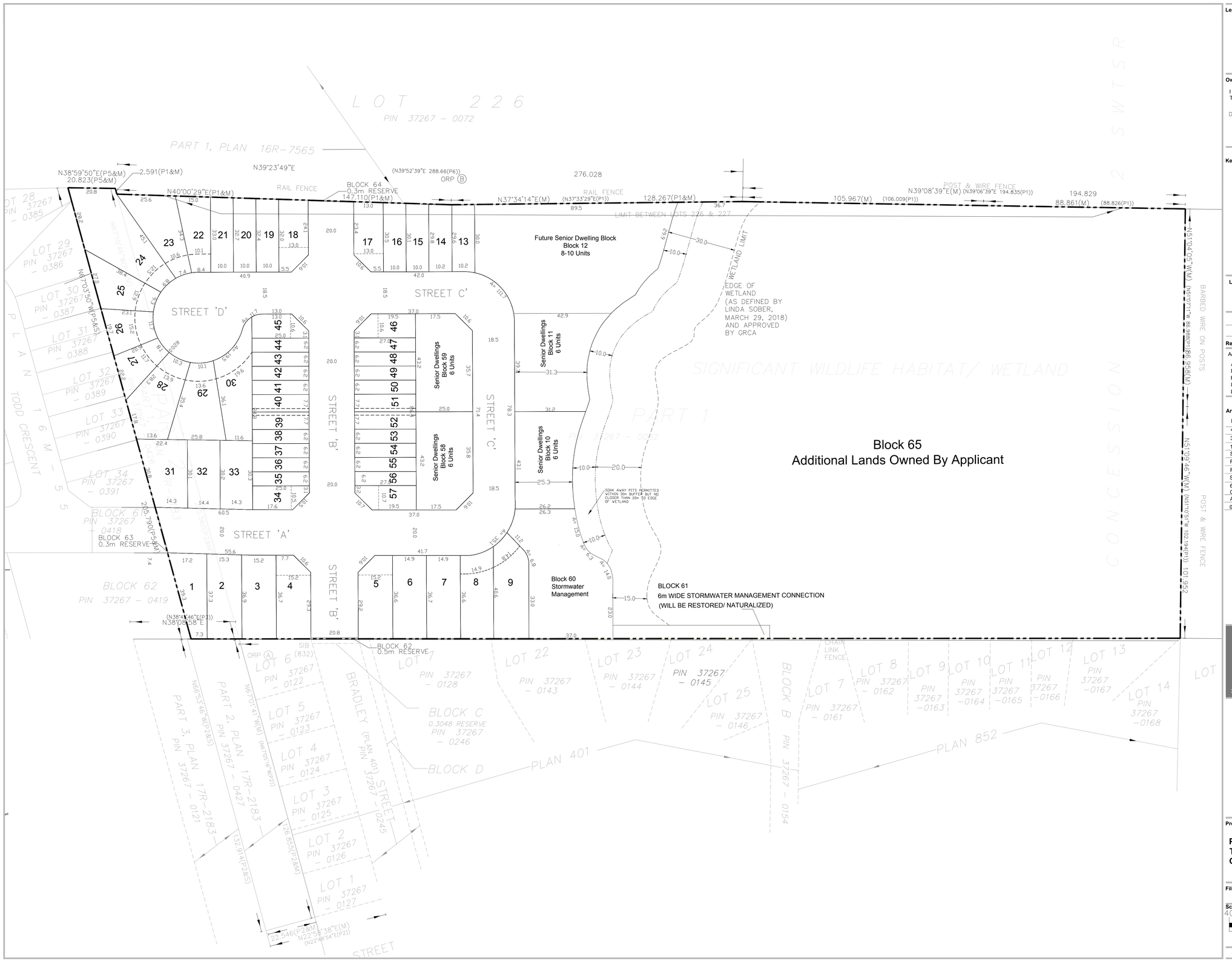
- STOP CONTROL
- TRAFFIC FLOW
- 25 am Peak / (25) pm Peak TRAFFIC VOLUMES
- TRAFFIC SIGNALS
- EXISTING ROAD
- PROPOSED ENTRANCE

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

FIGURE 5:
DEVELOPMENT PEAK HOUR TRIP DISTRIBUTION
(NOT TO SCALE)

APPENDIX A

Draft Plan of Subdivision



Legal Description

PART OF LOT 227, CONCESSION 2 SWTSR
PART 1 17R2183 AND AS IN R480846
(VILLAGE OF DUNDALK)
NOW IN THE TOWNSHIP OF SOUTHGATE
(GEOGRAPHIC TOWNSHIP OF PROTON)
COUNTY OF GREY

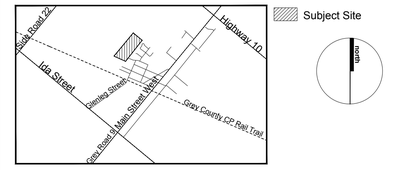
Owner's Certificate

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

DATE: _____

_____
DOMENIC DE PALMA
2570970 ONTARIO INC.

Key Plan NOT TO SCALE



Legend

Revision No.	Date	Issued / Revision	By

Additional Information Required Under Section 51(17) of the Planning Act R.S.O. 1990, c.P.13 as Amended

A. As Shown	B. As Shown	C. As Shown
D. Residential, Stormwater Management		E. As Shown
F. As Shown	G. As Shown	H. Municipal Water Supply
I. Listowel Silt Loam	J. As Shown	K. All Services As Required
L. As Shown		

Area Schedule

Description	Lots/Blocks	Units	Area
40' (12.2m) Single Detached	1-9,31-33	12	0.64ha (1.57ac)
30' (10.0m) Single Detached	13-30	18	0.80ha (1.98ac)
19.5' (6.0m) Townhouses	34-57	24	0.44ha (1.08ac)
Senior Dwelling Blocks (20' (6.2m))	Block 10-11,58-,59	24	0.47ha (1.17ac)
Future Senior Dwelling Block	Block 12	8-10	0.36ha (0.89ac)
Roads	Street 'A' - Street 'D'		1.14ha (2.82ac)
Stormwater Management	Block 60		0.19ha (0.48ac)
6m Stormwater Management Connection	Block 61		0.04ha (0.10ac)
Additional Lands Owned by Applicant	Block 65		4.79ha (11.84ac)
0.3m & 0.5m Reserve	Block 62-64		0.01ha (0.02ac)
		86-88	8.88ha (21.94ac)

White Rose Park

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
230-7050 WESTON ROAD WOODBRIDGE, ON. L4L 8G7 | P: 905 761 5588 F: 905 761 5589 | WWW.MHBCPLAN.COM

Date	May 11, 2020
File No.	13126B
Plan Scale	1:750
Drawn By	T.H.
Checked By	D.K & A.P.
Other	

Project

**Part of Lot 227 Concession 2,
Township of Southgate,
County of Grey**

North

File Name DRAFT PLAN OF SUBDIVISION

Dwg No. 1 of 1

Scale Bar

40 0 40 80

MEASUREMENTS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

N:\13126\B – Dundalk\2020\06. June\Draft Plan\CAD\8876 WHITE ROSE June 04 2020–C.dwg

TRAFFIC IMPACT STUDY

GLENELG PHASE 3

DUNDALK
GREY COUNTY, ONTARIO

PREPARED FOR:

DUNDALK VILLAGE TWO INC.

PREPARED BY:

C.F. CROZIER AND ASSOCIATES INC.
1 FIRST STREET, SUITE 200
COLLINGWOOD, ONTARIO
L9Y 1A1

1ST SUBMISSION: AUGUST 2022

CFCA FILE NO. 1060-6220

CROZIER
CONSULTING ENGINEERS

5.0 Site Generated Traffic

5.1 Trip Generation

Development of the subject property will result in additional vehicles on the boundary road network above background conditions. The trip generation of the development was forecast using the fitted curve equations provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 11th Edition. Per the most recent draft plan, the development is proposed to consist of 369 single detached dwelling units, 72 townhouse dwelling units, and 18 semi-detached dwelling. Accordingly, LUC 210 "Single-Family Detached Housing", and LUC 215 "Single Family Attached Housing" were used to forecast trips generated by the site. **Table 10** summarizes the residential trip generation of the subject property. **Appendix F** contains relevant excerpts from the ITE Trip Generation Manual.

Table 10: Site Trip Generation

	Peak Hour	Number of Trips		
		Inbound	Outbound	Total
LUC 210 'Single Family Homes' (369 Units)	Weekday A.M.	63	181	244
	Weekday P.M.	214	125	339
LUC 215 'Single Family Attached Housing' (90 Units)	Weekday A.M.	13	28	41
	Weekday P.M.	28	22	50
TOTAL	**Weekday A.M.**	**76**	**209**	**285**
	Weekday P.M.	**242**	**147**	**389**

5.2 Trip Distribution and Assignment

Trips generated by Glenelg Phase 3 were distributed to the boundary road network similar to what was applied in the Glenelg Phase 1 TIS and Glenelg Phase 2 TIS. The trip distribution was based on Transportation Tomorrow Survey (TTS) data. The TTS is a comprehensive survey of transportation characteristics in the Golden Horseshoe, and Simcoe County areas. TTS data is unavailable for the Community of Dundalk; however, data was available for the Township of Melancthon which is adjacent to Dundalk. This data is considered representative of the subject area.

TTS Data has been included in **Appendix J**. The trip distribution is as follows:

- 10 % to/from the north on Ida Street
  - 5 % Via Glenelg Phase 1 Site Access
  - 5 % Via Grey Street
- 10 % to/from the west on Grey Road 9 (Main Street) via Ida Street and via Grey Street
- 60 % to/from the south on Highway 10 via Bradley Street
  - 60 % westbound right movements at Owen Sound Street
  - 30 % southbound left movements at Owen Sound Street and 30% southbound left
- 20 % to/from Dundalk (downtown)
  - 15 % to/from the west on Toronto Street
  - 5 % to/from the west on Main Street at Dundalk Street

It is noted that 20% of the site-generated traffic volumes are expected to travel through the community outside of the study area road network.

The Subject Property is proposed to connect to the boundary road network through the Bradley Street extension and two accesses through Glenelg Phase 1. The Subject Property will directly

traffic operations.

Table 16: Eco Parkway Scenario - 2032 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Critical v/c ratio [2]
Ida Street and Grey Road 9 (Main Street)	Stop (Two-way)	A.M.	F	55.3 s	0.74 (NB)
		P.M.	F	177.0 s	**1.28 (NB)**
Dundalk Street and Main Street	Stop (T-intersection)	A.M.	E	44.4 s	0.75 (SB)
		P.M.	C	16.6 s	0.29 (SB)
Osprey Street and Main Street	Stop (Two-way)	A.M.	C	21.6 s	0.32 (NB)
		P.M.	C	22.0 s	0.20 (NB)
Owen Sound Street and Main Street	Stop (T-intersection)	A.M.	C	20.6 s	0.26 (SB)
		P.M.	C	21.1 s	0.25 (SB)

Note [1]: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000). The Level of Service of all-way stop-controlled intersection is based on the average delay per vehicle.

Note [2]: The critical v/c ratio is the maximum v/c ratio for movements at the intersection. All v/c ratios for movements greater than 0.85 are outlined and highlighted.

The study intersections are forecast to operate with a LOS "E" or better in the weekday a.m. and p.m. peak hours under 2032 future background traffic volumes conditions, except for the intersection of Ida Street and Main Street which is expected to operate at a LOS "F" during the weekday peak hours. The construction of the Eco Parkway extension is anticipated to detour traffic volumes from Main Street to Ida Street. The detoured traffic is forecast to slightly improves the p.m. peak hour operations and slightly reduces the a.m. peak hour operations at the intersections of Main Street with Dundalk Street, Osprey Street, and Owen Sound Street compared to general future background conditions.

The stop-controlled intersection of Ida Street and Main Street is expected to have a maximum control delay of 177.0 seconds (NB) and a maximum volume-to-capacity ratio of 1.28 (NB). When compared to the future background operations, this is a 163.4 second increase in delay which is caused by the increase in traffic from the proposed Eco Parkway extension and industrial lands. Potential mitigation measures are further discussed later in the report.

These metrics indicate that the boundary road network, with the exception of the Ida Street and Main Street intersection, have reserve capacity for increases in traffic volumes.

7.4 Eco Parkway Future Total Scenario

The operations of the study intersections were analyzed based on the 2032 total traffic volumes illustrated in **Figure 20**, which is based on the combined traffic volumes in **Figure 19** with the site generated traffic illustrated in **Figure 14**. **Table 18** outlines the 2032 horizon year future total traffic Levels of Service. Levels of Service definitions have been included in **Appendix C** and detailed capacity analyses worksheets are included in **Appendix D.**

Table 17: Eco Parkway Scenario - 2032 Future Total Levels of Service

Intersection	Control	Peak Hour	Level of Service [1]	Control Delay	Critical v/c ratio [2]
Ida Street and Grey Road 9 (Main Street)	Stop (Two-way)	A.M.	F	71.9 s	0.82 (NB)
		P.M.	F	254.7 s	**1.46 (NB)**
Dundalk Street and Main Street	Stop (T-intersection)	A.M.	E	48.1s	0.79 (SB)
		P.M.	C	17.1 s	0.32 (SB)
Osprey Street and Main Street	Stop (Two-way)	A.M.	E	38.9 s	0.56 (SB)
		P.M.	D	26.0 s	0.31 (SB)
Owen Sound Street and Main Street	Stop (T-intersection)	A.M.	E	35.8 s	0.58 (SB)
		P.M.	D	34.1 s	0.51 (SB)

Note [1]: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach (HCM 2000). The Level of Service of all-way stop-controlled intersection is based on the average delay per vehicle.

Note [2]: The critical v/c ratio is the maximum v/c ratio for movements at the intersection. All v/c ratios for movements greater than 0.85 are outlined and highlighted.

The intersections are forecast to operate with a LOS "E" or better in the weekday a.m. and p.m. peak hours under 2032 future total traffic volume conditions, except for the intersection of Ida Street and Main Street. The northbound movement is forecast to operate at a LOS "F" during the weekday peak hours. Traffic signals are not warranted, and poor operations are forecast under future background conditions of the Eco Parkway Scenario as well. With multiple background developments proposed in the area, it is recommended that the road authority continue to monitor the operations at this intersection.

The southbound approach at the Dundalk Street and Main Street intersection is forecast to operate at a LOS "E" under future background conditions with and without the proposed Eco Parkway extension. A maximum volume to capacity ratio of 0.79 is forecast for the southbound movements which represents an increase of 0.04 when compared to the scenario's future background operations. Due to multiple proposed developments in the area, it is recommended that the road authority continue to monitor the operations of the intersection.

The southbound approach at the Osprey Street and Main Street intersection is forecast to operate at a LOS "E" under future total conditions with the proposed Eco Parkway extension. A maximum volume to capacity ratio of 0.56 is forecast for the southbound movements which represents an increase of 0.24 when compared to the scenario's future background operations. Due to multiple proposed developments in the area, it is recommended that the road authority continue to monitor the operations of the intersection.

The southbound approach at the Owen Sound Street and Main Street intersection is forecast to operate at a LOS "E" or better under future total conditions with and without the proposed Eco Parkway extension. It is noted that with the addition of the industrial developments adjacent to the Eco Parkway extension, the maximum volume to capacity ratio is forecast to be 0.58. This represents an increase of the v/c ratio by a maximum of 0.03 when compared to the scenario's future background operations. Due to multiple proposed developments in the area, it is recommended that the road authority continue to monitor the operations of the intersection.

7.4.1. Eco Parkway Future Total Scenario – Potential Improvement Measures

With the introduction of the Eco Parkway extension and full build-out of the industrial lands, the intersection of Ida Street and Main Street is forecast to operate at a LOS "F" under 2032 future background conditions. It is acknowledged that these metrics are associated with assumptions relating to 10 years of growth, multiple background developments, and expected trip distributions.

Consideration was given to implementing a roundabout at the Ida Street and Main Street intersection to alleviate poor operations. Township staff indicated a roundabout was preferred over signalization to mitigate poor intersection operations at this location. Using Arcady analysis software, it is forecast that a roundabout would operate at a LOS "A" with a 95th percentile queue length of 1 vehicle or less. **Attachment H** contains an overlay of a potential roundabout over the existing Ida Street and County Road 9 intersection. It is noted that additional land will be required to accommodate the roundabout and is presented as conceptual at this time.

Traffic signal warrants indicate that signalization of the intersection of Ida Street and Main Street is not warranted. However, improvements may be needed to address poor operations with the build-out of the Eco Parkway extension and industrial lands. Should the road authority proceed with signalizing the intersection, the intersection is forecast to operate at a LOS "B" with a v/c of less than 0.82 for all movements. In the signalized Eco Parkway scenario, no critical movements are noted with the addition of the Glenelg Phase 3 site generated traffic.

8.0 Conclusions

The detailed analysis contained within this report resulted in the following key findings:

- Intersection analysis of the existing traffic volumes indicates that all study intersections are operating at a Level of Service (LOS) "B" or better during the weekday a.m. and p.m. peak hours. The study intersections have capacity for increases in traffic volumes.

- Several background developments have been considered for the assessment of the background conditions. These developments include Glenelg Phase 1, Glenelg Phase 2, the unoccupied Edgewood Greens units, and White Rose Phase 3. Consideration was also given to the development of the industrial lands surrounding the proposed Eco Parkway extension in a Scenario, the findings will be summarized later in the conclusions.

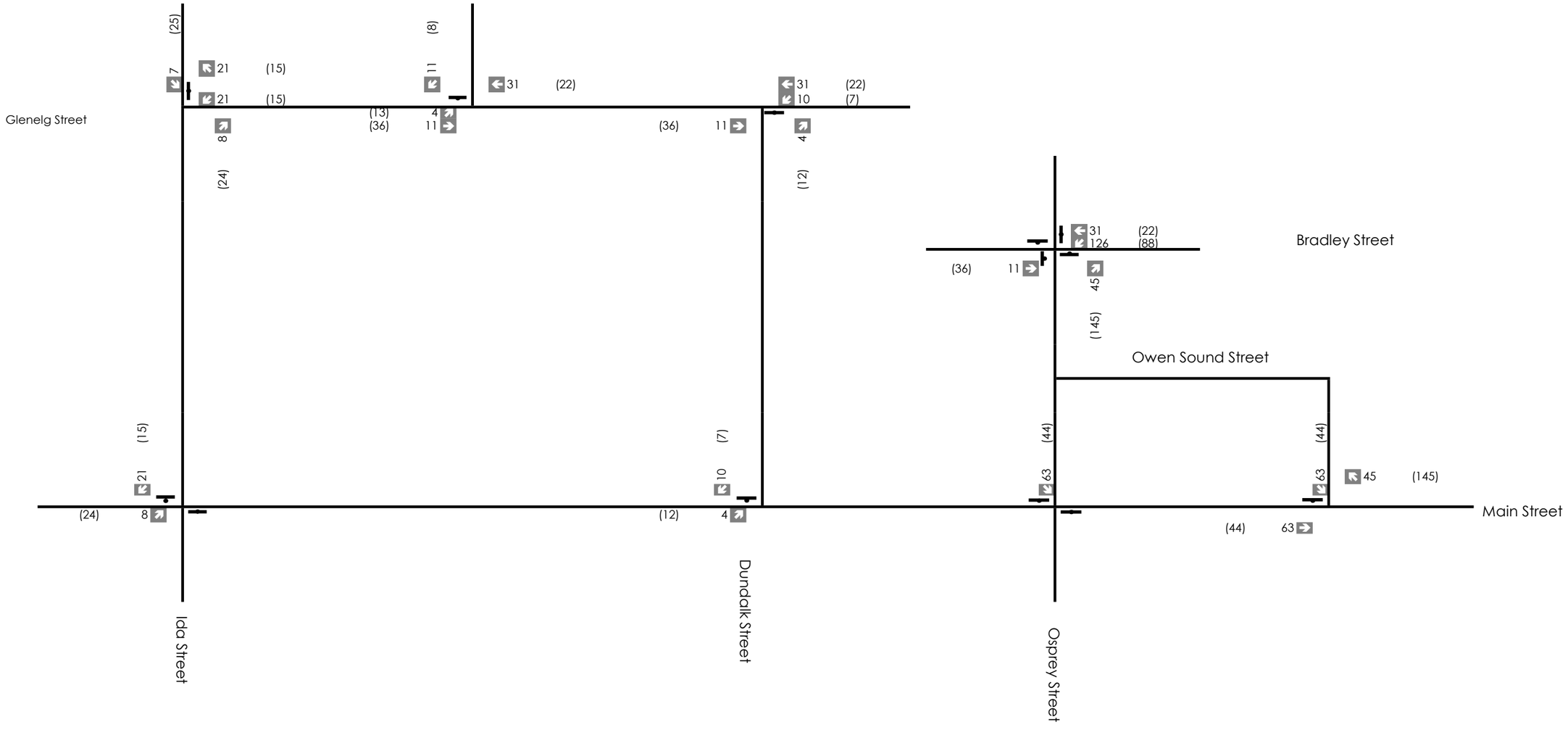
- Intersection analysis of the 2032 future background traffic volumes indicates the following:

    - The southbound movement at the Dundalk Street and Main Street intersection is forecast to operate with a LOS "E" during the weekday a.m. and p.m. peak hours.
        - A maximum volume-to-capacity ratio of 0.70 (SB) and control delay 37.4 seconds are forecast.
    - The remaining study intersections are forecast to operate at a LOS "C" or better.

- The proposed development is estimated to generate 285 and 389 total two-way primary trips during the weekday a.m. and p.m. peak hours, respectively.

- Intersection analysis of the 2032 future total traffic volumes indicates the following:

    - The study intersections are forecast to continue operating with a LOS "B" or better in the weekday a.m. and p.m. peak hours under 2032 future background traffic volume conditions, except for the intersections of: Dundalk Street and Main Street, Osprey



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xx A.M. Peak Hour Traffic Volumes
(XX) P.M. Peak Hour Traffic Volumes
Stop Sign

Glenelg Phase 3

Site Trip Assignment

CROZIER CONSULTING ENGINEERS

Figure 14
Project No. 1060-6220
Date. 2022/08/31
Analyst. E.H.

INDUSTRIAL ACCESS ROAD
GREY ROAD 9 AND IDA STREET
TRAFFIC IMPACT STUDY

JUNE, 2017

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

18 Robb Boulevard, Unit 8
Orangeville, Ontario
L9W 3L2
Tel: (519) 941-0330
Fax: (519) 941-1830
ORANGEVILLE • FERGUS • GRAVENHURST

1.0 INTRODUCTION

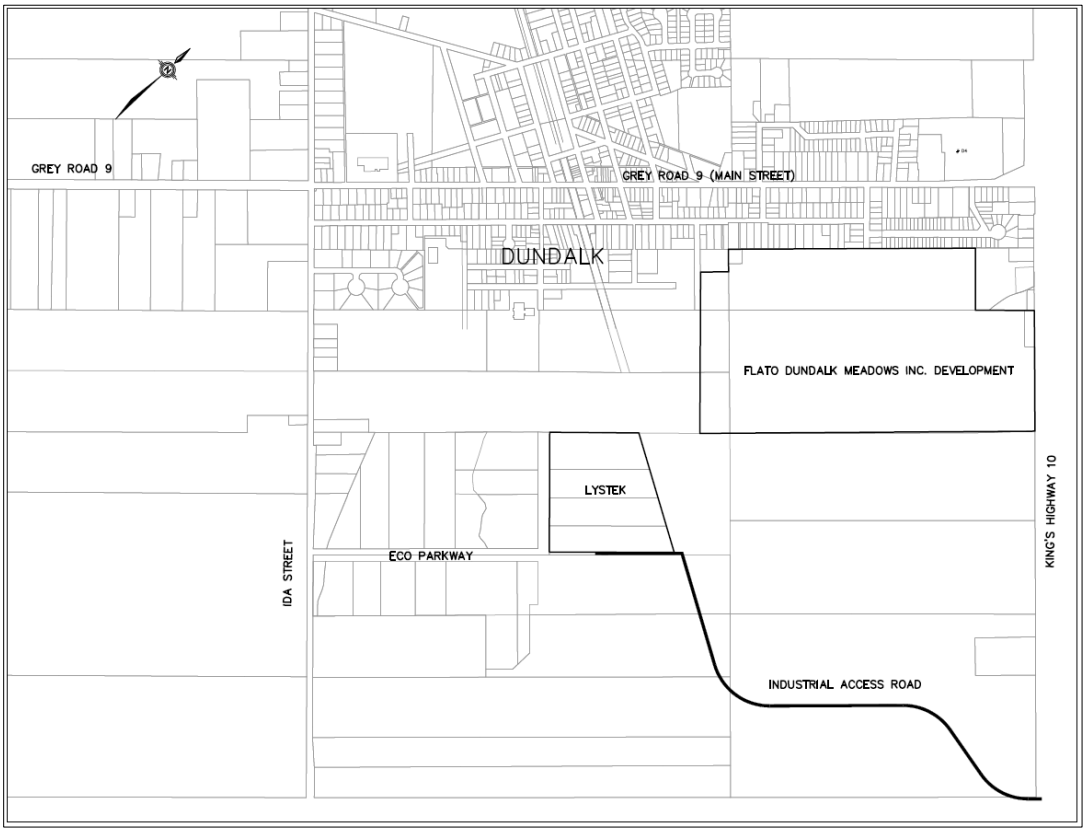
Triton Engineering Services Limited was retained by the Township of Southgate to undertake a Traffic Impact Study to assess the impact on the intersection of Grey Road 9 (Main Street) and Ida Street resulting from the construction of the proposed Industrial Access Road south of Dundalk.

This report summarizes the following:

- Future traffic volumes from the proposed industrial land developments at 50% build-out and full build-out;
- Existing and future levels of service at the Grey Road 9 and Ida Street intersection;
- Future intersection configuration and traffic control to meet future traffic demands.

2.0 PROPOSED DEVELOPMENTS AND ROAD NETWORK

The proposed Industrial Access Road will be an east-west arterial road that connects Ida Street (via Eco Parkway) and King's Highway 10 south of Dundalk. The location of the proposed road is shown below.



The lands on both sides of the Industrial Access Road have been designated for industrial use. Eco Parkway currently ends at the entrance to Lystek International (an organic materials revcovery centre), which is only one of two existing developments on Eco Parkway.

The land surrounding the industrial use zones is a mix of agriculture and natural areas, with the community of Dundalk to the north. There is a residential development (Flato Dundalk Meadows Inc.) to be constructed south of Dundalk by 2020.

The Township of Southgate has undertaken a Class EA for the Access Road. As part of the review process, Grey County requested a traffic impact study to assess the impact of constructing the Industrial Access Road on the intersection of Grey Road 9 and Ida Street. This report will investigate the effects of a 50% build-out and a full build-out of the industrial lands surrounding the Access Road.

Grey Road 9 is an east-west arterial road with a posted speed of 50 km/h. Ida Street is a north-south rural local road with a posted speed of 50 km/h. Both roads have one lane in each direction with stop control provided on Ida Street.

3.0 EXISTING TRAFFIC

Weekday morning and afternoon peak period traffic counts were obtained on April 19, 2018 at the Grey Road 9 and Ida Street intersection. The existing Weekday AM and PM peak hours were determined and the traffic volumes are illustrated in Figure 1.

Existing levels of service were analyzed based on the *Highway Capacity Manual, 2000*, using Synchro 10, Version 10.1. Level of Service definitions are included in Appendix A. The detailed capacity analyses are included in Appendix B. Table 1 outlines the existing traffic levels of service and volume to capacity ratios for the Grey Road 9 and Ida Street intersection.

Table 1: Existing Traffic Levels of Service

Intersection	Movement	Level of Service		v/c Ratio	
		AM	PM	AM	PM
Grey Road 9 and Ida Street (Unsignalized)	EB Overall	A	A	0.00	0.00
	WB Overall	A	A	0.02	0.02
	NB Overall	A	B	0.03	0.09
	SB Overall	B	B	0.06	0.05

The unsignalized Grey Road 9 and Ida Street intersection is currently operating at a very good and good level of service during both the Weekday AM and PM Peak hours.

4.0 BACKGROUND TRAFFIC

Background traffic is traffic growth generated from sources other than the developments being studied. This will allow an analysis of the effect that the developments will have on the existing road network.

For the purpose of this study, it was assumed that the road construction of the industrial Access Road would be completed in 2019. This study will analyze the traffic volumes at the Grey Road 9 and Ida Street intersection in 2019 (after the road is completed), in 2024 (full and 50% build-out of industrial lands), and a 5 year horizon (2029). A conservative growth rate of 2% was applied to existing traffic volumes to establish background volumes for 2019, 2024, and 2029.

Flato Dundalk Meadows Inc. (residential development site) is located immediately south of Dundalk and is expected to be constructed and fully occupied by 2030. C.F. Crozier & Associates Inc. completed a traffic impact study (Addendum – June 2016) for the development with the trips generated distributed on the existing local roads. C.F. Crozier had assumed that 30% of the trips generated would travel to and from the west (including downtown Dundalk). To incorporate the additional traffic from this residential development, it is assumed that only 10% of the trips generated would travel to and from Grey Road 9 past Ida Street (with the remaining 20% dispersing in downtown Dundalk). This additional traffic is shown on Figure 2 and was added to the background traffic.

Once the Industrial Access Road is constructed, some traffic will re-route based on more direct connections. It was assumed for the purpose of this study that 30% of the traffic on Grey Road 9 through Dundalk would use the Access Road as a bypass route around the community. This is considered to be a conservative estimate. It was also assumed that all truck traffic currently going through Dundalk would use the Access Road to bypass the village or access the industrial lands.

The following list summarizes the movements that are affected by these assumptions:

- 30% of SB-left cars will be added to SB-thru;
- 30% of EB-thru cars will be added to EB-right;
- 30% of WB-thru cars will be added to NB-left;
- 30% of WB-right cars will be added to NB-thru;
- SB-left trucks will be added to SB-thru;
- EB-thru trucks will be added to EB-right;
- WB-left trucks will be removed;
- WB-thru trucks will be added to NB-left;
- WB-right trucks will be added to NB-thru; and,
- NB-right trucks will be removed.

5.0 SITE GENERATED TRAFFIC

5.1 Trip Generation

Trip generation is a forecast of the additional traffic created by future developments from studies of similar developments to assess the impact of the additional traffic on the surrounding road network. The *Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition* (ITE Code 130 – Industrial Park) was used in this analysis.

The types of developments surrounding the Access Road are not known at this time. The ITE Code 130 – Industrial Park will provide a conservative trip generation. To account for a level of uncertainty, and that a full build-out of the industrial lands is expected to take longer than 5 years, a scenario of 50% build-out was also analyzed to assess when improvements to the Grey Road 9 and Ida Street intersection will be required.

Based on the legal plan provided, an approximate area of 259.75 acres was used to forecast the trips generated by a full build-out of the industrial lands surrounding the proposed Access Road. The 50% build-out area used was 129.875 acres. For this study, it is assumed that all trips generated by the developments are primary trips, thus providing a conservative approach.

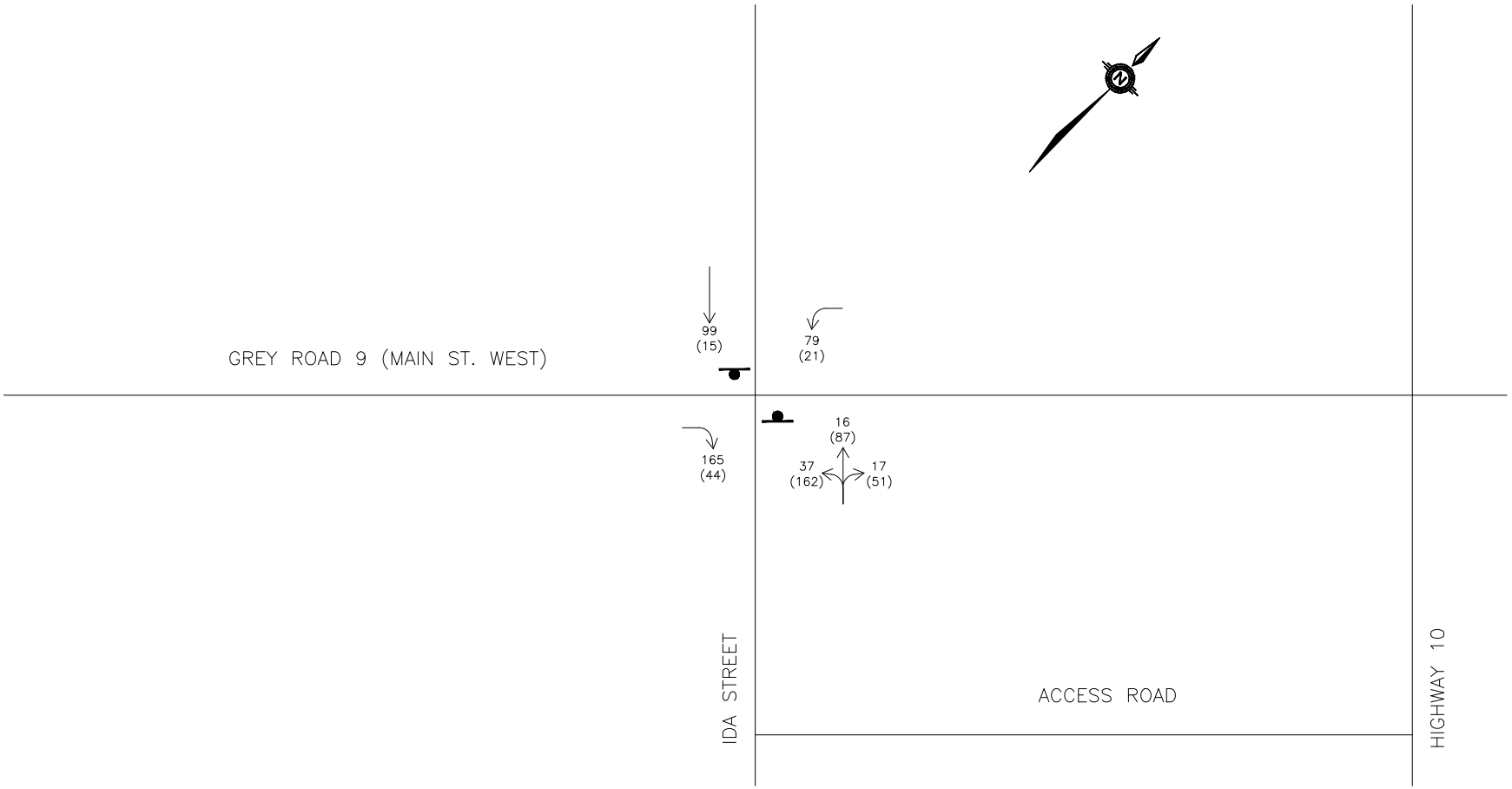
The total number of trips generated by the developments for the Weekday AM and PM peak hours are summarized in Table 5 for both 50% build-out and full build-out. The equations used to calculate the number of trips, can be found in Appendix C. It is noted that the 50% development scenario still generates a conservative estimate of 802 and 769 additional trips in the AM and PM peak hours respectively.

Table 5: Trip Generation Summary

Land Use	Weekday AM			Weekday PM		
	Trips Entering	Trips Exiting	Total Trips	Trips Entering	Trips Exiting	Total Trips
Industrial Lands – 50% build-out	666	136	802	161	608	769
Industrial Lands – full build-out	1142	234	1376	266	1000	1266

5.2 Trip Distribution

The trips generated by the developments were distributed and assigned to the road network based on local traffic patterns, as well as expected origin and destination. It was assumed that 70% of the trips generated would head towards/come from Highway 10 on the Access Road. For a conservative approach, it was assumed that all of the site



LEGEND:

STOP CONTROL

25 (25) 8:00am – 9:00am 4:30pm – 5:30pm TRAFFIC VOLUMES

EXISTING ROAD

TRAFFIC FLOW

TRAFFIC SIGNALS

PROPOSED ENTRANCE

TRITON ENGINEERING SERVICES LIMITED
Consulting Engineers

FIGURE 7:
DEVELOPMENT PEAK HOUR TRIP DISTRIBUTION - FULL BUILD-OUT
(NOT TO SCALE)

APPENDIX G

ITE Trip Generation 11th Edition Excerpts

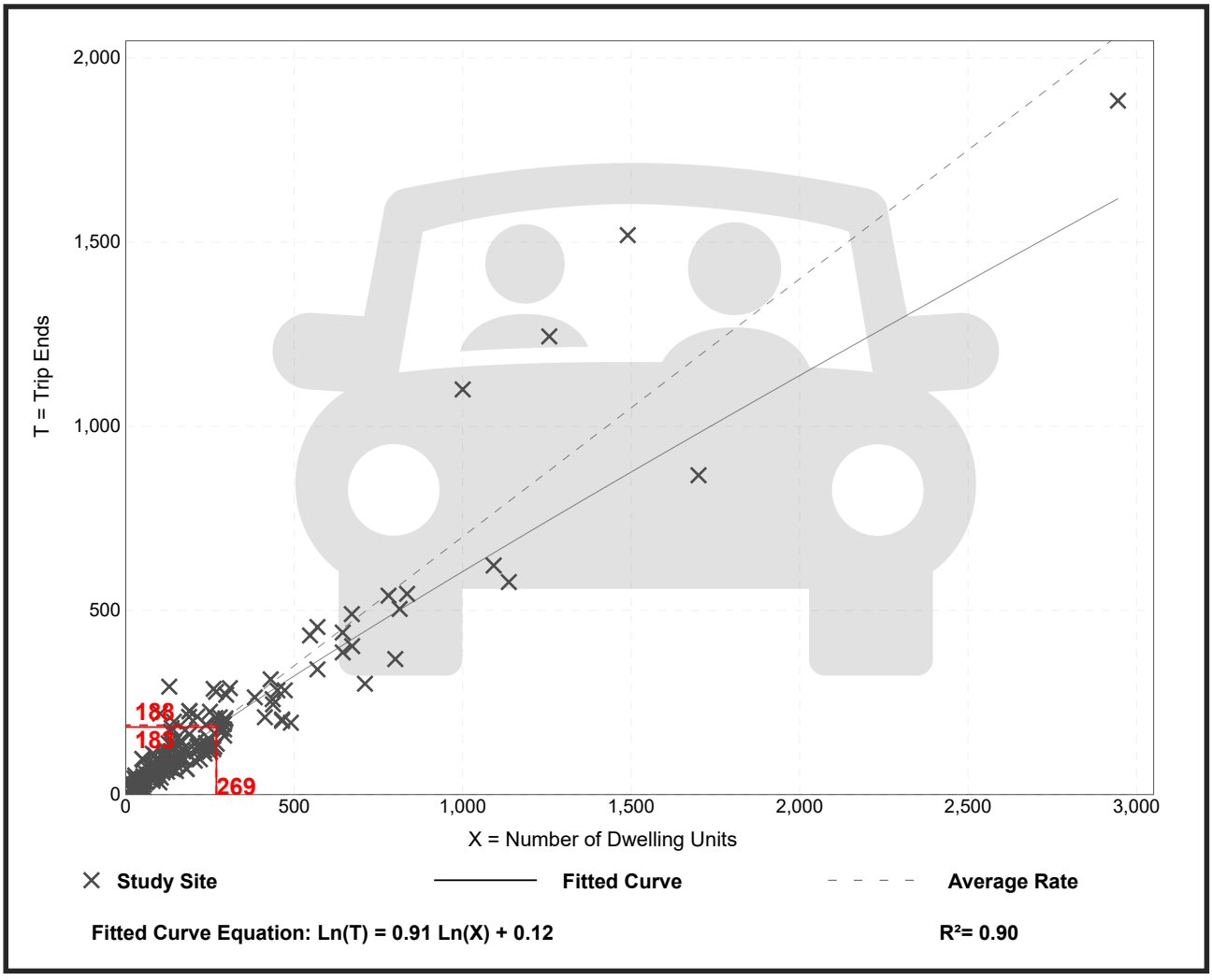
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 192
Avg. Num. of Dwelling Units: 226
Directional Distribution: 25% entering, 75% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.70	0.27 - 2.27	0.24

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

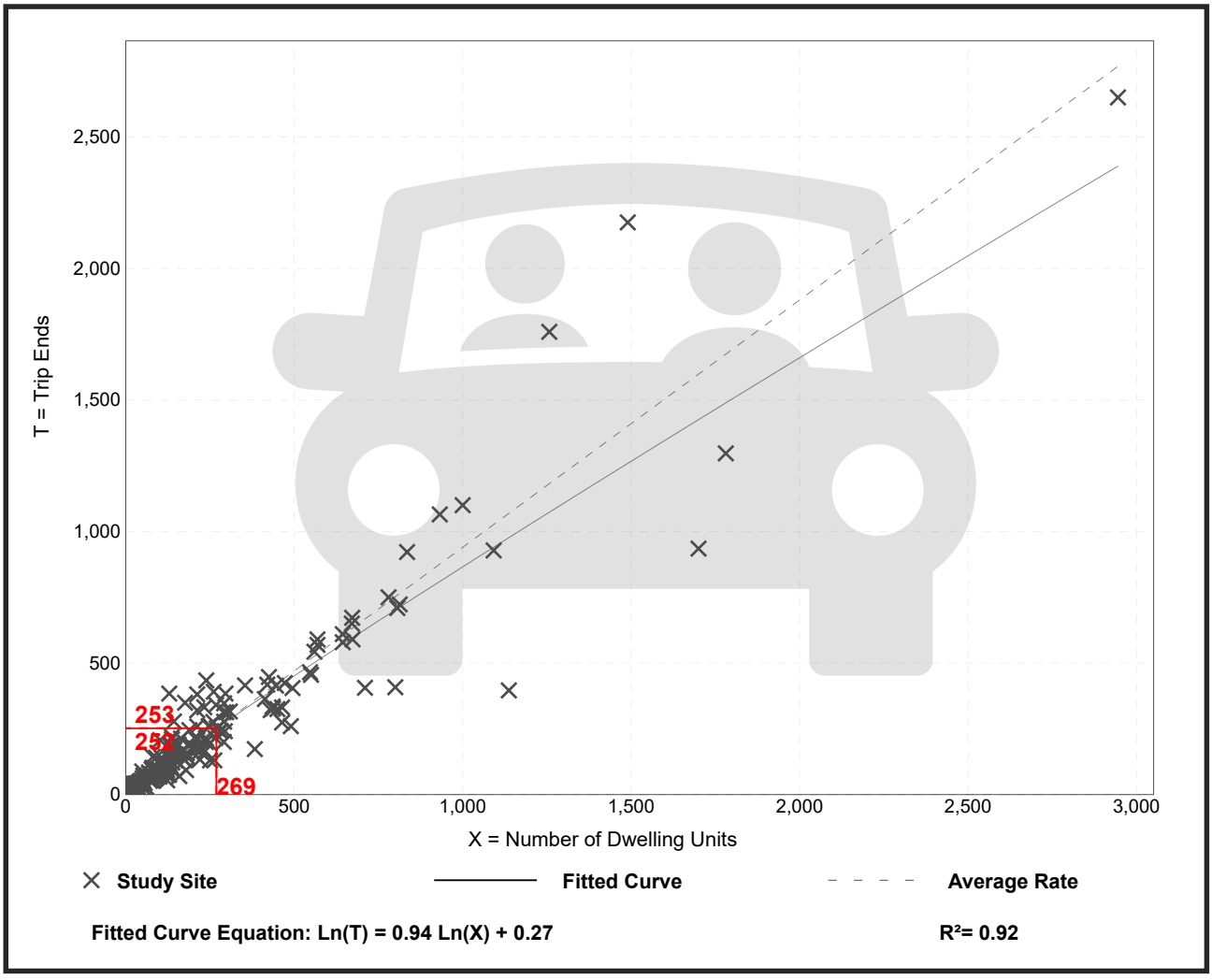
Single-Family Detached Housing
(210)

Vehicle Trip Ends vs: **Dwelling Units**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 208
Avg. Num. of Dwelling Units: 248
Directional Distribution: 63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.94	0.35 - 2.98	0.31

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

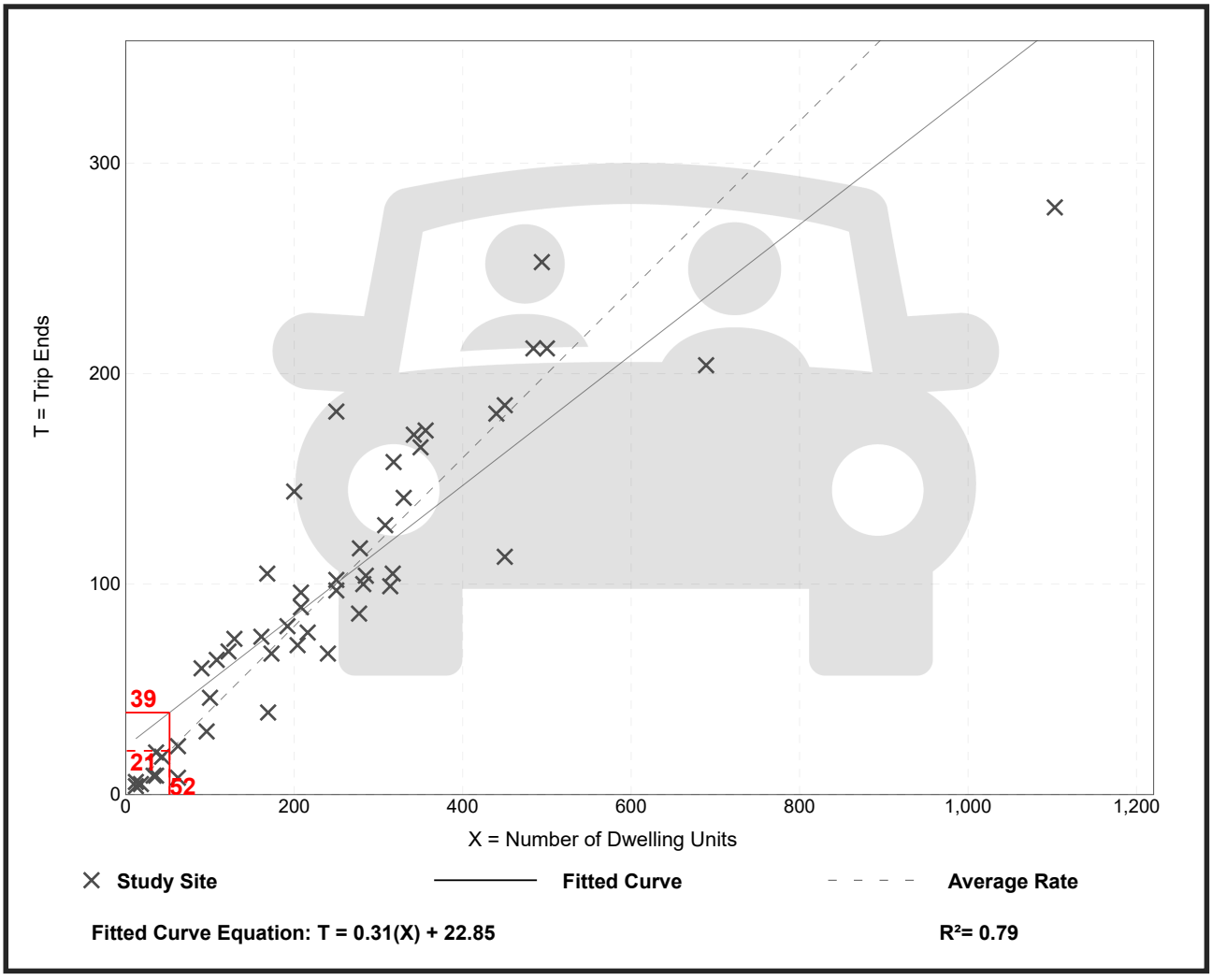
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 7 and 9 a.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	49
Avg. Num. of Dwelling Units:	249
Directional Distribution:	24% entering, 76% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.40	0.13 - 0.73	0.12

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

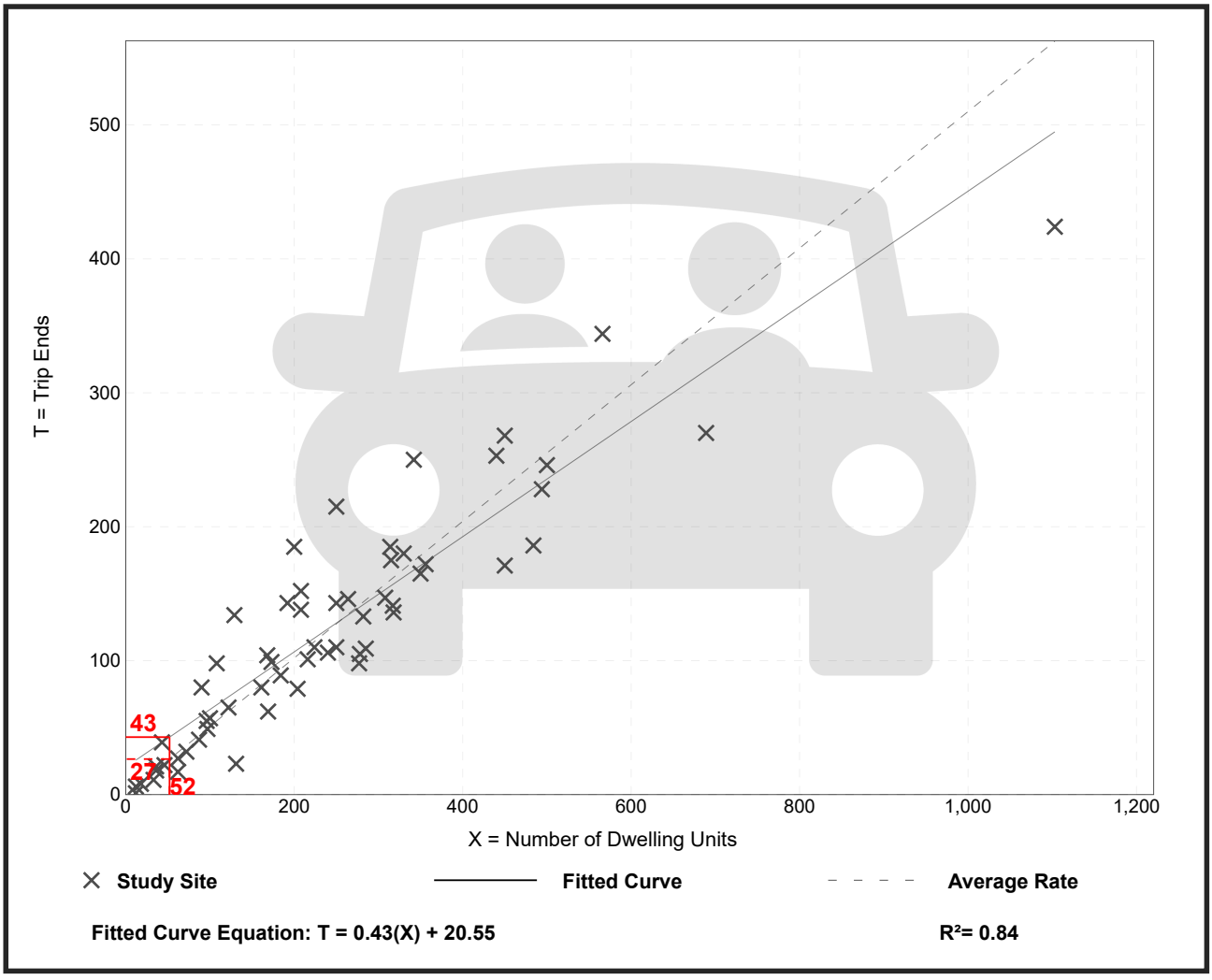
Multifamily Housing (Low-Rise)
Not Close to Rail Transit (220)

Vehicle Trip Ends vs:	**Dwelling Units**
On a:	**Weekday,**
	Peak Hour of Adjacent Street Traffic,
	One Hour Between 4 and 6 p.m.
Setting/Location:	**General Urban/Suburban**
Number of Studies:	59
Avg. Num. of Dwelling Units:	241
Directional Distribution:	63% entering, 37% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.51	0.08 - 1.04	0.15

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

APPENDIX H

Left-Turn Lane Warrants

Ontario

MTO DESIGN SUPPLEMENT

FOR

TAC GEOMETRIC DESIGN GUIDE (GDG) FOR

CANADIAN ROADS

APRIL 2020

STANDARDS &
SPECIFICATIONS BRANCH
DESIGN STANDARDS &
SPECIFICATIONS OFFICE

MTO Design Supplement

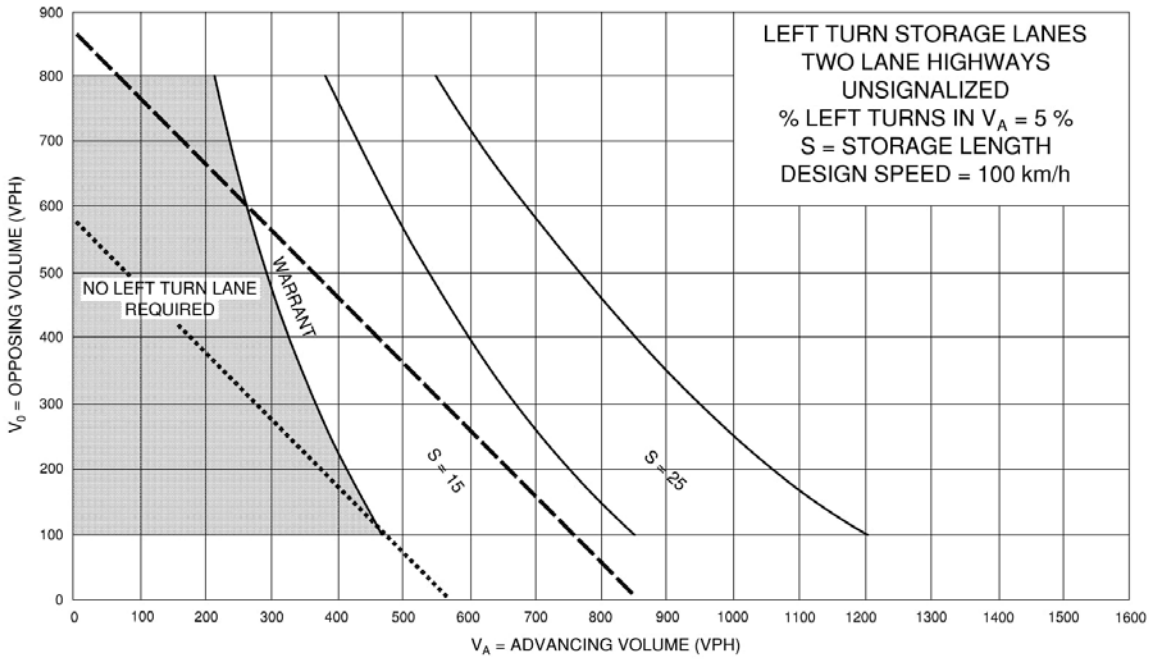
For
TAC Geometric Design Guide for
Canadian Roads

Appendix 9A for Section 9.17.2.1 Volume Warrants for Left-Turn Lanes

Chapter 9 - Intersections

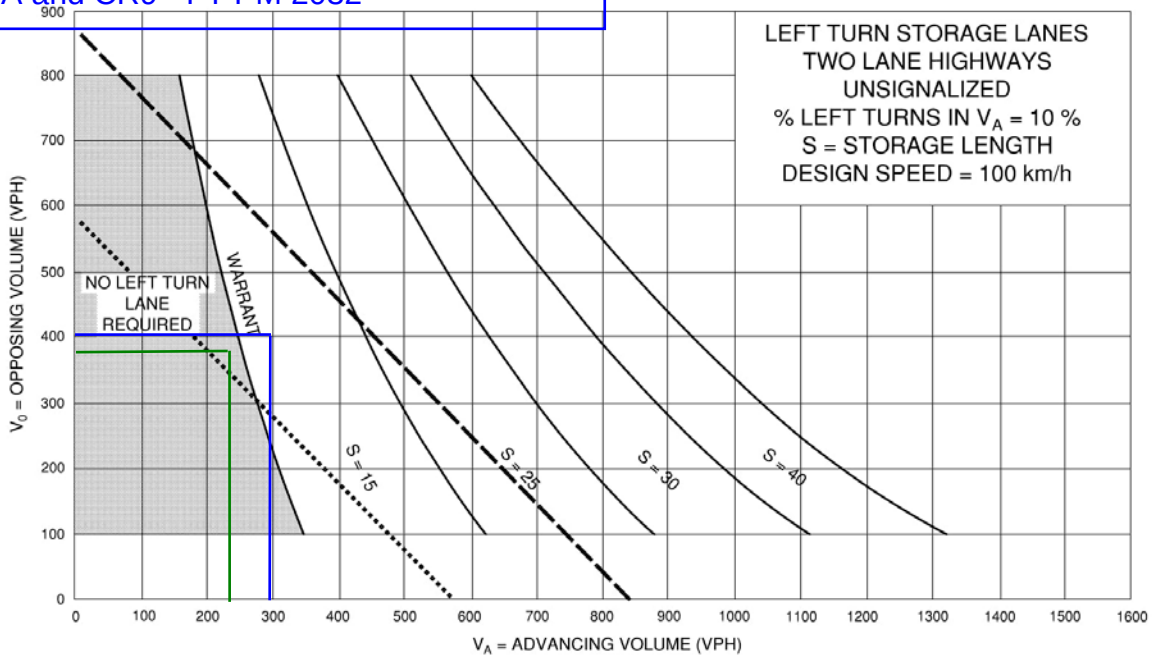
April 2020

Exhibit 9A-23



Access A and CR9- FT AM 2032

Access A and CR9 - FT PM 2032



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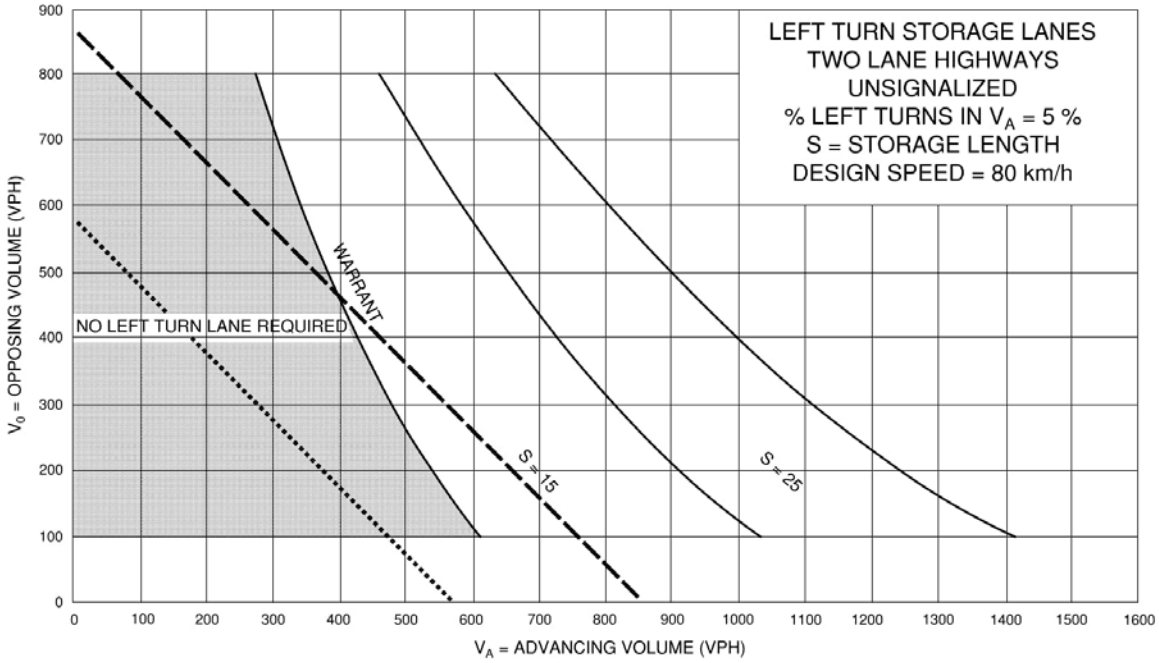
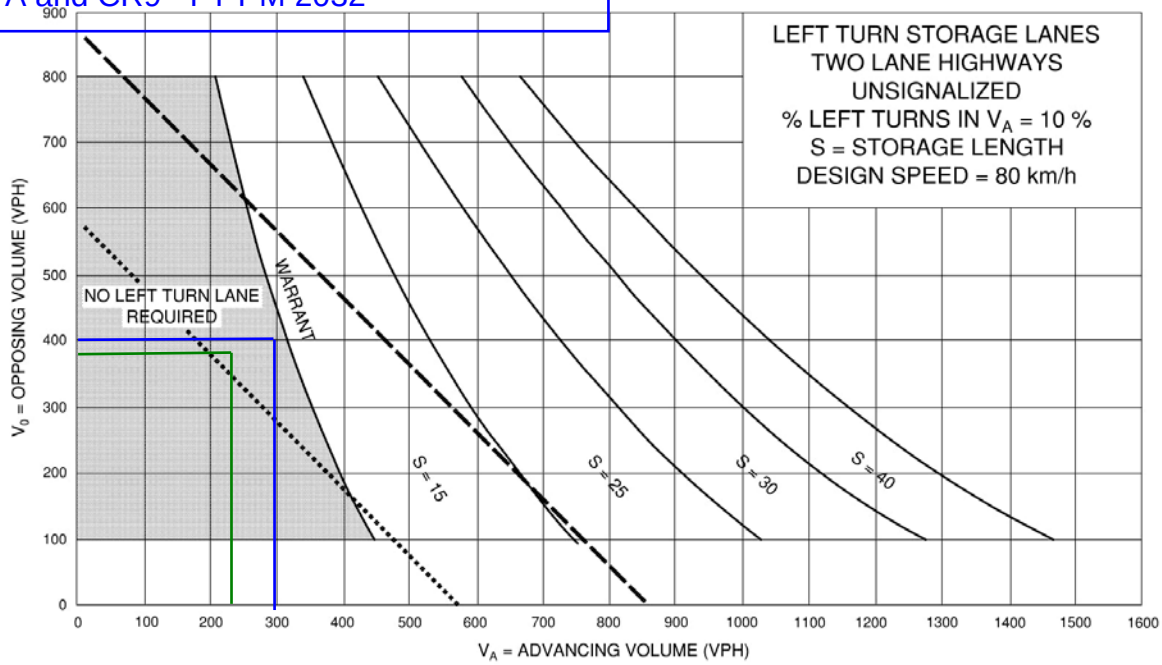


TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

Access A and CR9- FT AM 2032

Access A and CR9 - FT PM 2032



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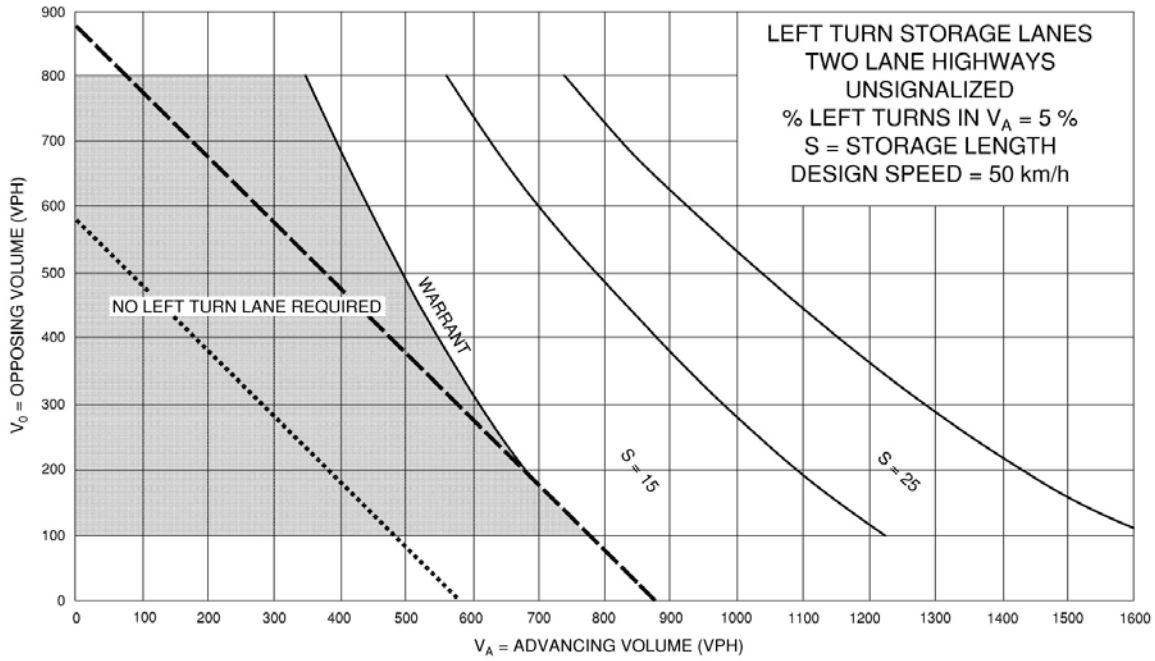
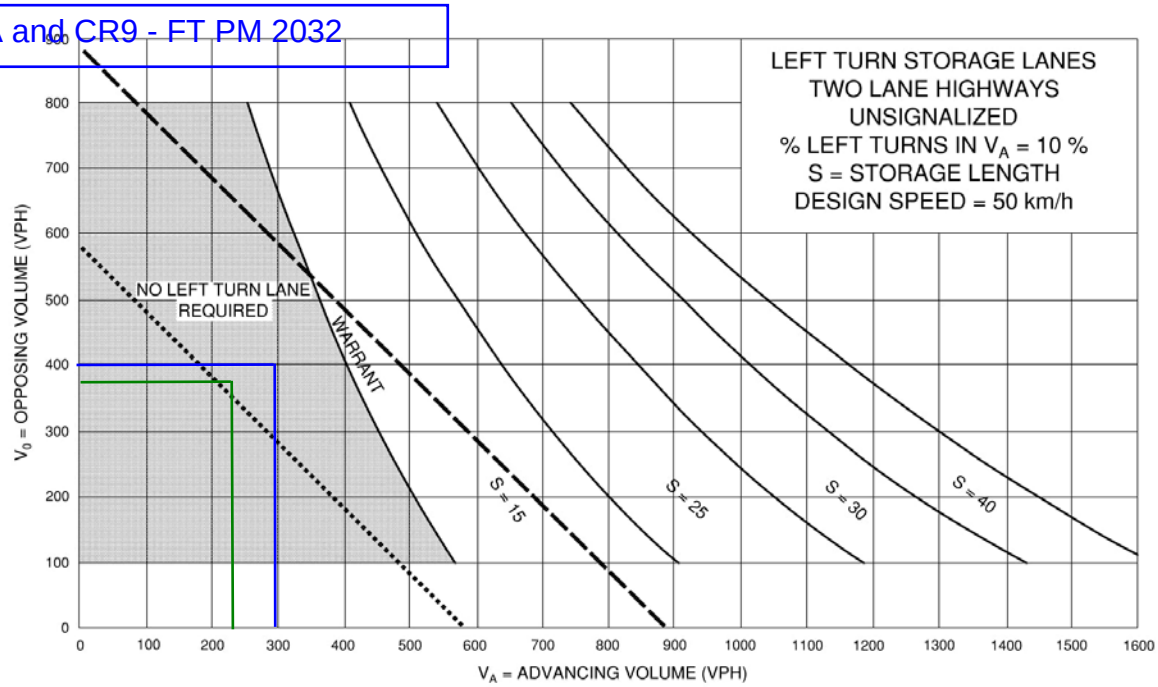


Access A and CR9- FT AM 2032

Access A and CR9 - FT PM 2032



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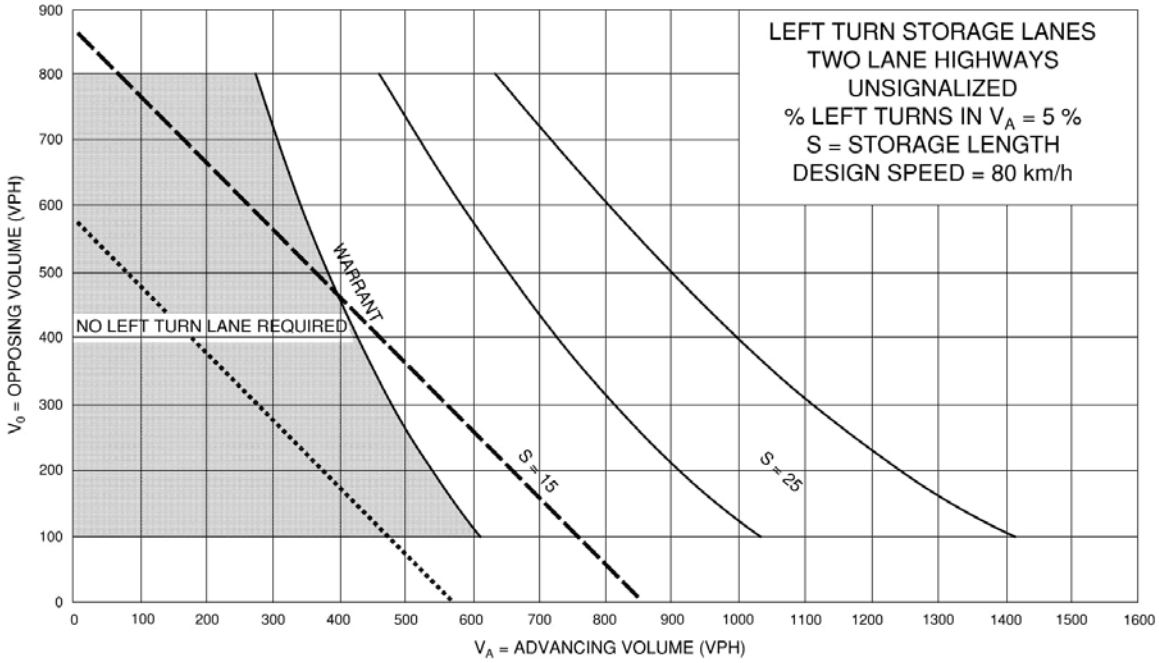
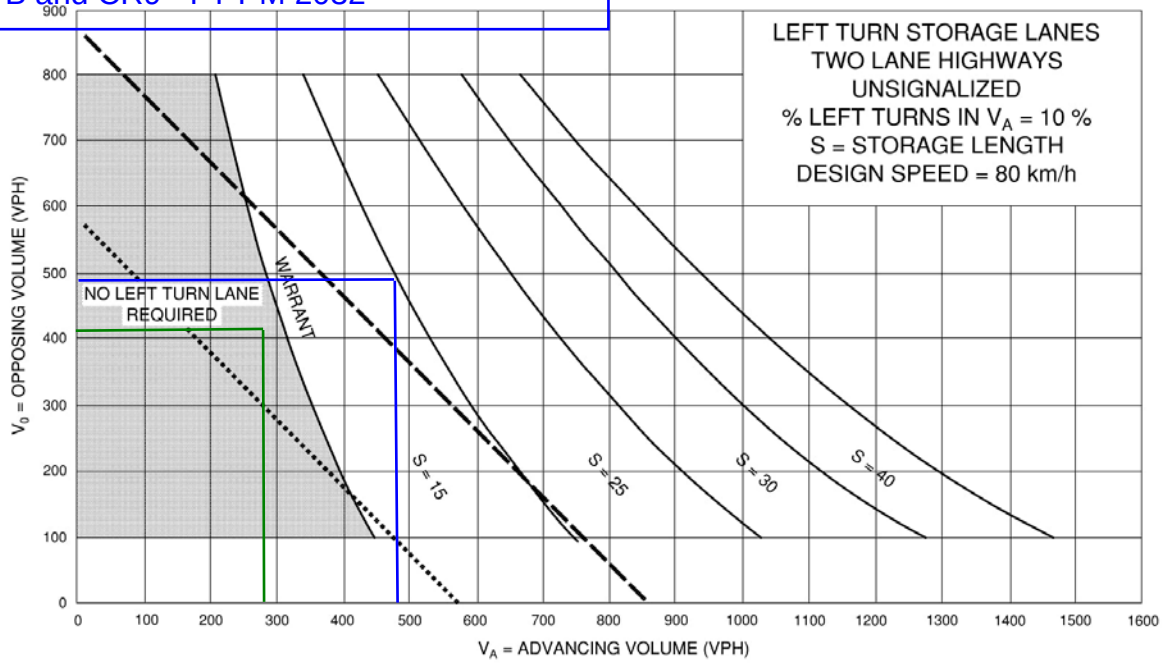


TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

Access B and CR9- FT AM 2032

Access B and CR9 - FT PM 2032



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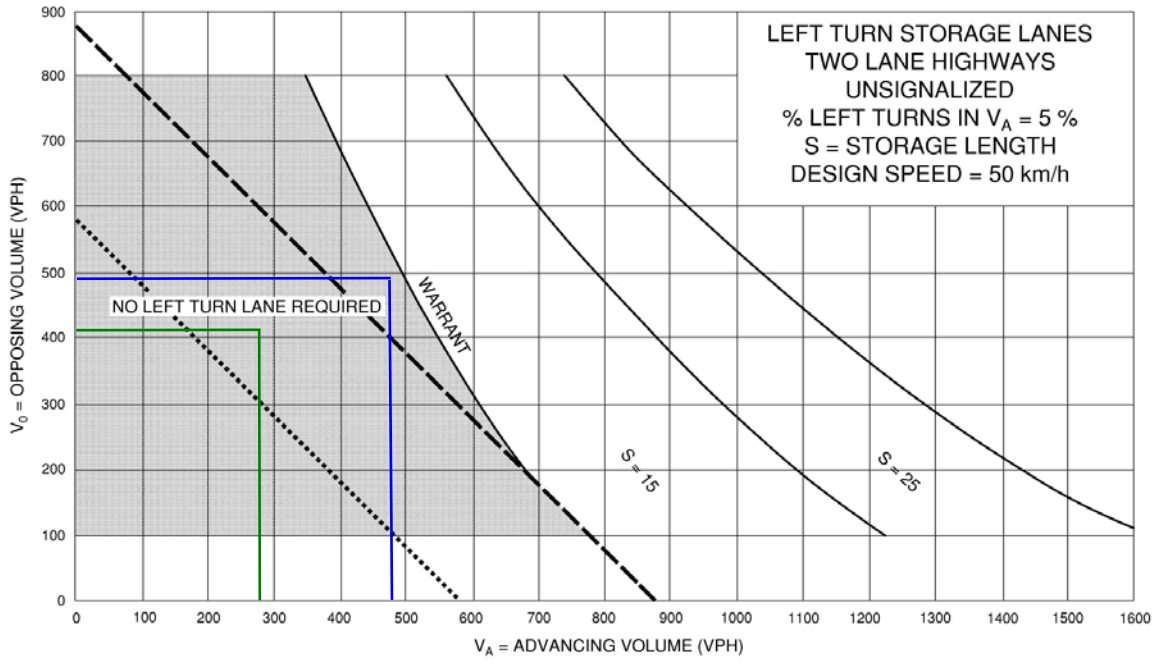

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 5 %
S = STORAGE LENGTH
DESIGN SPEED = 50 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
V_0 = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

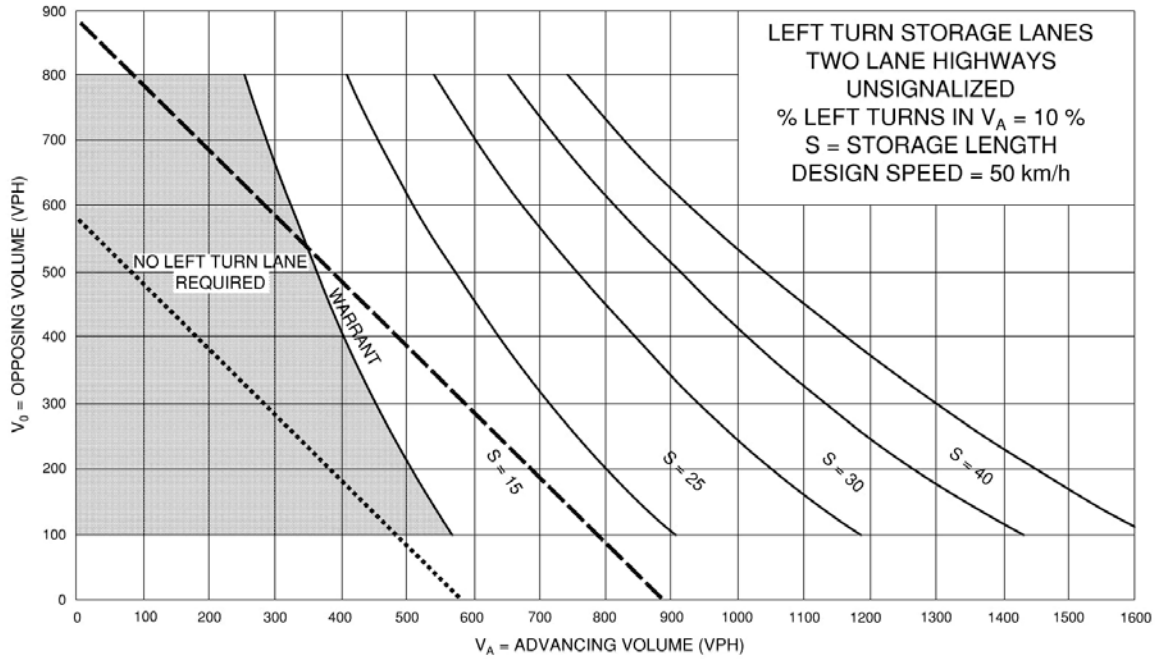
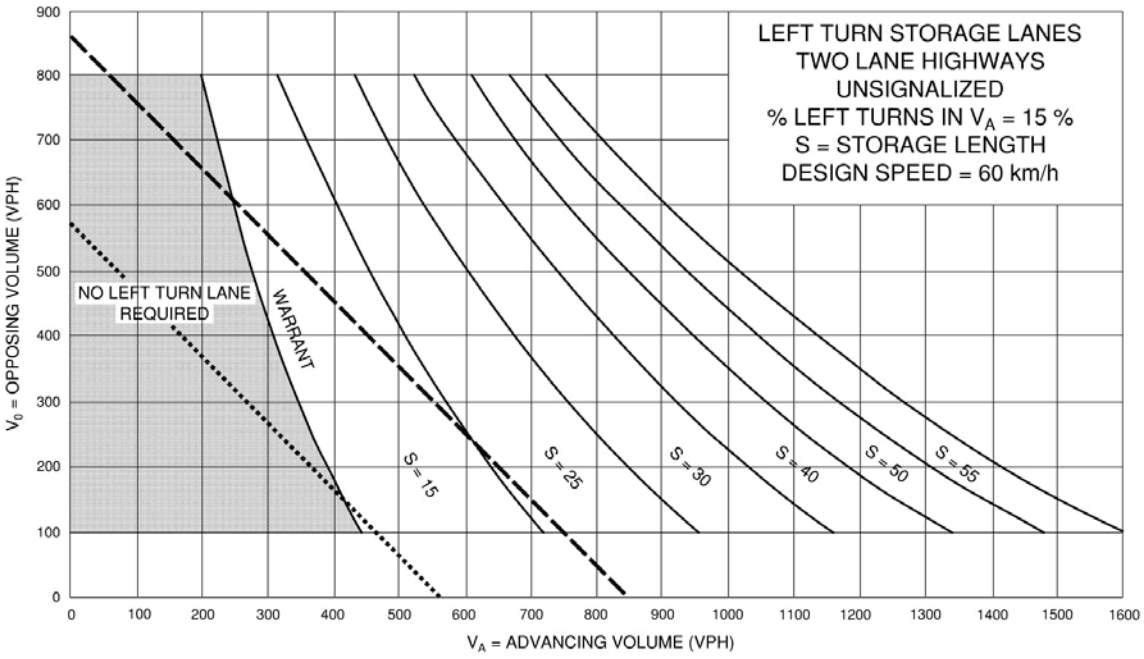
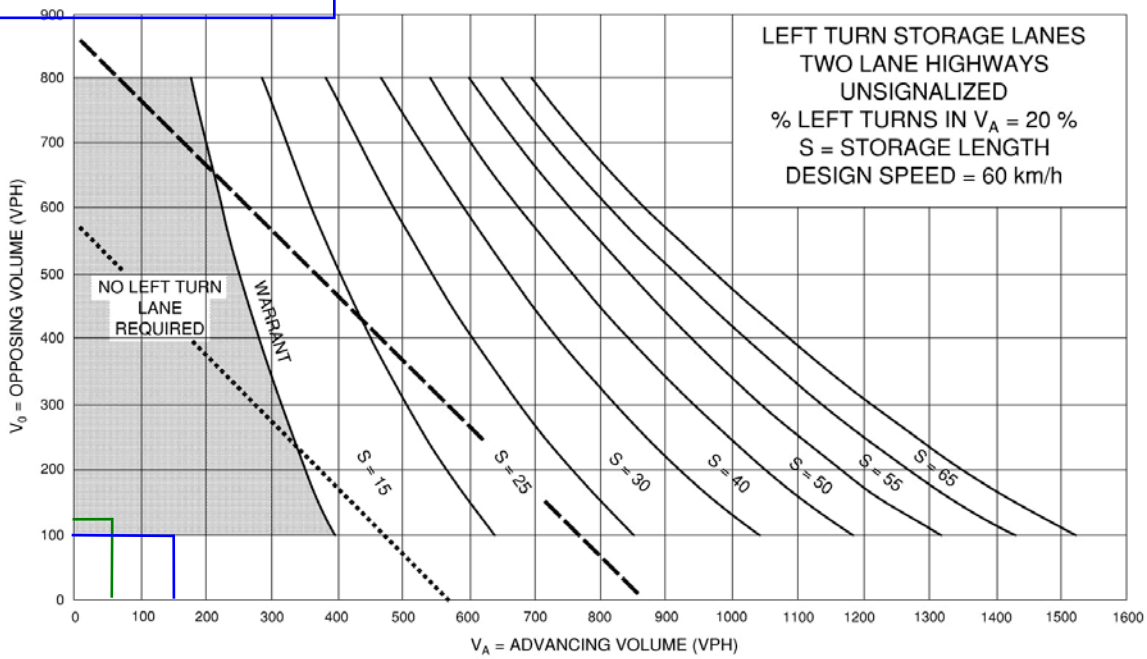

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 10 %
S = STORAGE LENGTH
DESIGN SPEED = 50 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S = 15
S = 25
S = 30
S = 40
V_0 = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

Exhibit 9A-8



Access 1 and Ida- FT AM 2032

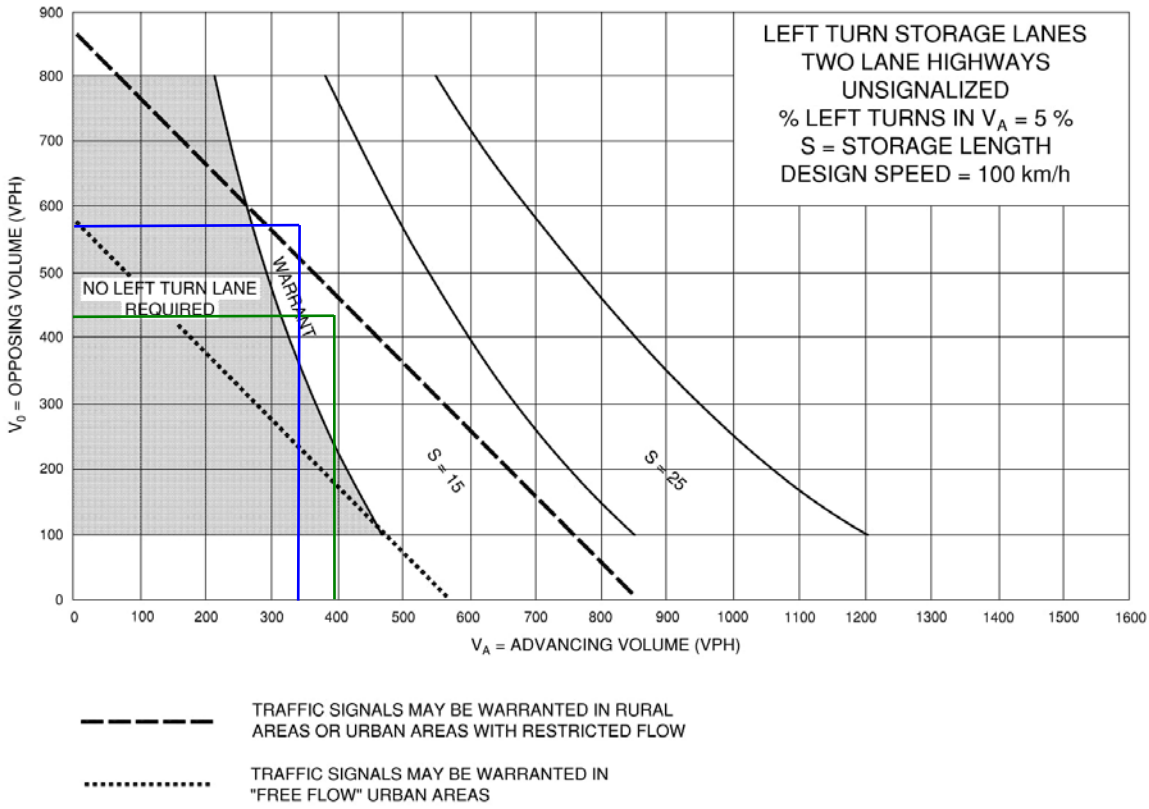
Access 1 and Ida - FT PM 2032

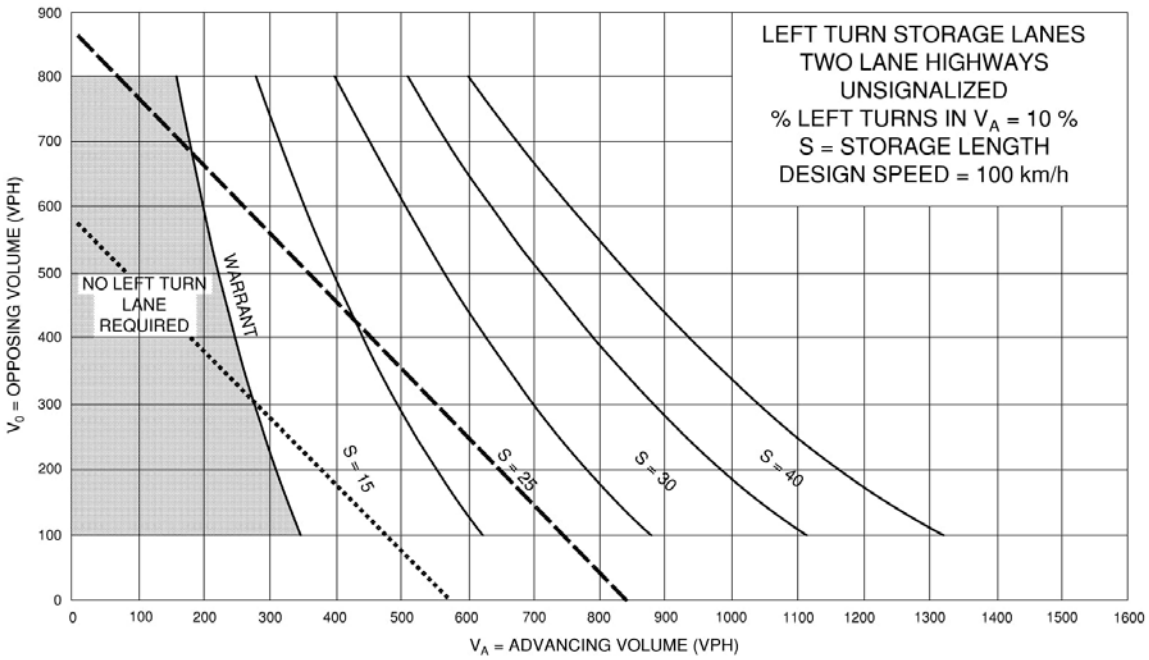


Access A and CR9 - FT AM 2032 (Eco-Parkway)

Access A and CR9 - FT PM 2032 (Eco-Parkway)

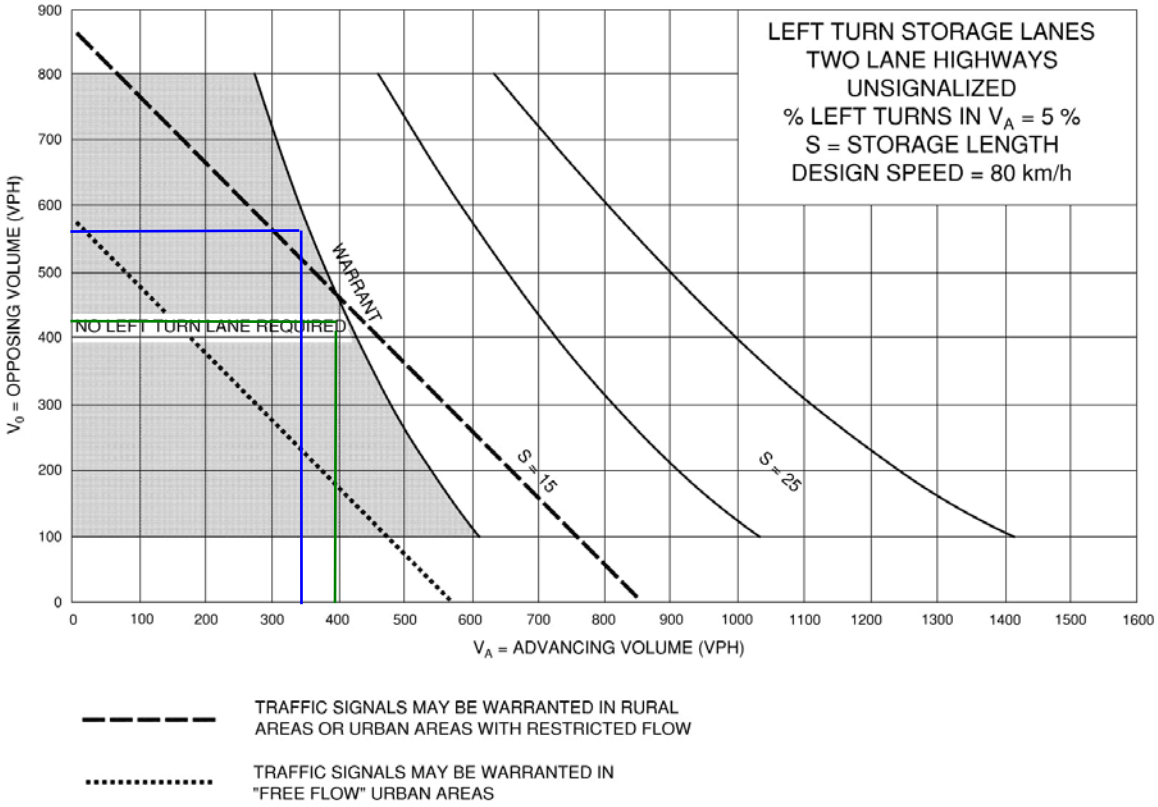
Exhibit 9A-23

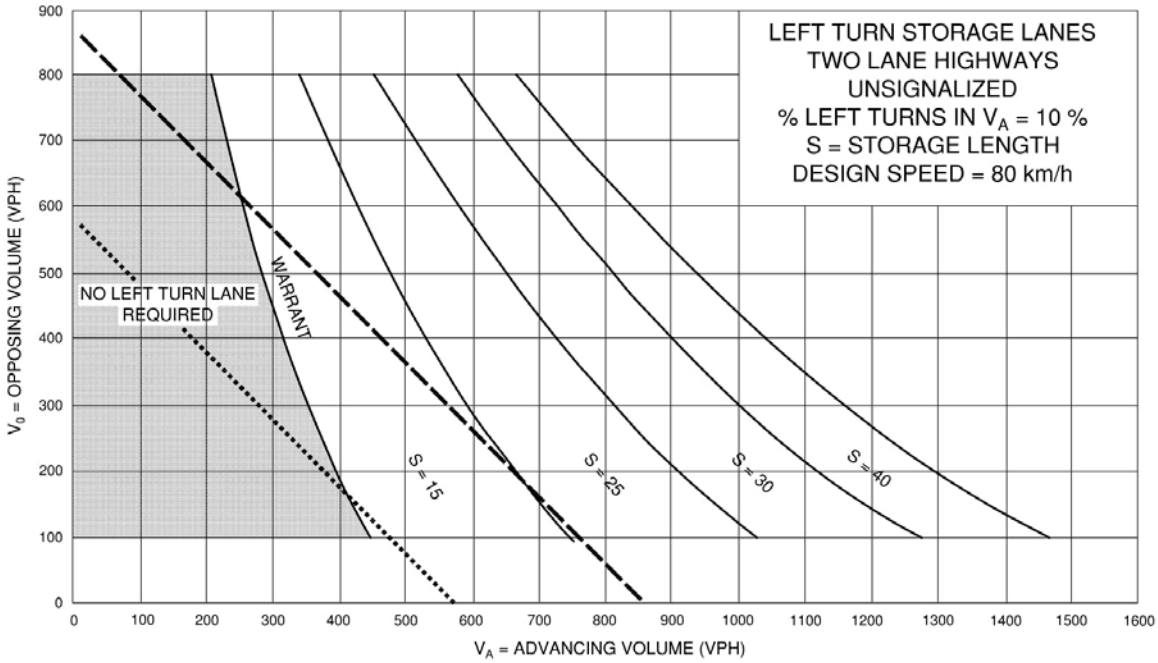




Access A and CR9 - FT PM 2032 (Eco-Parkway)

Exhibit 9A-15

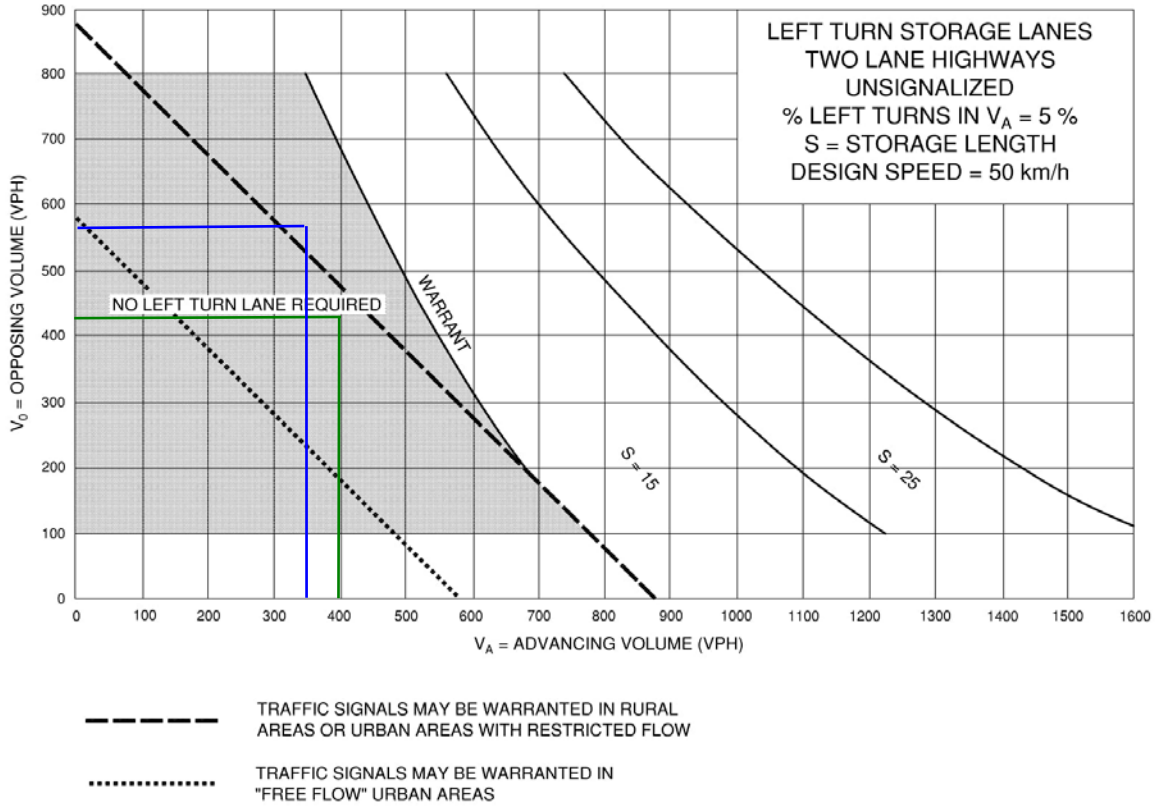


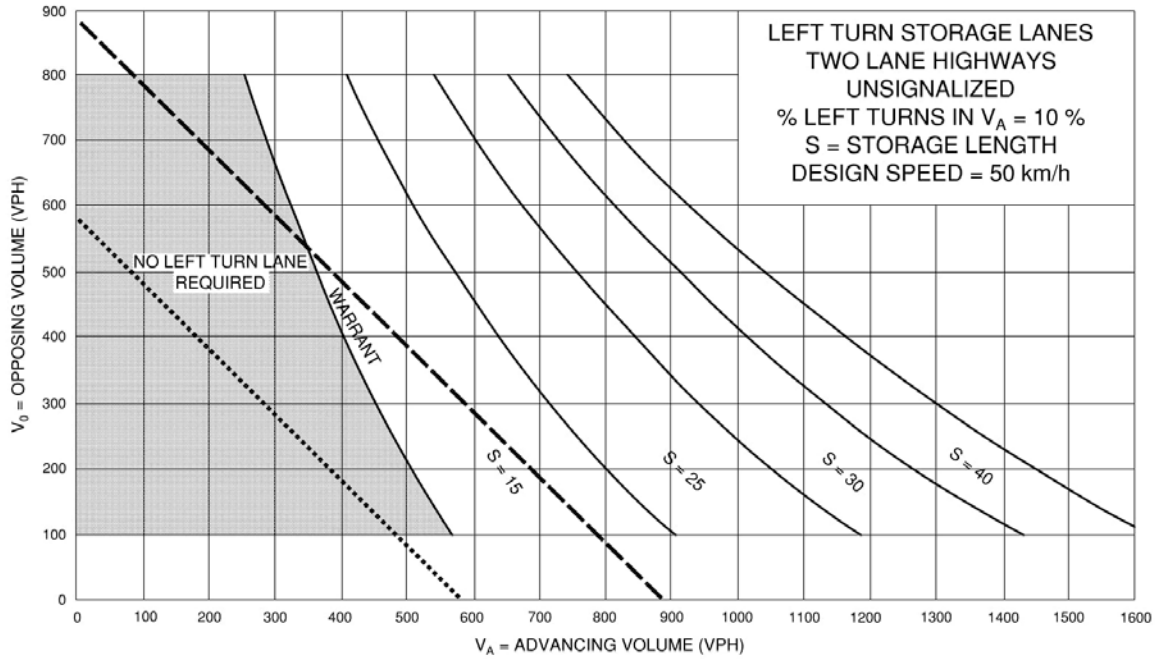


Access A and CR9- FT AM 2032 (Eco-Parkway)

Access A and CR9 - FT PM 2032 (Eco-Parkway)

Exhibit 9A-3





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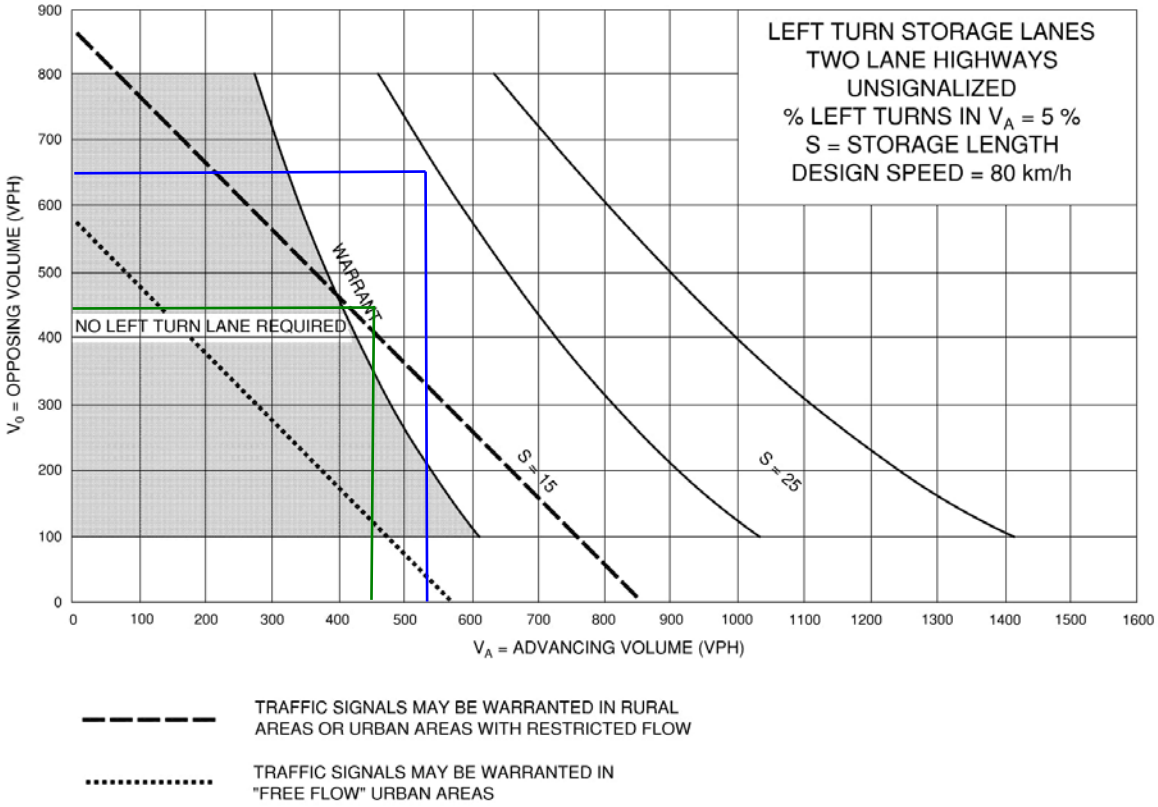
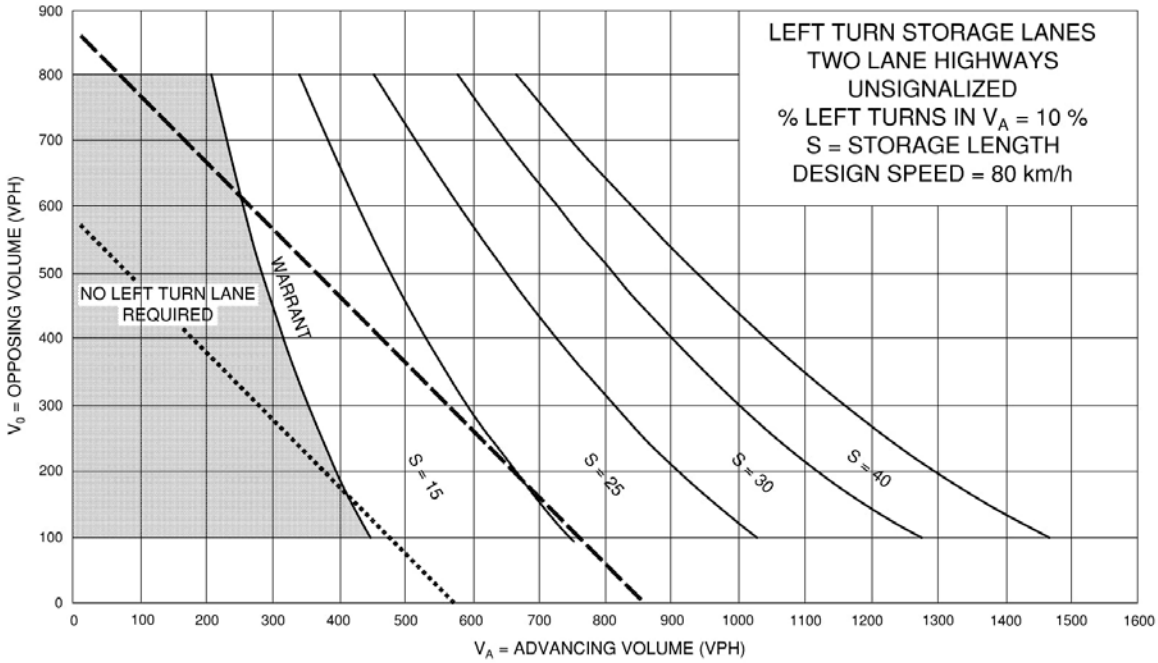
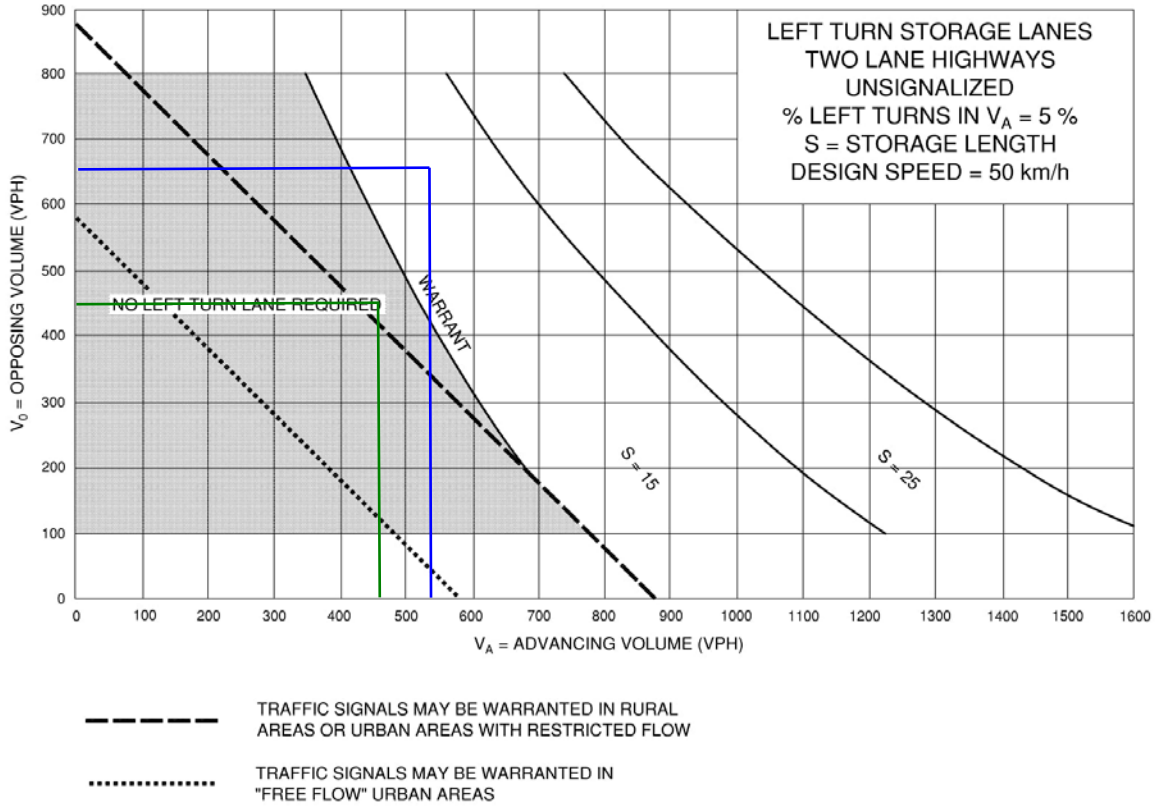


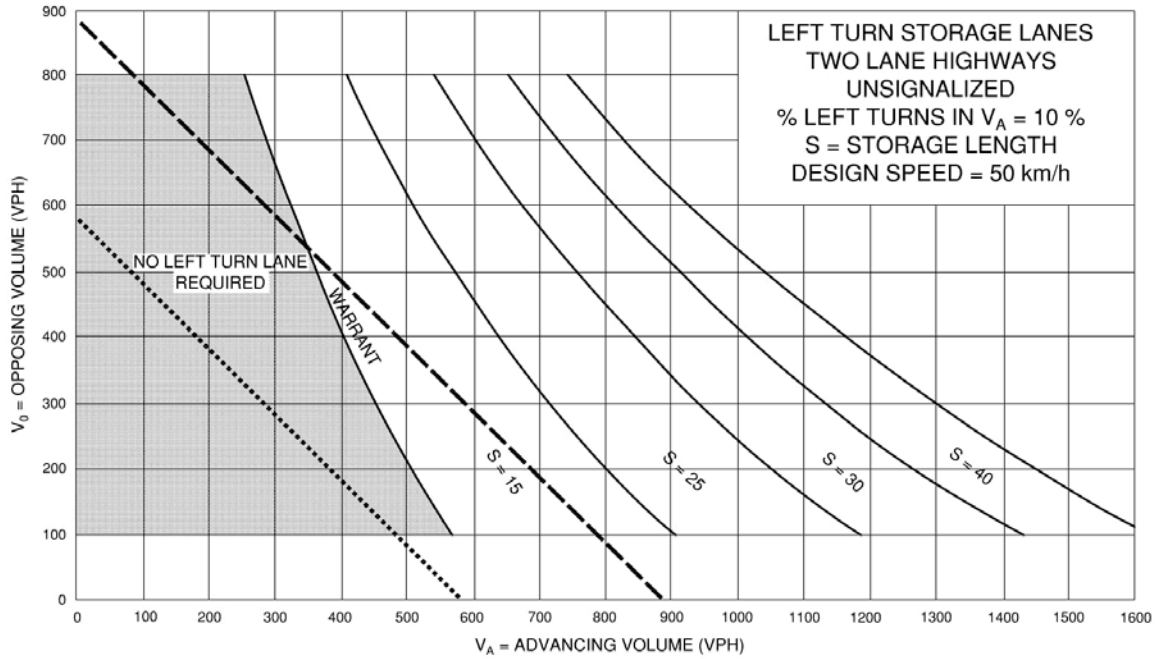


Access B and CR9- FT AM 2032 (Eco-Parkway)

Access B and CR9 - FT PM 2032 (Eco-Parkway)

Exhibit 9A-3





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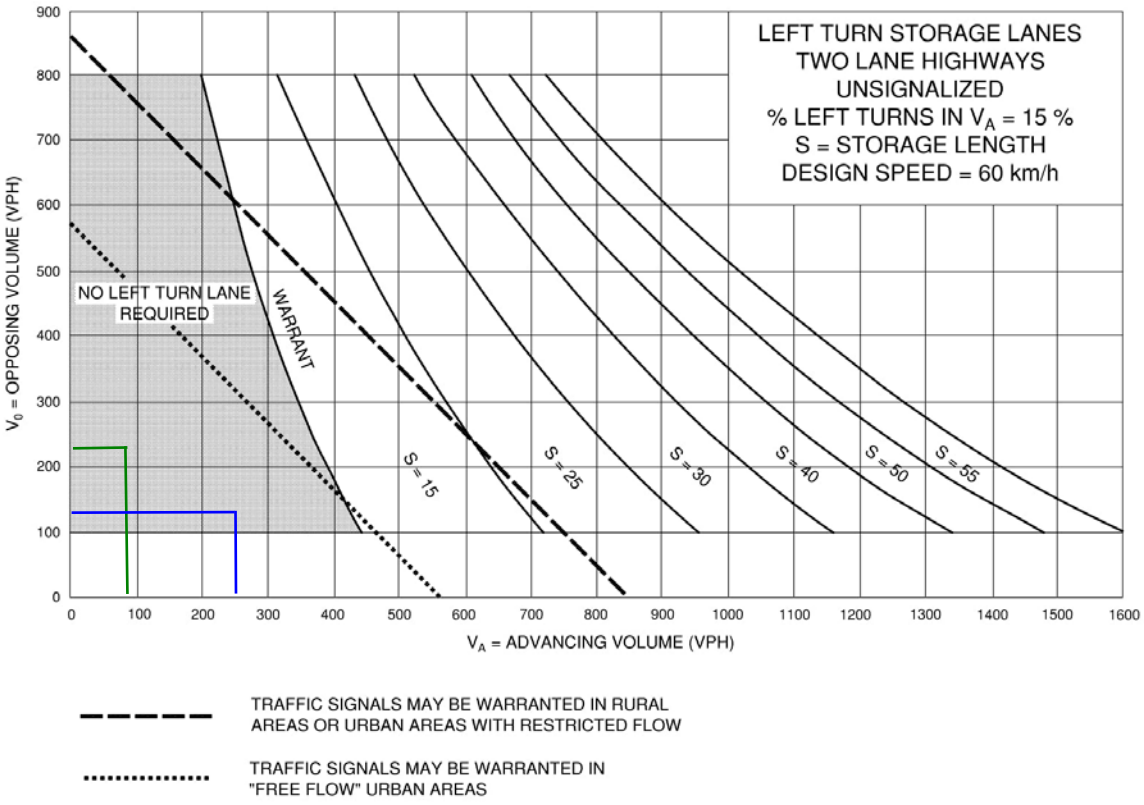
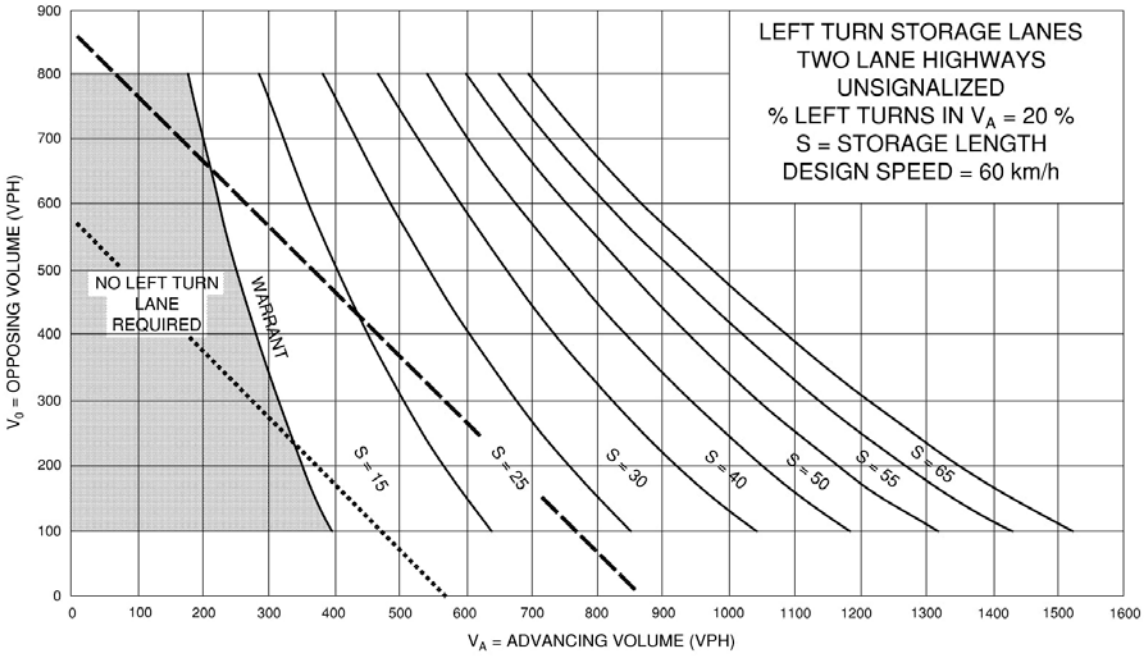

LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 15 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
V_0 = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW
TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS


LEFT TURN STORAGE LANES
TWO LANE HIGHWAYS
UNSIGNALIZED
% LEFT TURNS IN V_A = 20 %
S = STORAGE LENGTH
DESIGN SPEED = 60 km/h
NO LEFT TURN LANE REQUIRED
WARRANT
S=15
S=25
S=30
S=40
S=50
S=55
S=65
V_0 = OPPOSING VOLUME (VPH)
V_A = ADVANCING VOLUME (VPH)

APPENDIX I

TAC Excerpts

9.17 LEFT-TURN LANES

9.17.1 OVERVIEW

When the number of left-turning vehicles at intersections is such that it creates a hazard and reduces capacity, consideration should be given to the provision of a separate left-turn lane. This will facilitate the traffic flow on the through lanes. For undivided roadways, the application of the left-turn lane taper results in a deflection of the through traffic lanes. However, this can be minimized or softened by the use of flat curves at the beginning and end of tapers.

The following elements of a left-turn design are defined in **Section 9.14.1**:

- Approach taper (see **Section 9.17.3** for length)
- Departure taper (see **Section 9.17.3** for length)
- Bay taper (see **Section 9.17.4** for the single left-turn lane)
- Auxiliary lane (for lane widths, see **Chapter 4**; for length, see **Section 9.17.3**)

For other left-turn elements of design refer to the following sections

- Left turn slip around (**Section 9.17.4.9**)
- Two-way-left-turn lane (**Section 8.6** in **Chapter 8**)
- Divisional islands (**Section 9.15.8**.).

9.17.2 GUIDELINES FOR THE APPLICATION OF LEFT-TURN LANES

The left-turn lane requirements for two-lane and four-lane divided and undivided roadways are based on volume warrants and collision warrants.

9.17.2.1 Volume Warrants

Volume warrants for left turns are typically based on capacity analysis. When opposing traffic volumes are such that left-turning vehicles must wait for a gap to make their turn, they interfere with the through traffic. The magnitude of this interference depends on the opposing volume, the advancing volume, and the percentage of left-turning vehicles. When traffic signals are warranted, storage lengths are subject to the signal cycle timing.

9.17.2.2 Safety Warrants

A left-turn storage lane may also be considered at locations where four or more collisions related to left turns occur per year, or where six or more occur within a period of two years, provided the collisions are of a type that could reasonably be expected to be eliminated by providing a left-turn lane. The minimum storage length for the collision warrant is 15 m.

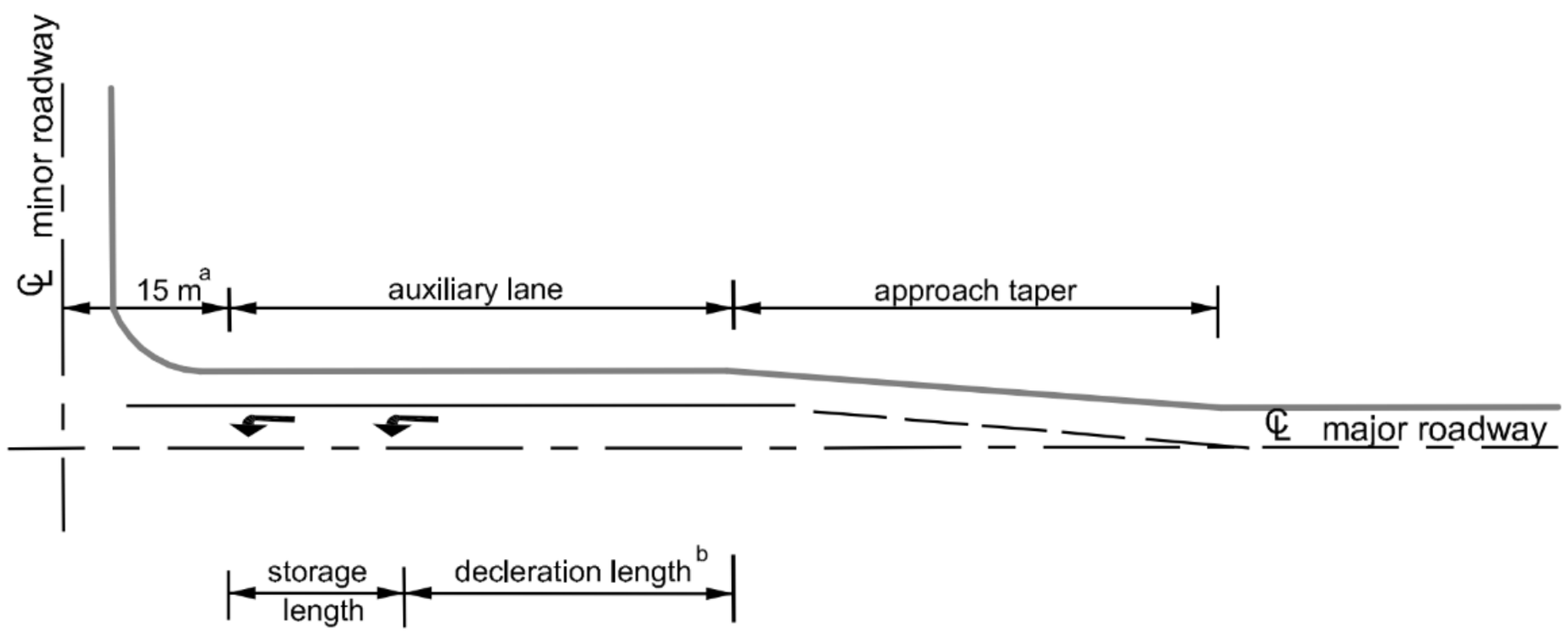
9.17.3 APPROACH AND DEPARTURE TAPERS

For flared intersections along undivided roadways, approach and departure tapers are needed to laterally shift the through lanes and provide the width needed for the left-turn lane and channelization, if applicable. **Figure 9.17.1** provides an example of a typical design.

Appropriate taper lengths are determined based on design speed and the desired lateral shift. **Table 9.17.1** presents a design domain for approach and departure taper ratios. The lower end of the range would be more appropriate for constrained urban conditions or for intersection retrofits where space is restricted. The higher end of the taper ratios would be appropriate for less constrained, rural conditions.

The tapers can be made smooth by using horizontal curves at the beginning and end of transitions. The radii of the horizontal curves typically vary from about 500 m for tapers at a design speed of 50 km/h, to 3,000 m for tapers at a design speed of 120 km/h.

Where space to develop tapers is limited, the taper length could also be based on running speed rather than design speed. Gradual approach and departure tapers are particularly important for the higher design speeds. It is also desirable to provide decision sight distance for the taper areas to enhance safe operation. Combinations of minimum sight distance and minimum taper ratios should be avoided.



Notes: a. 15 m is the assumed distance from minor roadway centreline to auxiliary lane.
b. In a constrained urban environment, deceleration may occur over taper length.
c. Terms also apply to divided roadways.

Figure 9.17.1: Left-Turn Lane, Pictorial Description of Terms

Table 9.17.1: Approach and Departure Taper Ratios and Lengths for Left Turns at Intersections

Design Speed (km/h)	Design Domain for Taper Ratio	Horizontal Curve to Smooth Taper R (m)
50	8:1 – 30:1	500
60	15:1 – 36:1	750
70	15:1 – 42:1	1,000
80	15:1 – 48:1	1,200
90	27:1 – 54:1	1,500
100	30:1 – 60:1	2,000
110	33:1 – 66:1	2,500
120	36:1 – 72:1	3,000

9.17.4 SINGLE LEFT-TURN LANE

The left-turn lane can be developed:

- On the right of the roadway centreline
- On the left of the roadway centreline
- Centred on the roadway centreline.

The left-turn lane designed on the right of the roadway centreline is the preferred type. The bypass lanes for the through traffic is developed on the right or outside of the original through lane, see **Figure 9.17.2 (a)**.[96] The lengths of bypass lanes are governed by the lengths of the left-turn lanes, which in turn vary with the volume of left-turning traffic and the roadway design speed. Appropriate curves can be applied throughout the bypass lane to soften the deflection angles.

The left-turn lane designed on the left side is applicable at intersections where the restrictions to the right-of-way do not permit the construction of an additional lane on the right of the roadway centreline. A well-defined pavement marking should be applied in the left-turn run-out lane on the far side of the intersection, to deflect opposing traffic around vehicles in the left-turn lane, especially in cases of curved alignment (see **Figure 9.17.2 (b)**).

The left-turn lane designed in the middle of the roadway (centred on centreline) is acceptable where the full additional lane width on the right of the centreline cannot be accommodated. Although the through traffic is deflected by one-half of the lane width, a well-defined pavement marking should be applied in the left-turn run-out lane (see **Figure 9.17.2 (c)**).

The design illustrated in **Figure 9.17.3** should be applied only when the projected traffic flow or collision data does not indicate a need for a left-turn lane in two directions.

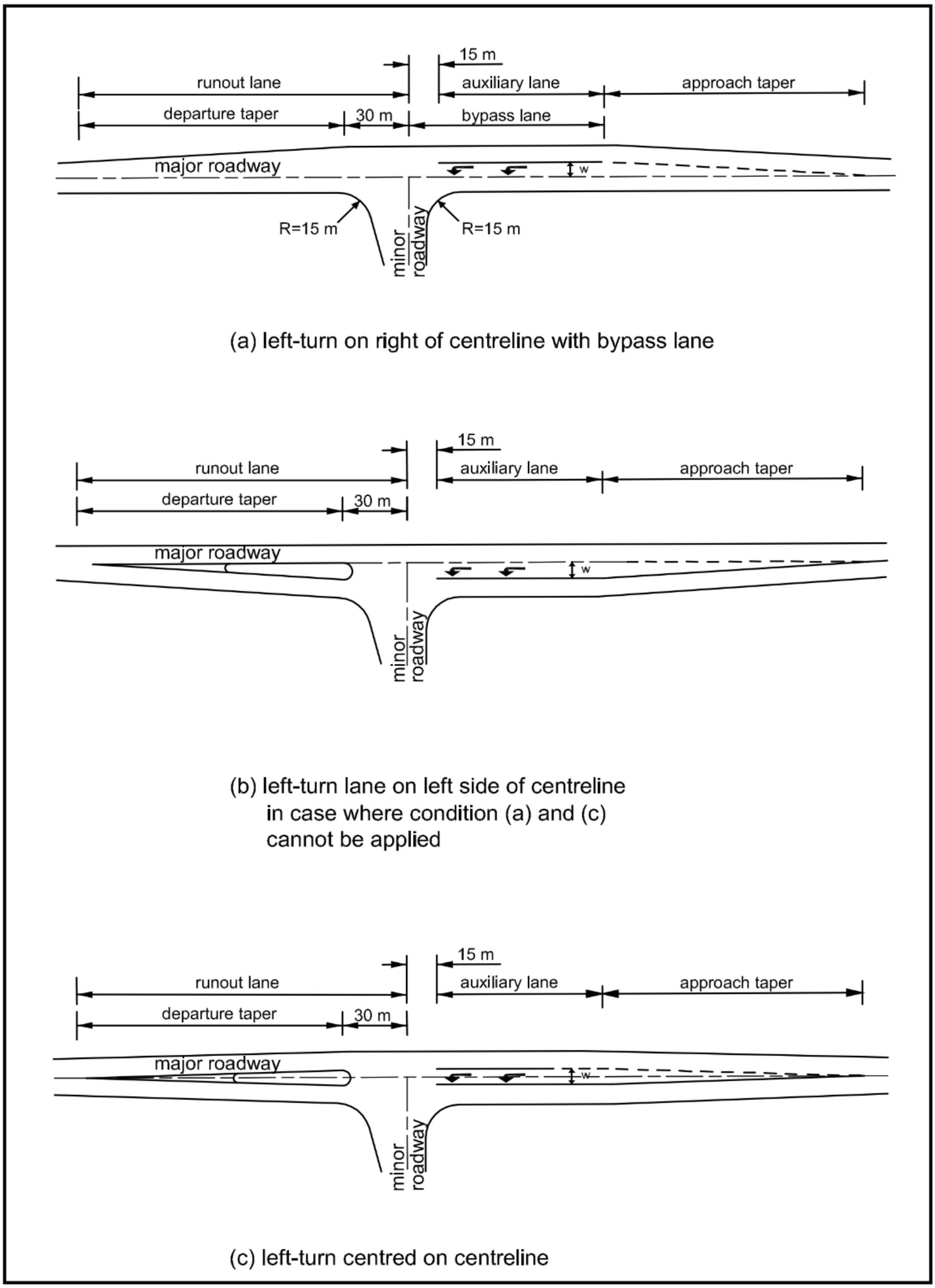


Figure 9.17.2: Left-Turn Lanes at T-Intersections

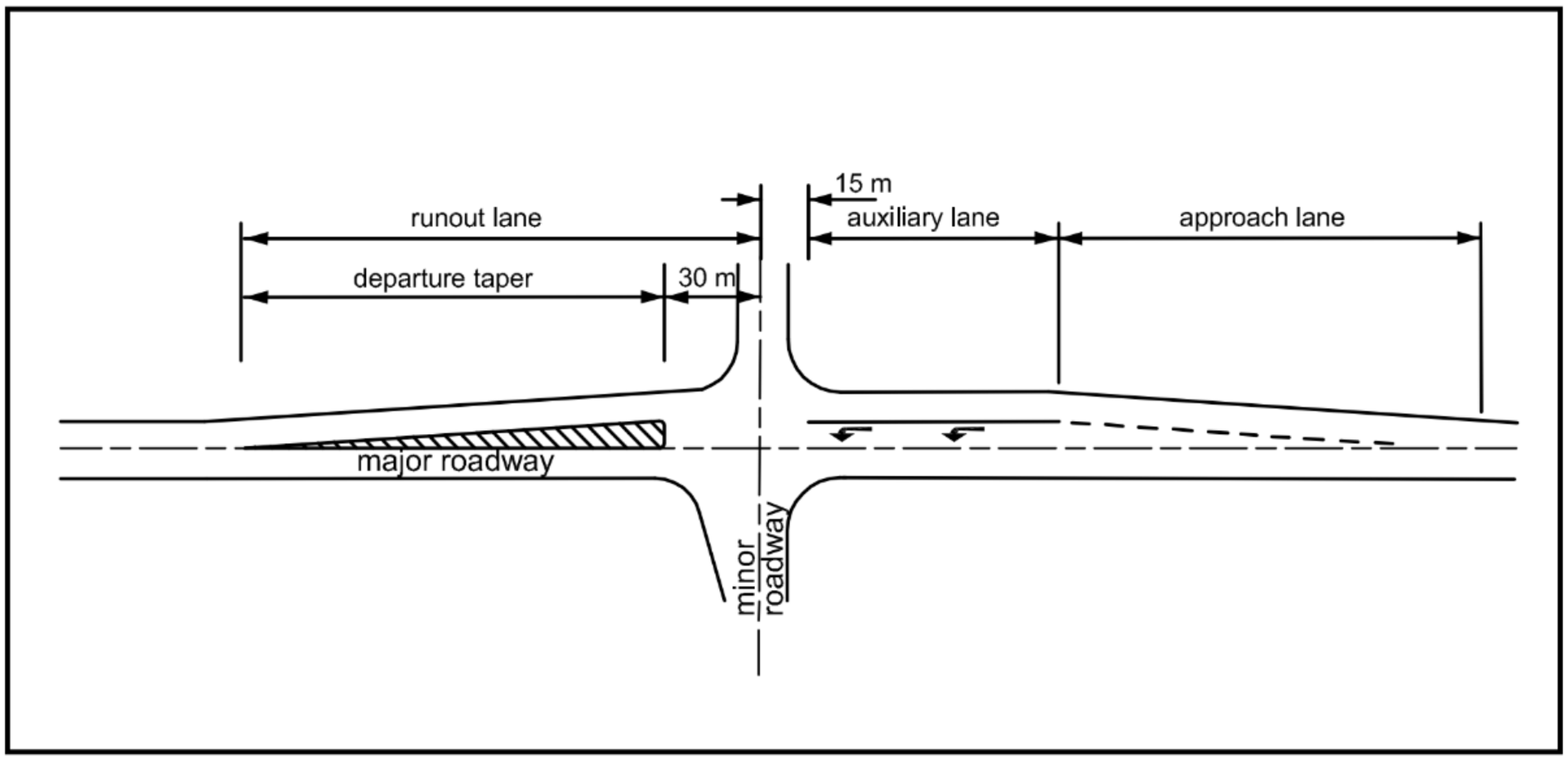


Figure 9.17.3: Left-Turn Lane at Cross-Intersection

9.17.4.1 Bay Tapers

On divided roadways, the bay taper is used to introduce the left-turn lane into the median. It is measured from the edge of the through lane at the start of the taper to the beginning of a full-width, left-turn lane at the end of the taper. This is different from the approach taper, which is used to shift the through lanes laterally to the right to provide width for a left-turn auxiliary lane.

Bay tapers can be designed as straight-line tapers or with reverse curves to smooth the alignment. Straight-line tapers generally provide a more visible definition of the transition area, and are therefore more effective than curvilinear tapers where the bay taper is defined solely with pavement markings. For tapers defined with curbs, it is common practice to use symmetrical reverse curves with a length of tangent between the two curves. **Figure 9.17.4** illustrates a bay taper utilizing the symmetrical reverse curve design.

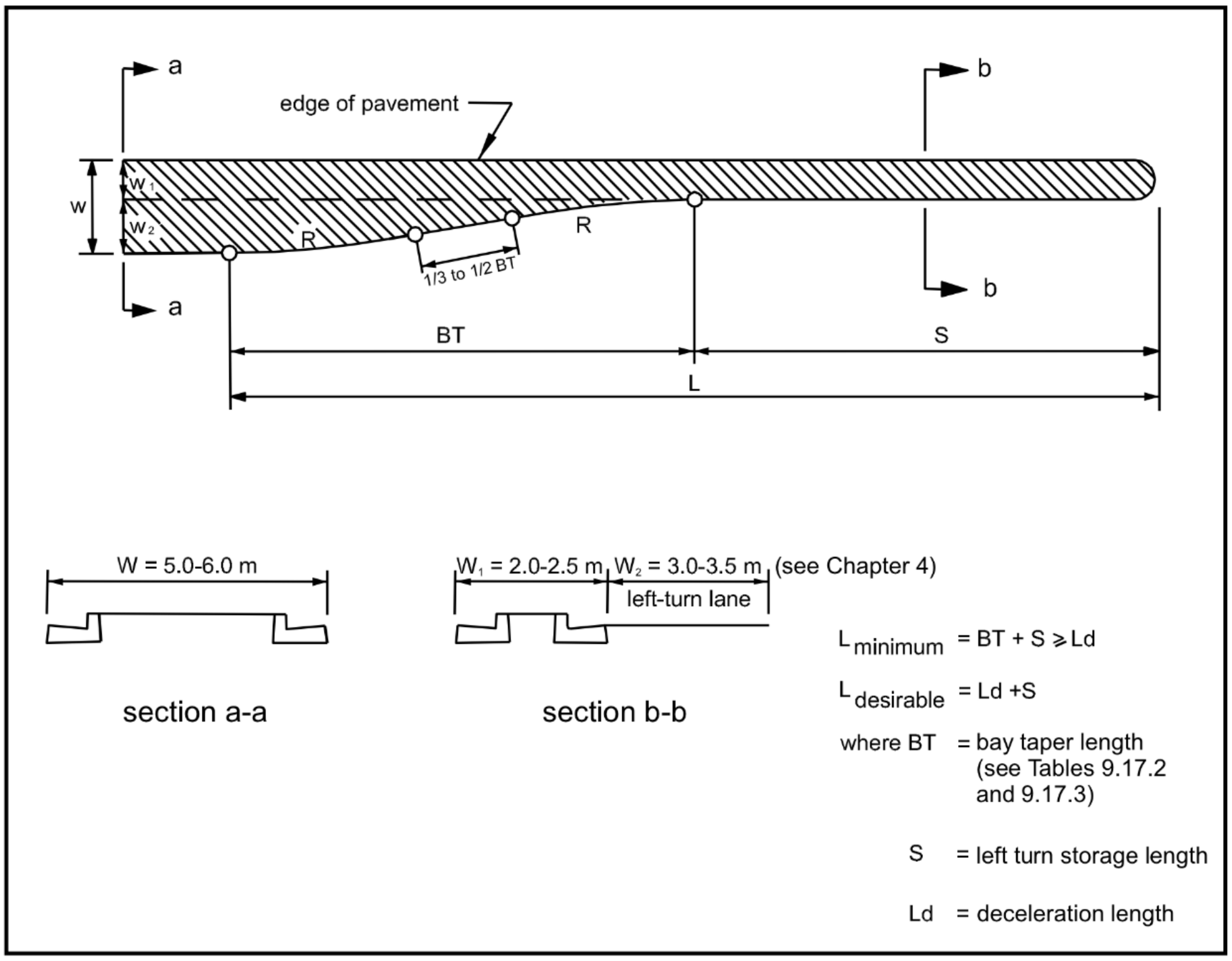


Figure 9.17.4: Left-Turn Lane and Taper with Symmetrical Reverse Curves

Bay taper designs are a function of design speed and the width of the left-turn auxiliary lane. **Table 9.17.2** provides suggested straight-line bay taper ratios for a range of design speeds. **Table 9.17.3** provides suggested taper ratios and radii for bay tapers designed using symmetrical reverse curves. Both tables are applicable to tangent main line alignments. Where the main line alignment is on curve, adjustments to the bay taper may be required.

Table 9.17.2: Bay Tapers Straight Line

Design Speed (km/h)	Taper Ratio Design Domain
50	10:1
60	10:1–12:1
70	10:1–18:1
80	13:1–20:1

Note: For higher design speeds, the 80 km/h design speed dimensions are used and the storage length is increased to provide deceleration length.

Table 9.17.3: Bay Tapers Symmetrical Reverse Curves

Design Speed (km/h)	Taper Ratio Design Domain	Radii (m)
50	10:1	90–150
60	10:1–12:1	150
70	10:1–18:1	150–220
80	13:1–20:1	150–300

Note: For higher design speeds, the 80 km/h design speed dimensions are used and the storage length is increased to provide deceleration length.

9.17.4.2 Deceleration Requirements

In the design of left-turn auxiliary lanes, it is important to consider the deceleration requirements. The minimum deceleration length is based on the distance needed for the driver to brake comfortably to come to a full stop at the intersection. Desirably, the distance needed for deceleration is provided by the auxiliary lane, exclusive of storage requirements. In urban conditions, it is often not feasible to provide both the deceleration distance and storage length due to other considerations, such as intersection spacing, access needs, and other physical controls. In these cases, the taper length may be used for deceleration distance. The deceleration distances for a range of speeds are provided in **Chapter 2**.

9.17.4.3 Storage Length

The storage length is normally designed to accommodate not only left-turning vehicles. It is also made sufficiently long so that vehicles queued in the through lanes do not block the entrance to the turning lane. As a minimum, the auxiliary lane length should be determined by checking that the storage length plus the bay taper length is equal to the deceleration length required for the design speed. Ideally, however, storage length should be provided in addition to deceleration length.

The storage length required to accommodate the left-turning vehicles depends on the number of left-turning vehicles approaching the intersection and whether or not the intersection is, or will be, signalized.

For an unsignalized intersection, storage length can be calculated using the equation outlined in Section 9.14. If the intersection is to be signalized, either initially or in the future, the turn lane provided is normally sufficiently long to store the left-turning traffic and to clear the equivalent per-lane volume of traffic stored on the through lanes, during unsaturated flow conditions. Additional storage length must be provided for larger design vehicles. The minimum storage length that should be provided is 15 m (see Section 9.17.2).

9.17.4.4 Run-out Lane

The run-out lane terminates the bypass lane on the far side of the intersection. The width of the parallel section of the run-out lane is the same as that of the bypass lane. The taper length varies with the design speed and is the same as that applied to the acceleration lane (see **Chapter 10**). The run-out lane is shown in **Figure 9.17.2** and **Figure 9.17.3**.

9.17.4.5 Left-Turn Lanes On Both Approaches

Two types of left-turn lane designs are applicable: opposing left-turn lanes (see **Figure 9.17.5 (a)**) and adjacent left-turn lanes (see **Figure 9.17.5 (b)**).

Opposing Left-Turn Lanes: The opposing left-turn lanes design is a desirable treatment for new construction of unsignalized intersections in rural areas. This configuration reduces the probability of head-on collisions as this configuration has the advantage of enabling drivers making simultaneous left turns to see past each other's vehicle; therefore, this design contributes to the ease and safety of left-turn movements. Visibility of approaching vehicles, however, can be reduced with larger vehicles in the left-turn lane. This treatment could also be applied to urban intersections where left-turn lanes are required.

Adjacent Left-Turn Lanes: The provision of adjacent left-turn lanes is not generally recommended due to the potential for collisions caused by visibility problems for left-turning vehicles. Visibility problems result from the presence of vehicles in adjacent left-turn lanes and, for this reason, such movements should generally only be used at signalized intersections with protected left turn phases. Adjacent left-turn lanes can be designed where the intersection is on or at the base of a steep down grade. The provision of an unobstructed run-out lane can help a driver avoid conflicts in adverse weather conditions when encroachment in the opposing left-turn lane may be a safety concern.[97]

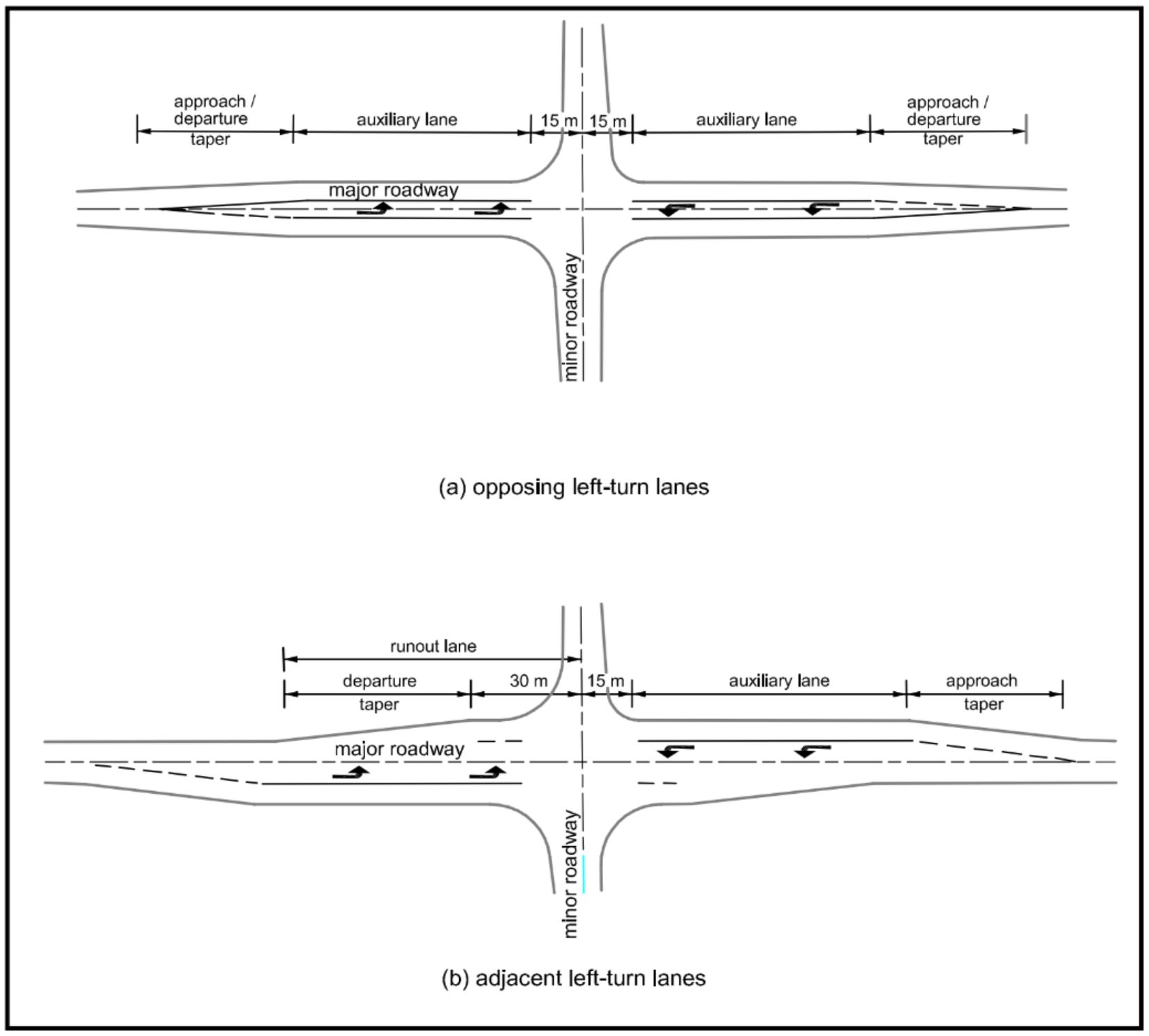


Figure 9.17.5: Left-Turn Lanes in Two Directions[98]

9.17.4.6 Partially Shadowed and Shadowed Turn Lanes

Figure 9.17.6 provides examples of minimum designs for intersections providing a left-turn area for four-lane roadways in rural areas. In these examples, the approach/departure and bay tapers are combined. This type of layout is often referred to as a partially-shadowed turn lane. In this design, deceleration of the turning vehicles is typically initiated while the vehicle is within or partially within the through lane. The turn lane area is not as well defined or protected as is a left-turn lane with a painted bay taper and/or an introduced median. Overhead signing may be desirable.

Figure 9.17.7 illustrates a left-turn lane with a painted approach and bay taper median area. The raised divisional island shown is optional but, where space permits, is desirable to assist in delineating the through and turn lanes. This type of design is commonly known as a shadowed turn lane. The design parameters in **Table 9.17.1** and **Table 9.17.2** should be used to define the geometry of a shadowed left-turn lane.

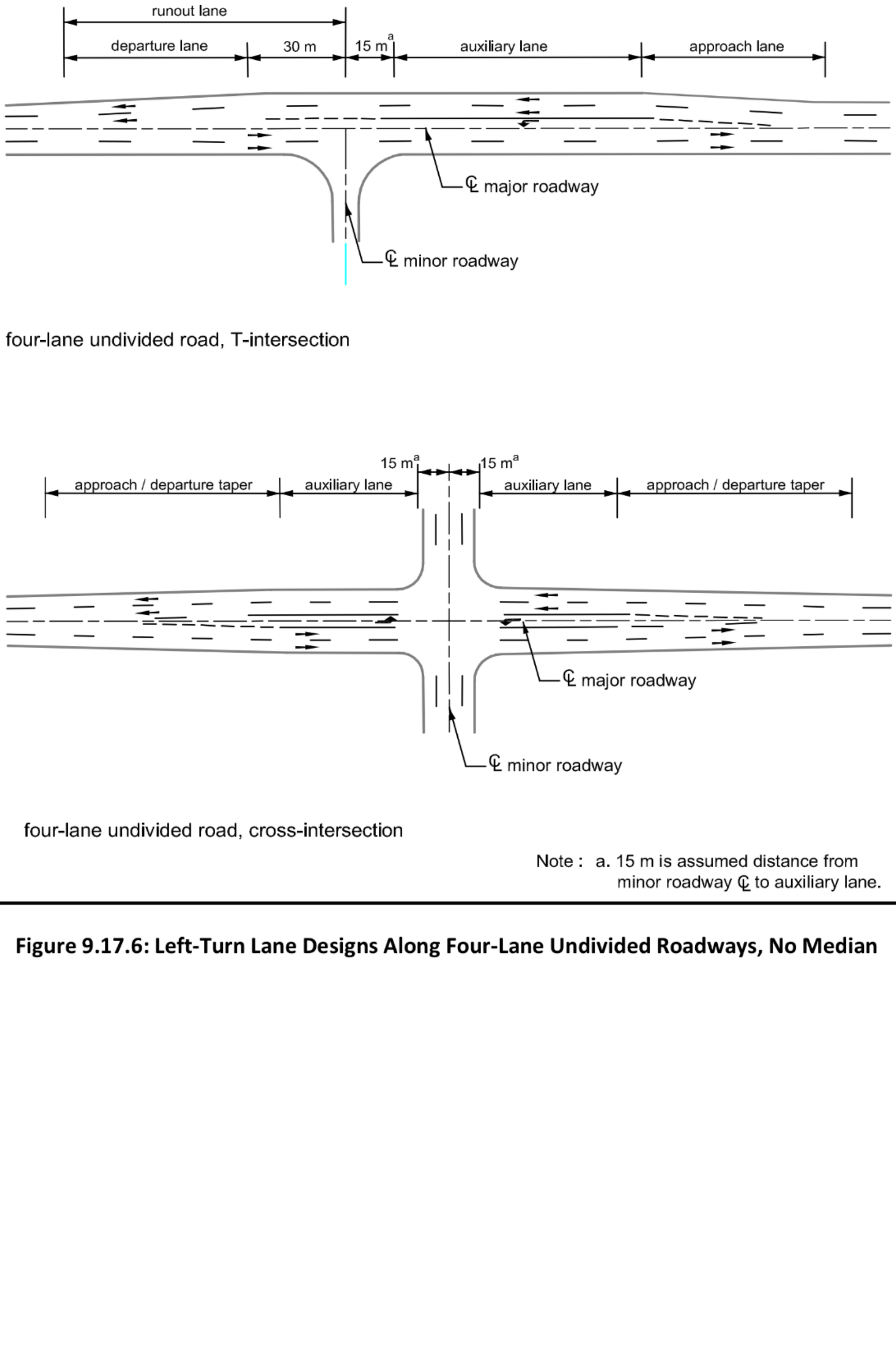


Figure 9.17.6: Left-Turn Lane Designs Along Four-Lane Undivided Roadways, No Median

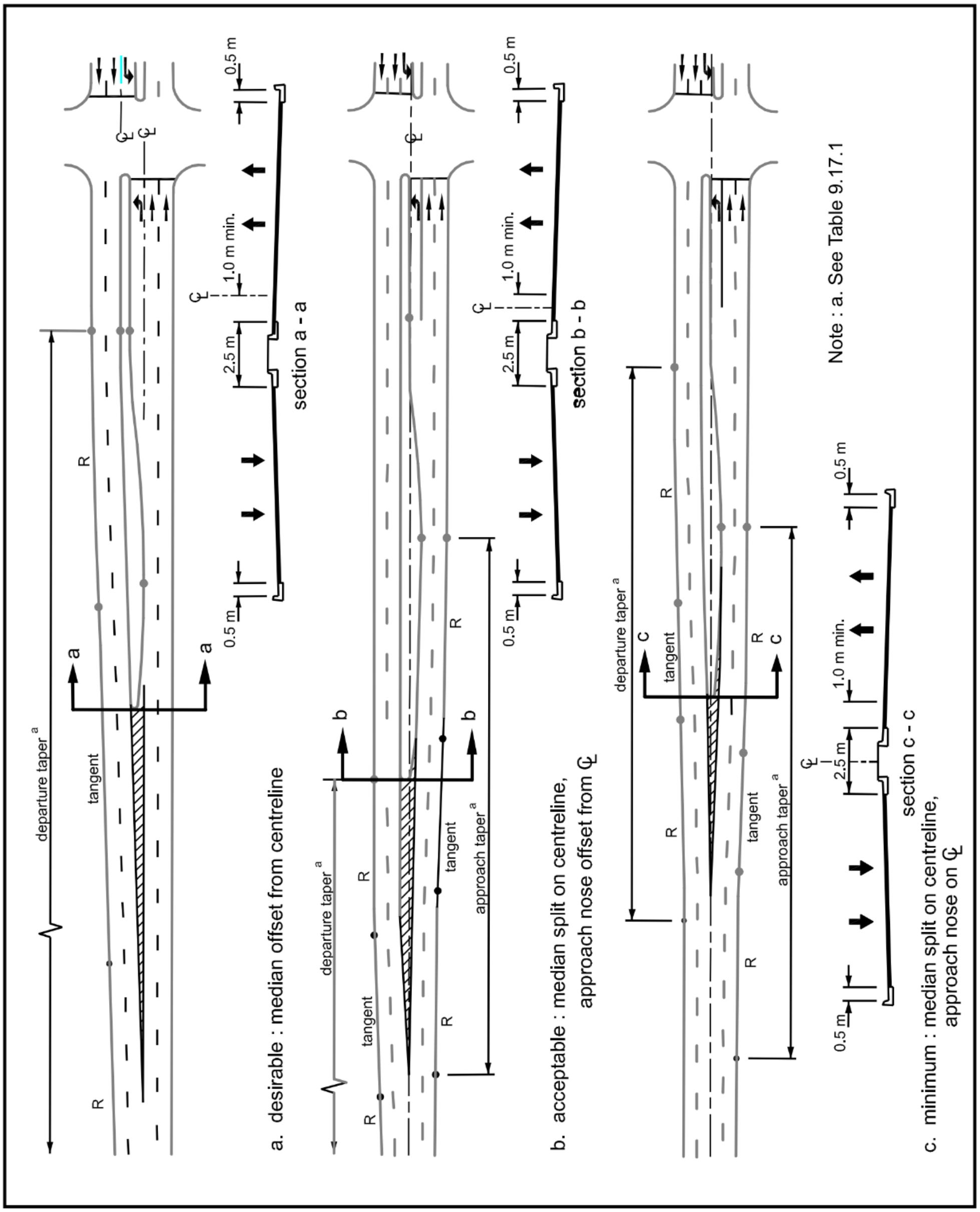


Figure 9.17.7: Introduced Raised Median

9.17.4.7 Introducing Raised Median

The ideal manner of widening the roadway to introduce a median is to widen gradually over the length of a large radius, on a main line horizontal curve. However, since most intersections occur on tangent alignments, it is often necessary to use other methods, three of which are illustrated in **Figure 9.17.7**. This figure illustrates the geometry of the approach departure tapers needed to introduce a raised median and provide a protected left-turn auxiliary lane. The lane, median, and gutter widths shown are typical and vary in accordance with cross section requirements.

The raised median, protecting the left-turn area, is effective in clearly defining the through vehicle paths and the left-turn storage area in all weather conditions. Also, if accesses exist near the intersection, the raised median reduces the type and number of turning-vehicle conflicts within the zone of the intersection. However, in instances where the length available for the left-turn auxiliary lane may not be sufficient to store all the left-turn vehicles during peak periods, it is advantageous to use a painted rather than a raised median area in advance of the left-turn lane. In this case, the painted median area can be used to provide additional storage during occasional peak traffic periods, reducing the problem of left-turning vehicles blocking the through lanes.

The approach and departure taper designs are a function of the design speed of the roadway. For high-speed roads (design speeds > 70 km/h), the importance of using a gradual taper cannot be over emphasized. Refer to **Table 9.17.1** for approach and departure taper geometry with design speed.

The characteristics of each of the three methods of introducing a median, as shown in **Figure 9.17.7**, are described in the following paragraphs.

- **Method "A"** illustrates the geometry for a median introduced totally to the left of the roadway centreline. A lateral shift is not required for the traffic approaching the intersection. For this condition to occur on both approaches to a single intersection, the centrelines of the approach roadways must be offset from each other. Although this is a desirable means of introducing a median, it is a rare case, occurring only where excess right-of-way is available, where the roadways are not centred within the right-of-way, or where the rights-of-way are offset appropriately across the intersection. In this method, only the lanes leaving the intersection are required to taper back to the normal undivided roadway cross section. To minimize the median length, the departure taper typically commences at the beginning of the parallel lane portion of the left-turn lane.
- **Method "B"** shows the centreline continuous through the intersection and the roadway widened symmetrically. In this method, the departure taper is continued beyond the approach taper, enabling the nose of the introduced median to be on the left side of the roadway centreline on the approach. The geometry results in a longer median length than that created by methods "A" or "C".
- **Method "C"** is similar to method "B" in that the roadway is widened symmetrically about the centreline. To reduce the median length, the departure taper commences near the beginning of the parallel lane portion of the left-turn lane. The approach nose to the median is centred on the roadway centreline.

9.17.4.8 Divided Roadway

Figure 9.17.8 illustrates a typical layout of a left-turn lane and a right-turn lane along a divided roadway. The right-turn lane layout is also applicable to undivided roadways.

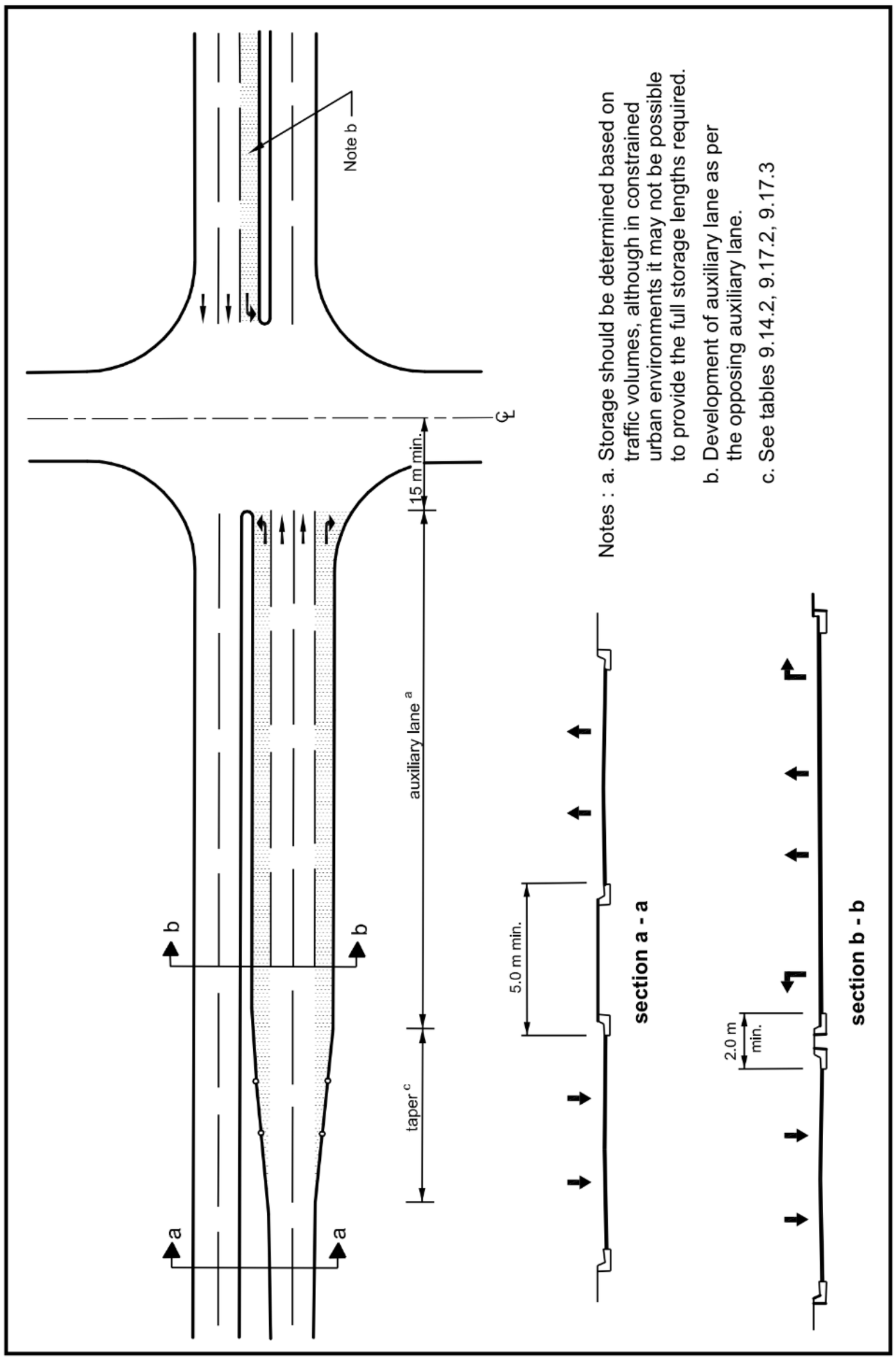


Figure 9.17.8: Turning Lane Design, Raised Median

9.17.4.9 Left-Turn Slip-Around Treatment at T-Intersections

A left-turn slip-around can be introduced on a two-lane roadway at T-intersections under the following conditions:

- Where the left-turning volumes do not warrant a full left-turn lane but are sufficient to potentially affect through traffic
- Where through vehicles bypassing occasional left-turning vehicles throw gravel from the shoulder onto the roadway

The slip-around design includes an auxiliary lane and tapers at each end, as shown in **Figure 9.17.9**.[99] See **Section 9.17.3** for taper lengths. Usually the slip-around design is not applied on four-lane undivided roadways; however, where the left-turn lane is not warranted and turning vehicles impede the through traffic, the slip-around has its merit.

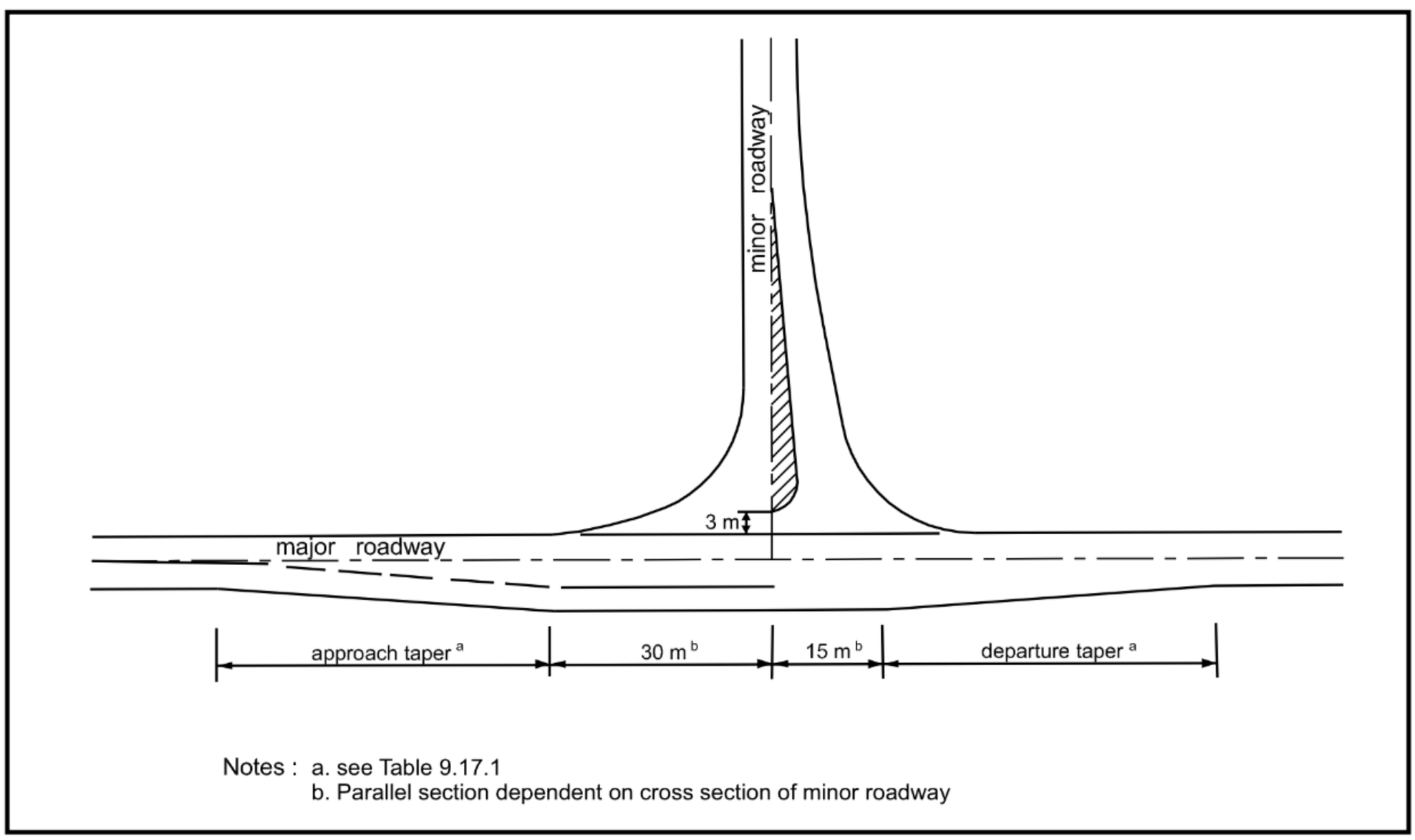


Figure 9.17.9: Left-Turn Slip Around Design – Tangent Alignment

9.17.4.10 Left-Turn Lane Design on Minor Road

It is undesirable to have a two-lane entry from the minor roadway to the main roadway with stop control, except at certain low-speed urban locations. The possibility of an adjacent standing vehicle blocking the vision of a driver preparing to enter the major roadway may create an unsafe situation.

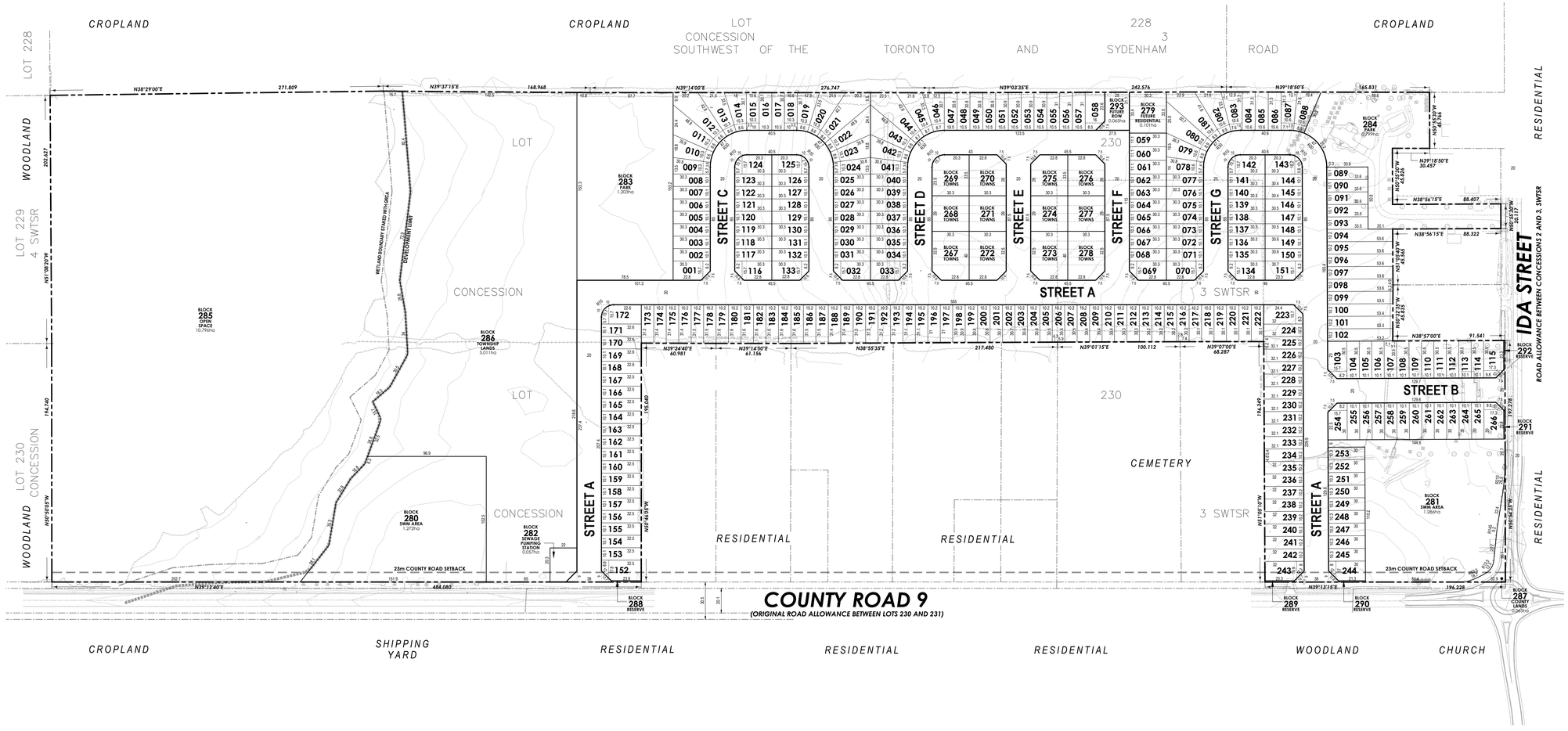
Signalization should be considered for intersections with two-lane entry on the minor road. If signal warrants are not met, the intersection should be designed for one-lane entry only.[100]

9.17.4.11 Left-Turn Lanes for Four-Lane and Six-Lane Roadways

The method chosen to accommodate the left turns from the centre lane is normally used uniformly along a road to avoid driver confusion. Where accesses to adjacent developments are spaced sufficiently, back-to-back painted left-turn lanes may be considered in the centre lane. **Figure 9.17.10** illustrates typical painted left-turn lanes within a four-lane cross section. The same concept may be applied to a six-lane cross section.

Typical left-turn lane design for four-lane undivided roadways is illustrated in **Figure 9.17.11** and **Figure 9.17.12**. This design is applied at T-intersections, and also at cross-intersections, where the opposing left-turn lane design is utilized, providing that the horizontal alignment within the area is on tangent. The deceleration lane length is the same as for two-lane roadways.

FIGURES



LAND USE SUMMARY

LAND USE	LOT / BLOCK #	UNITS	AREA
SINGLE DETACHED - 10.1m LOTS	001-266	266	9.454ha
TOWNHOUSE - 6.5m UNITS	267-278	52	1.218ha
FUTURE RESIDENTIAL	279	3	0.101ha
STORMWATER MANAGEMENT AREA	280, 281		2.558ha
SEWAGE PUMPING STATION	282		0.057ha
PARK	283, 284		2.002ha
OPEN SPACE	285		10.796ha
TOWNSHIP LANDS	286		5.011ha
COUNTY LANDS	287		0.065ha
0.3m RESERVE	288-292		0.003ha
FUTURE RIGHT OF WAY	293		0.065ha
RIGHT OF WAY	A, B, C, D, E, F, G		4.610ha
TOTALS		321	35.940ha

LEGAL DESCRIPTION

PART OF LOTS 229 AND 230
CONCESSION 3, SOUTHWEST OF THE TORONTO AND SYDENHAM ROAD
GEOGRAPHIC TOWNSHIP OF PROTON
TOWNSHIP OF SOUTHGATE
COUNTY OF GREY

OWNER'S CERTIFICATE

I HEREBY AUTHORIZE MACNAUGHTON HERMSEN BRITTON CLARKSON PLANNING LIMITED TO SUBMIT THIS PLAN FOR APPROVAL.

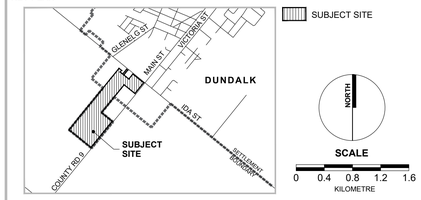
DATE: _____ _____

SURVEYOR'S CERTIFICATE

I HEREBY CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ON THIS PLAN AND THEIR RELATIONSHIP TO THE ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: _____ _____

KEY PLAN



LEGEND

- PROJECT BOUNDARY LINE
- RIGHT OF WAY LINE
- BLOCK LINE
- LOT LINE
- PARCEL FABRIC

REVISION No.	DATE	ISSUED / REVISION	BY

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT R.S.O. 1990 C.P.13 AS AMENDED

- **A.** AS SHOWN
- **B.** AS SHOWN
- **C.** AS SHOWN
- **D.** 321 SINGLE RESIDENTIAL LOTS
- **E.** AS SHOWN
- **F.** AS SHOWN
- **G.** AS SHOWN
- **H.** MUNICIPAL WATER SUPPLY
- **I.** SANDY SILT/SILTY SAND DEPOSITS WITH LOCALIZED SAND LAYERS
- **J.** AS SHOWN
- **K.** ALL SERVICES AS REQUIRED (WATER, SANITARY, STORMWATER, HYDRO)
- **L.** AS SHOWN

MHBC PLANNING URBAN DESIGN & LANDSCAPE ARCHITECTURE
113 COLLIER STREET, BARRIE, ON, L4M 1H2 | P: 705.728.0045 | WWW.MHBCPLAN.COM

STAMP

DATE	APR. 30, 2024
FILE No.	15184AC
SCALE	1:1,800 (ARCH D)
DRAWN BY	M.M.
CHECKED BY	K.C.
OTHER	

PROJECT

FLATO IDA
FLATO IDA DUNDALK INC.
3621 HIGHWAY 7 EAST, SUITE 503
MARKHAM, ON L3R 0G6
P:(905) 479-9292 F:(905) 429-9165
WWW.FLATOGROUP.COM

NORTH

FILE NAME
DRAFT
PLAN OF SUBDIVISION

DWG No. 1 of 1

SCALE BAR
0 9 18 27 36 45 60 90 135 180m
MEASUREMENTS SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048

N:\Southgate\752212 Ida Street, Dundalk – 15184AC\Drawings\Draft Plan\CAD\15184AC – Draft Plan – 2024-04-30.dwg

NTS

Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign

Ida Street

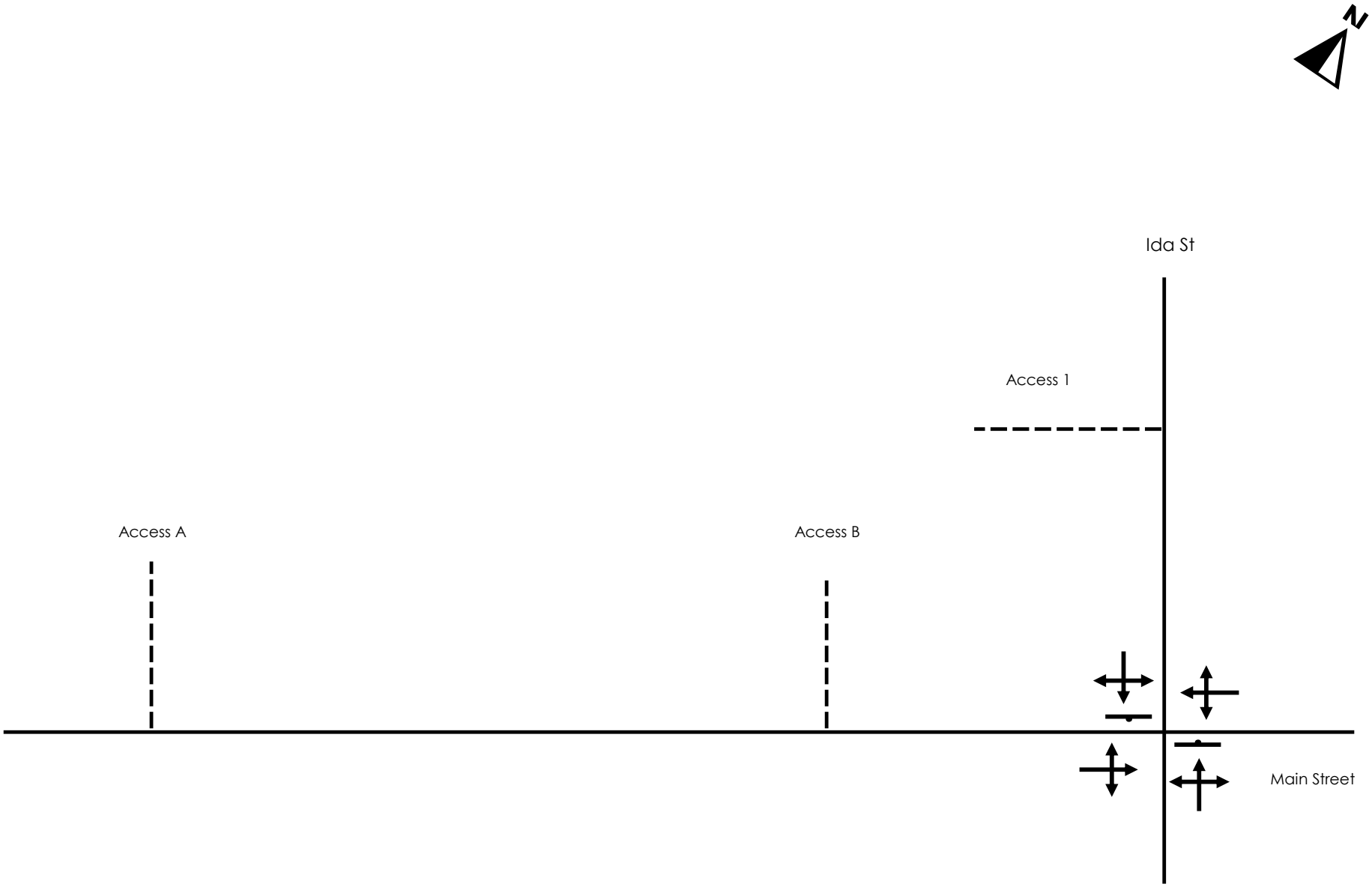
Site Location Plan

CROZIER CONSULTING ENGINEERS

Figure 2

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign

Ida Street

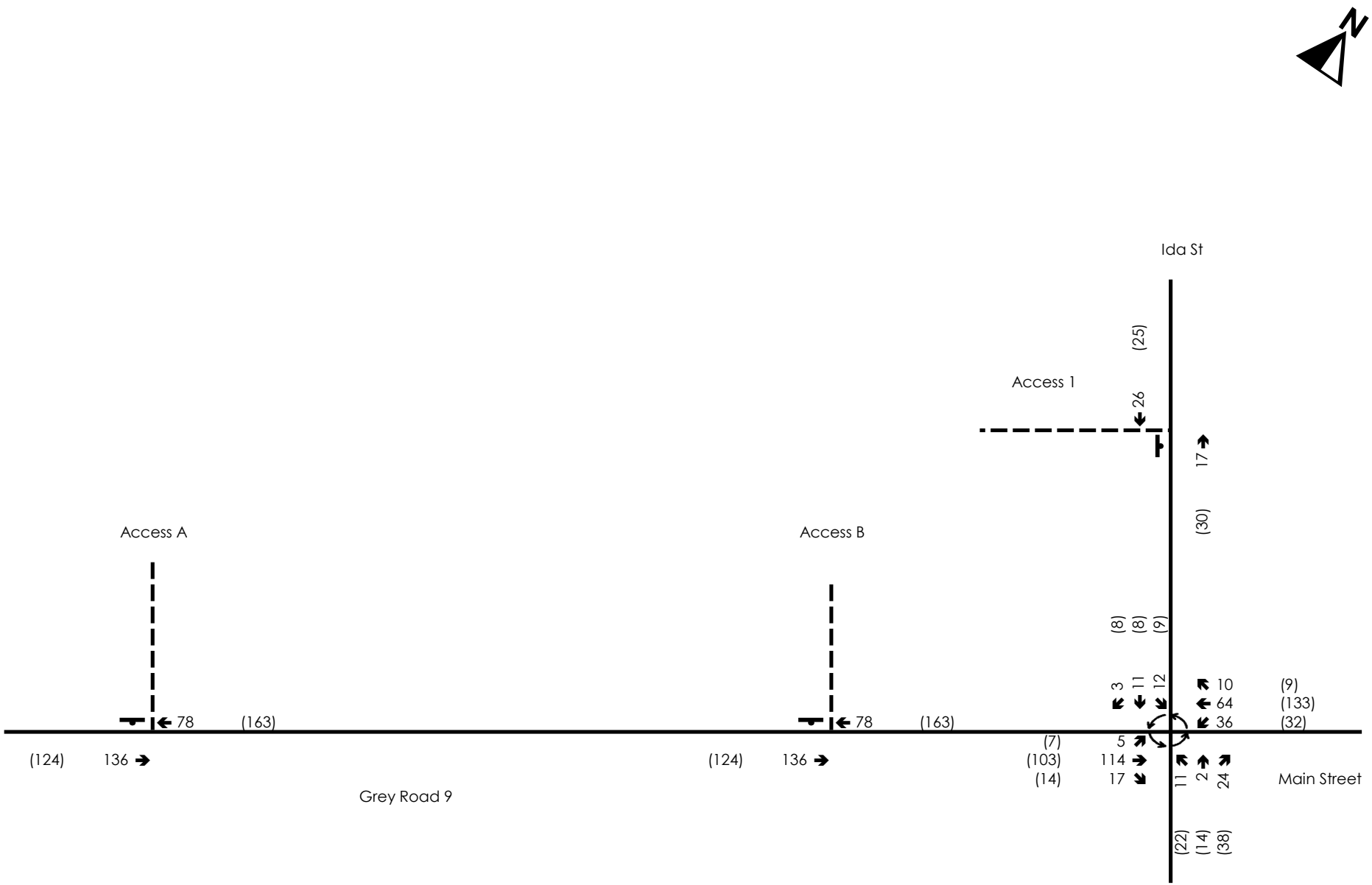
Existing Traffic Control and Lane Configuration

CROZIER CONSULTING ENGINEERS

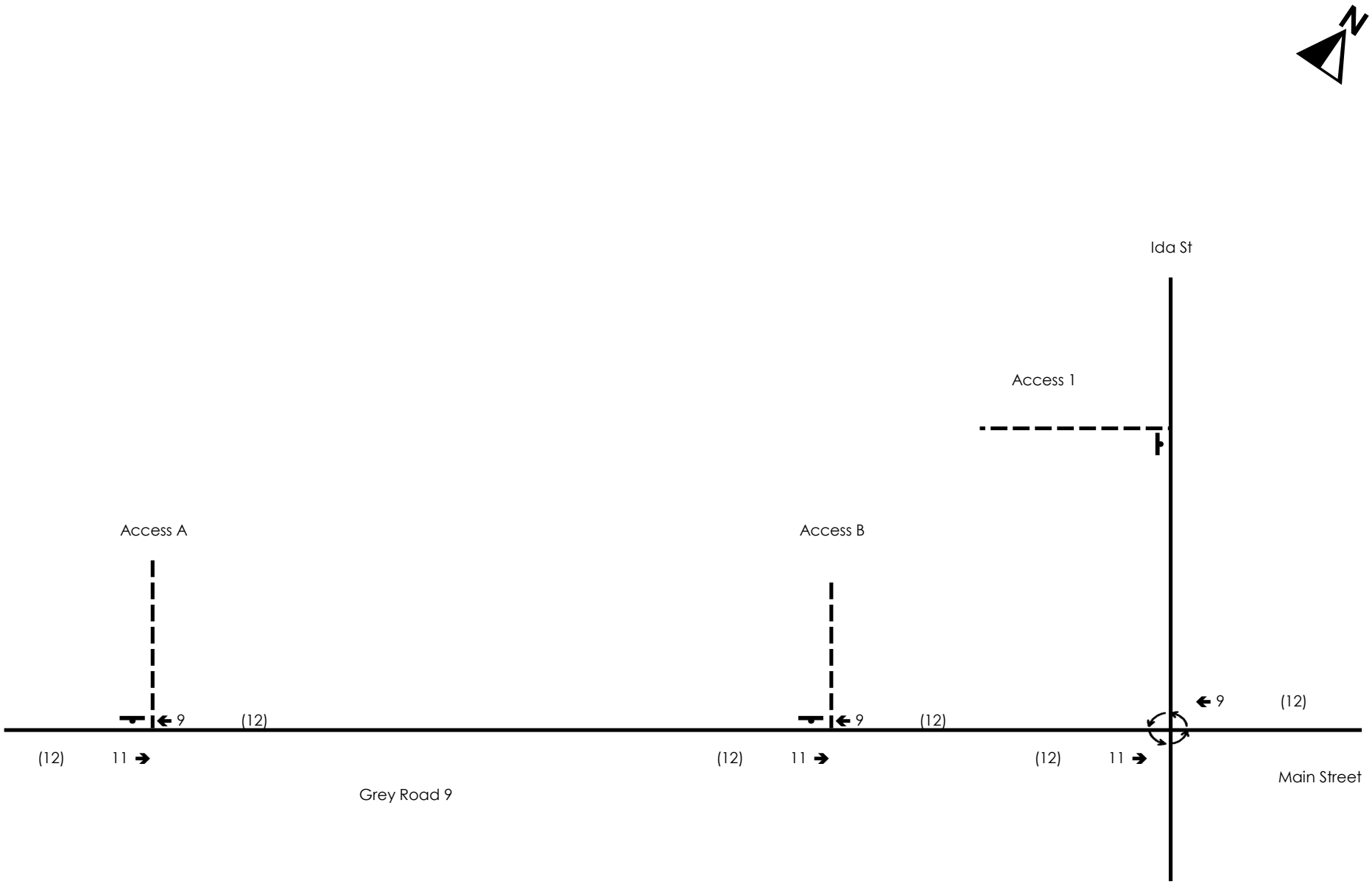
Figure 3

Project No. 1060-5590

Date. 2024/05/29



Legend	Ida Street		Figure 4
xx A.M. Peak Hour Traffic Volumes (xx) P.M. Peak Hour Traffic Volumes Stop sign Roundabout	2022 Existing Volumes	CROZIER CONSULTING ENGINEERS	Project No. 1060-5590 Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

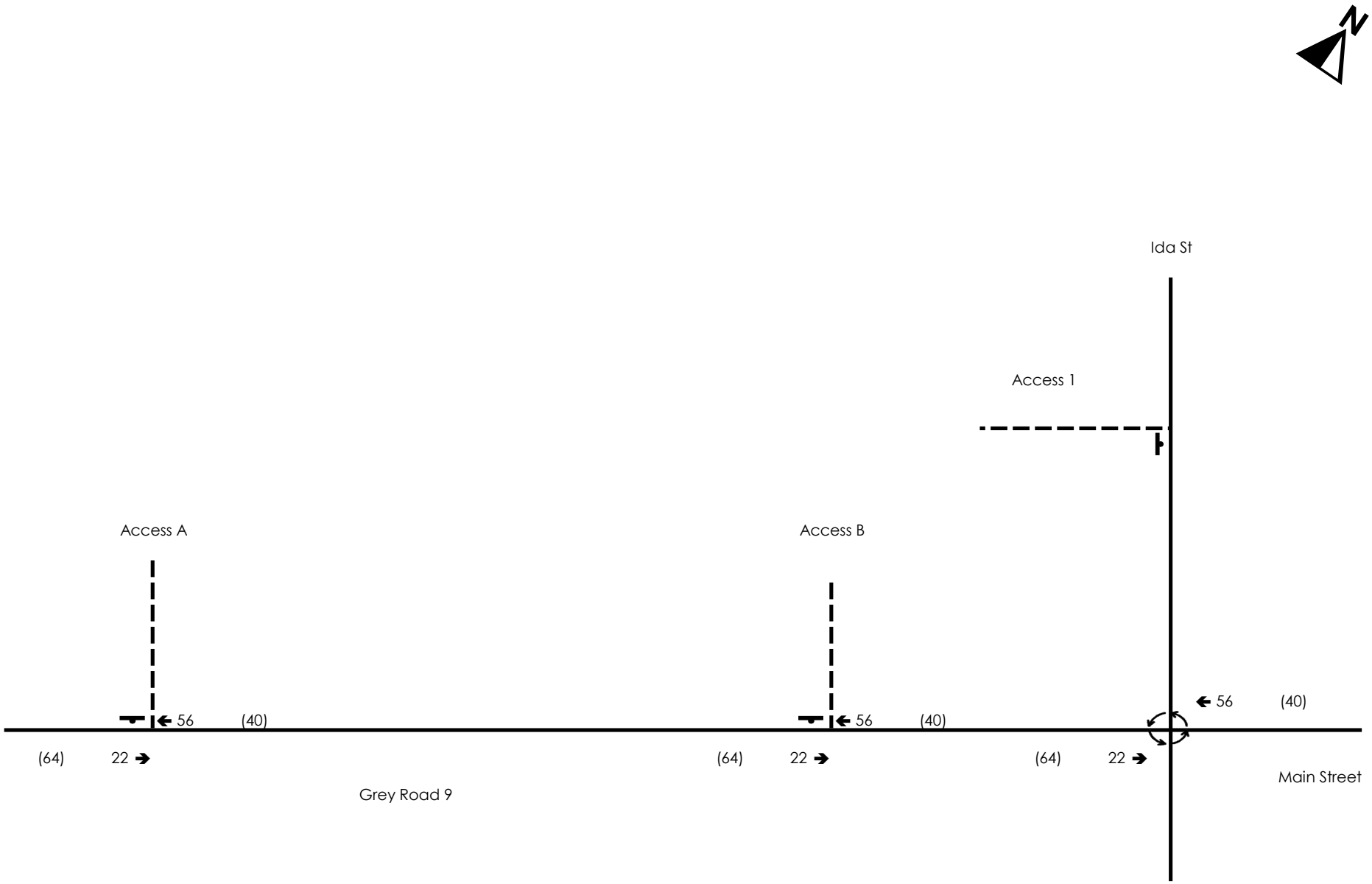
Edgewood Greens Commercial

CROZIER CONSULTING ENGINEERS

Figure 5

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

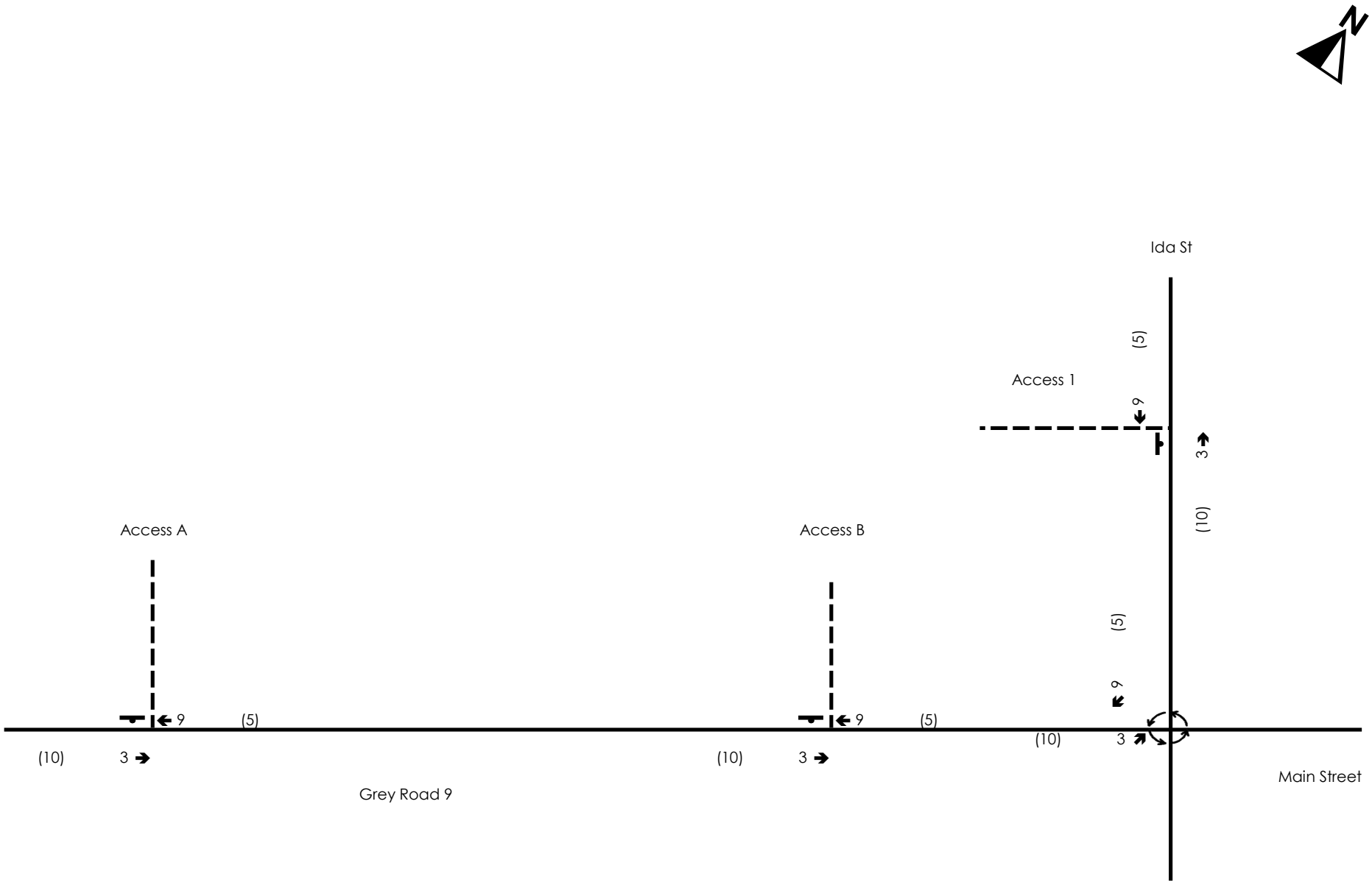
Edgewood Greens Residential

CROZIER CONSULTING ENGINEERS

Figure 6

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

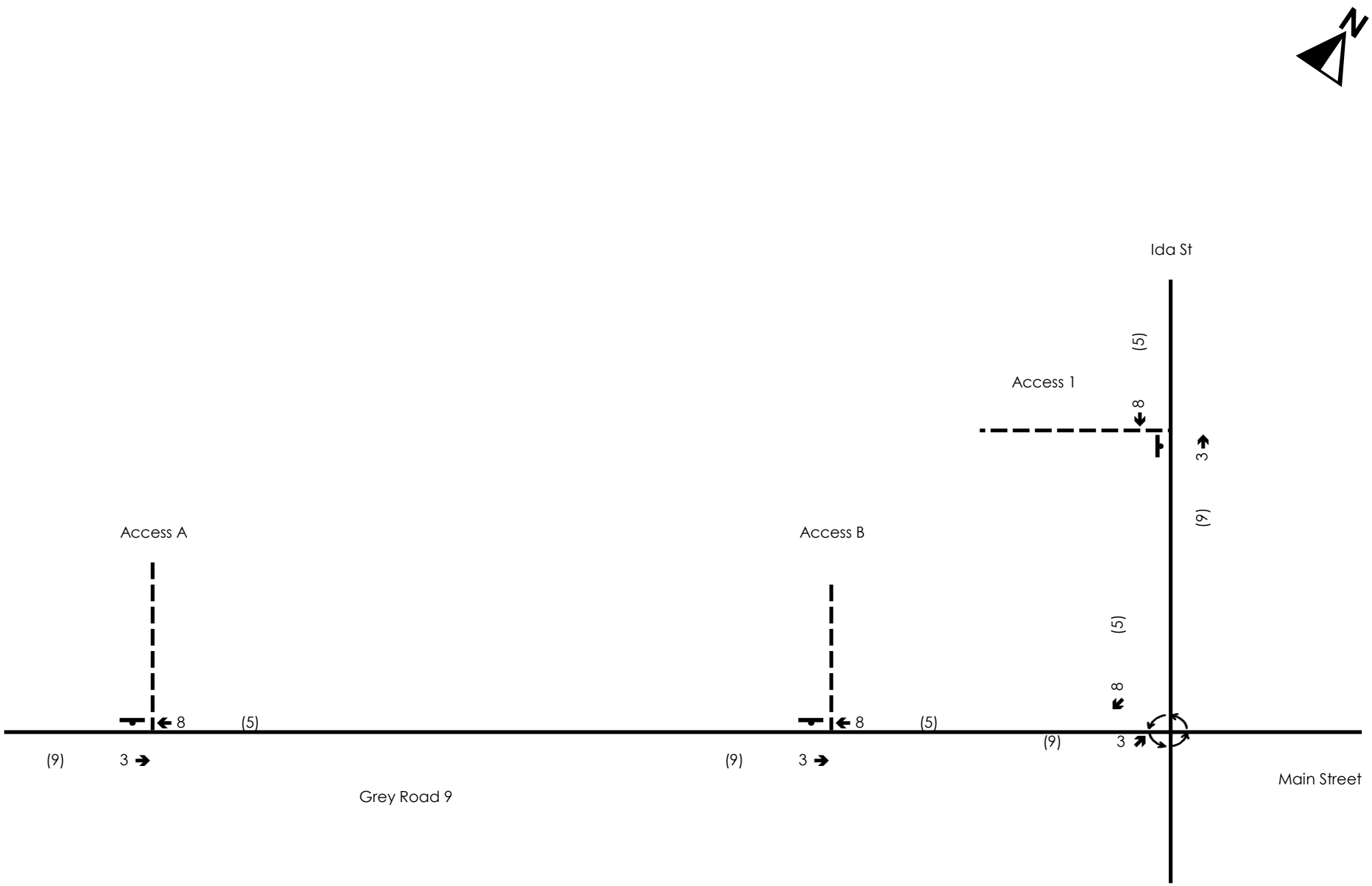
Glenelg Phase 1

CROZIER CONSULTING ENGINEERS

Figure 7

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

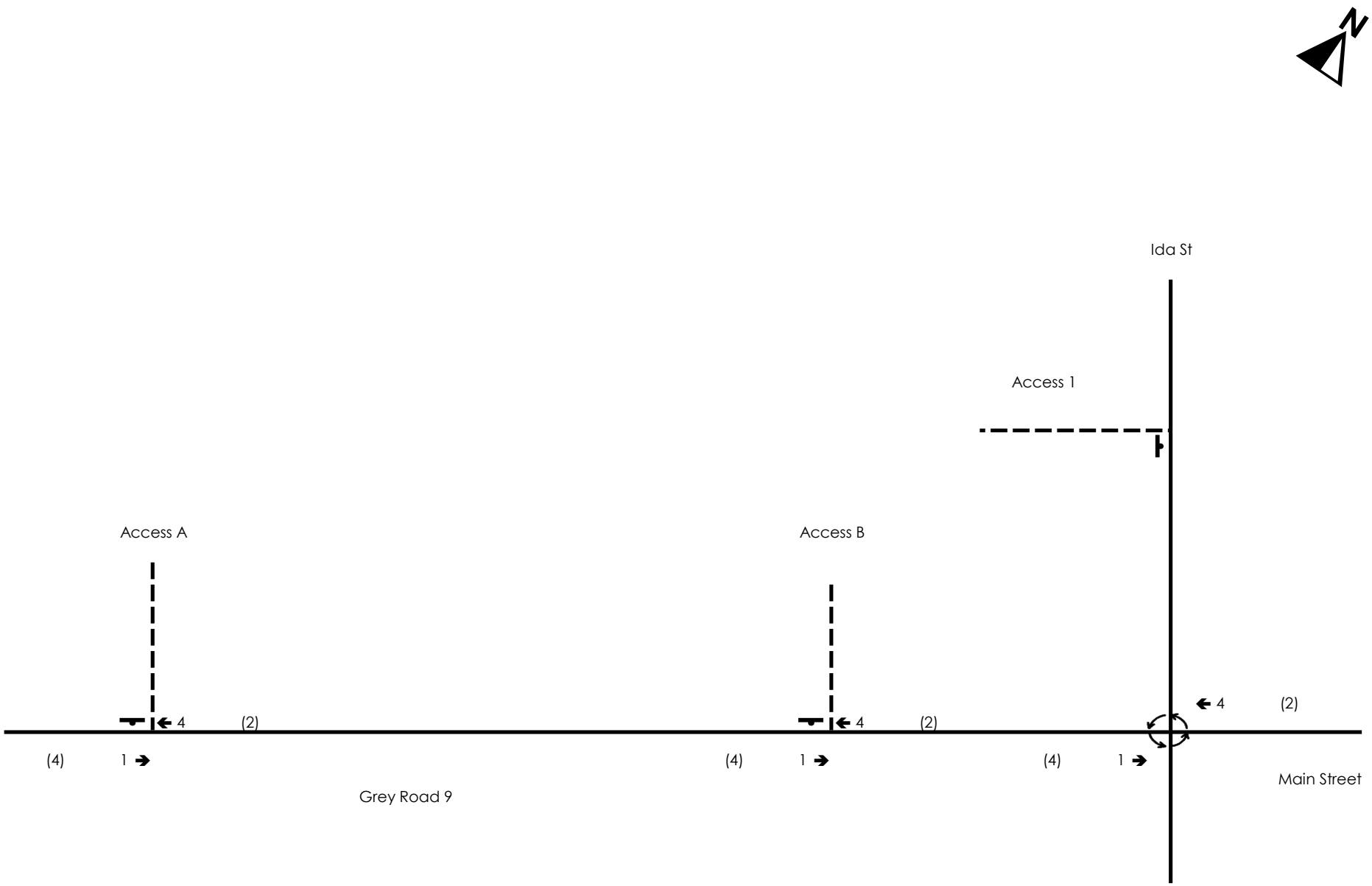
Glenelg Phase 2

CROZIER CONSULTING ENGINEERS

Figure 8

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

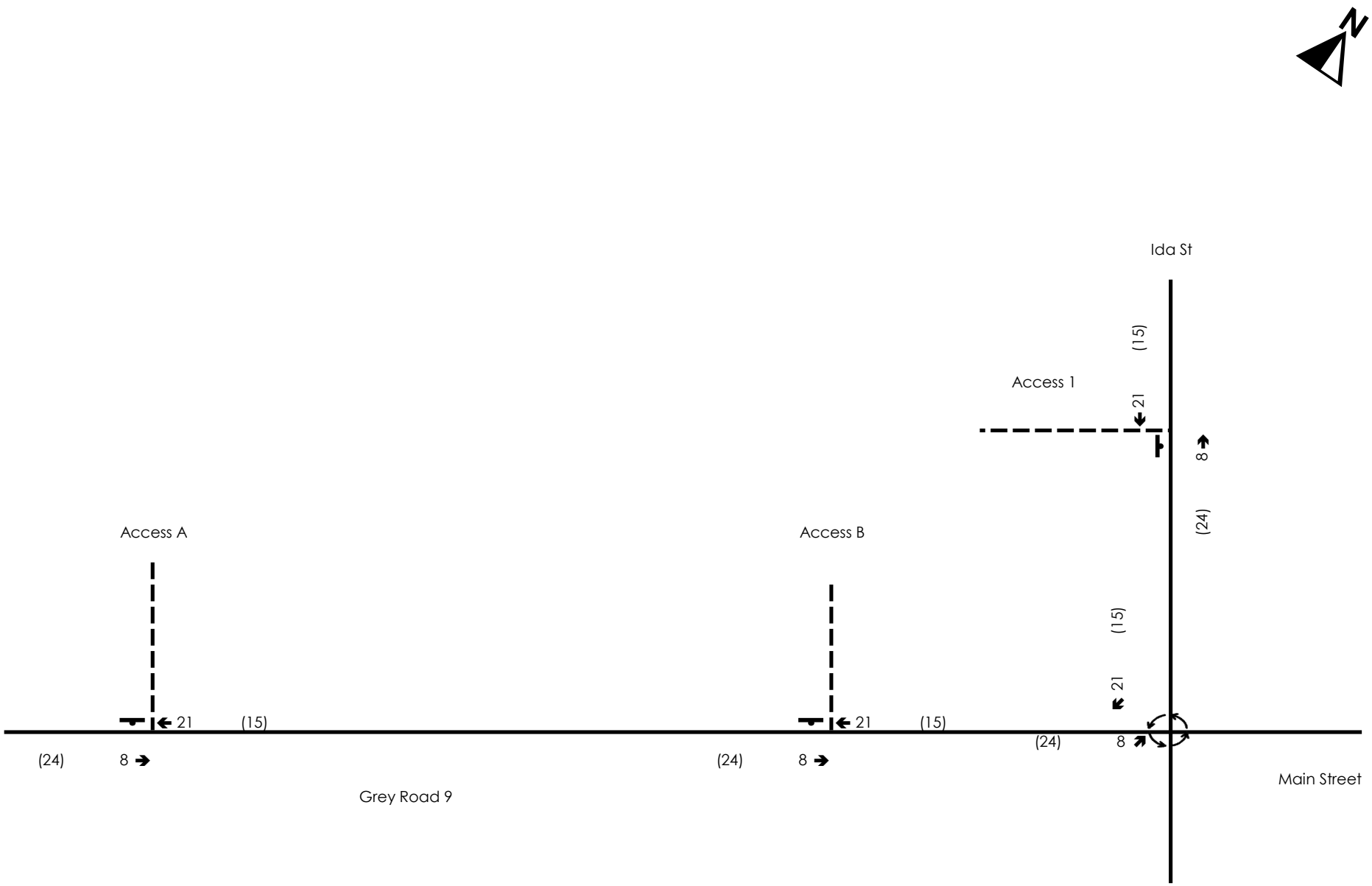
White Rose Park

CROZIER CONSULTING ENGINEERS

Figure 9

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

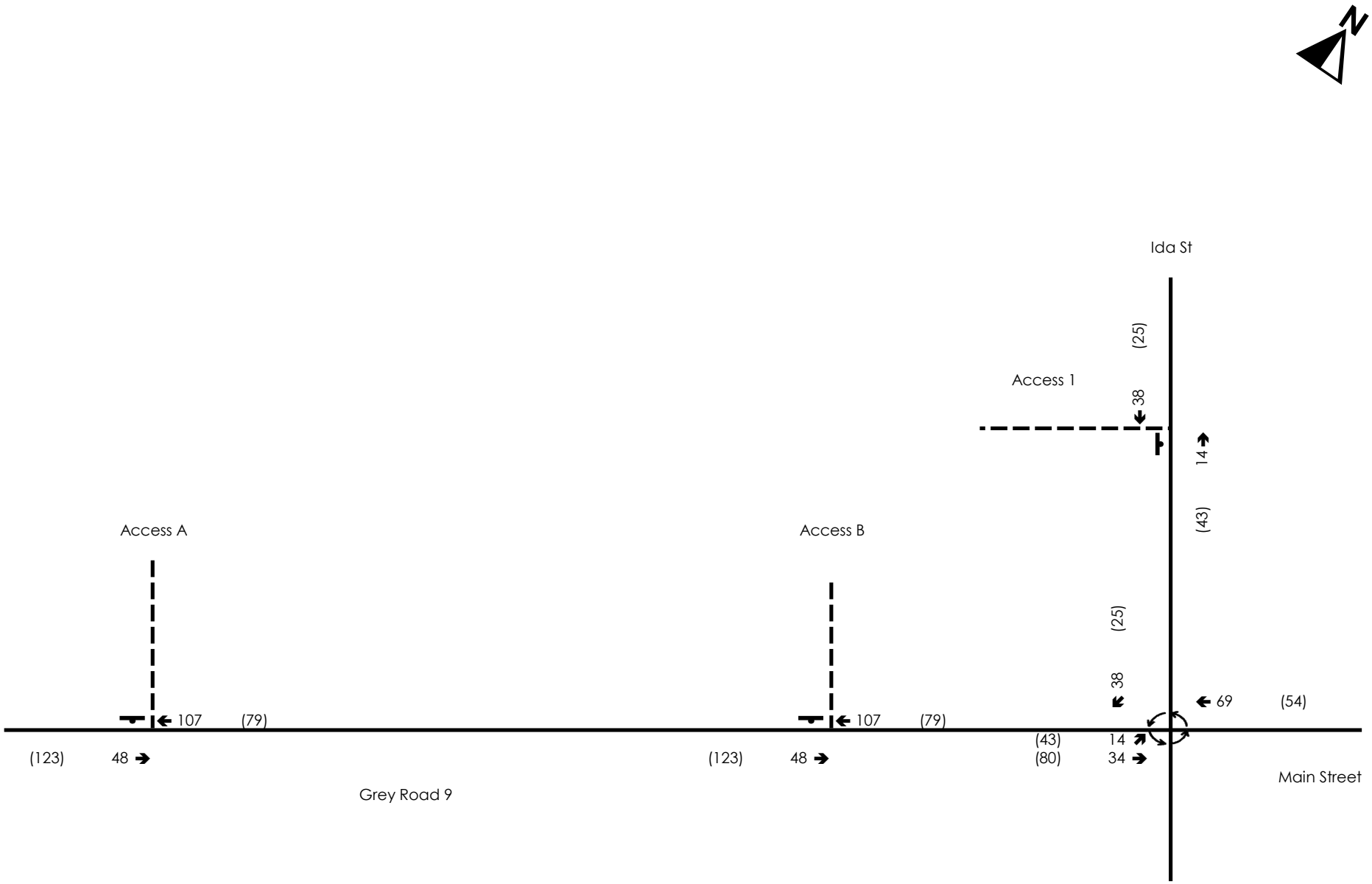
Glenelg Expansion Lands

CROZIER CONSULTING ENGINEERS

Figure 10

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

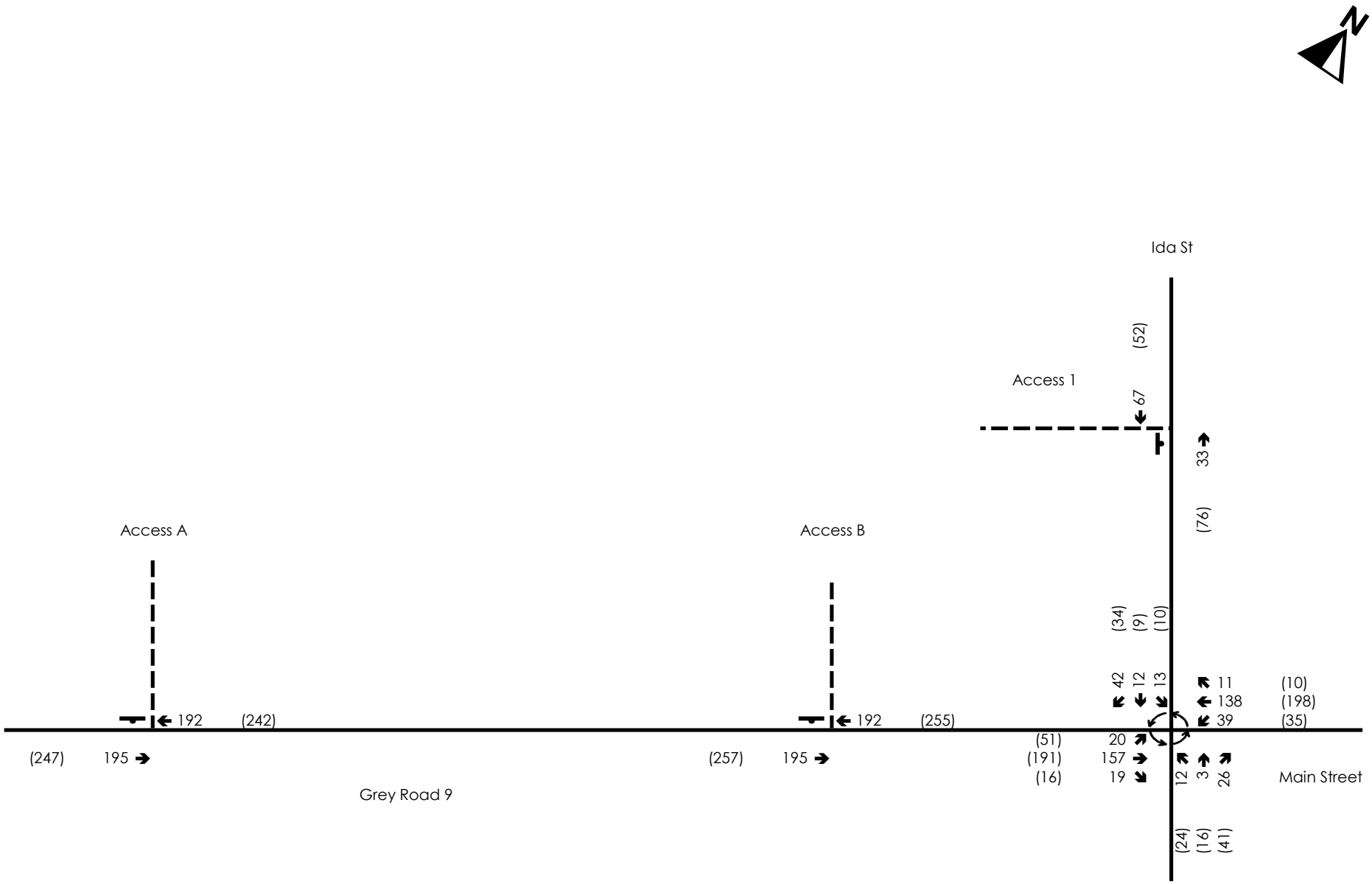
Background Development Trips

CROZIER CONSULTING ENGINEERS

Figure 11

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

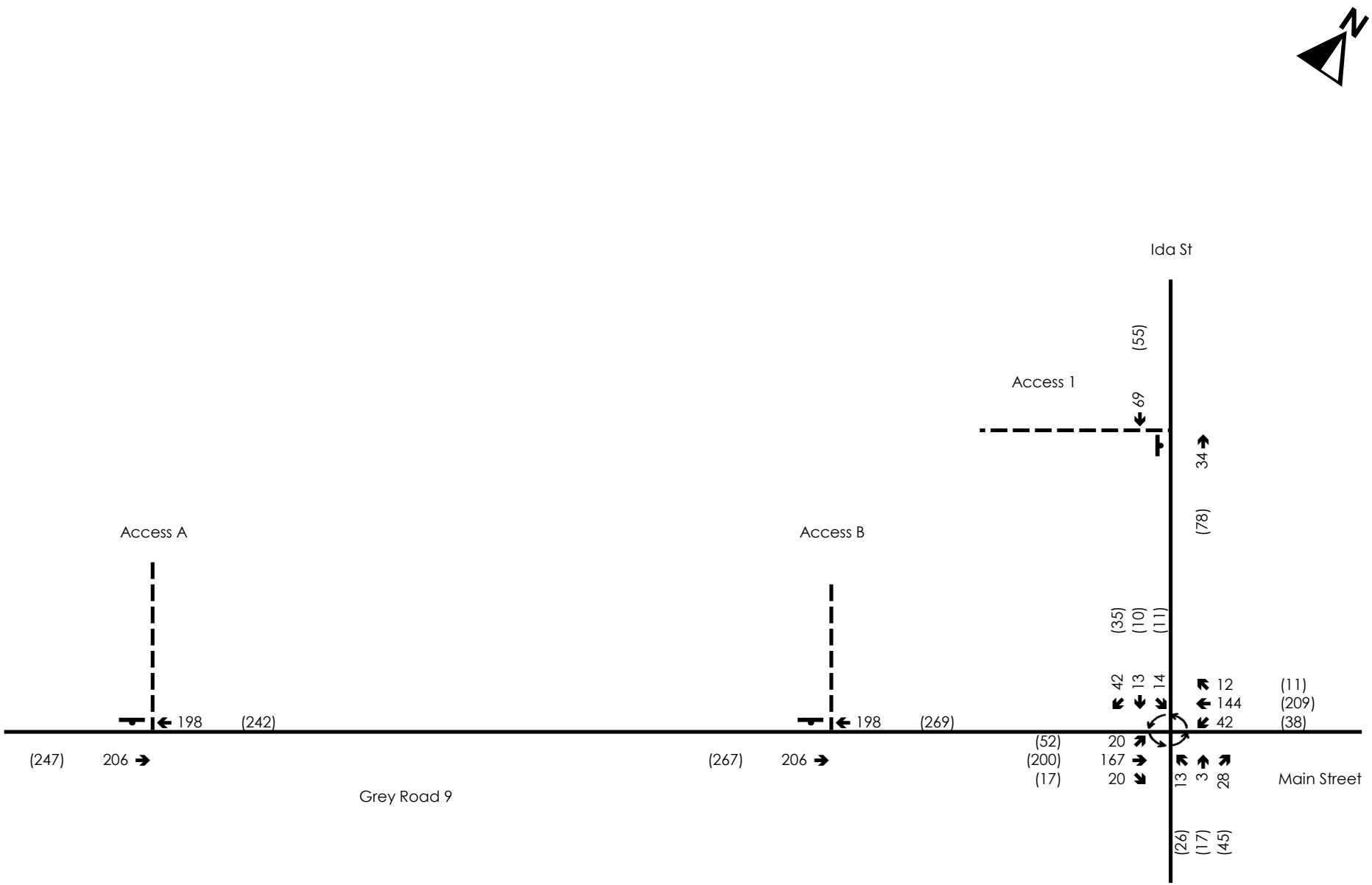
2027 Future Background

CROZIER CONSULTING ENGINEERS

Figure 12

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

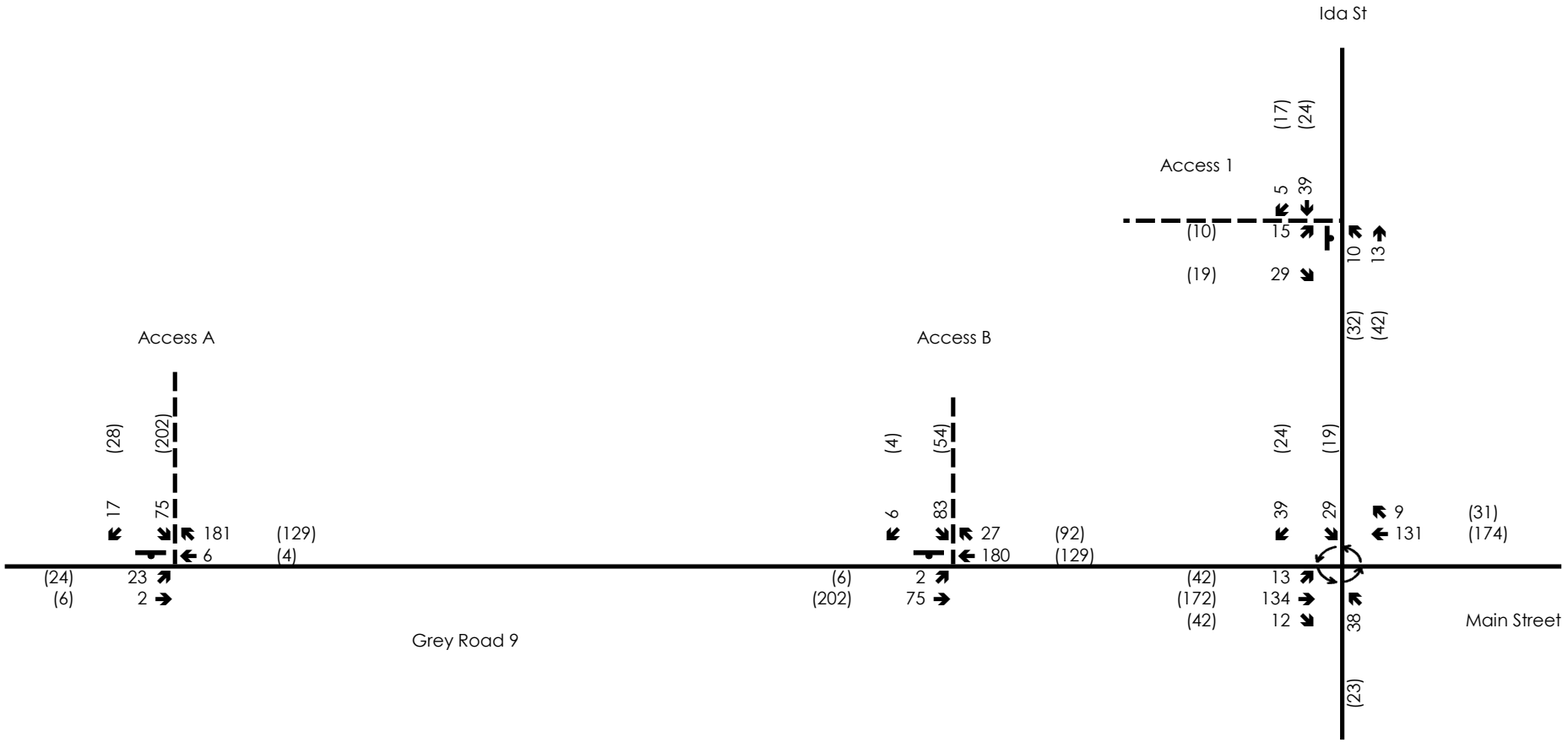
2032 Future Background

CROZIER CONSULTING ENGINEERS

Figure 13

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

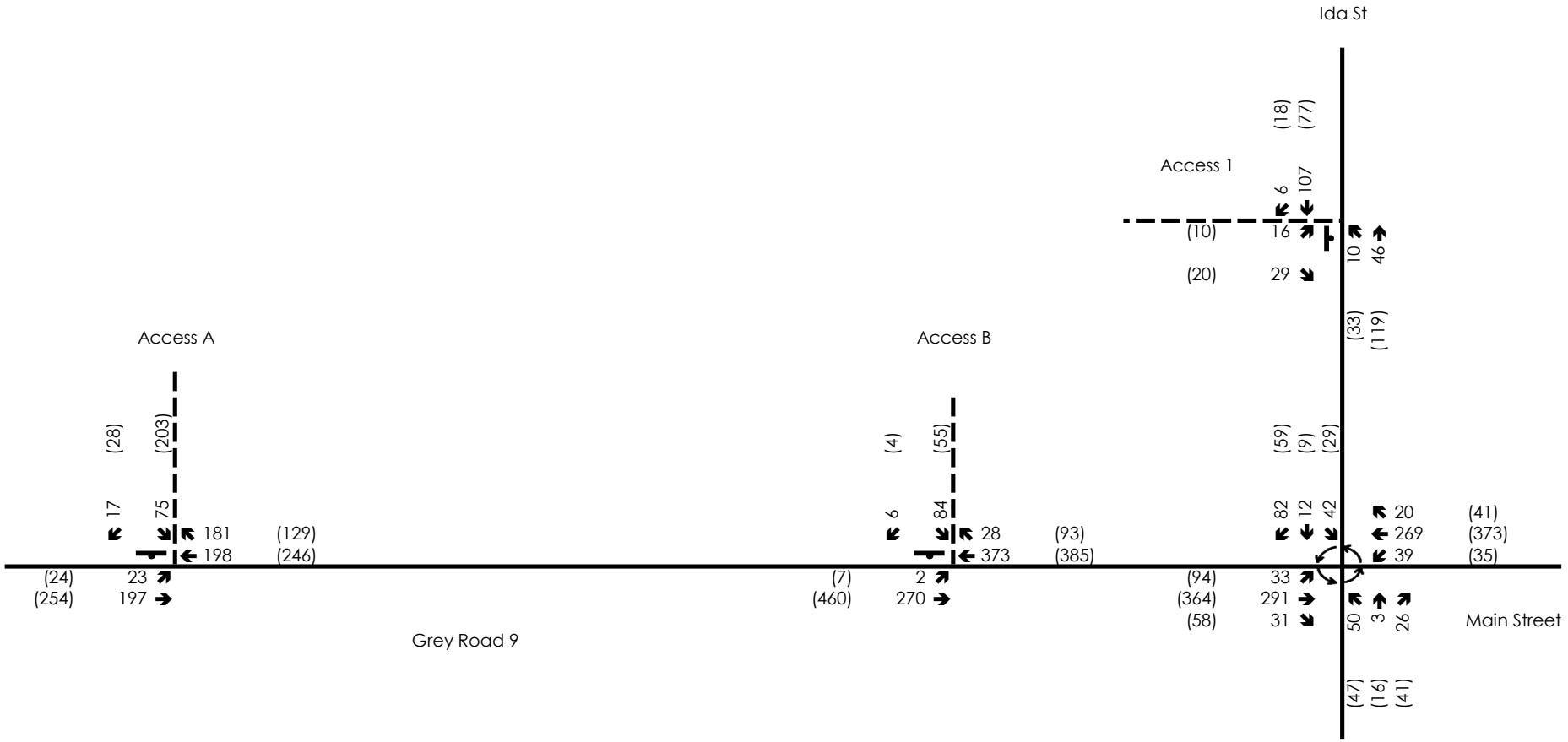
Subject Development Trip Assignment

CROZIER CONSULTING ENGINEERS

Figure 14

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

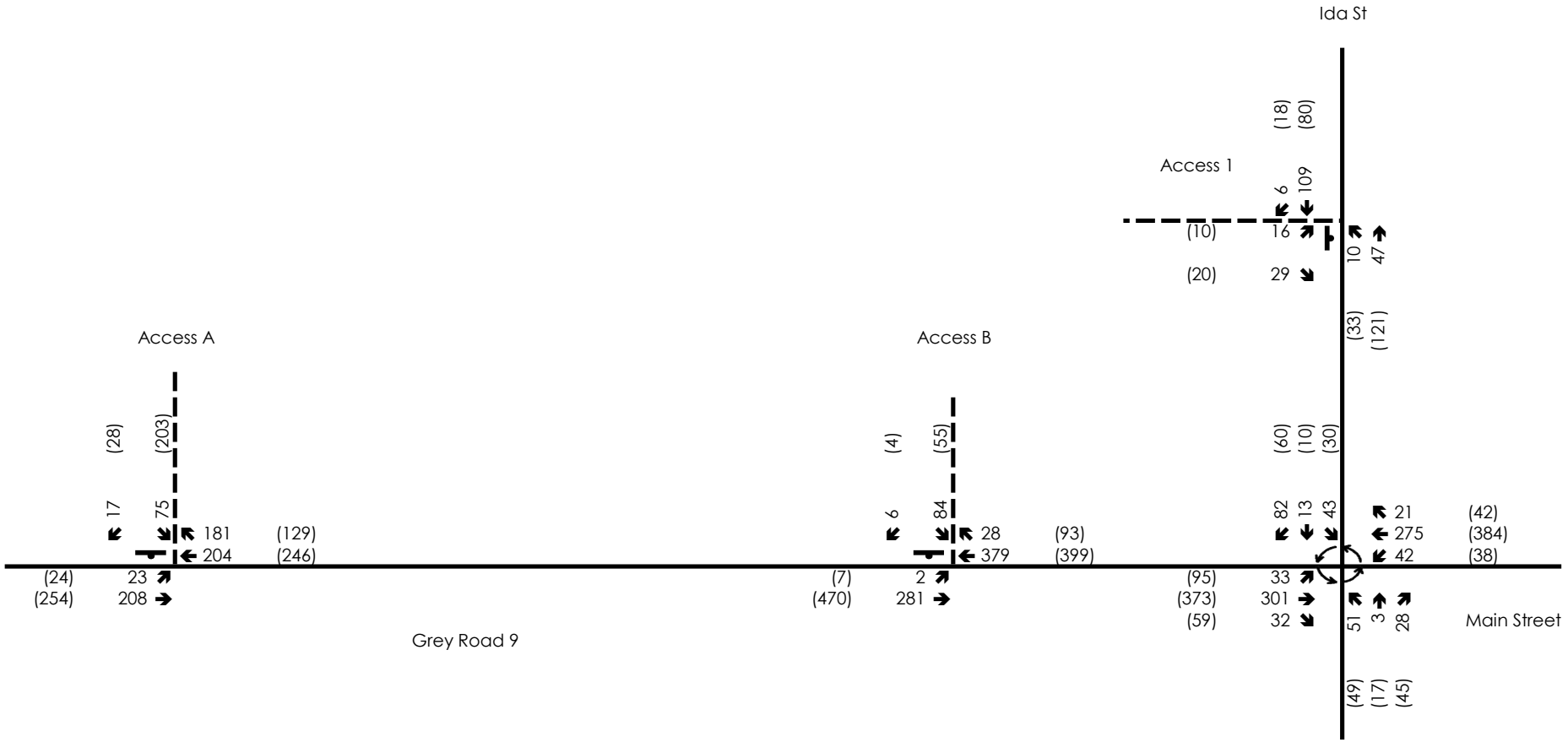
2027 Future Total

CROZIER CONSULTING ENGINEERS

Figure 15

Project No. 1060-5590

Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

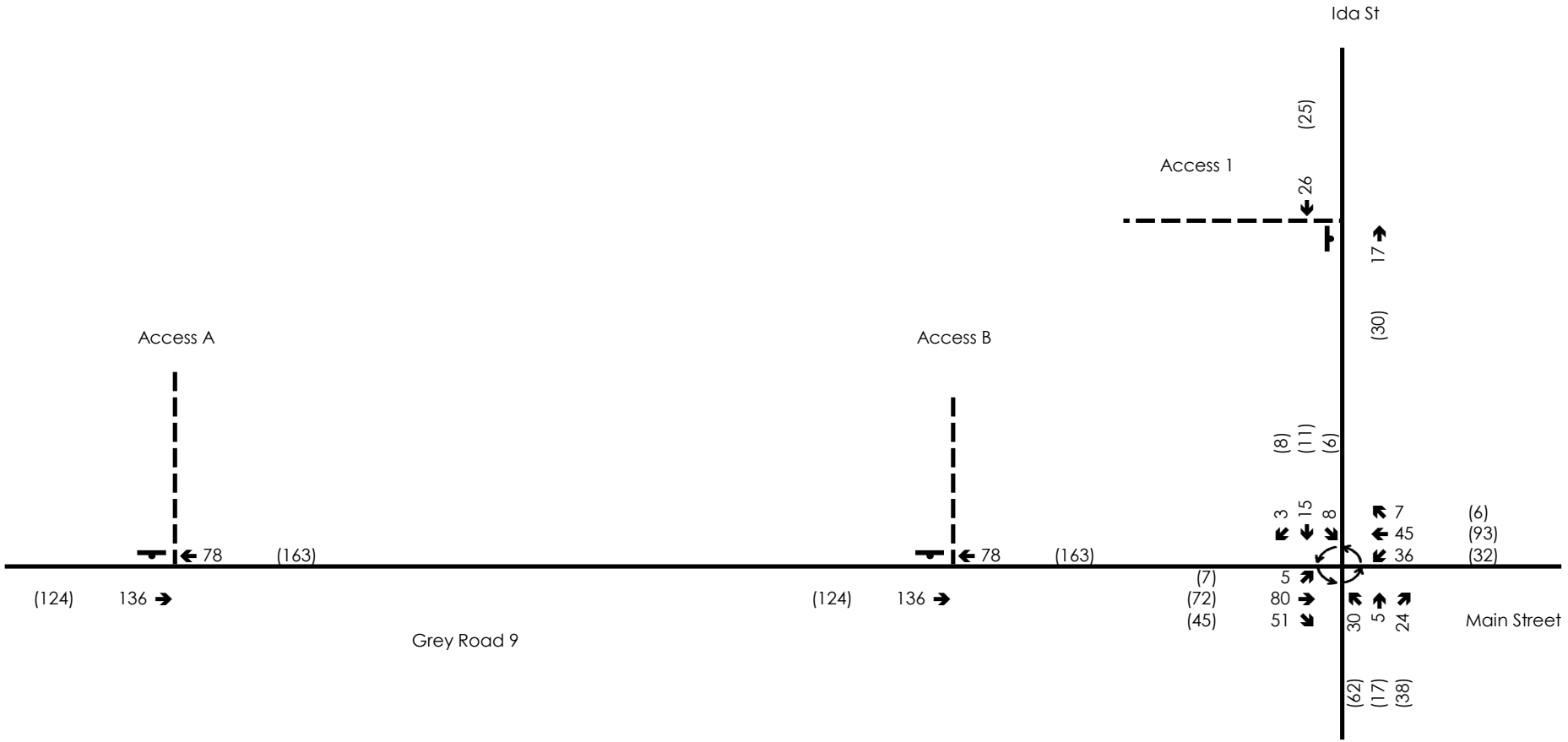
2032 Future Total

CROZIER CONSULTING ENGINEERS

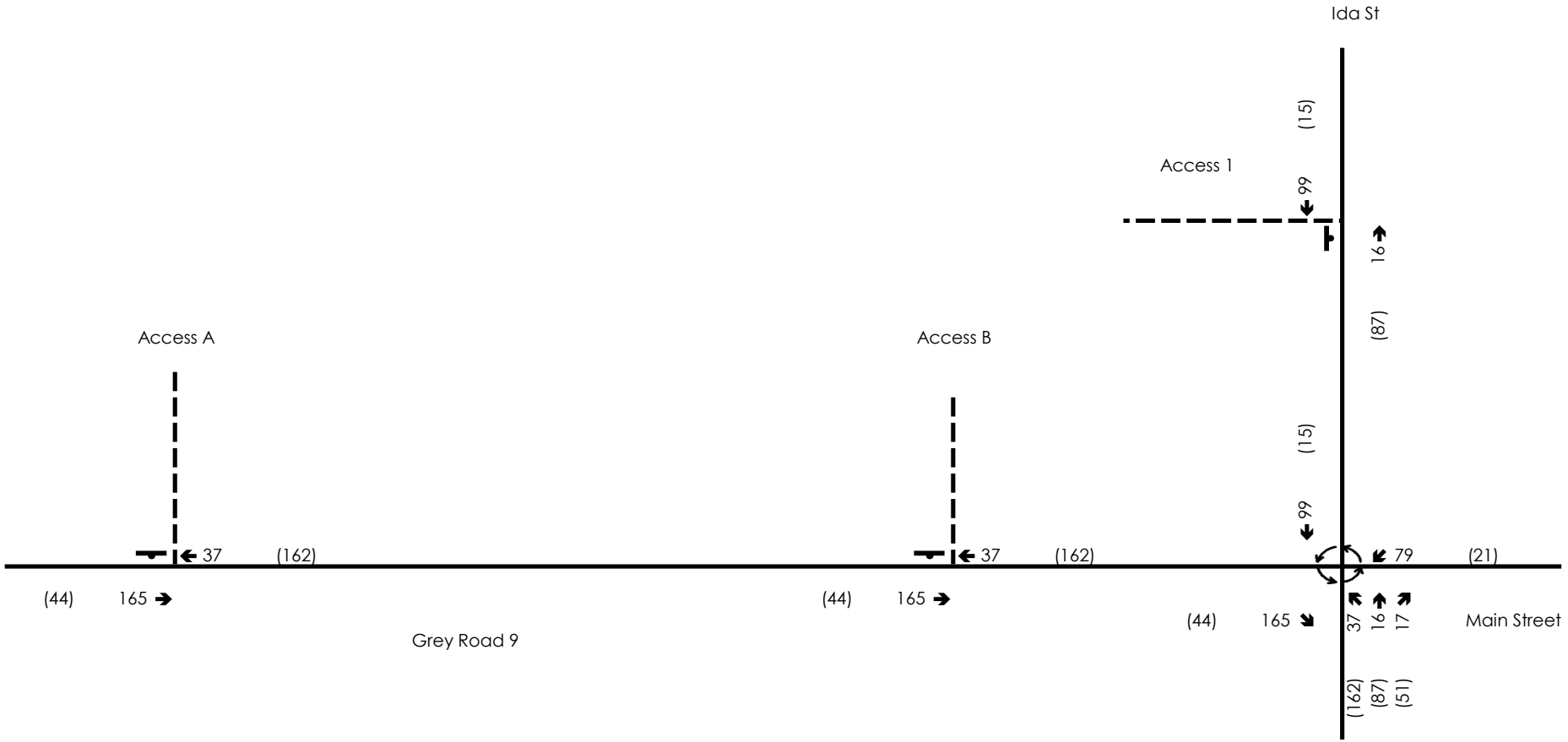
Figure 16

Project No. 1060-5590

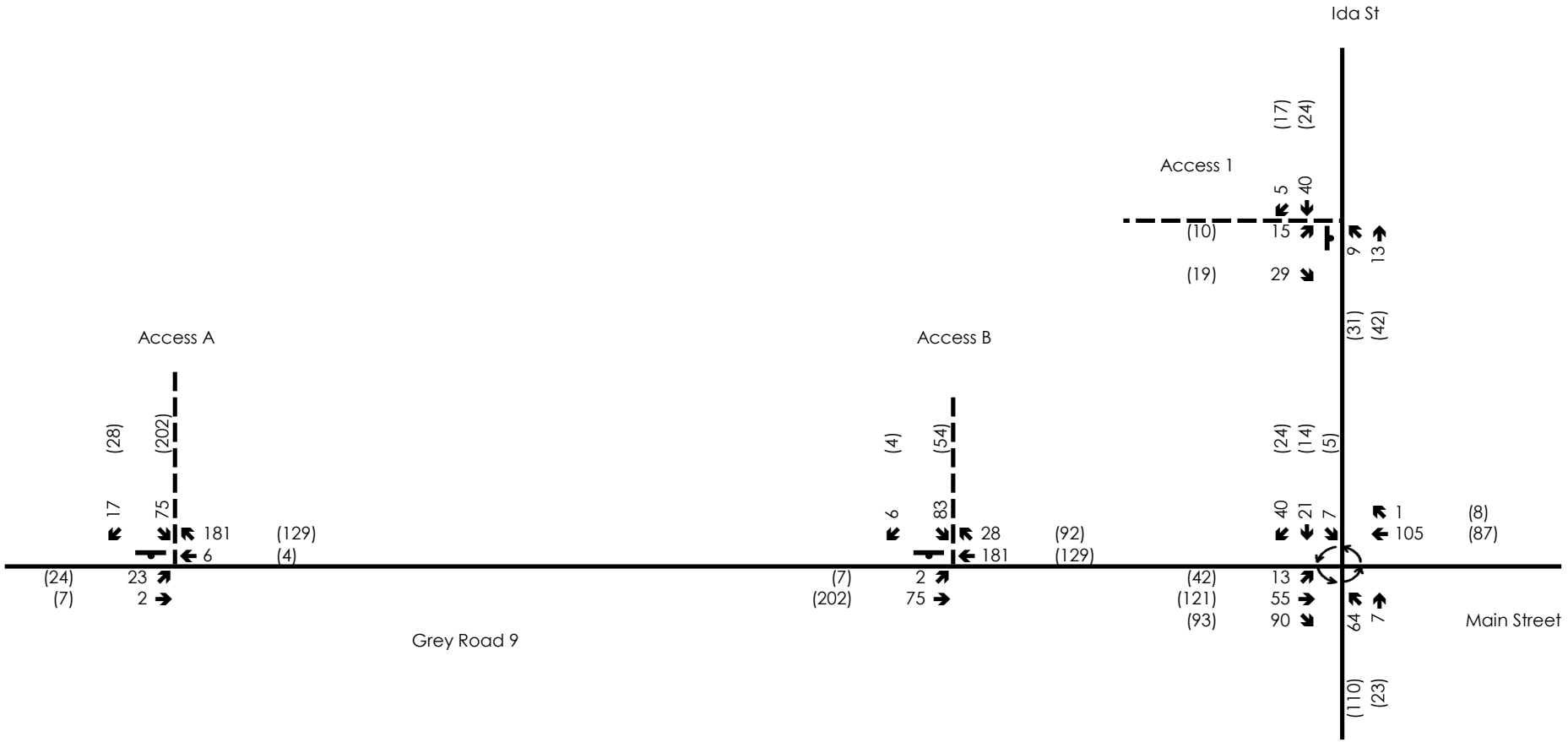
Date: May 2024



Legend	Ida Street		Figure 17
xx A.M. Peak Hour Traffic Volumes (xx) P.M. Peak Hour Traffic Volumes Stop sign Roundabout	2022 Existing Volumes (Eco-Parkway Adjustment)	CROZIER CONSULTING ENGINEERS	Project No. 1060-5590 Date: May 2024



Legend	Ida Street		Figure 18
xx A.M. Peak Hour Traffic Volumes (xx) P.M. Peak Hour Traffic Volumes Stop sign Roundabout	**Background Development** **Eco-Parkway**	CROZIER CONSULTING ENGINEERS	Project No. 1060-5590 Date: May 2024



Legend

xx A.M. Peak Hour Traffic Volumes
(xx) P.M. Peak Hour Traffic Volumes
Stop sign
Roundabout

Ida Street

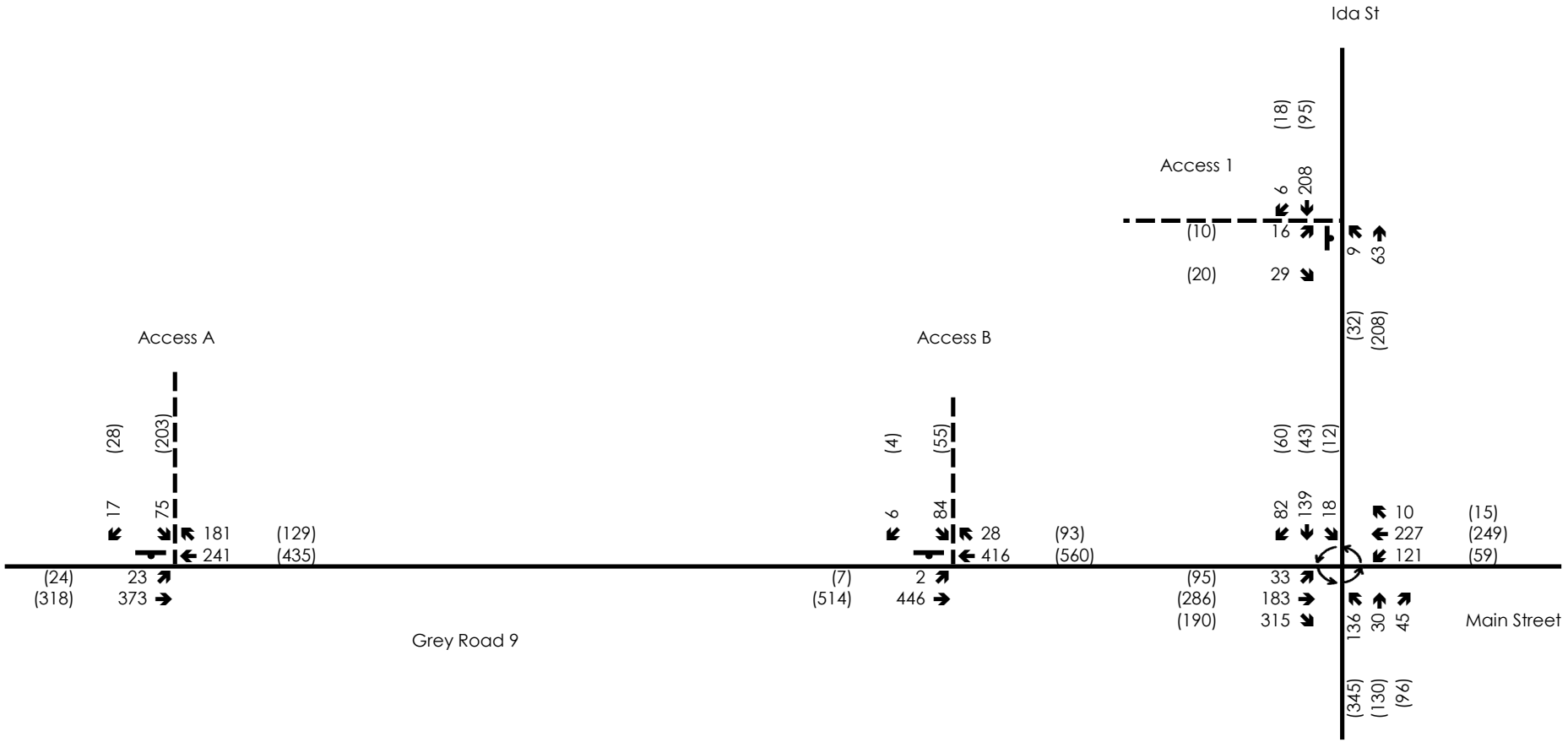
Subject Development Site Trip Assignment (Eco-Parkway)

CROZIER CONSULTING ENGINEERS

Figure 19

Project No. 1060-5590

Date: May 2024



Legend	Ida Street		Figure 20
xx A.M. Peak Hour Traffic Volumes (xx) P.M. Peak Hour Traffic Volumes Stop sign Roundabout	2032 Future Total EcoParkway Scenario	CROZIER CONSULTING ENGINEERS	Project No. 1060-5590 Date: May 2024