TRAFFIC ASSESSMENT

PARKBRIDGE CRAIGLEITH RIDGE
TOWN OF THE BLUE MOUNTAINS

PREPARED FOR:
PARKBRIDGE LIFESTYLE COMMUNITIES INC.

PREPARED BY:

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CONSULTING ENGINEERS

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1 EXECUTIVE SUMMARY

CF Crozier & Associates Inc. (Crozier) was retained by Parkbridge Lifestyle Communities Inc. to complete a Traffic Assessment in support of planning applications for the proposed residential development in Craigleith, Town of the Blue Mountains. The Traffic Impact Study was completed in December 2016 and submitted to the various approving authorities.

After receiving Town, County, and Ministry comments over a 6-month period, it was determined that further traffic assessment was required in order to address concerns from the approving authorities. Specifically, the Town of The Blue Mountains and the Ministry of Transportation have access layout preferences that cannot both simultaneously be accommodated.

In order to address the various comments, three internal roadway options were evaluated. These options are:

1. Private roadway to Parkbridge connecting Lakeshore Road and Grey Road 19. This configuration was originally submitted as part of the Traffic Impact Study – December 2016**.**
2. Public roadway connecting Lakeshore Road and Grey Road 19 within Parkbridge Lands. A concept was provided by the Town of The Blue Mountains**.**
3. Private roadway serving Parkbridge only, excluding connections to adjacent developments and Lakeshore Road. Access would be via a single entrance to Grey Road 19. This option was put forward because the MTO explicitly stated that any connection to Lakeshore Road would not be supported.

These options will hereafter be referred to as **Option 1, 2, and 3**, respectively.

Assessment of these three roadway options include the following key findings:

- Traffic operations for the three configuration options are minimally different and can all be supported from a traffic operations perspective.

- Environmental, archaeologic, and topographic constraints present significant challenges for **Option 2** due to the requirement to adhere to the Town of The Blue Mountains Engineering Standards. Adherence to these standards would lead to significant scarification of the Nipissing Ridge, due to the cuts and fills required to construct the roadway. Furthermore, the accorded buffer zones for the environmental features present on the site create additional development challenges.

- Active transportation facilities are proposed for all options, however, **Options 1 and 3** are preferable due to the reduced vehicular volumes and operating speed.

- Pedestrian connectivity between all three developments is proposed and is recommended to be implemented regardless of the option pursued.

- **Option 2** would result in a greater financial burden to the Town as a result of the ongoing responsibility for winter maintenance, roadway, and infrastructure rehabilitation.

- Liability associated with cyclist conflicts and pedestrian hazards (i.e. slip, trip, and falls) would fall under the responsibility of the Town for **Option 2**. With a private roadway **(Option 3),** this liability would fall under the responsibility of Parkbridge Lifestyle Communities Inc.

- Accesses provided for **Options 1 and 2** are sufficient, however, **Option 3** requires an additional emergency access due to the single entrance configuration. This can be accommodated and is reflected in the site plan included in **Appendix D.**

- A roundabout at the intersection of Grey Road 19 and Highway 26 is not recommended due to the lack of operational need and the significant property impacts that implementing a roundabout would have.

- Traffic volumes on Highway 26 are similar regardless of the Option selected. However, **Option 3** reduces turning movements at the intersection of Lakeshore Road and Highway 26 and is therefore recommended.

- Although **Option 1** and **3** are preferred, **Option 3** does not assign additional traffic to the intersection of Highway 26 and Lakeshore Road, which was an explicit request from the Ministry of Transportation.

Based on the foregoing analysis, it is our recommendation that the **Option 3** road configuration be pursued, consisting of private roads and no connection to Lakeshore Road.

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2 Introduction

C.F. Crozier and Associates Inc. (Crozier) was retained by Parkbridge Lifestyle Communities Inc. to complete a Traffic Impact Study in support of planning applications for the proposed residential development in Craigleith, Town of the Blue Mountains. The TIS was completed in December 2016 and submitted to the various approving authorities.

After receiving Town, County, and Ministry comments, it was determined that further traffic assessment was required in order to address concerns from the approving authorities. Specifically, the Town of The Blue Mountains and the Ministry of Transportation have access layout preferences that cannot both simultaneously be accommodated.

The purpose of the study was to assess the impacts of the proposed development on the boundary road network for three different internal road configurations, which are described below.

The Subject Property is bounded by Grey Road 19 and existing residential properties to the west, Lakeshore Road to the north, the proposed Eden Oak residential development to the east, and the proposed Home Farm residential development and existing residential lots to the south.

The location of the Subject Property is reflected on the development Site Location Plan included as Figure 1.

3 Background

C.F. Crozier and Associates Inc. completed the required Traffic Impact Study in December 2016 for submission to the Town, Grey County, and the MTO.

This TIS assessed the impacts of the proposed development on the boundary road network for the 2021, 2026, and 2031 horizon years, as per MTO TIS Guidelines. This assessment was completed assuming a private roadway connecting Lakeshore Road and Grey Road 19. However, any connection to Lakeshore Road is not supported by the MTO.

Conversely, the Town of The Blue Mountains has requested a public roadway connecting Grey Road 19 to Lakeshore Road.

Due to the conflicting requests by the different approval authorities, different internal roadway configuration options will be assessed, as described in **Section 4** below.

4 Roadway Configuration Options

This traffic assessment provides a comprehensive comparison of the following internal roadway configurations:

1. Private roadway to Parkbridge connecting Lakeshore Road and Grey Road 19. This configuration was originally submitted as part of the Traffic Impact Study – December 2016. This configuration option is included in **Appendix D.**
2. Public roadway connecting Lakeshore Road and Grey Road 19 within Parkbridge Lands. A concept was provided by the Town of The Blue Mountains and is included in **Appendix D.**
3. Private roadway serving Parkbridge only, excluding connections to adjacent developments and Lakeshore Road. Access would be via a single entrance to Grey Road 19 with an emergency connection only to Lakeshore Road.

5 Review of Traffic Operations

In order to fully understand the traffic impacts of the three internal roadway configurations previously mentioned, the assessment will also consider nearby developments, namely Eden Oak Trailshead and MacPherson Home Farm. Traffic Impact Studies for these projects have been previously been completed by Crozier and Associates and provide us significant background understanding of the traffic needs and operations within this area.

5.1 Eden Oak Trailshead – July 2012

Although the data used to generate this report is 5 years old, the trends and patterns, including the future background projections, provide valuable insight and a good estimate of future traffic patterns of this development.

The Eden Oak Trailshead proposed development consists of mixed residential unit types. 190 clustered or attached townhomes are proposed, along with 22 semi-detached units. The tenure of the main internal roadway system was planned to be publicly owned and contained within a 20-metre road allowance.

For the Traffic Impact Study, the following intersections were analyzed:

- Highway 26 and Old Lakeshore Road/Fraser Crescent

This development was assumed to be fully constructed by 2020. For this reason, the horizon years studied included 2020, 2025, and 2030, as required by the MTO TIS guidelines applicable at that time.

Intersection analysis of the 2030 total traffic volumes indicate that the intersections of Highway 26 with old Lakeshore Road/Fraser Crescent will experience minimal delay and operate at a LOS "C" with the implementation of a westbound left-turn lane on Highway 26 at Lakeshore Road.

Active transportation was not considered in this Traffic Impact Study.

5.2 Home Farm – December 2013

Although the data used to generate this report is 4 years old, likewise the trends and patterns, including the future background projections also provide valuable insight and a good estimate of future traffic patterns of this development.

The Home Farm Residential development was planned to contain 283 residential units that consist of 132 townhouse units and 151 detached units. The layout was planned to have two connections to Grey Road 19 via Helen Street and Ekarennoindi Street (proposed), opposite Birches Boulevard. A section of lands below Nipissing Ridge would not be internally connected but would be accessed through the Eden Oak lands. However, specific plans on these lands were not being advanced at the time of the planning application.

For the Traffic Impact Study, the following intersections were analyzed:

- Grey Road 19 and Birches Boulevard
- Grey Road 19 and Helen Street

At the time of writing this report, information regarding phasing of the development was not available. Therefore, it was assumed that the development will achieve full build out in 2018. For this reason, the

horizon years studied included 2018, 2023, and 2028, as required by the MTO TIS guidelines applicable at that time.

Intersection analysis of Grey Road 19 and Birches Boulevard and Grey Road 19 and Helen Street indicated that the intersections will experience minor delays and operate at a LOS "C" in the 2028 horizon year with the implementation of a southbound left-turn lane at the intersection of Grey Road 19 and Birches Boulevard.

Active transportation was not considered in this Traffic Impact Study.

5.3 Parkbridge Craigleith – December 2016

The Parkbridge residential development in Craigleith is approximately 27 hectares in size. The Concept Plan for the proposed development consists of 211 units comprising of 92 townhomes and 119 single-detached houses. The subject development is anticipated to be fully built out and occupied by 2021. Therefore, horizon years include 2021, 2026, and 2031, as required by the MTO TIS guidelines.

For the Traffic Impact Study, the following intersections were analyzed:

- Highway 26 and Grey Road 19
- Highway 26 and Lakeshore Road
- Grey Road 19 and Lakeshore Road
- Grey Road 19 and Craigleith Road

Intersection analysis of Highway 26 and Grey Road 19 is expected to continue operating at a LOS "B" in the 2031future total horizon year.

The intersection of Highway 26 and Lakeshore Road with and without the previously recommended westbound left-turn lane is expected to operate at a LOS "C" in the 2031 future total horizon year.

The intersection of Grey Road 19 and Craigleith Road is expected to operate at a LOS "B" in the 2031 future total horizon year.

All of the operations previously mentioned are expected to operate efficiently with minor increases to control delay given the addition of site generated traffic.

Active transportation was not analyzed within this study.

5.3.1 Parkbridge Trip Generation

The aforementioned operations were based on the following trip generation, as included in the December 2016 Traffic Impact Study.

Table 1 - Trip Generation

Subject Property Use	Roadway Peak Hour	Number of Trips		
		Inbound	Outbound	Total
Recreational Homes (Cat 260)	Weekday A.M.	23	11	34
	Weekday P.M.	23	33	56

In response to the MTO comments dated March 31st, 2017, a sensitivity analysis has been included in

Appendix I, which includes operational analysis using the revised trip generation calculations.

5.4 Summary of Traffic Operations

Table 2 below provides a summary of the intersections studied for the three previously mentioned Traffic Impact Studies.

Table 2 - Summary of Studied Intersections

Intersection	Study	Horizon Year	Control Delay (s)	Level of Service (LOS)
Highway 26 and Old Lakeshore Road/Fraser Crescent	Eden Oak	2030	18.7	C
Grey Road 19 and Birches Boulevard	Home Farm	2028	21.1	C
Grey Road 19 and Helen Street	Home Farm	2028	17.2	C
Highway 26 and Grey Road 19	Parkbridge Craigleith	2031	17.5	C
Highway 26 and Lakeshore Road	Parkbridge Craigleith	2031	24.8	C
Grey Road 19 and Lakeshore Road	Parkbridge Craigleith	2031	12.0	B
Grey Road 19 and Craigleith Road	Parkbridge Craigleith	2031	14.9	B

Although the Traffic Impact Studies were completed at different times, it is clear that all the aforementioned developments are anticipated to have minimal impact to the boundary road network.

6 Configuration Options Assessment

6.1 Trip Distribution

In order to determine the impacts caused by the three internal road configurations, the aforementioned completed studies were reviewed in order to determine overall trip distributions for residents in that area. In order to determine the overall trip distribution, the following reports were reviewed:

- Georgian Woodlands Phases IV,V & VI TIS – March 2008
- Eden Oak Trailshead TIS – July 2012
- Home Farm TIS – December 2013
- Windfall Medium Density Block TIS – August 2014
- Parkbridge Craigleith TIS – December 2016

Further to the above studies, The Orchard residential development located on the west side of Grey Road 19, accessible by Birches Boulevard, is a useful proxy site. This site was reviewed in order to determine the expected travel behaviour of residents within the area. With only one access to the Orchard development, all trips utilizing the intersection of Grey Road 19 and Birches Boulevard can be assumed to coming from or going to their place of residence. This single access allows us to determine a directional distribution of traffic from residents living in a similar area to the proposed developments (Parkbridge, Eden Oak, Home Farm).

Review of The Orchard residential development, in combination with the aforementioned reports, resulted in the following overall trip distribution.

- 50% to/from the east (towards Collingwood)
- 20% to/from the west (towards Thornbury)
- 30% to/from the south (towards Blue Mountain)

In order to provide consistency, this overall trip distribution will be utilized for all three configuration options.

Specific distributions vary depending on the connectivity of the internal road network and the travel time required to reach the destination. To determine whether motorists would utilize Grey Road 19 or Highway 26 to travel to/from Collingwood or beyond, travel time surveys were conducted on December 12th, 2017 and are included in **Appendix D**. A notable result of this survey was that from Craigleith Road to Collingwood, Highway 26 provided the shortest travel time whereas from Birches Boulevard to Collingwood, Grey Road 19 provided the shortest travel time. The three configurations are discussed further below.

6.2 Option 1 – Private roadway connecting Lakeshore Road and Grey Road 19

As illustrated in the concept plan included in **Appendix D**, this option contains a private roadway connecting Lakeshore Road and Grey Road 19, with no vehicle access to adjacent developments.

Previously determined impacts to the boundary road network are described in the December 2016 Traffic Impact Study, included in **Appendix C.** Traffic operations considering Home Farm, Eden Oak and Parkbridge are summarized below in **Table 3**, which vary slightly from the 2016 study due to the modified trip distribution and the consideration of the Home Farm residential development. Trip assignment and distribution information for this option is included in **Figures 3 to 9**. These operations are based on the future total volumes illustrated in **Figure 10.**

As described in the aforementioned Traffic Impact Study, the feasibility of entrances to Lakeshore Road was assessed despite the MTO comment that intensification to Highway 26/Lakeshore Road intersection would not be supported. Due to the private nature of the internal roadways proposed for this option, externally generated traffic (outside of the three considered developments) is not anticipated to use the internal road system in order to access Grey Road 19. This is further supported by the travel time comparison provided in **Table 4,** which illustrates the additional travel time required to circumvent the Grey Road 19/Highway 26 intersection. Additionally, in order to further deter external traffic from shortcutting through the private roadway system, Parkbridge Lifestyle Communities Incorporated has the ability to implement traffic calming measures which may include:

- Lowered speed limits
- Speed humps
- Raised crosswalks
- Raised intersections
- Curb extensions, road narrowing
- Additional pavement markings
- Warning signage
- Contrasting materials

Therefore, the only additional intensification to the Highway 26/Lakeshore Road intersection would be traffic generated by the subject lands. Due to the nature of the development, vehicles entering Highway 26 from Lakeshore Road are minimal and not expected to significantly change. Furthermore,

this additional volume is supportable from a traffic operations perspective.
Table 3 below outlines the intersection operations of the boundary road network considering the Parkbridge, Home Farm, and Eden Oak developments.

Table 3 - 2031 Future Total Level of Service (with Private Roadway)

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	14.3 s	0.58 (NBL)
		P.M.	B	18.6 s	0.87 (NBL)
Highway 26 and Grey Road 19	Signal (Optimized)	A.M.	B	16.3 s	0.57 (EBT)
		P.M.	B	18.5 s	0.71 (EBT)
Highway 26 and Lakeshore Road	Stop	A.M.	C	15.8 s	0.26 (WBT)
		P.M.	C	24.2 s	0.46 (WBT)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	10.6 s	0.12 (NBT)
		P.M.	B	10.5 s	0.20 (NBT)
Grey Road 19 and Craigleith Road/Parkbridge Entrance	Stop	A.M.	B	12.9 s	0.06 (WB)
		P.M.	C	16.2 s	0.08 (WB)
Grey Road 19 and Birches Boulevard	Stop	A.M.	B	12.5 s	0.14 (WB)
		P.M.	C	16.5 s	0.25 (NBT)
Grey Road 19 and Helen Street	Stop	A.M.	B	12.6 s	0.15 (WB)
		P.M.	C	16.4 s	0.31 (NB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Although the level of service and control delay results are acceptable under existing signal timings for the intersection of Highway 26 and Grey Road 19, optimized timing results are included to illustrate that the volume-to-capacity ratio can be less than 0.85 without capital improvements.

The corresponding traffic volumes are illustrated in **Figure 10**.

As described in **Table 3** above, no operational issues for any of the three developments are expected as a result of this internal road configuration.

6.3 Option 2 – Public roadway connecting Lakeshore Road and Grey Road 19 with Surrounding Developments

As illustrated in the connectivity figure included in **Appendix D**, this option includes a public roadway connecting Lakeshore Road and Grey Road 19 with Parkbridge and the surrounding developments, including Eden Oak and Home Farm. Impacts to the trip distribution are summarized below.

This proposed public roadway connection would provide an alternative route for traffic intending to turn left on Grey Road 19 and head south towards Blue Mountain, or those on Craigleith Road/Grey Road 19 destined to Collingwood. Traffic impacts are described in **Table 4** below.

Table 4 - Travel Time Comparison

Configuration	Route distance from Highway 26/Lakeshore Road to Craigleith Road/Grey Road 19 (km)	Predicted Travel Time
With Public Roadway	1.4	2 minutes 41 seconds*
Without Public Roadway	2.0	1 minute 54 seconds**

**estimated assuming 40 km/h average speed and three intersection delays*
***measured via travel time surveys*

Although the approximate travelling distance for vehicles utilizing the conceptual public roadway would be less, the travel times are greater for the circuitous route through local roadways than for the route on the County/Provincial arterial/highway roads. It has therefore been assumed that external traffic patterns would not change as a result of this public road. The travel time survey information is included in **Appendix E.**

Therefore, in order to provide an acceptable analysis, travel pattern behavioural changes will only be considered for the Home Farm, Eden Oak and Parkbridge developments.

With the implementation of the public roadway, trips to/from Eden Oak going to/coming from Blue Mountain would do so via the public road and Grey Road 19. Conversely, without a Lakeshore Road connection, trips to/from Eden Oak going to/coming from Blue Mountain would do so via Lakeshore Road and Grey Road 19.

Trips to/from Home Farm would not be affected as the travel times to/from Collingwood are less when utilizing Grey Road 19/Mountain Road in comparison to utilizing Highway 26 via the public roadway. Details of the travel time differences are included in **Appendix E.**

Trip assignment and distribution information for this option is included in **Figures 11 to 17**. These operations are based on the future total volumes illustrated in **Figure 18.**

Traffic operations of the modified trip distribution in relation to this option are illustrated in the **Table 5** below.

Table 5 - 2031 Future Total Level of Service (with Public Roadway)

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	14.3 s	0.58 (NBL)
		P.M.	B	18.6 s	0.87 (NBL)
Highway 26 and Grey Road 19	Signal (Optimized)	A.M.	B	16.3 s	0.57 (EBT)
		P.M.	B	18.5 s	0.71 (EBT)
Highway 26 and Lakeshore Road	Stop	A.M.	C	15.8 s	0.26 (WBT)
		P.M.	C	24.2 s	0.46 (WBT)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	10.6 s	0.12 (NBT)
		P.M.	B	10.5 s	0.20 (NBT)
Grey Road 19 and Craigleith Road	Stop	A.M.	B	12.9 s	0.06 (WB)
		P.M.	C	16.2 s	0.08 (WB)
Grey Road 19 and Birches Boulevard	Stop	A.M.	B	12.5 s	0.14 (WB)
		P.M.	C	16.5 s	0.25 (NBT)
Grey Road 19 and Helen Street	Stop	A.M.	B	12.6 s	0.15 (WB)
		P.M.	C	16.4 s	0.31 (NB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Although the level of service and control delay results are acceptable under existing signal timings for the intersection of Highway 26 and Grey Road 19, optimized timing results are included to illustrate that the volume-to-capacity ratio can be less than 0.85 without capital improvements.

The corresponding traffic volumes are illustrated in **Figure 18**.

As described in **Table 5**, no operational issues for any of the three developments are expected as a result of this internal road configuration.

6.4 Option 3 – Private Roadway Serving Parkbridge (No Connection to Lakeshore Road)

This option includes a private roadway serving only the Parkbridge residential development. For this option, the only connection to the boundary road network will occur along Grey Road 19. The proponent has confirmed that this connection would occur opposite of Craigleith road, in order to create a 4-legged intersection. This connection will ensure that further intensification of the intersection of Lakeshore Road and Highway 26 is avoided, as requested by the MTO.

Due to the single access point of this option, 80% of site generated traffic will be utilizing the intersection of Highway 26 and Grey Road 19. As indicated in in the travel survey included in **Appendix E,** trips originating from Grey Road 19 and Craigleith Road travelling to Collingwood are assumed to utilize Highway 26, as this route was determined to be quicker than travelling to Collingwood via Grey Road 19 and Mountain Road. This assumption also applies for the return trips from Collingwood to Craigleith Road.

Trip assignment and distribution information for this option is included in **Figures 19 to 25**. These operations are based on the future total volumes illustrated in **Figure 26.**

Traffic operations for this internal roadway configuration are illustrated below in **Table 6.**

Table 6 - 2031 Future Total Level of Service (No connection to Lakeshore Road)

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	14.2 s	0.58 (NBL)
		P.M.	B	18.6 s	0.88 (NBL)
Highway 26 and Grey Road 19	Signal (Optimized)	A.M.	B	14.9 s	0.53 (EBT)
		P.M.	B	17.9 s	0.70 (EBT)
Highway 26 and Lakeshore Road	Stop	A.M.	C	15.8 s	0.27 (WBT)
		P.M.	D	27.7 s	0.47 (WBT)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	12.6 s	0.13 (NBT)
		P.M.	B	13.7 s	0.23 (NBT)
Grey Road 19 and Craigleith Road	Stop	A.M.	B	10.3 s	0.05 (EB)
		P.M.	B	12.8 s	0.07 (EB/WB)
Grey Road 19 and Birches Boulevard	Stop	A.M.	B	12.5 s	0.14 (WB)
		P.M.	C	16.5 s	0.25 (NBT)
Grey Road 19 and Helen Street	Stop	A.M.	B	12.6 s	0.15 (WB)
		P.M.	C	16.4 s	0.31 (NB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Although the level of service and control delay results are acceptable under existing signal timings for the intersection of Highway 26 and Grey Road 19, optimized timing results are included to illustrate that the volume-to-capacity ratio can be less than 0.85 without capital improvements.

It should be noted that although the intersection of Highway 26 and Lakeshore Road operates at a reduced level of service when compared to **Option 1 and 2**, the calculated control delays for each option are minimally different suggesting similar operations of the intersection, regardless of the pursued option. This increased control delay is a result of the reduced volume of the low-delay northbound right-turn movements, thereby increasing the overall average delay of the intersection. The change to a level of service "D" is a result of the 25 second delay threshold.

The corresponding traffic volumes are illustrated in **Figure 26**. Overall volumes on Highway 26 are not anticipated to change, as both the Parkbridge and Eden Oak developments travel to Collingwood via Highway 26 for all three configuration options. The difference between the configurations is whether the vehicles travelling to Collingwood enter Highway 26 at Grey Road 19 or Lakeshore Road.

As described in **Table 6** above, no operational issues for any of the three developments are expected as a result of this internal road configuration.

7 Feasibility Review

7.1 Constraints to Consider

The subject lands lie within the upper and lower terrace physiographic region situated between the Niagara Escarpment toe and the Georgian Bay shoreline. The upper and lower terrace lands are described further in the *Functional Servicing and Stormwater Management Report* prepared by Crozier and Associates in December 2016. Specific site constraints are described further below.

7.1.1 Environmentally Sensitive Features

Existing on-site archeological features and environmental constraints (including butternut trees) are present and therefore have been accorded appropriate buffer zones in the updated development concept plan. Reports supporting these findings have been prepared and submitted by others under separate cover.

Additionally, watercourses 7,8,9 and 10 traverse the subject lands in varying fashions as described in the previously submitted Functional Service Report.

Furthermore, multiple archeological protected sites are present within the subject lands, thereby restricting the construction of a roadway within the limits.
In summary, the following environmental constraints are present within the subject lands:

- Multiple archaeological protected areas with buffer zones.
- Four watercourses traversing the subject lands.
- Numerous Butternut trees with 25m and 50m setbacks.
- Woodlots.

An illustration of these constraints is also provided in **Appendix D**.

7.1.2 Topographical Challenges

Topographic challenges exist for all three internal road configuration options previously mentioned. Since the Nipissing Ridge traverses directly through the site, there are significant elevation changes that need to be considered.

The Nipissing Ridge possesses slopes of approximately 25-50%, except for a portion directly east of the Watercourse 9 corridor (**Appendix D**), in the central portion of the site. Previous excavation works have lessened the slope of the Ridge in this area. Consequently, the Nipissing Ridge within the altered portion is general open and vegetated with clusters of younger trees as compared to the balance of the ridge, which is more densely forested.

For the private roadways included in **Options 1 and 3**, a minimum roadway width of 6.0 metres with an overall road allowance of 12.0 metres is proposed. This is considered acceptable for private roadways. Furthermore, this private roadway is not subject to the Town of The Blue Mountains Engineering Standards, which allows more flexibility to maneuver around the numerous site constraints. This private roadway would be required to conform to the Ontario Building Code, which is more lenient than the Town standards.

For **Option 2**, including the public roadway previously described, the Town of the Blue Mountains Engineering Standards would apply. Subsequently, the following roadway geometric qualities could present challenges as a result of being publicly designated.

- Minimum Right-Of-Way Width of 20.0 metres
- Maximum Grade of 8%
- Minimum Horizontal Radius of 80 metres
- Minimum Safe Stopping Distance of 65 metres

7.1.3 Traffic Operational Limitations

As illustrated in **Section 5**, traffic operational differences between the three roadway configuration options are negligible and provide no constraints, from an operations perspective.

7.2 Summary

As previously mentioned, all three options are supportable from a traffic operations perspective.

When considering the environmental (archeological areas, watercourses, and butternut trees) and topographical challenges of the subject lands, constructing a public roadway (**Option 2**) will present significant challenges, as previously mentioned. The current concept plan has been developed under the assumption that there would be private roadways with a total right-of-way of 12 metres. If a public roadway were to be constructed, the right-of-way width would need to be expanded to 20 metres. Furthermore, a public roadway would require a minimum horizontal radius of 80 metres, which limits the maneuverability of the road network. It can also reasonably be anticipated that a public road would cause greater scarification of the Nipissing Ridge, due to greater cuts and fills and side slopes needed to adhere to the Town of The Blue Mountains municipal roadway geometric standards. These requirements create significant challenges due to the severe topography of the subject lands.

Considering the above challenges, **Option 2** is not recommended.

8 Supplemental Considerations

In addition to the aforementioned traffic operations and site constraints, supplementary considerations are described below.

8.1 Costs of Roadway Configurations

A significant difference between the public and private roadway options is the variance in financial responsibility with regard to maintenance and capital construction.

For **Options 1 and 3**, all future construction and maintenance costs would be the sole responsibility of Parkbridge Lifestyle Communities Incorporated. For **Option 2**, maintenance costs would be the sole responsibility of the Town of The Blue Mountains while initial construction would be the responsibility of Parkbridge Lifestyle Communities Incorporated.

Estimated capital costs of various options are illustrated below.

Table 7 - Estimated Capital Construction Costs

Option	Length of Public Road*	Cross-Section	Road Width	Unit Costs (per centerline km)	Total Costs
1	1.0 km	Urban (including sidewalk – one side and streetlights)	6.0 m	$2,267,400***	**$2,267,400**
2			8.5 m	$2,834,250**	**$2,834,250**
3			6.0 m	$2,267,400***	**$2,267,400**

** Length is approximate*
*** Costs retrieved from the Town of The Blue Mountains Development Charges Background Study (August 2014)*
**** Private roadway costs were assumed to be 80% of the public roadway costs.*

As described in the Town of The Blue Mountains Development Charges Background Study (August 2014), the costs outlined in **Table 7** include: 12% Engineering, 10% Contingency, 3% Bonding and Insurance, 3% Mobilization/Demobilization, 1.5% Administration/Legal Advice, and 2% Project Management.

Further to the capital construction costs, annual maintenance would be the sole responsibility of the Town of The Blue Mountains. Furthermore, any road rehabilitation required during the life of the pavement would also be the responsibility of the Town. Estimated recurring costs are outlined in **Table 8** below. These costs were taken from a study titled "*Estimation of the representative annualized capital and maintenance costs of roads by functional class*" completed in March 2006 by Applied Research Associates (APA).

Table 8 - Estimated Annual Maintenance Costs

Description of Works	Road Type	Unit Costs (per lane km) *	Total Costs (per 2-lane roadway)
Pavements - Maintenance and Rehabilitation	Local Urban	$2,035	**$4,070**
Routine Maintenance		$1,650	**$3,300**
Winter Maintenance		$1,925	**$3,850**
All Other Road Infrastructure Maintenance and Rehabilitation		$1,283	**$2,566**
Total Annual Costs			**$13,786**
20-Year Total			**$275,720**

** Information retrieved from a study titled "Estimation of the representative annualized capital and maintenance costs of roads by functional class" completed in March 2006 by Applied Research Associates (APA).*
All costs reported in the above tables are annualized costs (using 6 percent discount rate and 60-year analysis period) for one one-km-long traffic lane.

Descriptions of the aforementioned works are included in the *APA* report and described below:

Pavements – Maintenance and Rehabilitation
Rehabilitation and maintenance costs include all expenditures that provide a measurable and lasting improvement in the condition of a road infrastructure asset and increase the value of the asset.

Routine Maintenance
Routine maintenance costs include expenditures that do not increase asset value. Typically, the cost for routine maintenance of road infrastructure is not assigned to specific projects and is budgeted as a lump sum. Routine maintenance costs include minor repairs such as filling potholes, minor guide rail repairs, cutting grass, maintenance of the right-of-way, and the removal of debris.

Winter Maintenance
The cost of winter maintenance includes the cost of the field operations for snow removal and ice control and the costs of all other associated and supporting activities and facilities.

All Other Road Infrastructure
All other infrastructure includes all road infrastructure components that are not a pavement or bridge, for example, earth work, drainage structures, landscaping and fencing, lighting, and safety and traffic control appurtenances.

It should be noted that all the calculated costs are estimates and may vary depending on real-world conditions.

As noted in **Table 8**, a public roadway/sidewalk would be the Town's financial responsibility and would introduce significant liability, which would not be borne under a private tenure.

8.2 Active Transportation

Regarding a plan specific to the municipality, The Town of the Blue Mountains does not have an active transportation plan that describes requirements of active transportation facilities for new developments. However, *The Town of The Blue Mountains Comprehensive Transportation Strategic Plan* was a study completed in 2010 that outlines various strategies for the municipality to adhere to when improving the transportation network as a whole.

Community designs that support active transportation and pedestrian connectivity provide numerous benefits including:

- Community Cohesion
- Health Benefits related to physical activity
- Improved community livability

The most significant benefit of active transportation are the numerous health advantages obtained by regularly staying active. These include, but are not limited to:

- Improved mental health
- Improved emotional being
- Improved social health due to the increase frequency of social interactions
- Reduced probability of developing chronic diseases such as diabetes or heart disease

These benefits have been long realized by various levels of government and are continually promoted through government led initiatives and studies.

Regarding active transportation in new development areas, it was recommended that policies should

be created that:

- Require sidewalks and multi-use trails;
- Require land dedication for future active transportation improvements;
- Improve cycling and pedestrian safety measures, thereby reducing injuries and fatalities associated with motor vehicle collisions;

As illustrated in the concept plan included in **Appendix D**, **Option 1** includes the construction of a pedestrian trail connecting the Parkbridge development to the Eden Oak development. All options are recommended to include pedestrian connections linking all the developments. This trail would ultimately connect to the mult-use Georgian Trail linking Collingwood to Meaford.

8.2.1 Safety of the Active Transportation Network

While all options provide satisfactory active transportation opportunities, it is considered that the lower speeds of the private road options, typically posted at 20 km/h, along with the reduced vehicle volumes is more advantageous to **Option 1 and 3**. The lower speeds and volumes increase driver response time reducing conflict probability and severity for cyclists, pedestrians and other motorists. Furthermore, the potential allowance of parked vehicles on the public roadway would provide additional conflict opportunities for vehicles and cyclists as sight lines may be obstructed. These conflict opportunities will not be present when considering **Options 1 and 3,** as roadside parking will be prohibited.

With a public roadway, liability associated with cyclist conflicts and pedestrian hazards (i.e. slip, trip, and falls) would fall under the responsibility of the Town. With a private roadway, this liability would fall under the responsibility of Parkbridge Lifestyle Communities Inc.

8.3 Supplemental Traffic Analysis/Considerations

8.3.1 Review of Emergency Vehicle Access Options

Option 1 includes a private roadway with two connections to Lakeshore Road and one to Grey Road 19. This provides three separate access points for emergency and maintenance vehicles. Further access point for emergency vehicles are not required.

Regarding winter maintenance, plowing the roads and sidewalks will be a requirement of Parkbridge Lifestyle Communities Incorporated. Additionally, any maintenance related to the streetlights would also be the responsibility of the proponent.

Option 2 contains a public road connection to Lakeshore Road and Grey Road 19. This will provide two separate access points for emergency and maintenance vehicles. Further access points for emergency vehicles are not required.

Regarding winter maintenances, plowing the roads and sidewalks would become the responsibility of The Town of The Blue Mountains. Additionally, any maintenance related to the streetlights would also be the responsibility of the Town.

Option 3 includes a private roadway with one connection to Grey Road 19. It is recommended that a second emergency access be included for this option in order to facilitate effective ingress/egress of emergency and maintenance vehicles. We recommend that the emergency access connect directly to Lakeshore Road in order to provide a secondary access located at the opposite end of the site in relation to the main access. This will reduce the probability that a blockage of the main access would also impact the emergency access. This has been shown on the proposed concept

plan as included in **Appendix D.**

Plowing the roads and sidewalks will be a requirement of Parkbridge Lifestyle Communities Incorporated. Additionally, any maintenance related to the streetlights would also be the responsibility of the proponent.

8.3.2 Review of Secondary Access Requirement

As described in *The Blue Mountains Engineering Standards*, the maximum number of residential units that may be constructed on a single access with a secondary emergency access is 150. The site plan dated July 8th, 2017 illustrates a full build-out of 211 units, therefore exceeding this limit.

Although Parkbridge Lifestyle Communities Incorporated have proposed two accesses off of Grey Road 19 and Lakeshore Road, the MTO has explicitly stated that they will not support any connection to Lakeshore Road. This constraint limits the development access to Grey Road 19, opposite of Craigleith Road.

As a result of this limitation, it is our recommendation that at least one emergency access connecting to Lakeshore Road be included in the revised site plan. This access could directly connect to Lakeshore Road, as this is the most feasible location due to the frontage available. This additional access will adhere to the MTO comments, while also providing a secondary option for residents in case the primary entrance is blocked, as previously discussed.

In the case of the subject development, more than 150 units under a single access with an emergency access to Lakeshore Road can be supported. Firstly, the traffic operations at the site entrance to Grey Road 19 are forecast to operate satisfactorily. Second, the emergency access and the main access are at opposite ends of the site, thereby reducing the probability that a blockage of the main access would also impact the emergency access.

8.3.3 Roundabout Feasibility (Highway 26 / Grey Road 19)

A conceptual roundabout design has been included in **Appendix G** for reference.

As illustrated in the prepared figure included in **Appendix G**, the entire intersection would need to be shifted to the south to account for the increased footprint of a roundabout. It should be noted that the roundabout illustrated in the figure has a 60-metre inscribed circle diameter, which would be expected for a multilane roundabout design of this scale.

Due to the requirement to shift the intersection to the south, the east and west legs of the intersection would need to be realigned southerly in order to effectively tie in to proposed roundabout. This would lead to significant impacts to adjacent properties.

In addition to the geometric challenges, the traffic operations of the 2031 future total conditions do not warrant any intersection improvements.

For the reasons stated above, it is not recommended to implement a roundabout at this location.

8.3.4 Collingwood/Blue Mountain Link

The Collingwood/Blue Mountain Link provides a transit stop at the Craigleith Community Centre located directly off of Lakeshore Road. This bus route provides residents the ability to take public transportation into the Town of Collingwood during a.m. and p.m. peak hours. A map of this bus route

is included in **Appendix F.**

8.3.5 Eden Oak Future Connection

Although timing information is unavailable, it is accepted that the planned roadway providing access to the Eden Oak development will ultimately continue southerly, connecting to Monterra Road. This future connection was not considered in the aforementioned analysis, but would reduce the impacts to Highway 26 and Grey Road 19 for trips destined to the Town of The Blue Mountains. This change in travel patterns would thus support the eventual connection to Monterra Road.

Furthermore, the eventual connection to Monterra Road would provide an opportunity to review the feasibility of closing access to Lakeshore Road via Highway 26.

It should be noted that a roadway connection between Eden Oak and Parkbridge was dismissed due to the archaeological and environmental constraints previously described namely, the protected archaeological areas, Butternut trees, and numerous watercourses traversing the site making such a connection impractical.

9 Conclusions

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

- Traffic operations for the three configuration options are minimally different and can all be supported from a traffic operations perspective.

- Environmental and topographic constraints present significant challenges for **Option 2** due to the requirement to adhere to the Town of The Blue Mountains Engineering Standards. Adherence to these standards would lead to significant scarification of the Nipissing Ridge, due to the cuts and fills required to construct the roadway. Furthermore, the accorded buffer zones for the environmental features present on the site create additional development challenges.

- Active transportation facilities are proposed for all options, however, **Options 1 and 3** are preferable due to the reduced vehicular volumes and operating speed.

- Pedestrian connectivity between all three developments is proposed and is recommended to be implemented regardless of the option pursued.

- **Option 2** would result in a greater financial burden to the Town as a result of the responsibility for winter maintenance and future infrastructure rehabilitation.

- Liability associated with cyclist conflicts and pedestrian hazards (i.e. slip, trip, and falls) would fall under the responsibility of the Town for **Option 2**. With a private roadway **(Option 3),** this liability would fall under the responsibility of Parkbridge Lifestyle Communities Inc.

- Accesses provided for **Options 1 and 2** are sufficient, however, **Option 3** requires an additional emergency access due to the single entrance configuration. This can be accommodated and is reflected in the site plan included in **Appendix D.**

- A roundabout at the intersection of Grey Road 19 and Highway 26 is not recommended due to the lack of operational need and the significant property impacts that implementing a roundabout would have.

- Traffic volumes on Highway 26 are similar regardless of the Option selected. However, **Option 3** reduces turning movements at the intersection of Lakeshore Road and Highway 26 and is therefore recommended.

- Although **Option 1 and 3** are preferred, **Option 3** does not assign additional traffic to the intersection of Highway 26 and Lakeshore Road, which was an explicit request from the Ministry of Transportation.

Based on the foregoing analysis, it is our recommendation that the **Option 3** road configuration be pursued.

The analysis undertaken within was prepared using the Concept Plan dated February 13, 2018 and the connectivity figure provided by The Town of The Blue Mountains in September 2017.

Prepared by,

C.F. CROZIER & ASSOCIATES INC.

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

C.F. CROZIER & ASSOCIATES INC.

Ryan MacLaughlan, P.Eng.
Project Engineer

/rm

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Appendix A
Correspondence

Ryan MacLaughlan

From: Silva Yousif <syousif@parkbridge.com>
Sent: Thursday, November 30, 2017 3:28 PM
To: Jon Proctor
Cc: Ryan MacLaughlan; Brad Dickieson; Michael Sproule; Rob Wagner; Tim Exner
Subject: RE: Parkbridge Craigleith Terms of Reference (1046-4031)

Hi Jon
As per our phone conversation .. please go ahead with the study and in case of any more comments / requests will come back, we can incorporate them accordingly . assuming 6 weeks Monday will put it right into end of Jan 2018 with Christmas and NYE holydays.

Also if you could have a chat with Bryan and see what is the need for getting the ToR sent to the county & MTO as the study was originally requested by ToBM

Let me know if you need anything else

Cheers

Silva Yousif, EIT, PMP
Urban & Regional Planning
Project Coordinator

T: 705 429-8630 ext. 4249
C: 705 828-3254
F: 705 422-0819
E: syousif@parkbridge.com

Parkbridge Lifestyle Communities Inc.
85 Theme Park Drive
Wasaga Beach, ON L9Z 1X7
www.parkbridge.com

From: Robert Wagner
Sent: November-30-17 2:12 PM
To: Jon Proctor <jproctor@cfcrozier.ca>; Silva Yousif <syousif@parkbridge.com>; Tim Exner <texner@parkbridge.com>
Cc: Ryan MacLaughlan <rmaclaughlan@cfcrozier.ca>; Brad Dickieson <bdickieson@cfcrozier.ca>; Michael Sproule <msproule@parkbridge.com>
Subject: RE: Parkbridge Craigleith Terms of Reference (1046-4031)

Hi Jon,

This is o.k. to be sent back to the Town.
Thanks.

Regards,

Rob

From: Jon Proctor [mailto:jproctor@cfcrozier.ca]
Sent: Thursday, November 30, 2017 2:08 PM
To: Robert Wagner <rwagner@parkbridge.com>; Silva Yousif <syousif@parkbridge.com>; Tim Exner <texner@parkbridge.com>
Cc: Ryan MacLaughlan <rmaclaughlan@cfcrozier.ca>; Brad Dickieson <bdickieson@cfcrozier.ca>; Michael Sproule <msproule@parkbridge.com>
Subject: RE: Parkbridge Craigleith Terms of Reference (1046-4031)

Hi Rob,

Responses below in blue. Let me know if you have further questions.

Please confirm if you comfortable with me circulating the updated versions back to the Town.

Regards,

Jon

| **JON PROCTOR** P.Eng. | ASSOCIATE | C.F. CROZIER & ASSOCIATES
| 40 Huron Street, Suite 301 | Collingwood, ON L9Y 4R3
| cfcrozier.ca | jproctor@cfcrozier.ca | tel 705 446 3510

From: Robert Wagner [mailto:rwagner@parkbridge.com]
Sent: Wednesday, November 29, 2017 8:54 AM
To: Jon Proctor <jproctor@cfcrozier.ca>; Silva Yousif <syousif@parkbridge.com>; Tim Exner <texner@parkbridge.com>
Cc: Ryan MacLaughlan <rmaclaughlan@cfcrozier.ca>; Brad Dickieson <bdickieson@cfcrozier.ca>; Michael Sproule <msproule@parkbridge.com>
Subject: RE: Parkbridge Craigleith Terms of Reference (1046-4031)

Hi Jon,

See my comments in red below.
Thanks.

Regards,

Rob

From: Jon Proctor [mailto:jproctor@cfcrozier.ca]
Sent: Thursday, November 23, 2017 11:38 AM
To: Silva Yousif <syousif@parkbridge.com>; Tim Exner <texner@parkbridge.com>; Robert Wagner <rwagner@parkbridge.com>
Cc: Ryan MacLaughlan <rmaclaughlan@cfcrozier.ca>; Brad Dickieson <bdickieson@cfcrozier.ca>
Subject: RE: Parkbridge Craigleith Terms of Reference (1046-4031)

Hello Silva, Rob & Tim,

While meeting recently with Brian Worsley regarding another matter in TOBM he provided a markup of our Terms of Reference for Traffic and Flood Studies with his comments. I have attached the updated versions for your review with additional language highlighted.

On the Flood Study requests include:

- Additional review and consideration of downstream channel capacities beyond Watercourse 7. Just to be clear, anything related to watercourse #7 as it passes through our property and travels beyond into Georgian Bay will be at the cost of Home Farm. Understood, this is consistent with how we have proceeded to date. This will expand the study to looking downstream at flood susceptibility in Watercourse #9. This area has not been historically identified as a flood damage center however the outlet channel does pass through private property between two historic cottages which Brian would like further study. (does this apply to the outlet channel for watercourse 7, 9 or both?) Essentially study of outlet channels for both.
- Completion of a high level erosion assessment to determine the impacts form outlet of stormwater flows. I have reached out to a colleague, Paul Villard a fluvial geomorphologist at Geomorphix to discuss what high level calculations could be completed. I will update when I get his response.

On the Traffic Study requests include:

- Queing distance analysis, signal timing and traffic control commentary at Hwy 26/CR 19. This information can be pulled out of our modeling with relative ease and reporting would include additional commentary on these items.
- Commentary on winter maintenance of emergency routes. This will be a very minor addition.

Please let me know if you have any comments or questions on the attached updated TOR. Once I hear your thoughts I will recirculate back to the Town.

Regards,

Jon

| **JON PROCTOR** P.Eng. | ASSOCIATE | C.F. CROZIER & ASSOCIATES
| 40 Huron Street, Suite 301 | Collingwood, ON L9Y 4R3
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Appendix B
Level of Service Definitions

Level of Service Definitions

Two-Way 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

Signalized Intersections

Level of Service	Control Delay per Vehicle (seconds)	Interpretation
A	≤ 10	EXCELLENT. Extremely favourable progression with most vehicles arriving during the green phase. Most vehicles do not stop and short cycle lengths may contribute to low delay.
B	> 10 and ≤ 20	VERY GOOD. Very good progression and/or short cycle lengths with slightly more vehicles stopping than LOS "A" causing slightly higher levels of average delay.
C	> 20 and ≤ 35	GOOD. Fair progression and longer cycle lengths lead to a greater number of vehicles stopping than LOS "B".
D	> 35 and ≤ 55	FAIR. Congestion becomes noticeable with higher average delays resulting from a combination of long cycle lengths, high volume-to-capacity ratios and unfavourable progression.
E	> 55 and ≤ 80	POOR. Lengthy delays values are indicative of poor progression, long cycle lengths and high volume-to-capacity ratios. Individual cycle failures are common with individual movement failures also common.
F	> 80	UNSATISFACTORY. Indicative of oversaturated conditions with vehicular demand greater than the capacity of the intersection.

Adapted from Highway Capacity Manual 2000, Transportation Research Board

Appendix C
Background TIS Reports

TRAFFIC IMPACT STUDY

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

PREPARED FOR:
PARKBRIDGE LIFESTYLE COMMUNITIES INC.

PREPARED BY:

C.F. CROZIER & ASSOCIATES INC.
40 HURON STREET, SUITE 301
COLLINGWOOD, ONTARIO
L9Y 4R3

DECEMBER 2016

CFCA FILE NO. 1046-4031

1.0 Executive Summary

CF Crozier & Associates Inc. (Crozier) was retained by Parkbridge Lifestyle Communities Inc. to complete a Traffic Impact Study in support of planning applications for the proposed residential development in Craigleith, Town of The Blue Mountains, County of Grey. The Subject Property is bounded by Grey Road 19 and existing residents to the west, Lakeshore Road to the north with existing residents in the north east corner, the proposed Eden Oak development to the East, and the proposed Home Farm development and existing residential lots to the south. The location of the proposed development is reflected in Figure 1.

The Subject Property is approximately 26.68 hectares (65.92 acres) in size. The Concept Plan for the proposed development consists of 94 townhomes and 119 single-detached houses. The proposed Concept Plan is reflected in Figure 2.

Analysis of existing traffic volumes has determined that the roadway system operates at a Level of Service "B" or better under current conditions.

A two percent growth rate was calculated using Annual Average Daily Traffic (AADT) volumes and factored for all movements on the boundary road intersections. The Eden Oak residential development is located to the east of the Subject Property. Accordingly, trips generated by this development were distributed to the boundary road network per the original Traffic Impact Study (Crozier, 2012) and included in the future background traffic analyses. Additionally, Eden Oak (Trailshead) Inc. is committed to constructing a dedicated westbound left-turn lane at the intersection of Highway 26 and Lakeshore Road. Thus, traffic operations were analyzed with and without the westbound left-turn lane.

Intersection analyses of the 2031 future background traffic volumes indicate that the Highway 26 and Grey Road 19 intersection is anticipated to continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Highway 26 and Lakeshore Road is expected to operate at a LOS "C" and "D" during the weekday a.m. and p.m. peak hours, respectively. The intersection of Grey Road 19 and Lakeshore Road is anticipated to operate at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Grey Road 19 and Craigleith Road is anticipated to continue operating at a LOS "A" in the weekday a.m. and p.m. peak hours.

The proposed development is expected to add 34 and 56 primary trips to the boundary road network in the weekday a.m. and p.m. peak hours respectively.

2031 total traffic operations were compared with the future background traffic operations. Intersection analyses of the 2031 total traffic volumes indicate that the Highway 26 and Grey Road 19 intersection is anticipated to continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Highway 26 and Lakeshore Road is expected to operate at a LOS "C" during the weekday a.m. and p.m. peak hours. The intersection of Grey Road 19 and Lakeshore Road is anticipated to continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Grey Road 19 and Craigleith Road is anticipated to continue operating at a LOS "A" in the weekday a.m. and p.m. peak hours.

The addition of site generated traffic will not materially affect the operations of the Highway 26 and Lakeshore Road intersection, thus site entrances to Lakeshore Road are supportable.

The analysis undertaken within was prepared using Concept Plan dated October 20th, 2016. Any minor changes to the Plan will not materially affect the conclusions contained within this report. The proposed development can be supported from a traffic operations perspective.

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2.0 Introduction

CF Crozier & Associates Inc. (Crozier) was retained by Parkbridge Lifestyle Communities Inc. to complete a Traffic Impact Study in support of planning applications for the proposed residential development in Craigleith, Town of The Blue Mountains, County of Grey.

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

The Subject Property is bounded by Grey Road 19 and existing residential properties to the west, Lakeshore Road to the north, the proposed Eden Oak residential development to the east, and the proposed Home Farm residential development and existing residential lots to the south.

The location of the Subject Property is reflected on the development Site Location Plan included as Figure 1.

The study analyzes the operations of the boundary road intersections, as well as the accesses to the Subject Property. The future traffic operations with and without the addition of the site generated vehicular trips are also analyzed.

The terms of reference for the study was confirmed with the Ministry, County and Town staff, with correspondence included in Appendix A. Notably, Ministry staff stated new access connections onto Lakeshore Road that significantly intensify the highway intersection will not be supported. This report addresses this element.

The study has been completed in accordance with the procedures set out in the Ontario Ministry of Transportation (MTO) "Traffic Impact Study Guidelines" and agreed upon Terms of Reference with the Town, County and MTO, with the associated analyses and findings outlined therein.

3.0 Existing Conditions

3.1 Development Lands

The Subject Property is an approximate 26.68 hectares (65.92 acres) undeveloped lot located in Craigleith, The Town of Blue Mountains, County of Grey. The subject property is bounded by Grey Road 19 and existing residents to the west, Lakeshore Road to the north with existing residents in the north east corner, the proposed Eden Oak development to the East, and the proposed Home Farm development and existing residential lots to the south. The Subject Property itself currently contains undeveloped forest and pasture lands.

3.2 Study Area

The study area encompasses the boundary road network surrounding the Subject Property, and is described in Section 3.3.

3.3 Boundary Road Network

With skewed directions, the directional orientation of Lakeshore Road and Highway 26 is ambiguous. To provide clarity throughout this report and in the supporting analysis Lakeshore Road and Highway 26 have been assigned an east-west orientation.

Grey Road 19 is a north-south two-way arterial roadway under the jurisdiction of County of Grey with a posted speed limit of 50 km/h. The roadway consists of one approximate 3.5 metre travel lane per direction and an approximate 2.0 metre wide paved shoulder on both sides of the roadway designated for pedestrian and cyclist traffic.

Highway 26 is an east-west provincial highway under the jurisdiction of the Ontario Ministry of Transportation (MTO) with a posted speed limit of 80 km/h. The roadway consists of one approximate 3.5 metre travel lane per direction and an approximate 3.25 metre wide granular shoulder on both sides of the roadway.

Lakeshore Road is an east-west two-way local road under the jurisdiction of the Town of The Blue Mountains with a posted speed limit of 50 km/h. The roadway consists of one approximate 3.25 metre travel lane per direction.

Craigleith Road is an east-west two-way collector roadway under the jurisdiction of the Town of The Blue Mountains with a posted speed limit of 50 km/h. The roadway consists of one approximate 4.5 metre travel lane per direction and an approximate 2.5 metre asphalt sidewalk on the south side of the roadway.

Fraser Crescent is a north-south two-way local road under the jurisdiction of the Town of The Blue Mountains. There is no posted speed limit and thus, it is assumed to be 50 km/h per municipal regulation. The roadway consists of one approximate 3.25 metre travel lane per direction.

The intersection of Grey Road 19 and Highway 26 is a signalized semi-actuated three-legged intersection. The south approach (Grey Road 19) consists of a right-turn lane and a left-turn lane with approximately 115 metres of effective storage. The west approach (Highway 26) consists of a through lane and an auxiliary right-turn lane with approximately 80 metres of effective storage. The east approach (Highway 26) consists of a through lane and a left-turn lane with approximately 190 metres of effective storage.

The intersection of Highway 26 and Lakeshore Road/Fraser Crescent is a two-way stop-controlled intersection. Each approach consists of a shared left/through/right-turn lane. The intersection is stop-controlled in the northbound and southbound directions and is free flowing in the eastbound and westbound directions (Highway 26).

The intersection of Grey Road 19 and Lakeshore Road is a two-way stop-controlled intersection. The east (Fraser Crescent) approach and west approach (Lakeshore Road) consists of a shared left/through/right-turn lane. The south approach (Grey Road 19) consists of a left turn lane extending to Highway 26 and a through/right-turn lane. The north approach (Grey Road 19) consists of a shared through/left-turn lane. The eastbound and westbound movements are stop controlled while the northbound and southbound movements are free-flowing.

The intersection of Grey Road 19 and Craigleith Road is a stop-controlled three-legged intersection. The west approach (Craigleith Road) consists of a shared left/right-turn lane. The south approach (Grey Road 19) consists of a shared through/left-turn lane. The north approach (Grey Road 19) consists of a shared through/right-turn lane. The eastbound movement is stop controlled while the northbound and southbound movements are free-flowing.

3.4 Development Proposal

The Subject Property will consist of 94 townhouses and 119 single-detached houses. The development Concept Plan dated October 20th, 2016 proposes two full moves accesses to Lakeshore Road and one full move access to Grey Road 19. The access to Grey Road 19, referred to as Street 1, will form the fourth leg (east approach) of the Grey Road 19 and Craigleith Road intersection. The westernmost access to Lakeshore Road is referred to as Street 4 and the easternmost access to Lake Shore Road is referred to as Street 6 for the remainder of the report.

3.5 Traffic Data

Turning movement counts for the boundary road intersections were undertaken by Ontario Traffic Inc. staff from 6:00 to 10:00 a.m. and from 3:00 to 7:00 p.m. on August 26th, 2016. A summer Friday was selected for traffic counts as MTO data for the segment of Highway 26 between Grey Roads 19 & 21 show greater summer average weekday Daily Traffic Volumes (2013: 11,300 vehicles) than Average Annual Daily Traffic Volumes (2013: 9,150 vehicles) or Winter Average Daily Traffic volumes (2013: 7,800). The traffic count data is summarized in Appendix C. Figure 3 illustrates the 2016 existing traffic volumes.

3.6 Intersection Operations

The operations of the critical intersections were analyzed on the basis of the traffic volumes illustrated in Figure 3.

Table 1
2016 Existing Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	12.0 s	0.36 (EBT)
		P.M.	B	13.7 s	0.59 (NBL)
Highway 26 and Lakeshore Road	Stop	A.M.	B	10.5 s	0.02 (NB)
		P.M.	B	12.0 s	0.01 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	A	9.9 s	0.01 (WB)
		P.M.	A	9.9 s	0.01 (WB)
Grey Road 19 and Craigleith Road	Stop	A.M.	A	9.0 s	0.03 (EB)
		P.M.	A	9.4 s	0.04 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

The signalized intersection of Highway 26 and Grey Road 19 is currently operating at a LOS "B" in both the weekday a.m. and p.m. peak hours. The delays of 12.0 seconds and 13.7 seconds and maximum volume-to-capacity ratios of 0.36 (EBT) and 0.59 (NBL) in the weekday a.m. and p.m. peak hours, respectively,

indicate that the intersection is operating efficiently with minor delays and with reserve capacity to accommodate future increases in volume.

The two-way stop controlled intersection of Highway 26 and Lakeshore Road is currently operating at a LOS "B" in both the weekday a.m. and p.m. peak hours. The delays of 10.5 seconds and 12.0 seconds and maximum volume-to-capacity ratios of 0.02 (NB) and 0.01 (NB) in the a.m. and p.m. peak hours, respectively, indicate that the intersection is operating efficiently with minor delays. This is a result of the low vehicular volumes as the minor road approaches.

The two-way stop controlled intersection of Grey Road 19 and Lakeshore Road is currently operating at a LOS "A" in both the weekday a.m. and p.m. peak hours. The delay of 9.9 seconds and maximum volume-to-capacity ratio of 0.01 (WB) in the a.m. and p.m. peak hours, indicate that the intersection is operating efficiently with minor delays and with reserve capacity to accommodate future increases in traffic volume.

The two-way stop controlled intersection of Grey Road 19 and Craigleith Road is currently operating at a LOS "A" in both the weekday a.m. and p.m. peak hours. The delays of 9.0 seconds and 9.4 seconds and maximum volume-to-capacity ratios of 0.03 (NB) and 0.04 (NB) in the a.m. and p.m. peak hours, respectively, indicate that the intersection is operating efficiently with minor delays and with reserve capacity to accommodate future increases in volume.

The traffic metrics listed above indicate that there are no traffic operational issues at the analyzed intersection under existing conditions.

4.0 Future Background Conditions

4.1 Horizon Years

The subject development is anticipated to be fully built out and occupied by 2021; therefore horizon years of 2026 and 2031 are assumed, representing five and ten year horizons, per MTO TIS Guidelines.

4.2 Growth Rate

Traffic growth rates were calculated based on historical AADT data provided by the Ministry of Transportation at the intersection of Highway 26 and Grey Road 19. Traffic volumes for the years 2006 to 2012 were used to calculate an average annual compounded growth rate of 1.69 percent. For the purpose of conservative analysis, an industry standard two percent growth rate was applied to the traffic volumes at all subject intersections.

4.3 Background Trip Generation

Two residential developments, the Eden Oak development and the Chaisson development are proposed east of the subject site and will contribute to the future background traffic on the boundary road network, and is thus included in the future background traffic analyses. Eden Oak is a proposed residential development consisting of 217 townhouse units, and the Chaisson proposed development residential will consist of eight single detached units.

Table 2 outlines the trip generation per Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition, as described in the original Eden Oak Blue Trails Development Traffic Impact Study (Crozier, 2012).

Table 2
Future Background Trip Generation: Eden Oak Development

Use	Units	Roadway Peak Hour	Number of Trips		
			Inbound	Outbound	Total
Single Family Detached (LU 210) (Chaisson Lands)	8	Weekday A.M.	2	4	6
		Weekday P.M.	5	3	8
Residential Condo/Townhouse (LU 230)	217	Weekday A.M.	16	79	95
		Weekday P.M.	76	37	113
Total	225	Weekday A.M.	18	83	101
		Weekday P.M.	81	40	121

Note: The trip generation above was adopted from the original Eden Oak TIS (Crozier, 2012)

4.4 Background Trip Distribution

The trips generated by the Eden Oak Blue Trails Development during future background scenarios were distributed on the basis of the trip distribution described in the original Eden Oak Blue Trails Development Traffic Impact Study (Crozier, 2012).

The trips generated by the Eden Oak development were distributed to the boundary roadways based on the location of retail, commercial and recreational destinations. With the Town of Collingwood located to the east of the subject lands, 60 percent of trips were assumed to travel to and from the east along Highway 26. 20 percent of trips were assumed to travel to and from the west along Lakeshore Road for the recreational and leisure destinations associated with the Niagara Escarpment, primarily the Village at Blue. The remaining 20 percent of trips were assumed to travel to and from Thornbury and areas west along Highway 26.

Refer to Figures 4 and 5 for background development trip distribution and trip assignments, respectively.

4.5 Future Roadway Improvements

Per the Eden Oak TIS (Crozier, 2012) a westbound left turn lane at the intersection of Highway 26 and Lakeshore Road is recommended to support the Eden Oak residential development. While the timing is not confirmed at this time, implementation is required at the 45th Eden Oak unit. Additionally, we have assumed that this would occur before full buildout of Parkbridge Craigleith. Thus, per email correspondence with Brian Worsley at the Town of The Blue Mountains, included in Appendix A, future background and future total traffic operations for the horizon years 2021, 2026 and 2031 were analyzed with and without a westbound left-turn lane at the intersection of Highway 26 and Lakeshore Road.

4.6 Intersection Operations

Tables 3 through 5 outline the 2021 through 2031 future background traffic levels of service associated with the boundary road network as based on the future background traffic volumes illustrated in Figures 6 through 8, with detailed capacity analyses included in Appendix E.

Analysis of the intersection of Highway 26 and Grey Road 19 through horizon year 2031 was analyzed on the basis of existing signal timings.

Table 3
2021 Future Background Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	12.3 s	0.4 (EBT)
		P.M.	B	14.6 s	0.65 (NBL)
Highway 26 and Lakeshore Road (Existing Configuration)	Stop	A.M.	B	13.4 s	0.17 (NB)
		P.M.	C	19.2 s	0.15 (NB)
Highway 26 and Lakeshore Road (With WB Left Turn Lane)	Stop	A.M.	B	13.4 s	0.17 (NB)
		P.M.	C	18.9 s	0.14 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	10.9 s	0.04 (WB)
		P.M.	B	11.5 s	0.03 (WB)
Grey Road 19 and Craigleith Road	Stop	A.M.	A	9.2 s	0.04 (EB)
		P.M.	A	9.6 s	0.05 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Table 4
2026 Future Background Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	12.7 s	0.44 (EBT)
		P.M.	B	16.6 s	0.72 (NBL)
Highway 26 and Lakeshore Road (Existing Configuration)	Stop	A.M.	B	14.3 s	0.18 (NB)
		P.M.	C	21.9 s	0.17 (NB)
Highway 26 and Lakeshore Road (With WB Left Turn Lane)	Stop	A.M.	B	14.2 s	0.18 (NB)
		P.M.	C	21.5 s	0.17 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	11.1 s	0.05 (WB)
		P.M.	B	11.8 s	0.03 (WB)
Grey Road 19 and Craigleith Road	Stop	A.M.	A	9.3 s	0.04 (EB)
		P.M.	A	9.8 s	0.06 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Table 5
2031 Future Background Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	13.7 s	0.56 (NBL)
		P.M.	B	17.2 s	0.80 (NBL)
Highway 26 and Lakeshore Road (Existing Configuration)	Stop	A.M.	C	15.4 s	0.20 (NB)
		P.M.	D	25.8 s	0.21 (NB)
Highway 26 and Lakeshore Road (With WB Left Turn Lane)	Stop	A.M.	C	15.4 s	0.20 (NB)
		P.M.	D	25.1 s	0.20 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	11.6 s	0.04 (WB)
		P.M.	B	12.2 s	0.04 (WB)
Grey Road 19 and Craigleith Road	Stop	A.M.	A	9.4 s	0.05 (EB)
		P.M.	A	9.9 s	0.06 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

The intersection of Highway 26 and Grey Road 19 is expected continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours through to the 2031 future background horizon year. The control delay of 13.7 seconds and 17.2 seconds in the a.m. and p.m. peak hours, respectively, represent an increase of 3.5 seconds or less when compared with the 2016 existing traffic conditions. The maximum volume-to-capacity ratio is expected to increase to 0.56 (NBL) and 0.80 (NBL) in the a.m. and p.m. peak hours, respectively representing an increase of 0.21 or less, when compared with 2016 existing traffic conditions. These metrics indicate that the intersection is expected to continue operating efficiently with minimal delays under 2031 future background traffic conditions with reserve capacity to accommodate increases in traffic volume.

The intersection of Highway 26 and Lakeshore Road was analyzed with and without a westbound left-turn lane. In both scenarios the intersection is expected to operate at a LOS "C" and "D" in the weekday a.m. and p.m. peak hours, respectively, through to the 2031 future background horizon year. The left-turn lane is expected to reduce the control delay by 0.7 seconds or less in the weekday p.m. peak hour and have no material impact to the weekday a.m. peak hour delay or maximum volume-to-capacity ratio. This is because the metric for an unsignalised intersection is the delay of the minor road approach. The intersection is expected to operate with delays of 15.4 seconds and 25.1 seconds and maximum volume-to-capacity ratios of 0.20 (NB) and 0.21 (NB) or less in the weekday a.m. and p.m. peak hours, respectively. These metrics indicate that the intersection is expected to continue operating efficiently with minimal delays under 2031 future background traffic conditions with reserve capacity to accommodate increases in traffic

volume.

The intersection of Grey Road 19 and Lakeshore Road is expected to operate at a LOS "B" in the weekday a.m. and p.m. peak hours through the 2031 future background study horizon. The control delay of 11.6 seconds and 12.2 seconds in the a.m. and p.m. peak hour, respectively, represents an increase of 1.7 seconds and 2.3 seconds when compared to the 2016 existing traffic conditions. The maximum volume-to-capacity ratio is expected to increase to 0.04 (WB) in the a.m. and p.m. peak hour representing an increase of 0.03, when compared with 2016 existing traffic conditions. These metrics indicate that the intersection is expected to continue operating efficiently with minimal delays under 2031 future background traffic conditions with reserve capacity to accommodate increases in traffic volume.

The intersection of Grey Road 19 and Craigleith Road is expected continue operating at a LOS "A" in the weekday a.m. and p.m. peak hours through the 2031 future background study horizon. The control delay of 9.4 seconds and 9.9 seconds in the a.m. and p.m. peak hour, respectively, represents an increase of 0.4 seconds and 0.5 seconds when compared to the 2016 existing traffic conditions. The maximum volume-to-capacity ratio is expected to increase to 0.05 (NBL) and 0.06 (NBL) in the a.m. and p.m. peak hour representing an increase of 0.02 when compared with 2016 existing traffic conditions. These metrics indicate that the intersection is expected to continue operating efficiently with minimal delays under 2031 future background traffic conditions with reserve capacity to accommodate increases in traffic volume.

5.0 Site Generated Traffic

5.1 Trip Generation

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. Parkbridge Lifestyle Communities Inc. (Parkbridge) is Canada's leading owner, operator and developer of residential land lease communities, recreational resorts and marinas. This proposed development will provide recreational homes for families and retirees. As such, the development was analyzed using the average rates found in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition, under Land Use Category 260 "Recreational Homes". Per the Concept Plan (Figure 2) dated October 20th, 2016 the Subject Property is comprised of 213 units. This is consistent with area demographics as a material properties of residents in the area are seasonal or part time.

Per the ITE Trip Generation Manual, the proposed residential development is forecasted to generate a total of 34 and 56 trips during the weekday a.m. and p.m. peak periods, respectively for the subject property.

The forecasted trips are tabulated in Table 6.

Table 6
Trip Generation

Subject Property Use	Roadway Peak Hour	Number of Trips		
		Inbound	Outbound	Total
Recreational Homes (Cat 260)	Weekday A.M.	23	11	34
	Weekday P.M.	23	33	56

5.2 Trip Distribution and Assignment

The trips generated by the development were distributed to the boundary roadways based on the trip distribution described for the traffic generated by the Eden Oak development, outlined in Section 4.5. The distribution is based on the location of retail, commercial and recreational destinations. With the Town of Collingwood located to the east of the subject lands, 60 percent of trips were assumed to travel to and from the east, 20 percent of trips were assumed to travel to and from the west towards Thurnbury, and the remaining 20 percent as assumed to travel to and from the south for the recreational and leisure destinations associated with the Niagara Escarpment, primarily the Village at Blue Mountain. Below is a breakdown of the roadways used to travel in each direction.

- 50% to/from east via Highway 26
- 10% to/from east via Grey Road 19/Mountain Road
- 15% to/from west via Highway 26
- 20% to/from south via Grey Road 19
- 5% to/from west via Grey Road 19/Highway 26

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

6.0 Total Future Conditions

6.1 Basis of Assessment

The traffic impacts arising from the proposed development were assessed on the basis of the site generated traffic illustrated in Figure 10 being superimposed on the future background traffic volumes in Figures 6 through 8. The resulting total traffic volumes for the weekday a.m. and p.m. peak hours are illustrated in Figures 11 through 13 for the 2021 through 2031 horizon years.

The two site accesses on Lakeshore Road were not analyzed since the low traffic volumes on Lakeshore Road, Street 4 and Street 6 are not typically associated with traffic operational issues.

6.2 Auxiliary Lane Assessment

Left turn and right turn lane warrants were not undertaken at the site entrance to Grey Road 19. This was because of the low volumes forecast to enter at this location (max seven northbound right turn vehicles and one southbound left turn vehicle). Similarly, auxiliary lane assessments were not undertaken at the Lakeshore Road enhances due to the low vehicle volumes (max 90 vehicles in all directions).

6.3 Intersection Operations

Tables 7 through 9 outline the 2021 through 2031 future total traffic conditions associated with the boundary road network, with detailed capacity analyses included in Appendix F

Analysis of the intersection of Highway 26 and Grey Road 19 through horizon year 2031 was analyzed on the basis of existing signal timings.

Table 7
2021 Future Total Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	12.4 s	0.40 (EBT)
		P.M.	B	14.8 s	0.67 (NBL)
Highway 26 and Lakeshore Road (Existing Configuration)	Stop	A.M.	B	13.6 s	0.18 (NB)
		P.M.	C	18.5 s	0.19 (NB)
Highway 26 and Lakeshore Road (With WB Left Turn Lane)	Stop	A.M.	B	13.5 s	0.18 (NB)
		P.M.	C	18.2 s	0.19 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	10.9 s	0.04 (WB)
		P.M.	B	11.3 s	0.04 (WB)
Grey Road 19 and Craigleith Road/Street 1	Stop	A.M.	B	10.7 s	0.04 (EB)
		P.M.	B	13.2 s	0.05 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Table 8
2026 Future Total Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	12.8 s	0.44 (EBT)
		P.M.	B	16.9 s	0.74 (NBL)
Highway 26 and Lakeshore Road (Existing Configuration)	Stop	A.M.	B	14.5 s	0.19 (NB)
		P.M.	C	21.0 s	0.22 (NB)
Highway 26 and Lakeshore Road (With WB Left Turn Lane)	Stop	A.M.	B	14.5 s	0.19 (NB)
		P.M.	C	20.6 s	0.22 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	11.2 s	0.05 (WB)
		P.M.	B	11.6 s	0.04 (WB)
Grey Road 19 and Craigleith Road	Stop	A.M.	B	11.0 s	0.04 (EB)
		P.M.	B	14.0 s	0.06 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

Table 9
2031 Future Total Level of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Max V/C Ratio
Highway 26 and Grey Road 19	Signal	A.M.	B	13.8 s	0.58 (NBL)
		P.M.	B	17.5 s	0.82 (NBL)
Highway 26 and Lakeshore Road (Existing Configuration)	Stop	A.M.	C	15.6 s	0.22 (NB)
		P.M.	C	24.8 s	0.26 (NB)
Highway 26 and Lakeshore Road (With WB Left Turn Lane)	Stop	A.M.	C	15.6 s	0.21 (NB)
		P.M.	C	24.1 s	0.25 (NB)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	11.5 s	0.05 (WB)
		P.M.	B	12.0 s	0.04 (WB)
Grey Road 19 and Craigleith Road	Stop	A.M.	B	11.3 s	0.05 (EB)
		P.M.	B	14.9 s	0.06 (EB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

The intersection of Highway 26 and Grey Road 19 is expected continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours through to the 2031 future total horizon year. The control delay of 13.8 seconds and 17.5 seconds and maximum volume-to-capacity ratios 0.58 (NBL) and 0.82 (NBL) in the a.m. and p.m. peak hours, respectively indicate that the intersection is expected to operate efficiently with minor increases to control delay given the addition of the site generated traffic.

The intersection of Highway 26 and Lakeshore Road was analyzed with and without a westbound left-turn lane. In both scenarios the intersection is expected to operate at a LOS "C" in the weekday a.m. and p.m. peak hour through to the 2031 future total horizon year. The left-turn lane is expected to reduce the control delay by 0.7 seconds or less in the weekday p.m. peak hour and have no material impact to the weekday a.m. peak hour delay or maximum volume-to-capacity ratio. The intersection is expected to operate with delays of 15.6 seconds and 24.1 seconds and maximum volume-to-capacity ratios of 0.22 (NB) and 0.25 (NB) in the weekday a.m. and p.m. peak hours, respectively. These metrics indicate that the intersection is expected to operate efficiently with minor increases to control delay given the addition of the site generated traffic.

It is highlighted that the traffic metrics for Highway 26 and Lakeshore Road intersection will remain vertically unchanged in the a.m. peak hour and improve by one second in the p.m. peak hour, as compared to Future Background operations. This is a result of site generated traffic volumes being added to the low delay northbound right turn movement, thereby improving average delay at the intersection.

The intersection of Grey Road 19 and Lakeshore Road is expected to continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours through the 2031 future total study horizon. The control delay of 11.5 seconds and 12.0 seconds and maximum volume-to-capacity ratios of 0.05 (WB) and 0.04 (WB) in the a.m. and p.m. peak hours, respectively indicate that the intersection is expected to operate efficiently with minor increases to control delay given the addition of the site generated traffic.

The intersection of Grey Road 19 and Craigleith Road is expected operate at a LOS "B" in the weekday a.m. and p.m. peak hours through the 2031 future total study horizon. The control delay of 11.3 seconds and 14.9 seconds in the a.m. and p.m. peak hour, respectively, represents an increase of 0.4 seconds and 0.5 seconds and maximum volume-to-capacity ratios of 0.05 (NBL) and 0.06 (NBL) in the a.m. and p.m. peak hour, respectively indicate that the intersection is expected to operate efficiently with minor increases to control delay given the addition of the site generated traffic.

6.4 Lakeshore Road Entrance Feasibility

The feasibility of entrances to Lakeshore Road was assessed based on the MTO comment that significant intensification to the Highway 26/Lakeshore Road intersection would not be supported.

Per section 6.3, the average delay to vehicles entering Highway 26 from Lakeshore will not materially charge with the addition of site generated traffic. Thus, entrances to Lakeshore Road are feasible from this perspective.

Further investigation of delay to Highway 26 through vehicles was undertaken to determine if site generated traffic would materially affect Highway 26 traffic flow.

No site generated eastbound right turns are forecast, thus there will be no impact to eastbound Highway 26 traffic flow. During the critical p.m. peak hour, 12 site generated vehicles will be added to the westbound left turn movement. When compared to the future background traffic conditions, no impact will result to the Highway 26 westbound traffic flow due to the future turn lane, and the control delay for the westbound, left turn movement will remain unchanged at 9.4 seconds in the 2031 horizon year.

Accordingly, it is concluded that the provision of site entrances to Lakeshore Road will not have a material impact to the Highway 26 and Lakeshore Road intersection and are therefore supportable.

7.0 Conclusions

Intersection analysis of the 2016 existing traffic volumes determined that the roadway system operates at a Level of Service "B" or better during the weekday a.m. and p.m. peak hours.

The Eden Oak residential development is located to the east of the Subject Property. Accordingly, trips generated by this development were distributed to the boundary road network per the original Traffic Impact Study (Crozier, 2012) and included in the future background traffic analyses. Additionally, Eden Oak (Trailshead) Inc. is committed to constructing a dedicated westbound left-turn lane at the intersection of Highway 26 and Lakeshore Road. Accordingly, traffic operations were analyzed with and without the westbound left-turn lane.

Intersection analyses of the 2031 future background traffic volumes indicate that the Highway 26 and Grey Road 19 intersection is anticipated to continue operating at a LOS "B" in the weekday a.m. and p.m. peak

hours. The intersection of Highway 26 and Lakeshore Road is expected to operate at a LOS "C" and "D" during the weekday a.m. and p.m. peak hours, respectively. The intersection of Grey Road 19 and Lakeshore Road is anticipated to operate at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Grey Road 19 and Craigleith Road is anticipated to continue operating at a LOS "A" in the weekday a.m. and p.m. peak hours.

The proposed development is expected to add 34 and 56 primary trips to the boundary road network in the weekday a.m. and p.m. peak hours respectively.

2031 total traffic operations were compared with the future background traffic operations. Intersection analyses of the 2031 total traffic volumes indicate that the Highway 26 and Grey Road 19 intersection is anticipated to continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Highway 26 and Lakeshore Road is expected to operate at a LOS "C" during the weekday a.m. and p.m. peak hours. The intersection of Grey Road 19 and Lakeshore Road is anticipated to continue operating at a LOS "B" in the weekday a.m. and p.m. peak hours. The intersection of Grey Road 19 and Craigleith Road is anticipated to continue operating at a LOS "A" in the weekday a.m. and p.m. peak hours.

The addition of site generated traffic will not materially affect the operations of the Highway 26 and Lakeshore Road intersection, thus site entrances to Lakeshore Road are supportable.

The analysis undertaken within was prepared using Concept Plan dated October 20th, 2016. Any minor changes to the Plan will not materially affect the conclusions contained within this report.

The proposed development can be supported from a traffic operations perspective.

Prepared by,
C.F. CROZIER & ASSOCIATES INC.

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

/MF

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TRAFFIC IMPACT STUDY

EDEN OAK – BLUE TRAILS RESIDENTIAL DEVLEOPMENT

EDEN OAK (TRAILSHEAD) INC. TOWN OF THE BLUE MOUNTAINS

PREPARED BY:

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JULY 2012

CFCA FILE NO. 218-2659

1.0 Executive Summary

CF Crozier & Associates Inc. was retained by Eden Oak (Trailshead) Inc. to complete a Traffic Impact Study for a proposed residential development at Highway 26 and Old Lakeshore Road in the village of Craigleith in the Town of The Blue Mountains. The study is to support an Official Plan Amendment, a Zoning By-Law Amendment and a Draft Plan of Subdivision Application on the lands.

Analysis contained herein is based on a development proposed to consist of 217 residential units of varying form. Minor changes to the unit count will not materially affect the conclusions and recommendations of the study.

The key recommendation of the study is that a westbound left-turn lane with 30 metres of storage is required at the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent, and that this westbound left-turn lane is required after the 55th unit is occupied.

The study has been completed in accordance with the procedures set out in the MTO "General Guidelines for the Preparation of Traffic Impact Studies" December 2009 guide, with the associated analysis and findings outlined herein. The scope of study has been confirmed with staff from MTO.

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2.0 Introduction

CF Crozier & Associates Inc. (Crozier) was retained by Eden Oak (Trailshead) Inc. to complete a Traffic Impact Study for the proposed Eden Oak – Blue Trails residential development. This study is to support an Official Plan Amendment, a Zoning By-law Amendment and a Draft Plan Application on the lands. The purpose of the study was to assess the impacts of the proposed development on the boundary road system and in particular, to determine the number of developable units before triggering the requirement for a westbound left-turn lane on Highway 26.

The study analyses the operations of the Highway 26 and Old Lakeshore Road intersection under several time horizons. The future traffic operations with and without the addition of the site generated vehicular trips are also analyzed.

The study has been completed in accordance with the procedures set out in the MTO "General Guidelines for the Preparation of Traffic Impact Studies" December 2009 guide, with the associated analysis and findings outlined herein. The scope of work for the study has been set in consultation with staff from MTO.

2.1 Project History

The subject lands were formerly Draft Approved in 2006 by the previous site owners for a 71 lot golf course community known as the Trailshead Golf & Residence Club. Subsequent to this approval, Eden Oak (Trailshead) Inc. purchased the subject lands and modified the development concept plan to reflect a 77 unit estate residential subdivision. This plan was Draft Approved in 2007.

Agreements with MTO specified that 40 units could be constructed before triggering the requirement of a westbound left-turn lane on Highway 26 at Old Lakeshore Road. The recent changes to the unit count and type necessitate a Traffic Impact Study to support the applications, and to determine the new unit count that would trigger external roadway improvements.

3.0 Existing Conditions

3.1 Study Area

The study area comprises the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent. These roadways and the intersection are described in Section 3.4.

Low density residential areas exist to the north of the property along Highway 26, and south of the property atop the Nipissing Ridge. Undeveloped areas exist to the east and west. Along Old Lakeshore Road, a mix of residential and vacant lands abut the roadway.

3.2 Boundary Road Network

Highway 26 is a two lane rural east-west highway under the jurisdiction of MTO. The posted speed transitions from 80 km/h to 60 km/h approximately 300 metres east of Old Lakeshore Road. The roadway consists of two 3.6 metre paved travel lanes with 3.0 metre granular shoulders.

Old Lakeshore Road is a two lane east-west rural local roadway under the jurisdiction of the Town of The Blue Mountains. The posted speed limit is 50 km/h. The roadway consists of two 3.0 metre paved travel lanes with 0.5 metre granular shoulders.

Fraser Crescent is a two-lane local rural roadway under the jurisdiction of the Town of The Blue Mountains. The speed limit is not posted and is therefore 50 km/h per municipal regulation. The roadway consists of a 50 metre unpaved platform with no shoulders.

The four-legged intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent is unsignalized. The east and west approaches (Highway 26) have no restriction to free-flow and consist of a shared left-turn/through/right-turn lane. The north approach (Fraser Crescent) and south approach (Old Lakeshore Road) are stop-controlled and consist of a shared left-turn/through/right-turn lane.

3.3 Development Proposal

The proposed development is to consist of mixed residential unit types. 128 clustered or attached townhomes are proposed, along with 62 semi-detached units. Additionally, five attached units are proposed away from the main site on the north side of Lakeshore. These units will serve as model homes for sales purposes.

The tenure of the internal roadway system is to be publically owned and contained within a 20 metre road allowance. Private condominium elements will exist within the site to serve the clustered townhomes.

Access to the public roadway will be through a single access to Old Lakeshore Road, approximately 85 metres south of the Highway 26 and Old Lakeshore Road/Fraser Crescent intersection. An allowance for a public road connection to undeveloped lands to the east has been made to accommodate future development to the east.

Refer to Figure 2 for the draft plan prepared by D.C. Slade & Associates, June, 2012.

3.4 Traffic Data

Turning movement counts at the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent were undertaken by C. F. Crozier & Associates staff from 7:00 to 9:00 a.m. and from 4:00 to 6:00 p.m. on June 22, 2012.

The a.m. peak hour was found to be from 8:00 to 9:00 a.m., and the p.m. peak hour was found to be from 4:15 to 5:15 p.m. The traffic count data is summarized in Appendix B.

Figure 3 illustrates the 2012 existing traffic volumes.

3.5 Intersection Operations

The operations of intersection were analyzed on the basis of the traffic volumes illustrated in Figure 3. The assessment of unsignalized intersections is based on the method outlined in the "Highway Capacity Manual, 2000" and was modeled using Synchro 8 software. The definitions for unsignalized intersections are included in Appendix A and detailed capacity analyses are included in Appendix C.
Table 1 outlines the 2012 traffic levels of service.

Table 1
2012 Existing Traffic Levels of Service

Intersection	Peak Hour	Level of Service	Control Delay	95%ile Queue Length	Volume-to-Capacity
Highway 26 and Old Lakeshore Road / Fraser Crescent	Weekday A.M.	A	11.3 s	1 veh.	0.01
	Weekday P.M.	B	10.9 s	1 veh.	0.01

Note: The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor public road movement (i.e. Old Lakeshore Road).

As indicated in Table 1, the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent operates at a Level of Service "A" in the weekday a.m. peak hour and a Level of Service "B" in the weekday p.m. peak hour. Both metrics refer to the south approach (Old Lakeshore Road), which experiences greater traffic volumes than the north approach. Volume-to-capacity ratios will be negligible with 95th percentile queue lengths of one vehicle. These metrics are indicative of an intersection that is operating with no capacity or congestion concerns.

4.0 Future Background Conditions

4.1 Horizon Years

At the time of writing of the report, decisions regarding phasing of the development had not been made. A full build-out horizon year of 2020 was assumed, which equates to an average of 30 units per year over seven years. This market absorption rate was considered reasonable for the Georgian Triangle Area. Accordingly, the year 2020 was selected as the first horizon year, with further horizon years of five and ten years (2025 and 2030) as per MTO guidelines.

4.2 Highway 26 Corridor Growth Rate

Traffic growth rates for Highway 26 were provided by MTO. A corridor growth rate of 1.25 was specified. This growth rate was applied to Highway 26 traffic volumes, as well as traffic volumes on Old Lakeshore Road and Fraser Crescent.

4.3 Other Local Area Developments

One other local area development that will directly influence future background traffic volumes is currently in the planning phase. The Craigleith Village mixed use development is proceeding through draft plan approval after receiving an Official Plan and Zoning By-Law Amendment. The development is located approximately one kilometre east of the subject property on the north side of Highway 26 between Blue Mountain Drive and Long Point Road. Traffic volumes available from the "Traffic Impact Study Update, Silver Creek at Craigleith", Crozier, May 2009 report were included in the calculation of future background traffic volumes. Excerpts of this report have been included in Appendix B.

Figures 4, 5 and 6 illustrate the future background traffic volumes for the 2020, 2025 and 2030 horizon years, respectively, and reflect the Highway 26 corridor growth and the development specific growth from the Craigleith Village mixed use development.

4.4 Intersection Operations

The operations of the critical intersections were analyzed on the basis of the traffic volumes illustrated in Figures 4, 5 and 6. Table 3 outlines the 2020, 2025 and 2030 future background traffic levels of service. Detailed capacity analyses are included in Appendix C.

Table 3
Future Background Traffic Levels of Service

Intersection	Horizon Year	Peak Hour	Level of Service	Control Delay	95%ile Queue Length	Volume-to-Capacity
Highway 26 and Old Lakeshore Road / Fraser Crescent	2020	A.M.	B	12.2 s	1 veh.	0.02
		P.M.	B	12.2 s	1 veh.	0.02
	2025	A.M.	B	12.5 s	1 veh.	0.02
		P.M.	B	12.5 s	1 veh.	0.02
	2030	A.M.	B	12.8 s	1 veh.	0.02
		P.M.	B	12.8 s	1 veh.	0.02

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

As indicated in Table 3 the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent will experience minor increases in delays to a maximum of two seconds by the 2030 p.m. peak hour. This is a result of the low volume of vehicles entering Highway 26 from Old Lakeshore Road.

5.0 Site Generated Traffic

The proposed development will result in additional vehicles on the boundary road network, as well as additional turning movements at the boundary road intersections.

5.1 Trip Generation

The ITE Trip Generation Manual, 8th Edition was used to model the various residential unit types proposed for the subject lands. No category exists for semi-detached units; therefore the rates corresponding to townhouses were substituted as the most similar.

The five model home townhouses that are proposed on the north side of Old Lakeshore Road have been tabulated separately from the main site units.

Eight future units known as the Chaisson lands are not a part of the subject development proposal, but will access the boundary road system through the development access to Old Lakeshore Road. These units have been accounted for and are included in the site trip generation as single-family detached units.

The specific categories used are specified in Table 4, along with the corresponding trips.

Table 4
Site Generated Residential Trips

Use	Units	Roadway Peak Hour	Number of Trips		
			Inbound	Outbound	Total
Single Family Lots Category 210 (Chaisson Lands)	8	Weekday A.M.	2	4	6
		Weekday P.M.	5	3	8
Semis/ Townhouses Category 230	212	Weekday A.M.	16	77	93
		Weekday P.M.	74	36	110
Model Home Townhouses Category 230	5	Weekday A.M.	0	2	2
		Weekday P.M.	2	1	3
Total Residential Trips	225	Weekday A.M.	18	83	101
		Weekday P.M.	81	40	121

5.2 Trip Distribution and Assignment

The trips generated by the development were distributed to the boundary roadways based on the location of retail, commercial and recreational destinations. With the Town of Collingwood located to the east of the subject lands, 60 percent of trips were assumed to arrive from/depart to the east along Highway 26. 20 percent of the trips were assumed to arrive from/depart to the west along Old Lakeshore Road for the recreational and leisure destinations associated with the Niagara Escarpment, primarily the Village at Blue. The remaining 20 percent of trips were assumed to arrive from/depart to Thornbury and areas west along Highway 26. Figure 7 illustrates the trip distribution.

The trips generated by the proposed development were assigned to the boundary road network as per the distribution illustrated in Figure 7. The trip assignment is illustrated in Figures 8.

6.0 Total Future Conditions

6.1 Basis of Assessment

The traffic impacts arising from the proposed development were assessed on the basis of the site generated traffic illustrated in Figure 8 being superimposed on the future background traffic volumes in Figures 4, 5 and 6. The resulting total traffic volumes for the weekday a.m. and p.m. peak hours are illustrated in Figures 9, 10 and 11 for the 2020, 2025 and 2030 horizon years, respectively.

6.2 Auxiliary Lane Analysis

A left-turn lane warrant was undertaken for the intersection of Highway 26 and the site entrance using the Ontario Ministry of Transportation (MTO) Geometric Design Standards for Ontario Highways (GDSOH). During the critical 2030 total traffic p.m. peak hour, 51 vehicles out of an advancing volume (Va) of 624 vehicles will make a westbound left-turn, equating to 8.2 percent. Accordingly, the 10 percent warrant chart with a design speed of 90 km/h was used. With an opposing volume of 601 vehicles, a left turn lane with 30 metres of storage is warranted in the p.m. peak hour under the 2030 total traffic condition per Figure EA-22 of the GDSOH. The left-turn lane warrant has been included in Appendix D.

Table E9-1 of the GDSOH prescribes a left-turn lane parallel and taper requirement of 60 metres and 145 metres, respectively for an 90 km/h design speed and a grade of less than 2 percent. Refer to Figure 12 for a preliminary design of the left-turn lane.

6.3 Auxiliary Lane Trigger

Analysis was undertaken to determine the number of units that could be occupied before triggering the requirement of a westbound left-turn lane on Highway 26 at Old Lakeshore Road. The trigger was selected to be the number of westbound left-turns that would cause the percentage of left-turns to be 2.5 percent of the total westbound traffic volumes. 2.5 percent represents the midpoint between no left-turns and the minimum 5 percent left-turn warrant chart. The 2020 p.m. peak hour was selected for analysis.

It was calculated that 14 additional left-turns would cause the left-turn percentage to exceed the 2.5 percent threshold. This volume of left-turns is equivalent to 55 occupied units in the development. Calculation sheets are provided in Appendix D.

6.4 Intersection Operations

The intersection levels of service were analyzed on the basis of the total traffic volumes illustrated in Figures 9, 10 and 11, and a westbound left-turn lane at the Highway 26 and Old Lakeshore Road/Fraser Crescent intersection. Table 5 outlines the year 2020, 2025 and 2030 total traffic levels of service, respectively. Detailed capacity analyses are included in Appendix C.

Table 5
Total Traffic Levels of Service

Intersection	Horizon Year	Peak Hour	Level of Service	Control Delay	95%ile Queue Length	Volume-to-Capacity
Highway 26 and Old Lakeshore Road / Fraser Crescent	2020	A.M.	C	15.4 s	1 veh.	0.19
		P.M.	C	16.9 s	1 veh.	0.12
	2025	A.M.	C	16.1 s	1 veh.	0.20
		P.M.	C	17.7 s	1 veh.	0.13
	2030	A.M.	C	16.9 s	1 veh.	0.21
		P.M.	C	18.7 s	1 veh.	0.14

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

The intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent will experience greater delay in all horizon years than under future background traffic volumes. During the a.m. peak hour, the increase will be four seconds or less with a maximum volume-to-capacity ratio of 0.21. During the p.m. peak hour, the increase in delay will be six seconds or less with a maximum volume-to-capacity ratio of 0.14.

These traffic operations metrics are indicative of a well-functioning intersection with no capacity or congestion concerns. The addition of site generated traffic through this intersection does not appreciably increase the very low levels of traffic on the Old Lakeshore Road approach. The volume-to-capacity ratios are low, and signify considerable excess capacity to serve any increase in demand.

7.0 Conclusions and Recommendations

Intersection analyses of existing traffic volumes indicate that the intersections of Highway 26 and Old Lakeshore Road/Fraser Crescent operates at a LOS "A" and "B" in the weekday a.m. and p.m. peak hours, respectively.

Intersection analyses of the 2020, 2025 and 2030 future background traffic volumes indicate that the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent is expected to operate at a LOS "B" during all peak hours through all horizon years.

The proposed development is expected to add 101 and 121 residential trips to the boundary road system in the a.m. and p.m. peak hours, respectively. These volumes include trips attributable to the Chaisson development, which will access Old Lakeshore Road through the site entrance.

A left-turn lane analysis was undertaken for the intersection of Highway 26 and Old Lakeshore Road/Fraser Crescent. It was concluded that a westbound left turn lane is warranted and that it be implemented consisting of 30 metres of storage length, 60 metres of parallel lane length, and 145 metres of taper length.

Analysis to determine the number of units that could be occupied before the westbound left-turn lane would be warranted was undertaken. It was concluded that 55 units could be occupied before triggering the requirement for the westbound left-turn lane at Highway 26 and Old Lakeshore Road/Fraser Crescent.

Intersection analysis of the 2020, 2025 and 2030 total background traffic volumes indicate that the intersections of Highway 26 with Old Lakeshore Road/Fraser Crescent will experience increased delay of six seconds or less and culminate in a LOS "C" during all peak hours through all horizon years.

The analysis undertaken within was prepared using the most recent draft plan. Any minor changes to the plan will not materially affect the conclusions and recommendations contained within this report.

It is concluded that the traffic affects associated with the proposed development can be mitigated through the implementation of a westbound left-turn lane at the site entrance, and that this auxiliary lane is required after the occupancy of the 55th unit.

Prepared by,

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Alex Fleming

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TRAFFIC IMPACT STUDY

HOME FARM RESIDENTIAL DEVELOPMENT
MACPHERSON BUILDERS LIMITED

COUNTY OF GREY

PREPARED BY:
C.F. CROZIER & ASSOCIATES INC.
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DECEMBER 2013

CFCA FILE NO. 721-3464

1.0 Executive Summary

CF Crozier & Associates Inc. (Crozier) was retained by MacPherson Builders Limited (MacPherson) to complete a Traffic Impact Study for a proposed residential development located north of Tyrolean Lane and east of Grey Road 19 in the Town of The Blue Mountains. The Traffic Impact Study was completed in support of an Official Plan Amendment, a Zoning By-law Amendment and a Draft Plan of Subdivision Application.

The development proposal is for a residential neighbourhood consisting of 151 single family detached units and 132 townhouse units.

Analysis of the total traffic volumes has determined that a southbound left-turn lane at the intersection of Grey Road 19 at Birches Boulevard/ Ekarenniondi Street may be required in the 2028 horizon year.

The development accesses along Grey Road 19 will experience Levels of Service "B" and Levels of Service "C" or better in the a.m. and p.m. peak periods, respectively, as adjusted to reflect peak traffic volumes in the 2028 horizon year.

The analysis undertaken herein was prepared using the most recent development plan. Any minor changes to the plan will not materially affect the conclusions and recommendations contained within this report.

It is concluded that the traffic generated from the proposed residential development will not materially affect the operations of the public roadway system.

The Draft Plan of Subdivision Application, the Zoning By-law Amendment and the Official Plan Amendment can be supported from a traffic operations perspective.

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2.0 Introduction

CF Crozier & Associates Inc. (Crozier) was retained by MacPherson Builders Limited (MacPherson) to complete a Traffic Impact Study for a proposed residential development located north of Tyrolean Lane and east of Grey Road 19 in the Town of The Blue Mountains. The Traffic Impact Study was completed in support of an Official Plan Amendment, a Zoning By-law Amendment and a Draft Plan of Subdivision Application. The purpose of the study was to assess the impacts of the proposed development on the boundary road system and to recommend any required mitigation measures.

The study analyzes the operations of the boundary road intersections, as well as the development accesses. The future traffic operations with and without the addition of the site generated vehicular trips are also analyzed.

The scope of work of the study was confirmed with the County of Grey and the Town of The Blue Mountains staff, with correspondence detailing such included in Appendix A. The study has been completed in accordance with the procedures set out in the MTO "General Guidelines for the Preparation of Traffic Impact Studies", with the associated analysis and findings outlined herein.

3.0 Existing Conditions

3.1 Development Lands

The subject properties proposed for development are currently zoned Recreational Residential and Institutional per the Town of The Blue Mountains Official Plan. The lands are currently vacant.

The property fronts Grey Road 19 to the west, Tyrolean lane to the South, and undeveloped lands to the north and east that are bounded by Highway 26. Refer to Figure 1 for the development location.

3.2 Study Area

The study area encompasses the boundary road network surrounding the subject lands, and is described in Section 3.3. Commercial and residential uses exist to the south within the Blue Mountain Village. Residential land uses exist to the east and west in the Town of The Blue Mountains and Georgian Bay exists to the north.

3.3 Boundary Road Network

Grey Road 19 is a north-south roadway classified as an arterial road per the County of Grey Official Plan. Grey Road 19 has a posted speed of 50 km/h. The roadway consists of two 3.5 metre travel lanes, one in each direction, with approximate 2.0 metre bike lanes and 0.5 metre granular shoulders along each side. The road has a rural cross section.

Birches Boulevard is an east-west private roadway that serves the Orchard development. The roadway consists of two approximate 5.0 metre travel lanes and a raised centre median. The roadway has an urban cross section and has no posted speed limit, therefore the speed limit is 50 km/h per municipal regulations.

Helen Street is an east-west roadway classified as a local road per the Town of The Blue Mountains Official Plan. Helen Street has no posted speed limit, therefore the speed limit is 50 km/h per municipal regulations. The roadway is currently a dead-end unpaved road that will be improved as a part of the proposed development.

The intersection of Birches Boulevard and Grey Road 19 is stop controlled in the eastbound direction along Birches Boulevard and free flow in the north-south direction along Grey Road 19. All three legs are two lane cross sections with one lane in each direction.

The intersection of Helen Street and Grey Road 19 is stop controlled in the westbound direction along Helen Street and free flow in the north-south direction along Grey Road 19.

3.4 Traffic Data

Turning movement counts at the intersections of Grey Road 19 and Birches Boulevard as well as Grey Road 19 and Helen Street were undertaken by Ontario Traffic Inc. staff from 7:00 to 10:00 a.m. and from 4:00 to 7:00 p.m. on Friday March 8, 2013. This date was selected to capture traffic volumes associated with seasonal visitors at the beginning of the March break holiday period. The a.m. peak hour was found to be 8:00 to 9:00 a.m. and the p.m. peak hour was found to be 4:30 to 5:30 p.m. at both intersections. The traffic count data is summarized in Appendix C. Figure 3 illustrates the 2013 existing traffic volumes.

3.5 Intersection Operations

The assessment of intersections is based on the method outlined in the "Highway Capacity Manual, 2000" using Synchro 8 modeling software. Intersections are assessed using a Level of Service metric, with ranges of delay assigned a letter from "A" to "F". The Level of Service metric for a stop-controlled intersection is based on the delay associated with the critical minor road approach. The Level of Service (LOS) definitions for un-signalized intersections are included in Appendix B.

The operations of the existing intersections were analyzed on the basis of the traffic volumes illustrated in Figure 3. Table 1 outlines the existing levels of service. Detailed capacity analyses are included in Appendix D.

Table 1
2013 Existing Levels of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard	Stop- Control	A.M.	A	9.9s	0.02
		P.M.	A	9.5s	0.03
Grey Road 19 and Helen Street	Stop- Control	A.M.	B	10.4s	0.00
		P.M.	B	10.1s	0.00

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

As indicated in Table 1, the intersection of Grey Road 19 and Birches Boulevard is operating at a LOS "A" in the a.m. and p.m. peak hours and the intersection of Grey Road 19 and Helen Street is operating at a LOS "B" in the a.m. and p.m. peak hours. Both intersections have minimal control delay and volume-to-capacity ratios as a result of the low traffic volumes on the road network.

4.0 Proposed Development

The proposed development will contain 283 residential units that consist of 132 townhouse units and 151 detached units.

The layout will have two connections to Grey Road 19 via Helen Street and Ekarennoindi Street (opposite Birches Boulevard. Refer to Figure 2 for the draft plan prepared by Higgins Engineering Limited, November 12, 2013.

5.0 Future Background Conditions

5.1 Horizon Years

Information regarding phasing of the development was not available at the time of the analysis. Therefore, it was assumed that the development will achieve full build out in 2018. As per MTO guidelines, horizon years of the full build out year as well as five and ten years beyond (2018, 2023 and 2028) were selected to assess the long term operations of the boundary road system.

5.2 Growth Rate

Traffic growth rates were based on data available from the Town of The Blue Mountains Comprehensive Transportation Strategic Plan (AECOM and C.C. Tatham and Associates, March 2010). A growth rate of five percent was calculated from projected traffic volumes in the report and included traffic growth from local area developments. The five percent is an average growth rate from 2013 to 2028 and was applied to all turning movements.

It is noted that the five percent growth rate is very high and typically only seen in areas of rapid development. The five percent growth rate may not be sustainable over the 15 year analysis period.

5.3 Intersection Operations

The operations of the critical intersections were analyzed on the basis of the traffic volumes illustrated in Figures 4, 5 and 6.

Tables 2, 3 and 4 outline the 2018, 2023 and 2028 future background traffic levels of service. Detailed capacity analyses are included in Appendix D.

Table 2
2018 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard	Stop- Control	A.M.	B	10.5s	0.03
		P.M.	A	9.8s	0.04
Grey Road 19 and Helen Street	Stop- Control	A.M.	B	11.1s	0.00
		P.M.	B	10.7s	0.00

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

Table 3
2023 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard	Stop- Control	A.M.	B	11.3s	0.04
		P.M.	B	10.4s	0.05
Grey Road 19 and Helen Street	Stop- Control	A.M.	B	12.1s	0.00
		P.M.	B	11.6s	0.00

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

Table 4
2028 Future Background Levels of Service

Intersection	Control	Peak Hour	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard	Stop- Control	A.M.	B	12.6s	0.06
		P.M.	B	11.3s	0.07
Grey Road 19 and Helen Street	Stop- Control	A.M.	B	13.7s	0.00
		P.M.	B	12.9s	0.00

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

The intersection of Grey Road 19 and Birches Boulevard will function at a LOS "B" in the a.m. and p.m. peak periods in the 2028 horizon year. The intersection will experience minor delays and a low volume-to-capacity ratio. The 95th percentile queue length is a maximum of one vehicle.

The intersection of Grey Road 19 and Helen Street will function at a LOS "B" in the a.m. and p.m. peak periods through the 2028 horizon year. The intersection will experience minor delays and a low volume-to-capacity ratio. The 95th percentile queue length is a maximum of one vehicle. The relatively low delays forecast at the intersections are indicative of operations with significant reserve capacity for growth.

6.0 Site Generated Traffic

6.1 Trip Generation

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.

The trip generation of the single family housing units and townhouse units were forecast using the rates provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 8th Edition.

Land use Category 210 "Single Family Detached Housing" and Category 230 "Residential Condominium/ Townhouse" were used to forecast the trips generated by the 151 single detached units and the 132 townhouse units in the a.m. and p.m. peak periods.

It is noted that the ITE trip generations are based on surveys undertaken in primarily urban and suburban areas with full time occupancy. As the subject development is expected to attract a proportion of seasonal, part-time residents, the site trip generation volumes forecast with the ITE methodology may not be realized.

The forecasted trips are tabulated in Table 5.

Table 5
Trip Generation

Use	Roadway Peak Hour	Number of Trips		
		Inbound	Outbound	Total
Single Family Detached Housing (151 Units)	Weekday A.M.	29	86	115
	Weekday P.M.	96	56	152
Residential Condominium/ Townhouse (132 Units)	Weekday A.M.	11	54	65
	Weekday P.M.	57	19	76
Total	Weekday A.M.	40	140	180
	Weekday P.M.	153	75	228

6.2 Trip Distribution and Assignment

The trips generated by the development were distributed to the boundary roadways based on the directional distribution noted at the Orchard development. The single access to Grey Road 19 at Birches Boulevard allowed for the measurement of the proportion of vehicles arriving from/ departing to the north and south. The distribution of trips at the development accesses was based on the site layout and the ease of access to and from the roadway system. The a.m. and p.m. peak hour trip distribution is illustrated in Figure 7.

The trips generated by the proposed development were assigned to the boundary road network as per the distributions. The trip assignment is illustrated in Figure 8.

7.0 Total Future Conditions

7.1 Basis of Assessment

The traffic impacts arising from the proposed development were assessed on the basis of the site generated traffic illustrated in Figure 8 being superimposed on the future background traffic volumes in Figures 4, 5 and 6. The resulting total traffic volumes for the weekday a.m. and p.m. peak hours are illustrated in Figures 9, 10 and 11 for the 2018, 2023 and 2028 horizon years, respectively.

7.2 Auxiliary Lane Analysis

A left-turn lane warrant was undertaken for the intersections of Grey Road 19 at Birches Boulevard/ Ekarenniondi Street and Helen Street using the Ontario Ministry of Transportation (MTO) Geometric Design Standards for Ontario Highways (GDSOH) during both a.m. and p.m. peak periods. The left-turn lane warrants are included in Appendix E.

The requirement for a southbound left-turn lane at the intersection of Grey Road 19 at Birches Boulevard/ Ekarenniondi Street was analyzed under the 2028 a.m. and p.m. peak hour timeframes. In the a.m. peak period when 13 left-turning vehicles are expected with an advancing volume of 366 vehicles and an opposing vehicular volume of 259 vehicles is forecast, the 5 percent left turn lane warrant chart is in effect. The a.m. peak hour volume does not warrant a left turn lane. In the p.m. peak period when 58 left-turning vehicles are expected with an advancing volume of 353 vehicles and an opposing vehicular volume of 420 vehicles is forecast, the 15 percent left turn lane warrant chart is in effect. The p.m. warrant resulted in a 15 metre left-turn storage lane requirement. Further analysis of 2023 p.m. peak hour total traffic volumes was undertaken to determine if the left-turn lane would be warranted before the 2028 horizon year. In the 2023 p.m. peak period when 58 left-turning vehicles are expected with an advancing volume of 289 vehicles and an opposing vehicular volume of 336 vehicles is forecast, the 20 percent left turn lane warrant chart is in effect. The 2023 p.m. peak hour volume does not warrant a left turn lane.

The requirement for a southbound left-turn lane at the intersection of the Grey Road 19 and Helen Street was analyzed under the 2028 a.m. and p.m. peak hour timeframes. In the a.m. peak period when 5 left-turning vehicles are expected with an advancing volume of 359 vehicles, the resulting percentage of left-turning vehicles is too low to trigger the minimum five percent warrant and thus, no left-turn lane required. In the p.m. peak period when 23 left-turning vehicles are expected with an advancing volume of 314 vehicles and an opposing vehicular volume of 430 vehicles are forecast, the 5 percent left turn lane warrant chart is in effect. The p.m. peak hour volumes do not warrant a left-turn lane.

As noted in Section 5.2, the five percent growth rate used to calculate the future background traffic volumes is unsustainably high. This figure represents a conservative upper bound to possible traffic along Grey Road 19. It is recommended that turning movement counts be undertaken at future phases to confirm or repudiate the left-turn lane warrant results. Should the warrants be confirmed, per Table E9-1 of the Geometric Design Standards for Ontario Highways, a 30 metre parallel lane with a 100 metre taper is required for a left-turn lane with a 60 km/h design speed.

A northbound left-turn lane at the intersection of Grey Road 19 at Birches Boulevard/ Ekarenniondi Street should also be considered. It is good practice to implement opposing left-turn lanes at four legged intersections where one left-turn lane is already required. The minimum 15 metre storage, along with a 30 metre parallel lane and a 100 metre taper would be required.

7.3 Intersection Operations

The intersection levels of service were analyzed on the basis of the total traffic volumes illustrated in Figures 9, 10 and 11. Tables 6, 7 and 8 outline the year 2018, 2023 and 2028 total traffic levels of service, respectively. Left-turn lanes at the intersection of Grey Road 19 at Birches Boulevard/ Ekarenniondi Street were incorporated into the analysis for the 2028 a.m and p.m. total traffic volumes per Section 7.2. Detailed capacity analyses are included in Appendix D.

Table 6
2018 Total Traffic Levels of Service

Intersection	Control	Peak Hour	Critical Approach	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard/ Ekarenniondi Street	Stop-Control	A.M.	Eastbound	B	11.7s	0.03
		P.M.	Westbound	B	14.5s	0.11
Grey Road 19 and Helen Street	Stop-Control	A.M.	Westbound	B	11.0s	0.10
		P.M.	Westbound	B	12.8s	0.10

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

Table 7
2023 Total Traffic Levels of Service

Intersection	Control	Peak Hour	Critical Approach	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard/ Ekarenniondi Street	Stop-Control	A.M.	Eastbound	B	12.9s	0.05
		P.M.	Westbound	C	17.0s	0.13
Grey Road 19 and Helen Street	Stop-Control	A.M.	Westbound	B	12.0s	0.11
		P.M.	Westbound	B	14.5s	0.12

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

Table 8
2028 Total Traffic Levels of Service

Intersection	Control	Peak Hour	Critical Approach	Level of Service	Control Delay	Volume-to-Capacity
Grey Road 19 and Birches Boulevard/ Ekarenniondi Street	Stop-Control	A.M.	Eastbound	B	14.5s	0.07
		P.M.	Westbound	C	21.1s	0.17
Grey Road 19 and Helen Street	Stop-Control	A.M.	Westbound	B	13.4s	0.13
		P.M.	Westbound	C	17.2s	0.14

Note: The level of service of a stop-controlled intersection is based on the delay associated with the critical minor road movement.

The intersection of Grey Road 19 and Birches Boulevard/ Ekarenniondi Street will operate at a LOS "B" in the a.m. and p.m. peak periods in the 2018 horizon year under total traffic volumes. These unchanged levels of service are a result of minimal increases in delay (4.7 seconds or less) and volume-to-capacity ratios (0.07 or less). The intersection of Grey Road 19 and Birches Boulevard/ Ekarenniondi Street will operate at a LOS "B" and LOS "C" in the a.m. and p.m. peak periods, respectively, in the 2023 and 2028 horizon years under total traffic volumes. These levels of service are a result of minor increases in delay (9.8 seconds or less) and increases in the volume-to-capacity ratios (0.10 or less). It is noted that the LOS "C" p.m. peak period traffic metrics are for the Ekarenniondi Street approach. The Birches Street approach will experience increases in delay of 1.3 seconds or less compared to future background traffic volumes.

The intersection of Grey Road 19 and Helen Street will operate at a LOS "B" in the a.m. and p.m. peak periods in the 2018 and 2023 horizon years under total traffic volumes. These levels of service are unchanged from future background traffic conditions. The intersection will operate at a LOS "B" and LOS "C" in the a.m. and p.m. peak periods, respectively, in the 2028 horizon year under total traffic volumes. These levels of service are a result of minor increases in delay (4.3 seconds or less) and increases in the volume-to-capacity ratios (0.14 or less).

8.0 Conclusions and Recommendations

Intersection analyses of existing traffic volumes indicate that the intersection of Grey Road 19 and Birches Boulevard is operating at a LOS "A" in both the a.m. and p.m. peak hours and the intersection of Grey Road 19 and Helen Street is operating at a LOS "B" in the a.m. and p.m. peak hours.

Intersection analyses of the 2018, 2023 and 2028 future background traffic volumes indicate that the boundary road network is expected to operate at a LOS "B" or better in the a.m. and p.m. peak periods.

The proposed development is expected to add 180 and 228 trips to the boundary road system in the a.m. and p.m. peak hours, respectively.

Analysis of the total traffic volumes has determined that a southbound left-turn lane at the intersection of

Grey Road 19 at Birches Boulevard/ Ekarenniondi Street may be required in the 2028 horizon year.

Intersection analysis of the 2018 total traffic volumes indicate that the boundary road network is expected to operate at a LOS "B" or better in the a.m. and p.m. peak periods.

Intersection analysis of the 2023 and 2028 total traffic volumes indicate that boundary road network is expected to operate at a LOS "B" and LOS "C" or better in the a.m. and p.m. peak period, respectively, in the 2023 and 2028 horizon year.

It is recommended that turning movement counts be undertaken at future phases to confirm or repudiate the requirement of a left-turn lane at Grey Road 19 and Birches Boulevard/ Ekarenniondi Street in the 2028 horizon year.

The analysis undertaken herein was prepared using the most recent development plan. Any minor changes to the plan will not materially affect the conclusions and recommendations contained within this report.

It is concluded that the traffic generated from the proposed residential development will not materially affect the operations of the boundary road system. The draft plan of subdivision application, the Zoning By-law Amendment and the Official Plan Amendment can be supported from a traffic operations perspective.

Prepared by,

C.F. CROZIER & ASSOCIATES INC.

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

C.F. CROZIER & ASSOCIATES INC.

Brittany Robertson, E.I.T

J:\700\721 - MacPherson Builders\3464 - Home Farm TIS\Traffic\Home Farm TIS.doc

Appendix D
Supporting Site Information


N
LEGEND:
INTERMITTENT WATERCOURSE
WATERCOURSE
30.0m WATERCOURSE SETBACK
BOTTOM OF SLOPE
TOP OF STABLE SLOPE
STAKED TOP OF SLOPE
MEDIUM HAZARD CONSTRAINT (AZIMUTH)
HIGH HAZARD CONSTRAINT (AZIMUTH)
GSCA HAZARD ZONE
GSCA ADDITIONAL HAZARD ZONE
20m ARCHAEOLOGICAL SITE BUFFER
ARCHAEOLOGICAL SITE
PLATER–FLEMING ARCHAEOLOGICAL AREA
BUTTER NUT TREE LOCATIONS WITH 25m AND 50m SETBACKS
THE KING'S HIGHWAY No. 26
GEORGIAN TRAIL (FORMER CANADIAN NATIONAL RAILWAY RIGHT OF WAY)
LAKESHORE ROAD
GREY CONDOMINIUM PLAN No. 7
GREY COUNTY ROAD No. 19
CRAIGLEITH ROAD
WATERCOURSE No. 9
WATERCOURSE No. 7
WATERCOURSE No. E
HAZARD ZONE
STABLE SLOPE
STAKED TOP OF SLOPE
BOTTOM OF SLOPE
STAKED LINE
PLATER–FLEMING ARCHAEOLOGICAL AREA
ARCHAEOLOGICAL SITE
ARCHAEOLOGICAL SITE 20.0m BUFFER AREA
ARCHAEOLOGICAL SITE BUFFER AREA
40.0m
20.0m
SCALE: 1:1500

Project

PARKBRIDGE LIFESTYLE DEVELOPMENT
TOWN OF THE BLUE MOUNTAINS

Drawing

CONSTRAINTS PLAN

CROZIER & ASSOCIATES 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	1046–4031
Check By	Check By	Scale 1:1500	Drawing CONSTRAINTS

Trails and Road Concept Plan

N

0 100 200 400 m

Legend

Concept Roads and Trails

- Road with sidewalk
- Trail

Active Transportation

Existing

- Designated Bike Lane
- Trail
- Sidewalk

Town of The Blue Mountains

- Assement Parcel
- Development Draft Plan

TOWN OF THE BLUE MOUNTAINS

LEGEND

- CONSTRAINTS – HIGH
- CONSTRAINTS – MEDIUM
- TYPE A BACK–TO–BACK TOWNS
- TYPE B 1–STOREY TOWNS
- TYPE C LOFT TOWNS
- TYPE D 1–STOREY SINGLE
- TYPE E 2–STOREY SINGLE

NOTE: DETACHED LOTS CAN ACCOMMODATE BOTH SINGLE TYPE D OR E

PHASE II

LAKESIDE COURTS
Total 30 units

SINGLES
11u@15mx30m
LOFT TOWNS
11u@6.7mx30m
1–STOREY TOWNS
8u@9mx30m
VISITOR PARKING
14 spaces

STORAGE BUILDING AREA 5670 SQ.FT.

EMERGENCY ACCESS ROAD ONLY

BOLLARDS

TRAIL NETWORK CONNECTION complete w/ SIGNAGE AT CROSSING

GEORGIAN BAY

HIGHWAY No. 26

GEORGIAN TRAIL

CANADIAN NATIONAL RAILWAY RIGHT OF WAY)

LAKESHORE RD

EPHEMERAL WATERCOURSE

PEDESTRIAN TRAIL

POTENTIAL PLAYGROUND

ENVIRONMENTAL AREA

PERMANENT WATERCOURSE

STORMWATER POND

OPEN SPACE/ PRESERVED AREA

PHASE III

CREEKSIDE COURTS
Total 65 units

SINGLES
34u@15mx30m
LOFT TOWNS
31u@6.7mx30m
VISITOR PARKING
30 spaces

GREY ROAD No. 19

PLATER–FLEMING CONSERVATION AREA

COMMUNITY CLUB HOUSE AREA 4730SQ.FT.

PERENNIAL GRASSLAND

HATCH INDICATES EXTENT OF MULTI–USE PATH

CRAIGLEITH RD

NIPISSING RIDGE

OPEN SPACE

STORMWATER POND

WETLAND PRESERVE

PEDESTRIAN PRIORITY ZONE

UNPAVED EMERGENCY ACCESS LOOP

PHASE I

HILLSIDE COURTS
Total 116 units

LOFT TOWNS
51u@6.7mx30m
BACK–TO–BACK TOWNS
48u@7.8mx15m
1–STOREY TOWNS
17u@9mx30m
VISITOR PARKING
37 spaces

SvN
110 Adelaide St. E.
Toronto, Canada
M5C 1K9
416.593.6499
www.svn–ap.com

41717 // Craigleith Ridge

Craigleith, Ontario

CRAIGLEITH RIDGE

TECHNICAL SITE PLAN
scale 1:2500

February 13, 2018

A0.1

Appendix E
Travel Time Survey Data

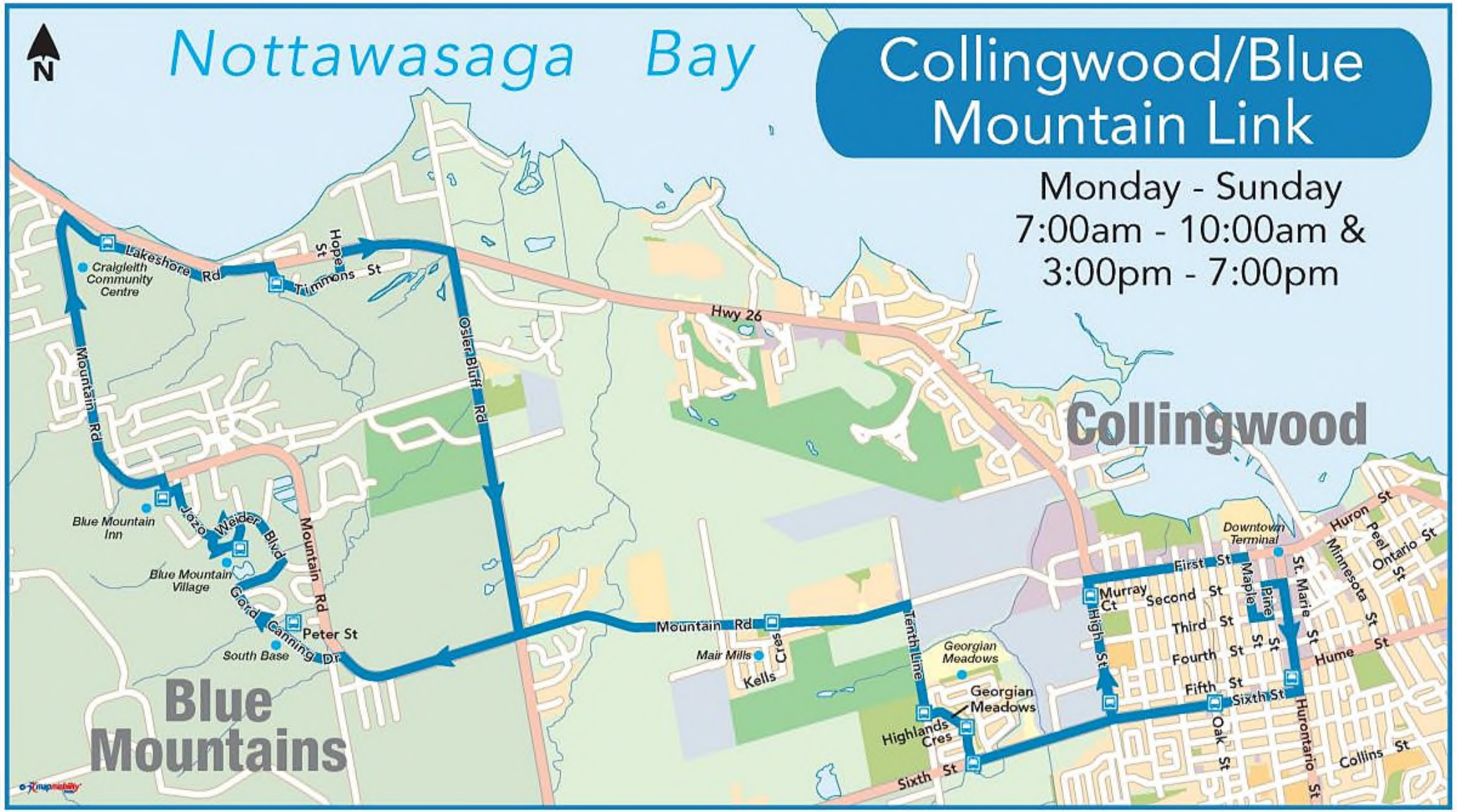
Parkbridge Travel Time Survey to Collingwood

Start/End High Street/First Street Collingwood

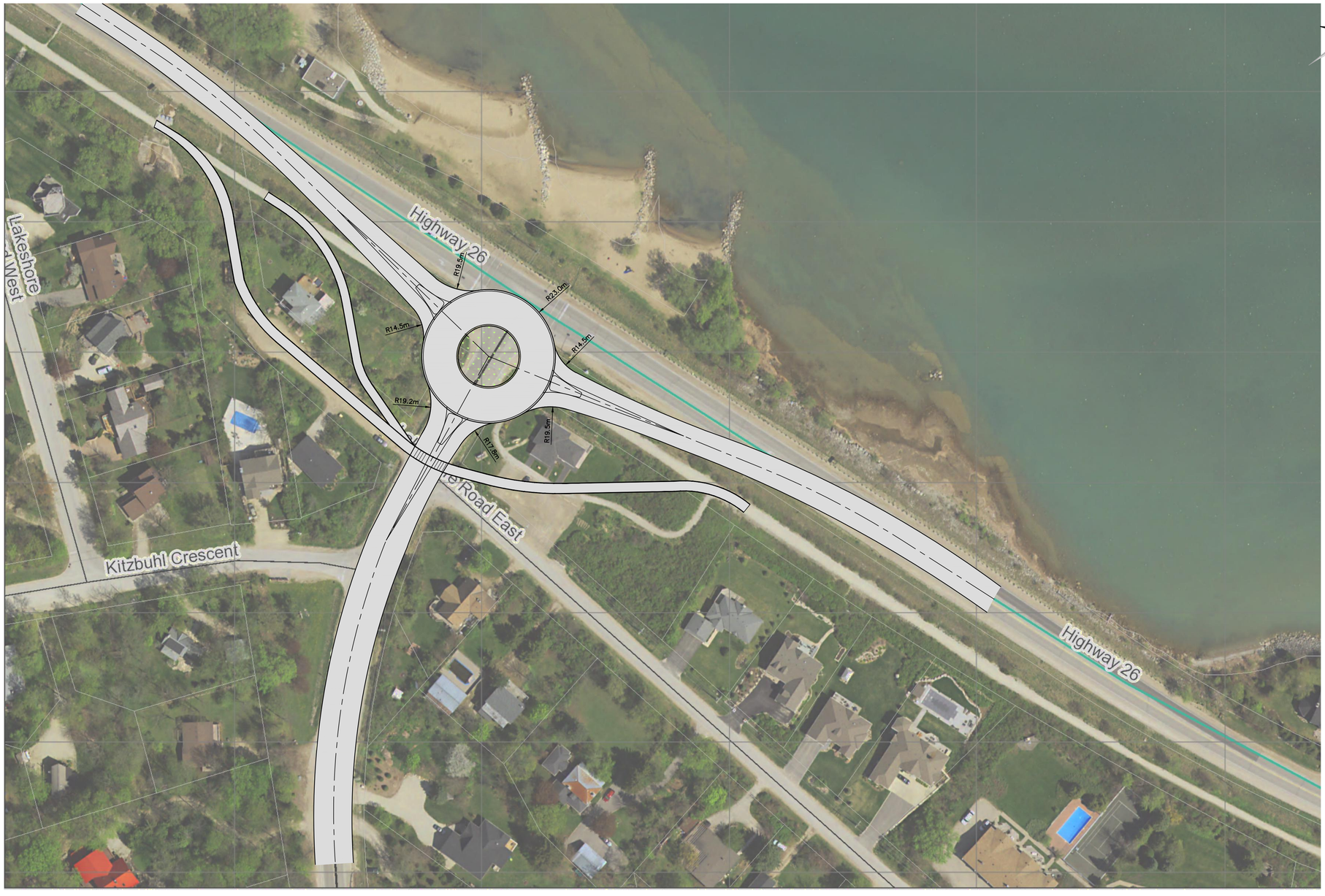
	Run 1			Run 2			Run 3			Run 4			Average
Intersection	Minutes	Seconds	Total Seconds	Minutes	Seconds	Total Seconds	Minutes	Seconds	Total Seconds	Minutes	Seconds	Total Seconds	Total Seconds
High St/First St	0	0	0	0	0	0	0	0	0	0	0	0	0
Hwy 26/Lakeshore	7	54	474	8	14	494	7	45	465	8	45	525	489.5
Hwy 26/GR 19	9	2	542	9	10	550	8	40	520	9	51	591	550.75
GR 19/Craigleith Rd	10	6	606	10	8	608	9	40	580	10	18	618	603
GR 19/Birches Blvd	10	34	634	10	35	635	10	7	607	10	47	647	630.75
High St/First St	21	35	1295	20	52	1252	19	48	1188	19	57	1197	1233

Craigleith Road to High Street/First Street	via GR 19	630
	via Hwy 26	603
Birches Blvd to High Street/First Street	via GR 19	602.25
	via Hwy 26	630.75

Appendix F
Collingwood/Blue Mountain Link Route


Nottawasaga Bay
N
Collingwood/Blue Mountain Link
Monday - Sunday
7:00am - 10:00am &
3:00pm - 7:00pm
Lakeshore Rd
Craigleith Community Centre
Hopedale St
Timmons St
Hwy 26
Osler Bluff Rd
Mountain Rd
Blue Mountain Inn
Jozo Weider Blvd
Blue Mountain Village
Gord Canning Dr
Peter St
South Base
Mountain Rd
Mair Mills
Kells Cres
Tenth Line
Georgian Meadows
Highlands Cres
Sixth St
Collingwood
Downtown Terminal
Murray Ct
High St
First St
Second St
Third St
Fourth St
Fifth St
Sixth St
Maple St
Pine St
St. Marie St
Huron St
Peel St
Minnesota St
Ontario St
Hume St
Oak St
Hurontario St
Collins St
Blue Mountains

Appendix G
Conceptual Roundabout Design



NOTE:

THIS DRAWING IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED

EXISTING DESIGN SPECIFICATIONS TO BE CONFIRMED DURING DETAILED DESIGN STAGE. TRAFFIC TO BE IN CONFORMANCE WITH ONTARIO TRAFFIC MANUAL.

No.	ISSUE / REVISION	YYYY/MMM/DD
0	ISSUED FOR SUBMISSION	2018/FEB/26

Project

PARKBRIDGE CRAIGLEITH RIDGE
RESIDENTIAL DEVELOPMENT
TOWN OF BLUE MOUNTAINS

Drawing

CONCEPTUAL ROUNDABOUT PLAN

NOT FOR CONSTRUCTION

Stamp

FOR REVIEW

Stamp

CROZIER & ASSOCIATES Consulting Engineers
2800 High Point Drive
Suite 100
Milton, ON L9T 6P4
905 875-0026 T
905 875-4915 F
www.cfcrozier.ca

Drawn	Design	Project No.	
S.T.T.	S.T.T.		1046-4031
Check	Check	Scale	Dwg.
R.M.	R.M.	N.T.S.	FIG 1

Appendix H
Detailed Capacity Analysis

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	119	36	338	148	57
Future Volume (vph)	422	119	36	338	148	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.417		0.950	
Satd. Flow (perm)	1724	1507	783	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		129				62
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	129	39	367	161	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	129	39	367	161	62
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	57.4	57.4	12.0	69.4	21.4	21.4
Total Split (%)	63.2%	63.2%	13.2%	76.4%	23.6%	23.6%
Maximum Green (s)	50.0	50.0	10.0	62.0	15.0	15.0
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	50.0	50.0	67.4	62.0	15.0	15.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.55	0.55	0.74	0.68	0.17	0.17
v/c Ratio	0.48	0.15	0.06	0.31	0.58	0.20
Control Delay	14.7	2.3	3.3	6.6	44.5	10.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.7	2.3	3.3	6.6	44.5	10.9
LOS	B	A	A	A	D	B
Approach Delay	12.0			6.3	35.2	
Approach LOS	B			A	D	
Queue Length 50th (m)	46.1	0.0	1.5	22.4	26.3	0.0
Queue Length 95th (m)	69.9	7.3	3.7	34.7	46.0	10.5
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	949	887	691	1188	276	308
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.15	0.06	0.31	0.58	0.20

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.58			
Intersection Signal Delay: 14.3		Intersection LOS: B	
Intersection Capacity Utilization 53.2%		ICU Level of Service A	
Analysis Period (min) 15			

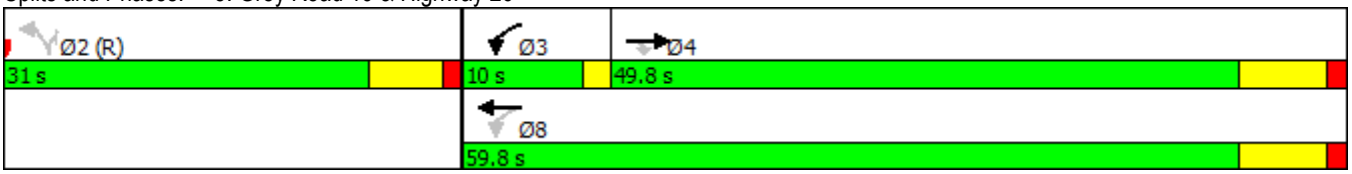
Splits and Phases: 8: Grey Road 19 & Highway 26

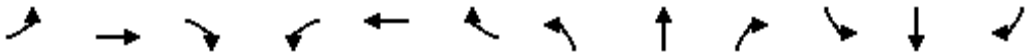
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	119	36	338	148	57
Future Volume (vph)	422	119	36	338	148	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.373		0.950	
Satd. Flow (perm)	1724	1507	701	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		129				62
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	129	39	367	161	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	129	39	367	161	62
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	49.8	49.8	10.0	59.8	31.0	31.0
Total Split (%)	54.8%	54.8%	11.0%	65.9%	34.1%	34.1%
Maximum Green (s)	42.4	42.4	8.0	52.4	24.6	24.6
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	42.4	42.4	57.8	52.4	24.6	24.6

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.47	0.47	0.64	0.58	0.27	0.27
v/c Ratio	0.57	0.17	0.07	0.37	0.36	0.13
Control Delay	21.1	3.2	6.5	11.6	29.5	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	3.2	6.5	11.6	29.5	7.8
LOS	C	A	A	B	C	A
Approach Delay	17.2			11.1	23.4	
Approach LOS	B			B	C	
Queue Length 50th (m)	56.1	0.0	2.3	31.8	22.7	0.0
Queue Length 95th (m)	85.2	8.9	5.7	49.2	39.7	9.0
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	805	772	541	1004	453	466
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.17	0.07	0.37	0.36	0.13

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.57			
Intersection Signal Delay: 16.3		Intersection LOS: B	
Intersection Capacity Utilization 53.2%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

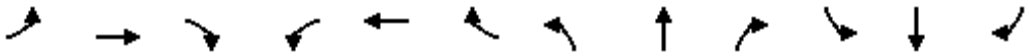




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	474	4	21	411	0	17	0	60	0	0	0
Future Volume (Veh/h)	1	474	4	21	411	0	17	0	60	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	515	4	23	447	0	18	0	65	0	0	0
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	447			519			1012	1012	517	1077	1014	447
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	447			519			1012	1012	517	1077	1014	447
tC, single (s)	4.1			4.2			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			98			92	100	88	100	100	100
cM capacity (veh/h)	1124			1027			216	226	562	172	235	616

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	520	23	447	83	0
Volume Left	1	23	0	18	0
Volume Right	4	0	0	65	0
cSH	1124	1027	1700	417	1700
Volume to Capacity	0.00	0.02	0.26	0.20	0.00
Queue Length 95th (m)	0.0	0.5	0.0	5.6	0.0
Control Delay (s)	0.0	8.6	0.0	15.8	0.0
Lane LOS	A	A		C	A
Approach Delay (s)	0.0	0.4		15.8	0.0
Approach LOS				C	A

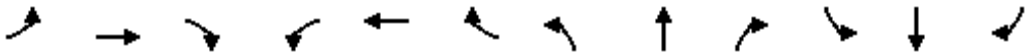
Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	3	0	5	0	188	3	10	161	0
Future Volume (Veh/h)	0	0	0	3	0	5	0	188	3	10	161	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	3	0	5	0	204	3	11	175	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	406	404	175	402	402	206	175			207		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	406	404	175	402	402	206	175			207		
tC, single (s)	7.1	6.5	6.2	7.4	6.5	6.5	4.1			4.3		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.8	4.0	3.5	2.2			2.4		
p0 queue free %	100	100	100	99	100	99	100			99		
cM capacity (veh/h)	552	534	874	504	535	780	1414			1264		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	0	8	0	207	186
Volume Left	0	3	0	0	11
Volume Right	0	5	0	3	0
cSH	1700	647	1700	1700	1264
Volume to Capacity	0.00	0.01	0.00	0.12	0.01
Queue Length 95th (m)	0.0	0.3	0.0	0.0	0.2
Control Delay (s)	0.0	10.6	0.0	0.0	0.5
Lane LOS	A	B			A
Approach Delay (s)	0.0	10.6	0.0		0.5
Approach LOS	A	B			

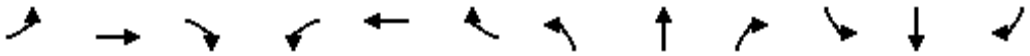
Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	26.7%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	35	28	0	1	42	149	12	2	137	8
Future Volume (Veh/h)	2	0	35	28	0	1	42	149	12	2	137	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	38	30	0	1	46	162	13	2	149	9
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	424	154	456	422	168	158			175		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	419	424	154	456	422	168	158			175		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	96	94	100	100	97			100		
cM capacity (veh/h)	533	503	898	480	504	876	1357			1401		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	40	31	221	160
Volume Left	2	30	46	2
Volume Right	38	1	13	9
cSH	868	487	1357	1401
Volume to Capacity	0.05	0.06	0.03	0.00
Queue Length 95th (m)	1.1	1.5	0.8	0.0
Control Delay (s)	9.3	12.9	1.8	0.1
Lane LOS	A	B	A	A
Approach Delay (s)	9.3	12.9	1.8	0.1
Approach LOS	A	B		

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	37.0%	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	0	6	56	0	14	7	182	16	4	191	5
Future Volume (Veh/h)	7	0	6	56	0	14	7	182	16	4	191	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	7	61	0	15	8	198	17	4	208	5
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	448	450	210	446	444	206	213			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	448	450	210	446	444	206	213			215		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	88	100	98	99			100		
cM capacity (veh/h)	510	502	832	517	506	837	1363			1361		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	15	76	8	215	4	213
Volume Left	8	61	8	0	4	0
Volume Right	7	15	0	17	0	5
cSH	623	559	1363	1700	1361	1700
Volume to Capacity	0.02	0.14	0.01	0.13	0.00	0.13
Queue Length 95th (m)	0.6	3.6	0.1	0.0	0.1	0.0
Control Delay (s)	10.9	12.5	7.7	0.0	7.7	0.0
Lane LOS	B	B	A		A	
Approach Delay (s)	10.9	12.5	0.3		0.1	
Approach LOS	B	B				

Intersection Summary				
Average Delay	2.3			
Intersection Capacity Utilization	23.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	57	14	191	17	4	249
Future Volume (Veh/h)	57	14	191	17	4	249
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	65	16	217	19	5	283
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	520	226			236	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	520	226			236	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	98			100	
cM capacity (veh/h)	517	815			1337	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	81	236	288
Volume Left	65	0	5
Volume Right	16	19	0
cSH	557	1700	1337
Volume to Capacity	0.15	0.14	0.00
Queue Length 95th (m)	3.8	0.0	0.1
Control Delay (s)	12.6	0.0	0.2
Lane LOS	B		A
Approach Delay (s)	12.6	0.0	0.2
Approach LOS	B		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	212	57	625	235	75
Future Volume (vph)	586	212	57	625	235	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.285		0.950	
Satd. Flow (perm)	1824	1551	535	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		230				82
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	230	62	679	255	82
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	230	62	679	255	82
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	57.4	57.4	12.0	69.4	21.4	21.4
Total Split (%)	63.2%	63.2%	13.2%	76.4%	23.6%	23.6%
Maximum Green (s)	50.0	50.0	10.0	62.0	15.0	15.0
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	50.0	50.0	67.4	62.0	15.0	15.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.55	0.55	0.74	0.68	0.17	0.17
v/c Ratio	0.63	0.24	0.12	0.54	0.87	0.25
Control Delay	17.7	2.1	3.6	9.2	67.2	10.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	2.1	3.6	9.2	67.2	10.0
LOS	B	A	A	A	E	B
Approach Delay	13.6			8.7	53.3	
Approach LOS	B			A	D	
Queue Length 50th (m)	71.9	0.0	2.4	51.8	43.9	0.0
Queue Length 95th (m)	106.7	9.4	5.2	76.7	#85.0	11.8
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	1004	957	534	1257	292	332
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.24	0.12	0.54	0.87	0.25

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 18.6		Intersection LOS: B	
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

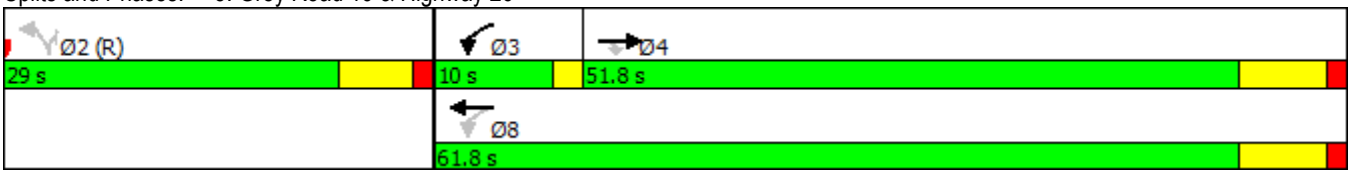
Splits and Phases: 8: Grey Road 19 & Highway 26

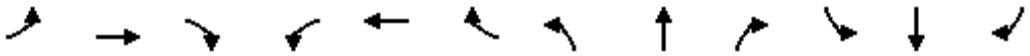
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	212	57	625	235	75
Future Volume (vph)	586	212	57	625	235	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.241		0.950	
Satd. Flow (perm)	1824	1551	453	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		230				82
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	230	62	679	255	82
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	230	62	679	255	82
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	51.8	51.8	10.0	61.8	29.0	29.0
Total Split (%)	57.0%	57.0%	11.0%	68.1%	31.9%	31.9%
Maximum Green (s)	44.4	44.4	8.0	54.4	22.6	22.6
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	44.4	44.4	59.8	54.4	22.6	22.6

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.49	0.49	0.66	0.60	0.25	0.25
v/c Ratio	0.71	0.26	0.15	0.62	0.58	0.18
Control Delay	23.8	2.7	6.3	14.6	36.0	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.8	2.7	6.3	14.6	36.0	7.5
LOS	C	A	A	B	D	A
Approach Delay	18.2			13.9	29.1	
Approach LOS	B			B	C	
Queue Length 50th (m)	83.5	0.0	3.4	69.0	39.1	0.0
Queue Length 95th (m)	123.9	10.9	7.4	102.3	63.1	10.5
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	891	875	415	1103	441	460
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.26	0.15	0.62	0.58	0.18

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 18.5		Intersection LOS: B	
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

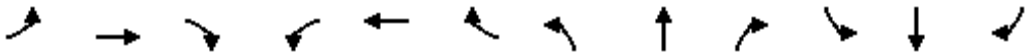




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	643	18	67	723	1	8	0	47	0	0	1
Future Volume (Veh/h)	2	643	18	67	723	1	8	0	47	0	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	699	20	73	786	1	9	0	51	0	0	1
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	787			719			1646	1646	709	1696	1656	786
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	787			719			1646	1646	709	1696	1656	786
tC, single (s)	4.1			4.1			7.1	6.5	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.4	3.5	4.0	3.3
p0 queue free %	100			92			88	100	88	100	100	100
cM capacity (veh/h)	841			892			75	92	415	61	91	395

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	721	73	787	60	1
Volume Left	2	73	0	9	0
Volume Right	20	0	1	51	1
cSH	841	892	1700	247	395
Volume to Capacity	0.00	0.08	0.46	0.24	0.00
Queue Length 95th (m)	0.1	2.0	0.0	7.0	0.1
Control Delay (s)	0.1	9.4	0.0	24.2	14.1
Lane LOS	A	A		C	B
Approach Delay (s)	0.1	0.8		24.2	14.1
Approach LOS				C	B

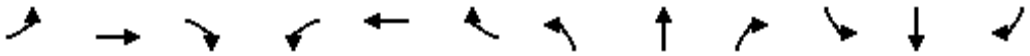
Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	69.9%	ICU Level of Service		C
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	2	1	0	11	2	300	14	15	255	1
Future Volume (Veh/h)	0	0	2	1	0	11	2	300	14	15	255	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	2	1	0	12	2	326	15	16	277	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	652	654	278	649	648	334	278			341		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	652	654	278	649	648	334	278			341		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	98	100			99		
cM capacity (veh/h)	374	383	766	380	386	713	1296			1229		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	2	13	2	341	294
Volume Left	0	1	2	0	16
Volume Right	2	12	0	15	1
cSH	766	668	1296	1700	1229
Volume to Capacity	0.00	0.02	0.00	0.20	0.01
Queue Length 95th (m)	0.1	0.5	0.0	0.0	0.3
Control Delay (s)	9.7	10.5	7.8	0.0	0.6
Lane LOS	A	B	A		A
Approach Delay (s)	9.7	10.5	0.0		0.6
Approach LOS	A	B			

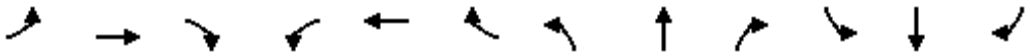
Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	35.8%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	42	22	0	3	38	281	31	2	218	8
Future Volume (Veh/h)	2	0	42	22	0	3	38	281	31	2	218	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	46	24	0	3	41	305	34	2	237	9
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	652	666	242	696	654	322	246			339		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	652	666	242	696	654	322	246			339		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	99	100	94	93	100	100	97			100		
cM capacity (veh/h)	372	367	778	327	373	719	1291			1220		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	27	380	248
Volume Left	2	24	41	2
Volume Right	46	3	34	9
cSH	744	348	1291	1220
Volume to Capacity	0.06	0.08	0.03	0.00
Queue Length 95th (m)	1.6	1.9	0.7	0.0
Control Delay (s)	10.2	16.2	1.1	0.1
Lane LOS	B	C	A	A
Approach Delay (s)	10.2	16.2	1.1	0.1
Approach LOS	B	C		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	48.9%	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)	4	0	16	30	0	8	12	338	61	16	251	15
Future Volume (Veh/h)	4	0	16	30	0	8	12	338	61	16	251	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	0	17	33	0	9	13	367	66	17	273	16
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	717	774	281	750	749	400	289			433		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	717	774	281	750	749	400	289			433		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	98	90	100	99	99			98		
cM capacity (veh/h)	335	322	760	315	333	652	1279			1132		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	21	42	13	433	17	289
Volume Left	4	33	13	0	17	0
Volume Right	17	9	0	66	0	16
cSH	612	355	1279	1700	1132	1700
Volume to Capacity	0.03	0.12	0.01	0.25	0.02	0.17
Queue Length 95th (m)	0.8	3.0	0.2	0.0	0.3	0.0
Control Delay (s)	11.1	16.5	7.8	0.0	8.2	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	11.1	16.5	0.2		0.5	
Approach LOS	B	C				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	34.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	31	8	403	61	16	281
Future Volume (Veh/h)	31	8	403	61	16	281
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	35	9	458	69	18	319
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	848	492			527	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	848	492			527	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	328	578			1045	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	44	527	337
Volume Left	35	0	18
Volume Right	9	69	0
cSH	359	1700	1045
Volume to Capacity	0.12	0.31	0.02
Queue Length 95th (m)	3.1	0.0	0.4
Control Delay (s)	16.4	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	16.4	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	119	36	338	148	57
Future Volume (vph)	422	119	36	338	148	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.417		0.950	
Satd. Flow (perm)	1724	1507	783	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		129				62
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	129	39	367	161	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	129	39	367	161	62
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	57.4	57.4	12.0	69.4	21.4	21.4
Total Split (%)	63.2%	63.2%	13.2%	76.4%	23.6%	23.6%
Maximum Green (s)	50.0	50.0	10.0	62.0	15.0	15.0
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	50.0	50.0	67.4	62.0	15.0	15.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.55	0.55	0.74	0.68	0.17	0.17
v/c Ratio	0.48	0.15	0.06	0.31	0.58	0.20
Control Delay	14.7	2.3	3.3	6.6	44.5	10.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.7	2.3	3.3	6.6	44.5	10.9
LOS	B	A	A	A	D	B
Approach Delay	12.0			6.3	35.2	
Approach LOS	B			A	D	
Queue Length 50th (m)	46.1	0.0	1.5	22.4	26.3	0.0
Queue Length 95th (m)	69.9	7.3	3.7	34.7	46.0	10.5
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	949	887	691	1188	276	308
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.15	0.06	0.31	0.58	0.20

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.58			
Intersection Signal Delay: 14.3		Intersection LOS: B	
Intersection Capacity Utilization 53.2%		ICU Level of Service A	
Analysis Period (min) 15			

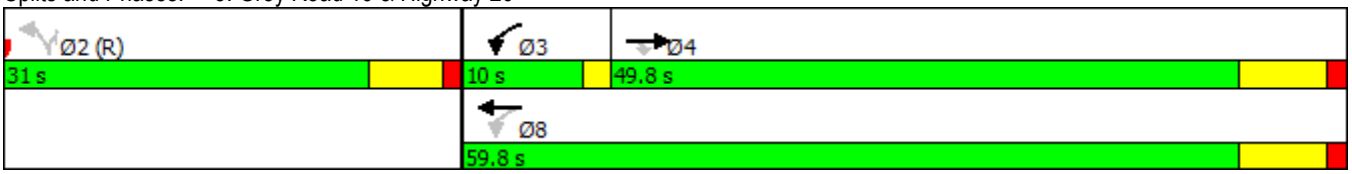
Splits and Phases: 8: Grey Road 19 & Highway 26

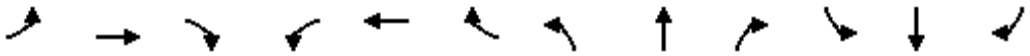
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	119	36	338	148	57
Future Volume (vph)	422	119	36	338	148	57
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.373		0.950	
Satd. Flow (perm)	1724	1507	701	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		129				62
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	129	39	367	161	62
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	129	39	367	161	62
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	49.8	49.8	10.0	59.8	31.0	31.0
Total Split (%)	54.8%	54.8%	11.0%	65.9%	34.1%	34.1%
Maximum Green (s)	42.4	42.4	8.0	52.4	24.6	24.6
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	42.4	42.4	57.8	52.4	24.6	24.6

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.47	0.47	0.64	0.58	0.27	0.27
v/c Ratio	0.57	0.17	0.07	0.37	0.36	0.13
Control Delay	21.1	3.2	6.5	11.6	29.5	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.1	3.2	6.5	11.6	29.5	7.8
LOS	C	A	A	B	C	A
Approach Delay	17.2			11.1	23.4	
Approach LOS	B			B	C	
Queue Length 50th (m)	56.1	0.0	2.3	31.8	22.7	0.0
Queue Length 95th (m)	85.2	8.9	5.7	49.2	39.7	9.0
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	805	772	541	1004	453	466
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.57	0.17	0.07	0.37	0.36	0.13

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.57			
Intersection Signal Delay: 16.3		Intersection LOS: B	
Intersection Capacity Utilization 53.2%		ICU Level of Service A	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

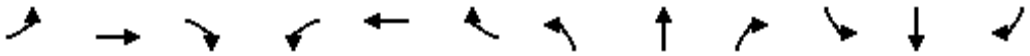




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	474	4	21	411	0	17	0	60	0	0	0
Future Volume (Veh/h)	1	474	4	21	411	0	17	0	60	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	515	4	23	447	0	18	0	65	0	0	0
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	447			519			1012	1012	517	1077	1014	447
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	447			519			1012	1012	517	1077	1014	447
tC, single (s)	4.1			4.2			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			98			92	100	88	100	100	100
cM capacity (veh/h)	1124			1027			216	226	562	172	235	616

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	520	23	447	83	0
Volume Left	1	23	0	18	0
Volume Right	4	0	0	65	0
cSH	1124	1027	1700	417	1700
Volume to Capacity	0.00	0.02	0.26	0.20	0.00
Queue Length 95th (m)	0.0	0.5	0.0	5.6	0.0
Control Delay (s)	0.0	8.6	0.0	15.8	0.0
Lane LOS	A	A		C	A
Approach Delay (s)	0.0	0.4		15.8	0.0
Approach LOS				C	A

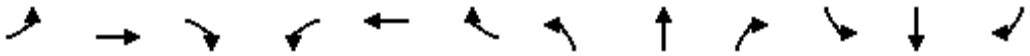
Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	37.3%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	3	0	5	0	188	3	10	161	0
Future Volume (Veh/h)	0	0	0	3	0	5	0	188	3	10	161	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	3	0	5	0	204	3	11	175	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	406	404	175	402	402	206	175			207		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	406	404	175	402	402	206	175			207		
tC, single (s)	7.1	6.5	6.2	7.4	6.5	6.5	4.1			4.3		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.8	4.0	3.5	2.2			2.4		
p0 queue free %	100	100	100	99	100	99	100			99		
cM capacity (veh/h)	552	534	874	504	535	780	1414			1264		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	0	8	0	207	186
Volume Left	0	3	0	0	11
Volume Right	0	5	0	3	0
cSH	1700	647	1700	1700	1264
Volume to Capacity	0.00	0.01	0.00	0.12	0.01
Queue Length 95th (m)	0.0	0.3	0.0	0.0	0.2
Control Delay (s)	0.0	10.6	0.0	0.0	0.5
Lane LOS	A	B			A
Approach Delay (s)	0.0	10.6	0.0		0.5
Approach LOS	A	B			

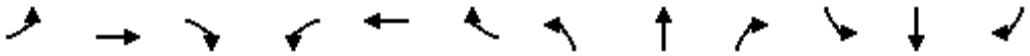
Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	26.7%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	35	28	0	1	42	149	12	2	137	8
Future Volume (Veh/h)	2	0	35	28	0	1	42	149	12	2	137	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	38	30	0	1	46	162	13	2	149	9
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	424	154	456	422	168	158			175		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	419	424	154	456	422	168	158			175		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	96	94	100	100	97			100		
cM capacity (veh/h)	533	503	898	480	504	876	1357			1401		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	40	31	221	160
Volume Left	2	30	46	2
Volume Right	38	1	13	9
cSH	868	487	1357	1401
Volume to Capacity	0.05	0.06	0.03	0.00
Queue Length 95th (m)	1.1	1.5	0.8	0.0
Control Delay (s)	9.3	12.9	1.8	0.1
Lane LOS	A	B	A	A
Approach Delay (s)	9.3	12.9	1.8	0.1
Approach LOS	A	B		

Intersection Summary				
Average Delay	2.7			
Intersection Capacity Utilization	37.0%	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	0	6	56	0	14	7	182	16	4	191	5
Future Volume (Veh/h)	7	0	6	56	0	14	7	182	16	4	191	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	7	61	0	15	8	198	17	4	208	5
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	448	450	210	446	444	206	213			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	448	450	210	446	444	206	213			215		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	88	100	98	99			100		
cM capacity (veh/h)	510	502	832	517	506	837	1363			1361		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	15	76	8	215	4	213
Volume Left	8	61	8	0	4	0
Volume Right	7	15	0	17	0	5
cSH	623	559	1363	1700	1361	1700
Volume to Capacity	0.02	0.14	0.01	0.13	0.00	0.13
Queue Length 95th (m)	0.6	3.6	0.1	0.0	0.1	0.0
Control Delay (s)	10.9	12.5	7.7	0.0	7.7	0.0
Lane LOS	B	B	A		A	
Approach Delay (s)	10.9	12.5	0.3		0.1	
Approach LOS	B	B				

Intersection Summary				
Average Delay	2.3			
Intersection Capacity Utilization	23.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	57	14	191	17	4	249
Future Volume (Veh/h)	57	14	191	17	4	249
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	65	16	217	19	5	283
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	520	226			236	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	520	226			236	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	98			100	
cM capacity (veh/h)	517	815			1337	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	81	236	288
Volume Left	65	0	5
Volume Right	16	19	0
cSH	557	1700	1337
Volume to Capacity	0.15	0.14	0.00
Queue Length 95th (m)	3.8	0.0	0.1
Control Delay (s)	12.6	0.0	0.2
Lane LOS	B		A
Approach Delay (s)	12.6	0.0	0.2
Approach LOS	B		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	212	57	625	235	75
Future Volume (vph)	586	212	57	625	235	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.285		0.950	
Satd. Flow (perm)	1824	1551	535	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		230				82
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	230	62	679	255	82
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	230	62	679	255	82
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	57.4	57.4	12.0	69.4	21.4	21.4
Total Split (%)	63.2%	63.2%	13.2%	76.4%	23.6%	23.6%
Maximum Green (s)	50.0	50.0	10.0	62.0	15.0	15.0
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	50.0	50.0	67.4	62.0	15.0	15.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.55	0.55	0.74	0.68	0.17	0.17
v/c Ratio	0.63	0.24	0.12	0.54	0.87	0.25
Control Delay	17.7	2.1	3.6	9.2	67.2	10.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	2.1	3.6	9.2	67.2	10.0
LOS	B	A	A	A	E	B
Approach Delay	13.6			8.7	53.3	
Approach LOS	B			A	D	
Queue Length 50th (m)	71.9	0.0	2.4	51.8	43.9	0.0
Queue Length 95th (m)	106.7	9.4	5.2	76.7	#85.0	11.8
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	1004	957	534	1257	292	332
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.24	0.12	0.54	0.87	0.25

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.87			
Intersection Signal Delay: 18.6		Intersection LOS: B	
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

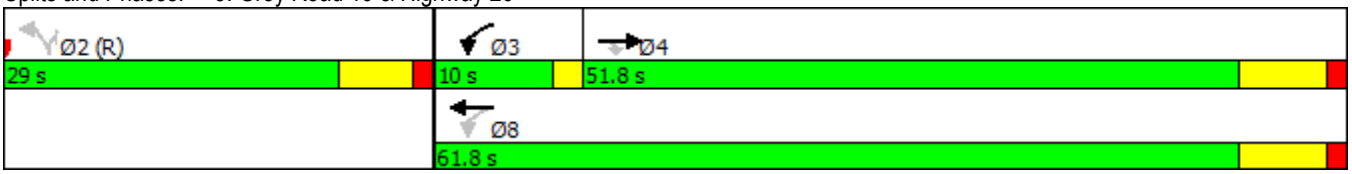
Splits and Phases: 8: Grey Road 19 & Highway 26

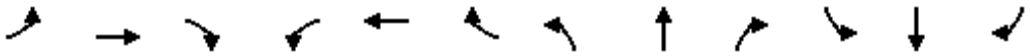
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	212	57	625	235	75
Future Volume (vph)	586	212	57	625	235	75
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.241		0.950	
Satd. Flow (perm)	1824	1551	453	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		230				82
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	230	62	679	255	82
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	230	62	679	255	82
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	51.8	51.8	10.0	61.8	29.0	29.0
Total Split (%)	57.0%	57.0%	11.0%	68.1%	31.9%	31.9%
Maximum Green (s)	44.4	44.4	8.0	54.4	22.6	22.6
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	44.4	44.4	59.8	54.4	22.6	22.6

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.49	0.49	0.66	0.60	0.25	0.25
v/c Ratio	0.71	0.26	0.15	0.62	0.58	0.18
Control Delay	23.8	2.7	6.3	14.6	36.0	7.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.8	2.7	6.3	14.6	36.0	7.5
LOS	C	A	A	B	D	A
Approach Delay	18.2			13.9	29.1	
Approach LOS	B			B	C	
Queue Length 50th (m)	83.5	0.0	3.4	69.0	39.1	0.0
Queue Length 95th (m)	123.9	10.9	7.4	102.3	63.1	10.5
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	891	875	415	1103	441	460
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.26	0.15	0.62	0.58	0.18

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.71			
Intersection Signal Delay: 18.5		Intersection LOS: B	
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

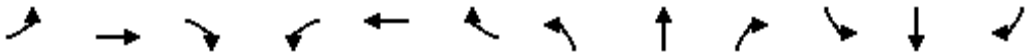




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	643	18	67	723	1	8	0	47	0	0	1
Future Volume (Veh/h)	2	643	18	67	723	1	8	0	47	0	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	699	20	73	786	1	9	0	51	0	0	1
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	787			719			1646	1646	709	1696	1656	786
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	787			719			1646	1646	709	1696	1656	786
tC, single (s)	4.1			4.1			7.1	6.5	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.4	3.5	4.0	3.3
p0 queue free %	100			92			88	100	88	100	100	100
cM capacity (veh/h)	841			892			75	92	415	61	91	395

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	721	73	787	60	1
Volume Left	2	73	0	9	0
Volume Right	20	0	1	51	1
cSH	841	892	1700	247	395
Volume to Capacity	0.00	0.08	0.46	0.24	0.00
Queue Length 95th (m)	0.1	2.0	0.0	7.0	0.1
Control Delay (s)	0.1	9.4	0.0	24.2	14.1
Lane LOS	A	A		C	B
Approach Delay (s)	0.1	0.8		24.2	14.1
Approach LOS				C	B

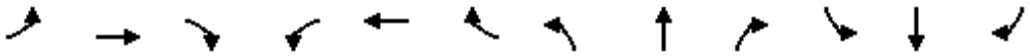
Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	69.9%	ICU Level of Service		C
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	2	1	0	11	2	300	14	15	255	1
Future Volume (Veh/h)	0	0	2	1	0	11	2	300	14	15	255	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	2	1	0	12	2	326	15	16	277	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	652	654	278	649	648	334	278			341		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	652	654	278	649	648	334	278			341		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	100	100	98	100			99		
cM capacity (veh/h)	374	383	766	380	386	713	1296			1229		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	2	13	2	341	294
Volume Left	0	1	2	0	16
Volume Right	2	12	0	15	1
cSH	766	668	1296	1700	1229
Volume to Capacity	0.00	0.02	0.00	0.20	0.01
Queue Length 95th (m)	0.1	0.5	0.0	0.0	0.3
Control Delay (s)	9.7	10.5	7.8	0.0	0.6
Lane LOS	A	B	A		A
Approach Delay (s)	9.7	10.5	0.0		0.6
Approach LOS	A	B			

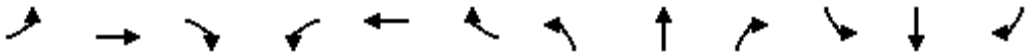
Intersection Summary				
Average Delay	0.5			
Intersection Capacity Utilization	35.8%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	42	22	0	3	38	281	31	2	218	8
Future Volume (Veh/h)	2	0	42	22	0	3	38	281	31	2	218	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	46	24	0	3	41	305	34	2	237	9
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	652	666	242	696	654	322	246			339		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	652	666	242	696	654	322	246			339		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	99	100	94	93	100	100	97			100		
cM capacity (veh/h)	372	367	778	327	373	719	1291			1220		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	27	380	248
Volume Left	2	24	41	2
Volume Right	46	3	34	9
cSH	744	348	1291	1220
Volume to Capacity	0.06	0.08	0.03	0.00
Queue Length 95th (m)	1.6	1.9	0.7	0.0
Control Delay (s)	10.2	16.2	1.1	0.1
Lane LOS	B	C	A	A
Approach Delay (s)	10.2	16.2	1.1	0.1
Approach LOS	B	C		

Intersection Summary				
Average Delay	2.0			
Intersection Capacity Utilization	48.9%	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)	4	0	16	30	0	8	12	338	61	16	251	15
Future Volume (Veh/h)	4	0	16	30	0	8	12	338	61	16	251	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	0	17	33	0	9	13	367	66	17	273	16
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	717	774	281	750	749	400	289			433		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	717	774	281	750	749	400	289			433		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	98	90	100	99	99			98		
cM capacity (veh/h)	335	322	760	315	333	652	1279			1132		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	21	42	13	433	17	289
Volume Left	4	33	13	0	17	0
Volume Right	17	9	0	66	0	16
cSH	612	355	1279	1700	1132	1700
Volume to Capacity	0.03	0.12	0.01	0.25	0.02	0.17
Queue Length 95th (m)	0.8	3.0	0.2	0.0	0.3	0.0
Control Delay (s)	11.1	16.5	7.8	0.0	8.2	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	11.1	16.5	0.2		0.5	
Approach LOS	B	C				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	34.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	31	8	403	61	16	281
Future Volume (Veh/h)	31	8	403	61	16	281
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	35	9	458	69	18	319
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	848	492			527	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	848	492			527	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	328	578			1045	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	44	527	337
Volume Left	35	0	18
Volume Right	9	69	0
cSH	359	1700	1045
Volume to Capacity	0.12	0.31	0.02
Queue Length 95th (m)	3.1	0.0	0.4
Control Delay (s)	16.4	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	16.4	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	120	47	338	148	63
Future Volume (vph)	422	120	47	338	148	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.417		0.950	
Satd. Flow (perm)	1724	1507	783	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		130				68
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	130	51	367	161	68
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	130	51	367	161	68
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	57.4	57.4	12.0	69.4	21.4	21.4
Total Split (%)	63.2%	63.2%	13.2%	76.4%	23.6%	23.6%
Maximum Green (s)	50.0	50.0	10.0	62.0	15.0	15.0
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	50.0	50.0	67.4	62.0	15.0	15.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.55	0.55	0.74	0.68	0.17	0.17
v/c Ratio	0.48	0.15	0.07	0.31	0.58	0.22
Control Delay	14.7	2.3	3.4	6.6	44.5	10.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	14.7	2.3	3.4	6.6	44.5	10.7
LOS	B	A	A	A	D	B
Approach Delay	11.9			6.2	34.4	
Approach LOS	B			A	C	
Queue Length 50th (m)	46.1	0.0	1.9	22.4	26.3	0.0
Queue Length 95th (m)	69.9	7.3	4.4	34.7	46.0	10.8
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	949	888	691	1188	276	313
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.15	0.07	0.31	0.58	0.22

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.58			
Intersection Signal Delay: 14.2		Intersection LOS: B	
Intersection Capacity Utilization 58.9%		ICU Level of Service B	
Analysis Period (min) 15			

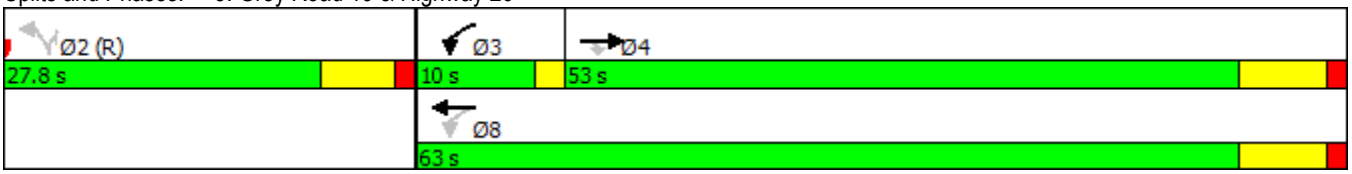
Splits and Phases: 8: Grey Road 19 & Highway 26

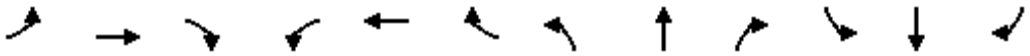
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	120	47	338	148	63
Future Volume (vph)	422	120	47	338	148	63
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.393		0.950	
Satd. Flow (perm)	1724	1507	738	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		130				68
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	130	51	367	161	68
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	130	51	367	161	68
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	53.0	53.0	10.0	63.0	27.8	27.8
Total Split (%)	58.4%	58.4%	11.0%	69.4%	30.6%	30.6%
Maximum Green (s)	45.6	45.6	8.0	55.6	21.4	21.4
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	45.6	45.6	61.0	55.6	21.4	21.4

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.50	0.50	0.67	0.61	0.24	0.24
v/c Ratio	0.53	0.16	0.09	0.34	0.41	0.16
Control Delay	18.2	2.8	5.4	9.8	33.1	8.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.2	2.8	5.4	9.8	33.1	8.4
LOS	B	A	A	A	C	A
Approach Delay	14.8			9.2	25.8	
Approach LOS	B			A	C	
Queue Length 50th (m)	51.9	0.0	2.6	28.7	23.9	0.0
Queue Length 95th (m)	78.7	8.2	6.1	44.5	41.8	9.8
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	865	821	588	1065	394	418
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.53	0.16	0.09	0.34	0.41	0.16

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.53			
Intersection Signal Delay: 14.9		Intersection LOS: B	
Intersection Capacity Utilization 58.9%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

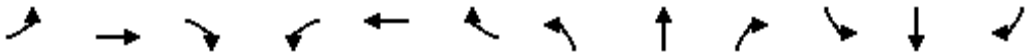




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	480	4	9	422	0	17	0	54	0	0	0
Future Volume (Veh/h)	1	480	4	9	422	0	17	0	54	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	522	4	10	459	0	18	0	59	0	0	0
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			526			1005	1005	524	1064	1007	459
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	459			526			1005	1005	524	1064	1007	459
tC, single (s)	4.1			4.2			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			99			92	100	89	100	100	100
cM capacity (veh/h)	1113			1021			220	231	557	180	240	606

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	527	10	459	77	0
Volume Left	1	10	0	18	0
Volume Right	4	0	0	59	0
cSH	1113	1021	1700	410	1700
Volume to Capacity	0.00	0.01	0.27	0.19	0.00
Queue Length 95th (m)	0.0	0.2	0.0	5.2	0.0
Control Delay (s)	0.0	8.6	0.0	15.8	0.0
Lane LOS	A	A		C	A
Approach Delay (s)	0.0	0.2		15.8	0.0
Approach LOS				C	A

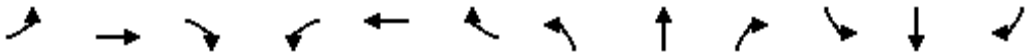
Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	37.2%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	28	0	4	0	195	8	8	175	0
Future Volume (Veh/h)	0	0	0	28	0	4	0	195	8	8	175	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	30	0	4	0	212	9	9	190	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	424	429	190	424	424	216	190			221		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	424	429	190	424	424	216	190			221		
tC, single (s)	7.1	6.5	6.2	7.4	6.5	6.5	4.1			4.3		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.8	4.0	3.5	2.2			2.4		
p0 queue free %	100	100	100	94	100	99	100			99		
cM capacity (veh/h)	538	518	857	487	521	769	1396			1249		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	0	34	0	221	199
Volume Left	0	30	0	0	9
Volume Right	0	4	0	9	0
cSH	1700	509	1700	1700	1249
Volume to Capacity	0.00	0.07	0.00	0.13	0.01
Queue Length 95th (m)	0.0	1.6	0.0	0.0	0.2
Control Delay (s)	0.0	12.6	0.0	0.0	0.4
Lane LOS	A	B			A
Approach Delay (s)	0.0	12.6	0.0		0.4
Approach LOS	A	B			

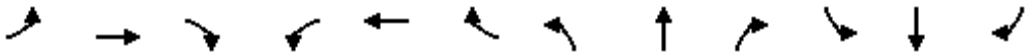
Intersection Summary				
Average Delay	1.1			
Intersection Capacity Utilization	25.7%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	35	3	0	8	42	154	7	16	162	8
Future Volume (Veh/h)	2	0	35	3	0	8	42	154	7	16	162	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	38	3	0	9	46	167	8	17	176	9
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	486	482	180	516	482	171	185			175		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	486	482	180	516	482	171	185			175		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	100	100	96	99	100	99	97			99		
cM capacity (veh/h)	472	462	867	433	461	873	1326			1401		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	40	12	221	202
Volume Left	2	3	46	17
Volume Right	38	9	8	9
cSH	833	696	1326	1401
Volume to Capacity	0.05	0.02	0.03	0.01
Queue Length 95th (m)	1.1	0.4	0.8	0.3
Control Delay (s)	9.5	10.3	1.9	0.7
Lane LOS	A	B	A	A
Approach Delay (s)	9.5	10.3	1.9	0.7
Approach LOS	A	B		

Intersection Summary				
Average Delay	2.2			
Intersection Capacity Utilization	30.2%	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	0	6	56	0	14	7	182	16	4	191	5
Future Volume (Veh/h)	7	0	6	56	0	14	7	182	16	4	191	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	7	61	0	15	8	198	17	4	208	5
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	448	450	210	446	444	206	213			215		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	448	450	210	446	444	206	213			215		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	88	100	98	99			100		
cM capacity (veh/h)	510	502	832	517	506	837	1363			1361		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	15	76	8	215	4	213
Volume Left	8	61	8	0	4	0
Volume Right	7	15	0	17	0	5
cSH	623	559	1363	1700	1361	1700
Volume to Capacity	0.02	0.14	0.01	0.13	0.00	0.13
Queue Length 95th (m)	0.6	3.6	0.1	0.0	0.1	0.0
Control Delay (s)	10.9	12.5	7.7	0.0	7.7	0.0
Lane LOS	B	B	A		A	
Approach Delay (s)	10.9	12.5	0.3		0.1	
Approach LOS	B	B				

Intersection Summary				
Average Delay	2.3			
Intersection Capacity Utilization	23.0%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	57	14	191	17	4	249
Future Volume (Veh/h)	57	14	191	17	4	249
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	65	16	217	19	5	283
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	520	226			236	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	520	226			236	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	98			100	
cM capacity (veh/h)	517	815			1337	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	81	236	288
Volume Left	65	0	5
Volume Right	16	19	0
cSH	557	1700	1337
Volume to Capacity	0.15	0.14	0.00
Queue Length 95th (m)	3.8	0.0	0.1
Control Delay (s)	12.6	0.0	0.2
Lane LOS	B		A
Approach Delay (s)	12.6	0.0	0.2
Approach LOS	B		

Intersection Summary			
Average Delay	1.8		
Intersection Capacity Utilization	27.0%	ICU Level of Service	A
Analysis Period (min)	15		

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	213	68	625	236	91
Future Volume (vph)	586	213	68	625	236	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.285		0.950	
Satd. Flow (perm)	1824	1551	535	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		232				99
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	232	74	679	257	99
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	232	74	679	257	99
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	57.4	57.4	12.0	69.4	21.4	21.4
Total Split (%)	63.2%	63.2%	13.2%	76.4%	23.6%	23.6%
Maximum Green (s)	50.0	50.0	10.0	62.0	15.0	15.0
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	50.0	50.0	67.4	62.0	15.0	15.0

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.55	0.55	0.74	0.68	0.17	0.17
v/c Ratio	0.63	0.24	0.14	0.54	0.88	0.29
Control Delay	17.7	2.1	3.7	9.2	68.2	9.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	17.7	2.1	3.7	9.2	68.2	9.6
LOS	B	A	A	A	E	A
Approach Delay	13.5			8.7	51.9	
Approach LOS	B			A	D	
Queue Length 50th (m)	71.9	0.0	2.8	51.8	44.3	0.0
Queue Length 95th (m)	106.7	9.5	5.9	76.7	#86.0	12.9
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	1004	958	534	1257	292	347
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.24	0.14	0.54	0.88	0.29

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.88			
Intersection Signal Delay: 18.6		Intersection LOS: B	
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			
# 95th percentile volume exceeds capacity, queue may be longer.			
Queue shown is maximum after two cycles.			

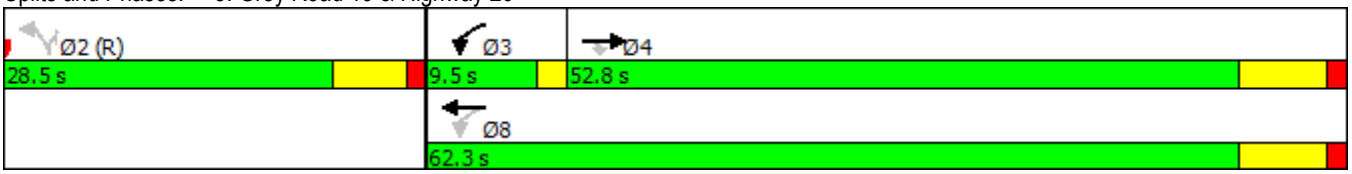
Splits and Phases: 8: Grey Road 19 & Highway 26

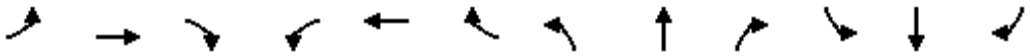
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	213	68	625	236	91
Future Volume (vph)	586	213	68	625	236	91
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.249		0.950	
Satd. Flow (perm)	1824	1551	468	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		232				99
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	232	74	679	257	99
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	232	74	679	257	99
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	52.8	52.8	9.5	62.3	28.5	28.5
Total Split (%)	58.1%	58.1%	10.5%	68.6%	31.4%	31.4%
Maximum Green (s)	45.4	45.4	7.5	54.9	22.1	22.1
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	45.4	45.4	60.3	54.9	22.1	22.1

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.50	0.50	0.66	0.60	0.24	0.24
v/c Ratio	0.70	0.26	0.18	0.61	0.60	0.21
Control Delay	22.6	2.5	6.4	14.2	37.1	7.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.6	2.5	6.4	14.2	37.1	7.3
LOS	C	A	A	B	D	A
Approach Delay	17.2			13.4	28.8	
Approach LOS	B			B	C	
Queue Length 50th (m)	81.4	0.0	4.0	67.9	39.8	0.0
Queue Length 95th (m)	120.9	10.7	8.3	100.7	64.3	11.6
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	912	891	419	1113	431	464
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.70	0.26	0.18	0.61	0.60	0.21

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.70			
Intersection Signal Delay: 17.9		Intersection LOS: B	
Intersection Capacity Utilization 65.4%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

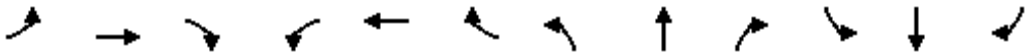




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	659	18	55	734	1	8	0	30	0	0	1
Future Volume (Veh/h)	18	659	18	55	734	1	8	0	30	0	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	716	20	60	798	1	9	0	33	0	0	1
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	799			736			1685	1685	726	1718	1694	798
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	799			736			1685	1685	726	1718	1694	798
tC, single (s)	4.1			4.1			7.1	6.5	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.4	3.5	4.0	3.3
p0 queue free %	98			93			87	100	92	100	100	100
cM capacity (veh/h)	833			879			70	86	405	61	85	389

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	756	60	799	42	1
Volume Left	20	60	0	9	0
Volume Right	20	0	1	33	1
cSH	833	879	1700	200	389
Volume to Capacity	0.02	0.07	0.47	0.21	0.00
Queue Length 95th (m)	0.6	1.7	0.0	5.8	0.1
Control Delay (s)	0.6	9.4	0.0	27.7	14.3
Lane LOS	A	A		D	B
Approach Delay (s)	0.6	0.7		27.7	14.3
Approach LOS				D	B

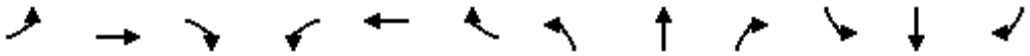
Intersection Summary				
Average Delay	1.3			
Intersection Capacity Utilization	65.9%	ICU Level of Service		C
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	2	13	0	8	2	320	38	13	269	1
Future Volume (Veh/h)	0	0	2	13	0	8	2	320	38	13	269	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	2	14	0	9	2	348	41	14	292	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	682	714	292	695	694	368	293			389		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	682	714	292	695	694	368	293			389		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	96	100	99	100			99		
cM capacity (veh/h)	358	355	752	355	364	681	1280			1181		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	2	23	2	389	307
Volume Left	0	14	2	0	14
Volume Right	2	9	0	41	1
cSH	752	437	1280	1700	1181
Volume to Capacity	0.00	0.05	0.00	0.23	0.01
Queue Length 95th (m)	0.1	1.3	0.0	0.0	0.3
Control Delay (s)	9.8	13.7	7.8	0.0	0.5
Lane LOS	A	B	A		A
Approach Delay (s)	9.8	13.7	0.0		0.5
Approach LOS	A	B			

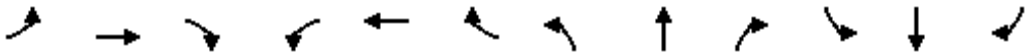
Intersection Summary				
Average Delay	0.7			
Intersection Capacity Utilization	39.3%	ICU Level of Service	A	
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	2	0	42	10	0	23	38	305	7	16	230	8
Future Volume (Veh/h)	2	0	42	10	0	23	38	305	7	16	230	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	46	11	0	25	41	332	8	17	250	9
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	732	710	254	752	711	336	259			340		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	732	710	254	752	711	336	259			340		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	99	100	94	96	100	96	97			99		
cM capacity (veh/h)	316	342	765	296	342	706	1277			1219		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	36	381	276
Volume Left	2	11	41	17
Volume Right	46	25	8	9
cSH	722	496	1277	1219
Volume to Capacity	0.07	0.07	0.03	0.01
Queue Length 95th (m)	1.6	1.8	0.8	0.3
Control Delay (s)	10.3	12.8	1.1	0.6
Lane LOS	B	B	A	A
Approach Delay (s)	10.3	12.8	1.1	0.6
Approach LOS	B	B		

Intersection Summary				
Average Delay	2.1			
Intersection Capacity Utilization	41.2%	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)	4	0	16	30	0	8	12	338	61	16	251	15
Future Volume (Veh/h)	4	0	16	30	0	8	12	338	61	16	251	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	0	17	33	0	9	13	367	66	17	273	16
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	717	774	281	750	749	400	289			433		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	717	774	281	750	749	400	289			433		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	98	90	100	99	99			98		
cM capacity (veh/h)	335	322	760	315	333	652	1279			1132		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	21	42	13	433	17	289
Volume Left	4	33	13	0	17	0
Volume Right	17	9	0	66	0	16
cSH	612	355	1279	1700	1132	1700
Volume to Capacity	0.03	0.12	0.01	0.25	0.02	0.17
Queue Length 95th (m)	0.8	3.0	0.2	0.0	0.3	0.0
Control Delay (s)	11.1	16.5	7.8	0.0	8.2	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	11.1	16.5	0.2		0.5	
Approach LOS	B	C				

Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	34.8%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	31	8	403	61	16	281
Future Volume (Veh/h)	31	8	403	61	16	281
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	35	9	458	69	18	319
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	848	492			527	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	848	492			527	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	328	578			1045	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	44	527	337
Volume Left	35	0	18
Volume Right	9	69	0
cSH	359	1700	1045
Volume to Capacity	0.12	0.31	0.02
Queue Length 95th (m)	3.1	0.0	0.4
Control Delay (s)	16.4	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	16.4	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

Appendix I
Sensitivity Analysis

JANUARY 25, 2018

PROJECT NO: 1046-4031

SENT VIA: EMAIL
RWAGNER@PARKBRIDGE.COM

Parkbridge Lifestyle Communities Inc.
85 Theme Park Drive
Wasaga Beach, ON L9Z 1X7

Attention: Rob Wagner

RE: COMMENT RESPONSE LETTER
PARKBRIDGE CRAIGLEITH RIDGE RESIDENTIAL DEVELOPMENT
TOWN OF THE BLUE MOUNTAINS, COUNTY OF GREY

Dear Rob,

This letter has been prepared in response to the MTO's comments dated March 31, 2017 pertaining to the trip generation land use category utilized in the original Traffic Impact Study (TIS) (Crozier, December 2016) for the proposed Parkbridge Craigleith Ridge residential development.

In response to the MTO's comment, we have provided a sensitivity analysis illustrating the modified trip generation and corresponding operations for the preferred scenario, Option 3.

As described in the main body of the Traffic Assessment, the original TIS used Land Use Category 260: "Recreational Homes", which resulted in a total trip generation of 34 and 56 trips in the weekday a.m. and p.m. peak hours, respectively.

As requested by the MTO, the modified trip generation considered Land Use Category 210: "Single Family Detached Housing" and Land Use Category 220: "Multifamily Housing (Low-rise)". The trip generation was calculated using the fitted curve equations provided in the Institute of Transportation Engineers (ITE) Trip Generation Manual, 10th Edition. The resulting trip generation is summarized in **Table 1** below.

Table 1 – Trip Generation

Subject Property Use	Roadway Peak Hour	Number of Trips		
		Inbound	Outbound	Total
L.U. 210: Single Family Detached Housing (119 Units)	Weekday A.M.	22	67	89
	Weekday P.M.	76	44	120
L.U. 220: Multifamily Housing (Low-Rise) (92 Units)	Weekday A.M.	10	34	44
	Weekday P.M.	35	20	55
Total	**Weekday A.M.**	**32**	**101**	**133**
	Weekday P.M.	**111**	**64**	**175**

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CROZIER CONSULTING ENGINEERS

The resulting trip generation represents an increase of 99 and 119 trips in the weekday a.m. and p.m. peak hours, respectively. This trip generation is considered an over-estimation, as the revised land use categories do not align with other typical Parkbridge developments.

Table 2 below outlines the traffic operations for both trip generation scenarios.

Table 2 - 2031 Future Total Level of Service (No connection to Lakeshore Drive)

Intersection	Control	Peak Hour	Level of Service	Control Delay	Control Delay (Original Trip Generation)	Max V/C Ratio	Max V/C Ratio (Original Trip Generation)
Highway 26 and Grey Road 19	Signal (Optimized)	A.M.	B	15.2 s	14.9 s	0.54 (EBT)	0.53 (EBT)
		P.M.	B	18.4 s	17.9 s	0.73 (EBT)	0.70 (EBT)
Highway 26 and Lakeshore Road	Stop	A.M.	C	16.8 s	15.8 s	0.27 (WBT)	0.27 (WBT)
		P.M.	D	30.1 s	27.7 s	0.50 (WBT)	0.47 (WBT)
Grey Road 19 and Lakeshore Road	Stop	A.M.	B	13.6 s	12.6 s	0.13 (NBT)	0.13 (NBT)
		P.M.	B	14.8 s	13.7 s	0.24 (NBT)	0.23 (NBT)
Grey Road 19 and Craigleith Road	Stop	A.M.	B	11.5 s	10.3 s	0.17 (WB)	0.05 (EB)
		P.M.	C	15.1 s	12.8 s	0.16 (WB)	0.07 (EB/WB)
Grey Road 19 and Birches Boulevard	Stop	A.M.	B	12.8 s	12.5 s	0.14 (WB/SB)	0.14 (WB)
		P.M.	C	17.3 s	16.5 s	0.27 (NBT)	0.25 (NBT)
Grey Road 19 and Helen Street	Stop	A.M.	B	12.9 s	12.6 s	0.15 (WB)	0.15 (WB)
		P.M.	C	17.0 s	16.4 s	0.33 (NB)	0.31 (NB)

Note: The Level of Service of a signalized intersection is based on the average control delay per vehicle. The Level of Service of a stop-controlled intersection is based on the delay associated with the critical minor road approach; ie., Lakeshore Road and Craigleith Road

As illustrated in the above table, the additional traffic caused by modifying the trip generation assumptions has a marginal impact on the overall traffic operations of the boundary road network. For this reason, the revised trip generation is not expected to materially impact the recommendations and conclusions summarized in the original TIS or the Traffic Assessment (Crozier, January, 2018).

Auxiliary Lane Analysis

A left-turn lane warrant was undertaken in the original TIS for a southbound left-turn lane at the intersection of Grey Road 19 and Craigleith Road. The analysis indicated that a left-turn lane is not warranted. The results of this analysis are summarized in **Table 3** below. The analysis was revised to account for the change in trip generation, as requested by the MTO.

The analysis was completed using the Ontario Ministry of Transportation (MTO) Geometric Design Standards for Ontario Highways (GDSOH) during the weekday a.m. and p.m. periods under future total conditions. In keeping with the traffic engineering convention of design speeds 10 km/h in excess of the posted speed limit for typical roadways, a 60 km/h design speed at the subject site

was assumed. Thus, the warrants were governed by Figures EA-6 and EA-8 from the GDSOH, which cover unsignalized intersections with a design speed of 60 km/h. **Table 4** summarizes the left-turn lane warrant results. The MTO left-turn lane warrant charts have been attached for reference.

Table 3 – Original Trip Generation Left-Turn Lane Warrant

Intersection	Peak Hour	V_a	V_o	%LT in V_a	Warranted	Required Storage
Grey Road 19 and Craigleith Road	A.M.	186	203	9%	✖	N/A
	P.M	254	350	6%	✖	N/A

Table 4 – Sensitivity Left-Turn Lane Warrant

Intersection	Peak Hour	V_a	V_o	%LT in V_a	Warranted	Required Storage
Grey Road 19 and Craigleith Road	A.M.	192	206	11%	✖	N/A
	P.M	316	376	25%	✓	15 m

As summarized in **Table 3,** a left-turn lane is not warranted under the original trip generation land use assumption of recreational homes. Given the revised assumption of single family detached and multifamily low-rise, a left-turn lane would be warranted with a 15 metre storage length.

Although a left-turn lane is warranted at this location using the revised trip generation, the future total operations indicate that the southbound through and right-turn movements experience very minimal delays, and as such, the existing lane configuration is supportable from an operations perspective. The control delay for the southbound movement without the implementation of a left-turn lane is **2.6 seconds,** thereby supporting the original configuration without a left-turn lane.

As noted previously, the revised trip generation represents a conservative analysis, as the modified land use categories do not align with the travel patterns and behaviors anticipated for this development. Accordingly, it is recommended that turning movement counts be re-taken after the development has occupancy, in order to establish peak hour traffic patterns, and determine if left-turn lanes are justified.

We trust this supplementary information is acceptable and addresses any outstanding concerns related to the trip generation. Should you have any questions or require any further information, please do not hesitate to contact the undersigned.

Sincerely,

C.F. CROZIER & ASSOCIATES INC.

Ryan MacLaughlan, P.Eng

Project Engineer
/rm

c.c. Enclosure

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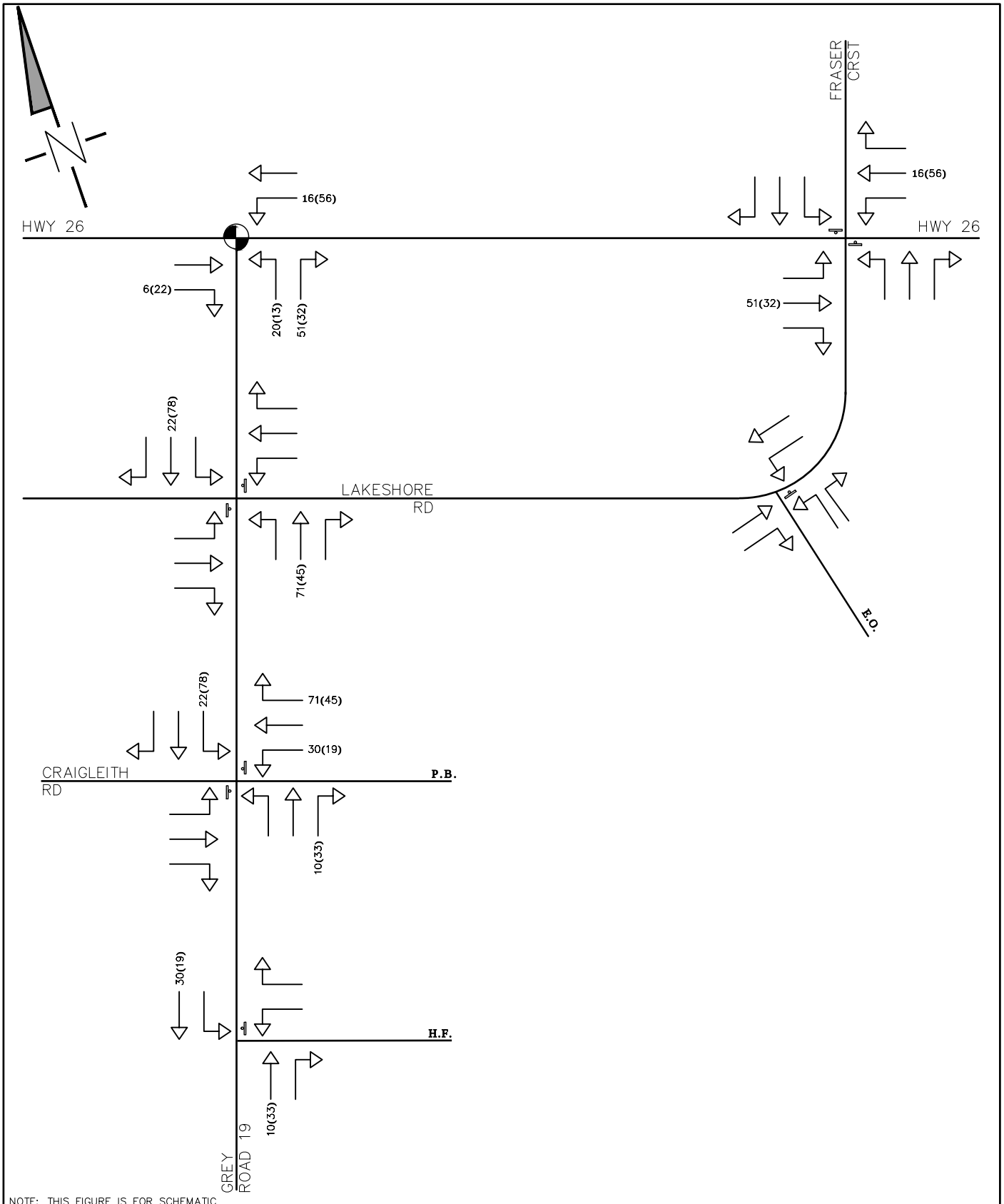

NOTE: THIS FIGURE IS FOR SCHEMATIC PURPOSES ONLY & IS NOT TO BE SCALED.

Legend

SIGNAL CONTROL

STOP CONTROL

XX(YY) AM (PM)

Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - PARKBRIDGE ASSIGNMENT: SENSITIVITY ANALYSIS

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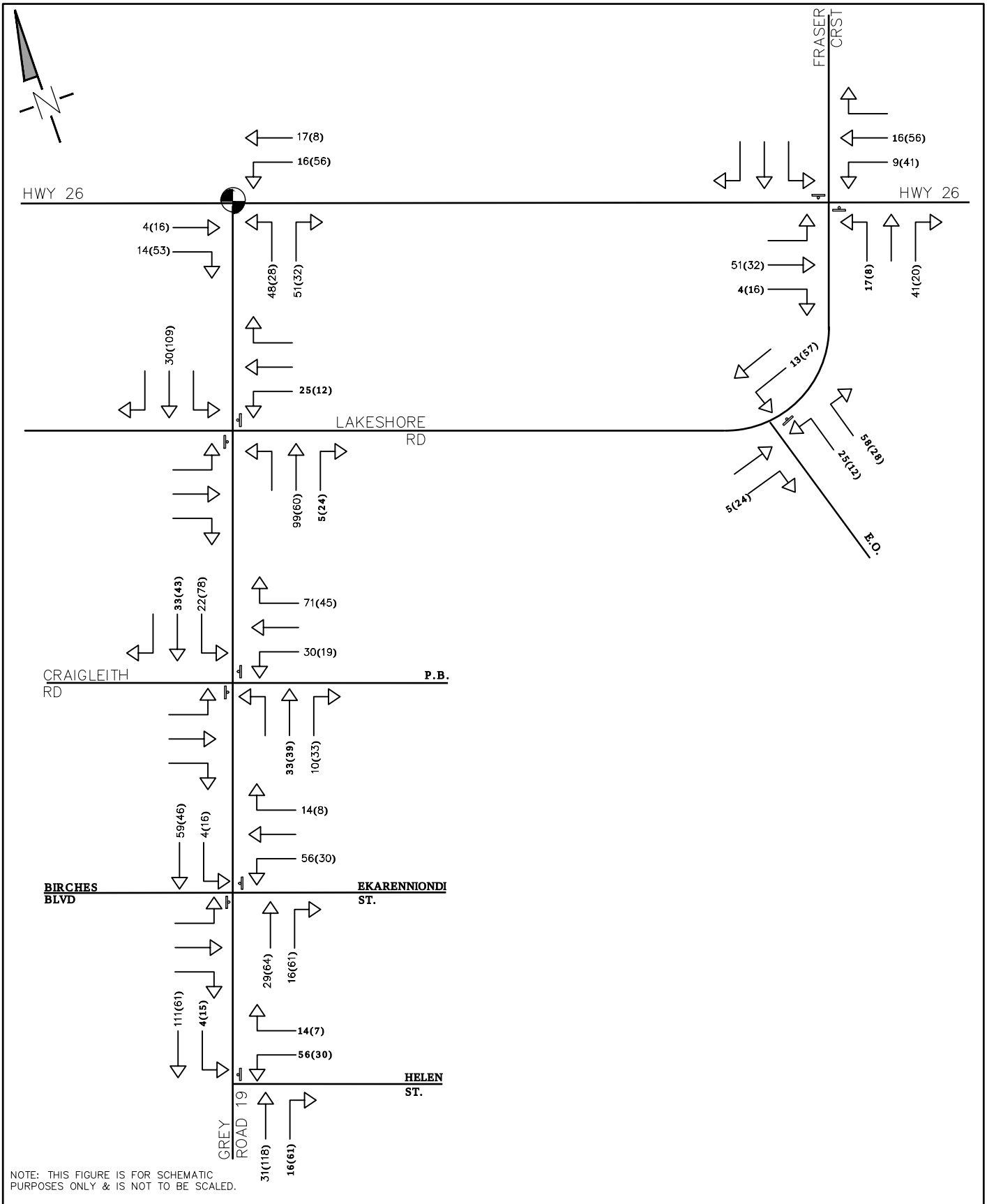
Drawn By	Design By	Project
J.I.M.	M.N.F.	1046 - 4031

Scale	Date	Check By	Drawing
N.T.S.	JAN. 24, 2018	R.M.	FIG. i



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

Legend

SIGNAL CONTROL

STOP CONTROL

XX(YY) AM (PM)

Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - TOTAL TRIP ASSIGNMENT: SENSITIVITY ANALYSIS

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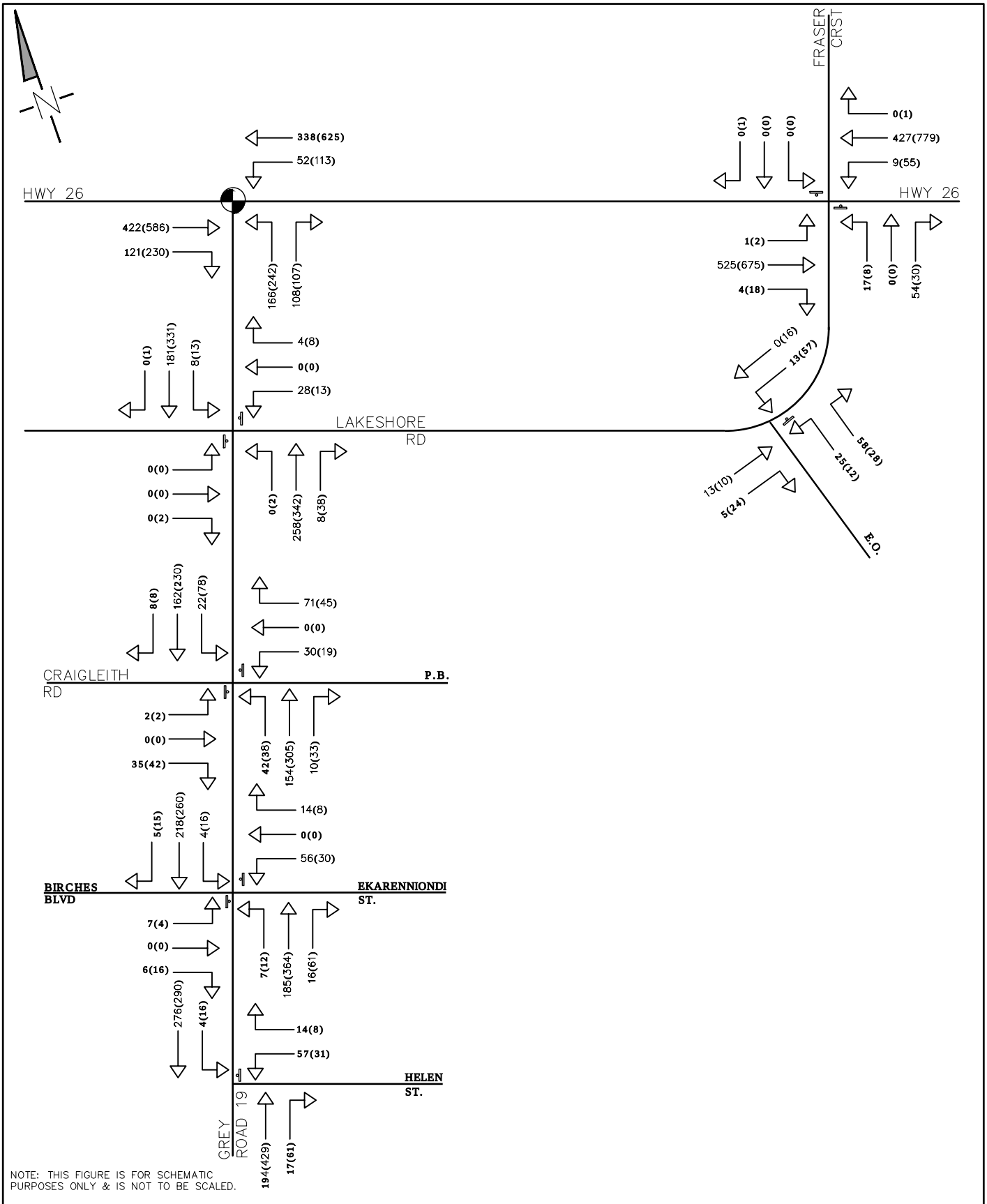
Drawn By	Design By	Project
J.I.M.	M.N.F.	1046 - 4031

Scale	Date	Check By	Drawing
N.T.S.	JAN. 24, 2018	R.M.	FIG. ii



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

Legend

SIGNAL CONTROL

STOP CONTROL

XX(YY) AM (PM)

Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - FUTURE TOTAL 2031: SENSITIVITY ANALYSIS

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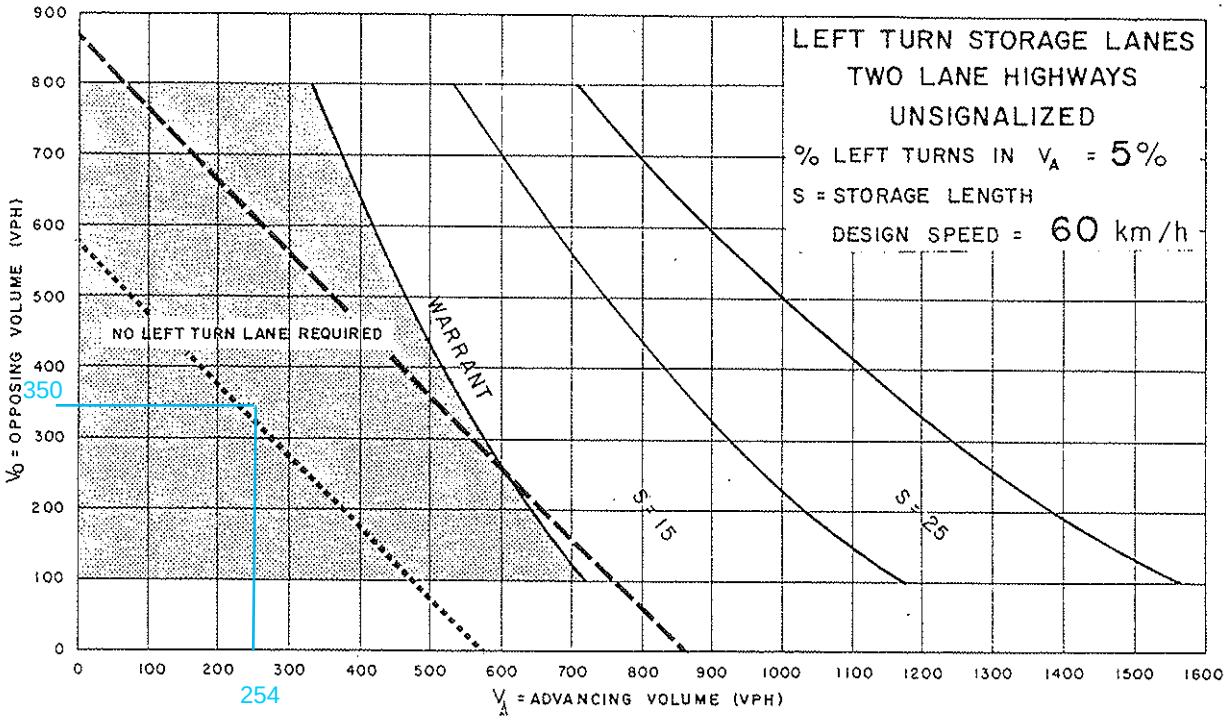
Drawn By	Design By	Project
J.I.M.	M.N.F.	1046 - 4031

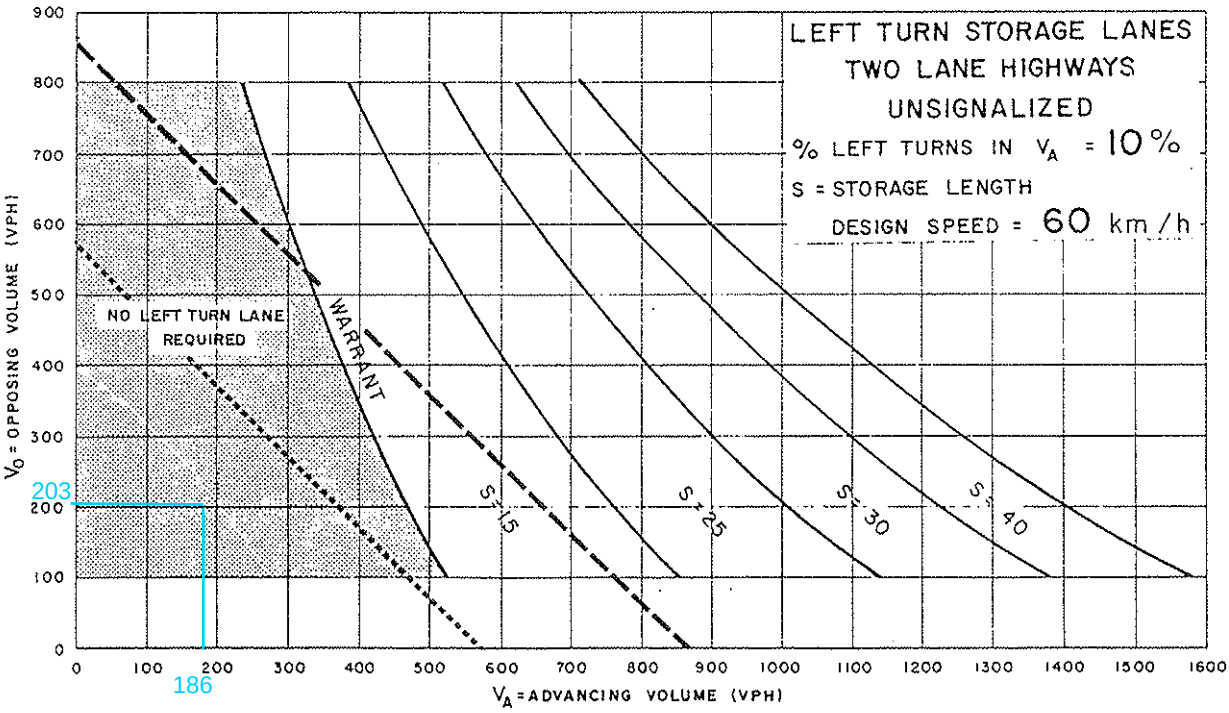
Scale	Date	Check By	Drawing
N.T.S.	JAN. 24, 2018	R.M.	FIG. iii



— Weekday P.M. - Original

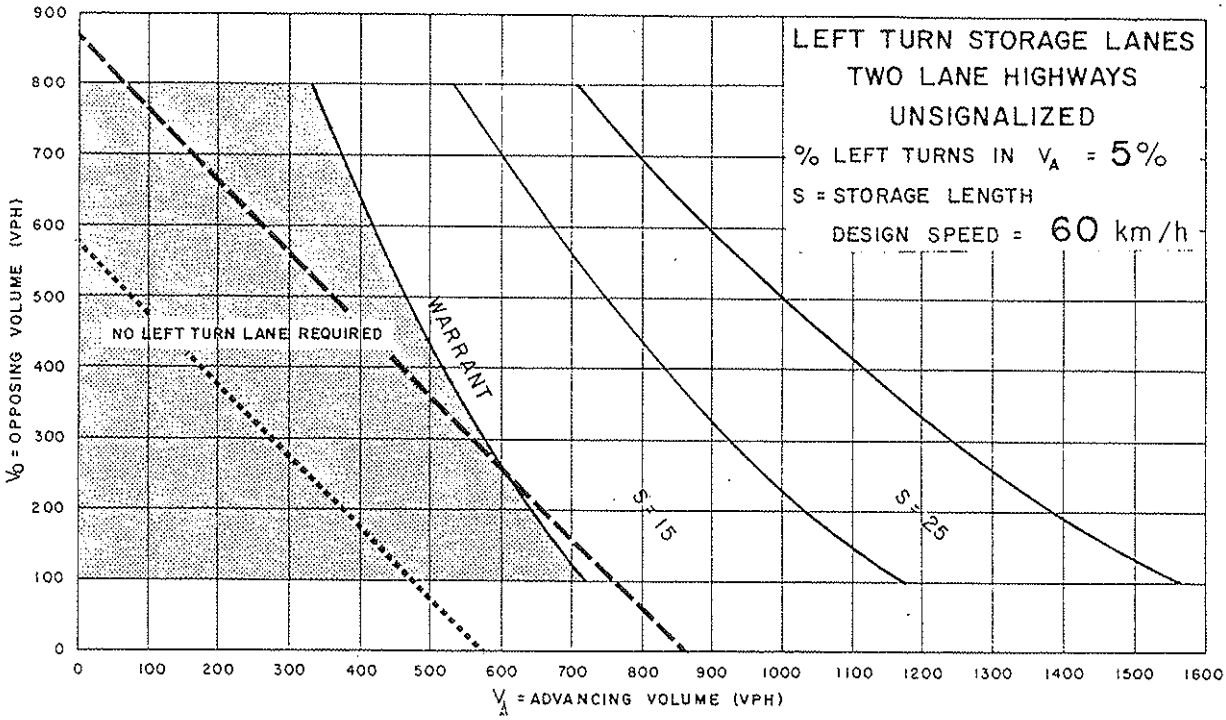
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS



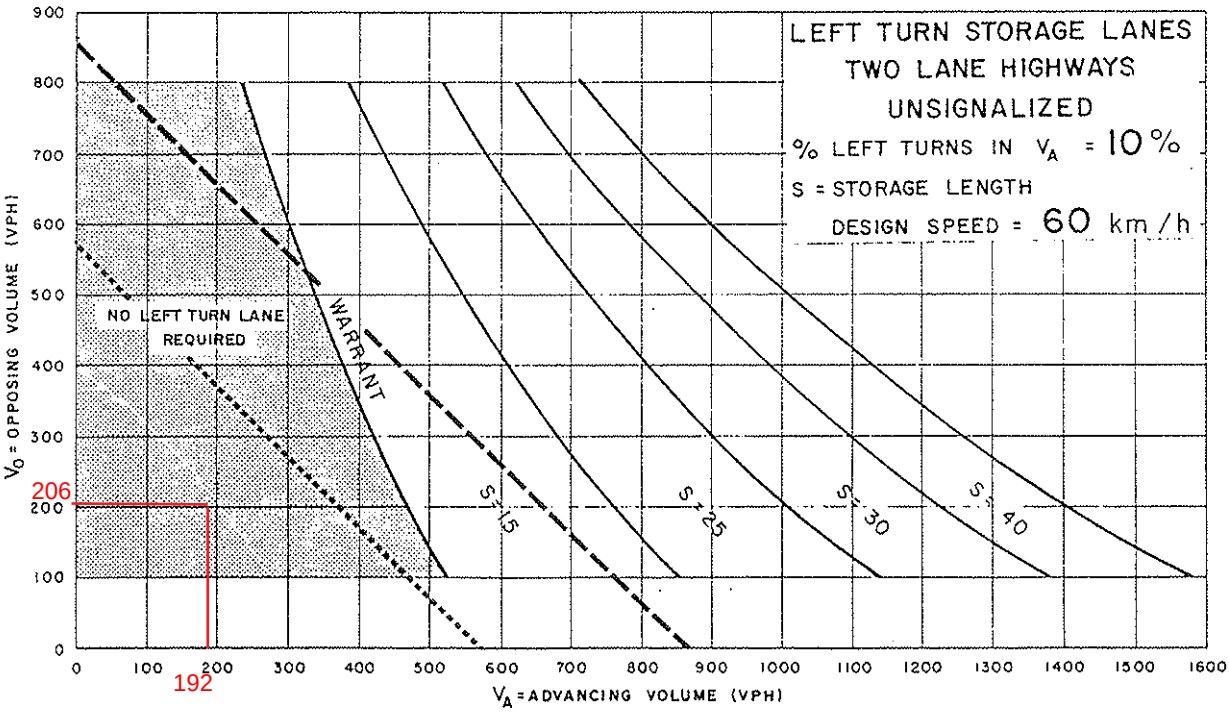
— Weekday A.M. - Original

Figure EA-6



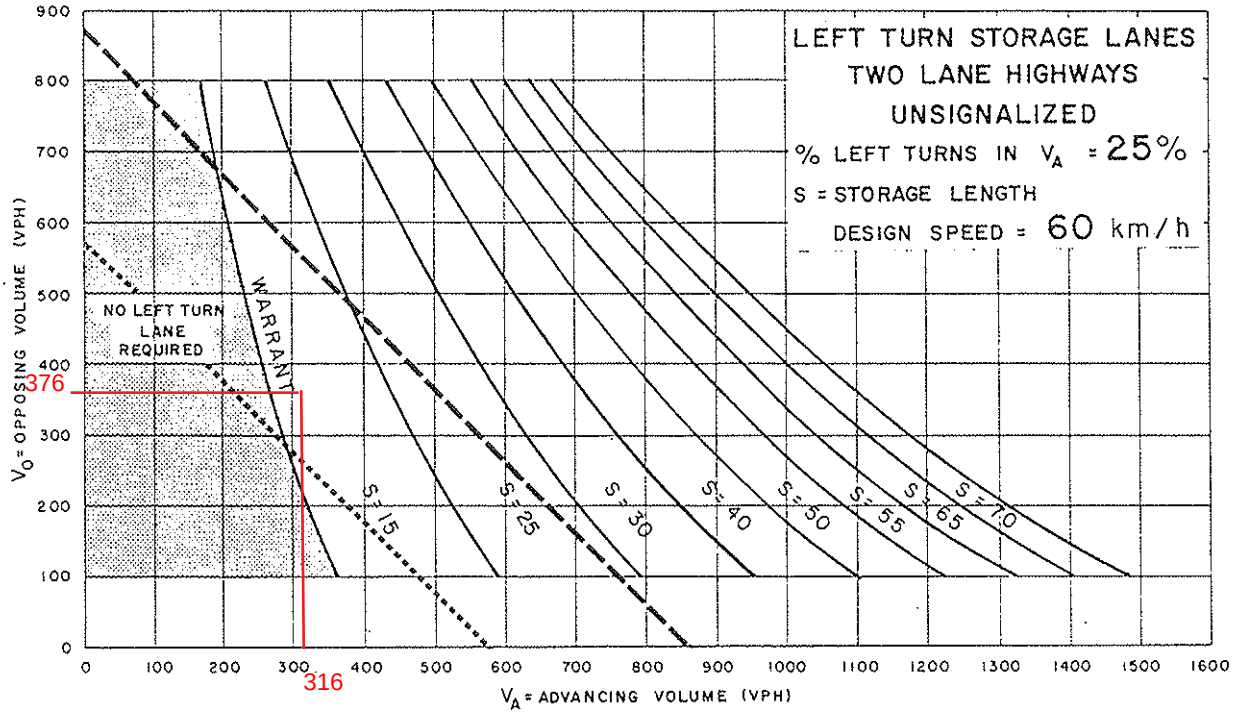
TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS



— Weekday A.M. - Sensitivity

Figure EA-6



— Weekday P.M. - Sensitivity

TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

TRAFFIC SIGNALS MAY BE WARRANTED IN "FREE FLOW" URBAN AREAS

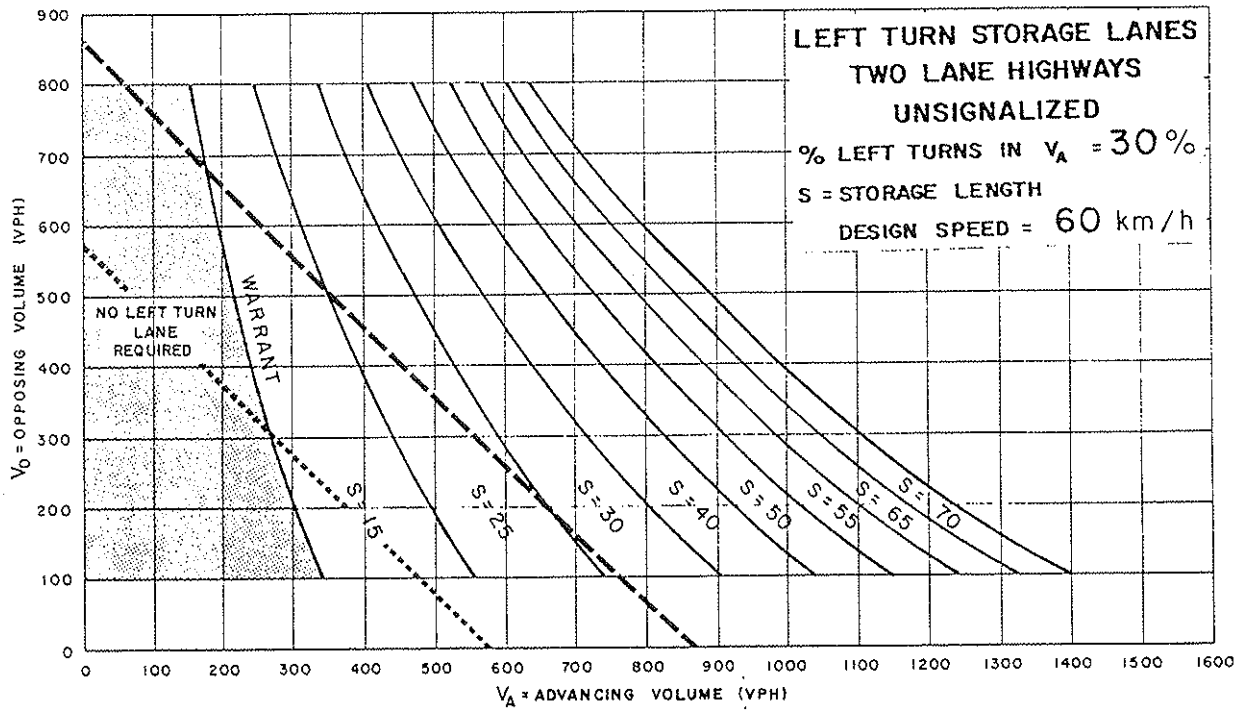


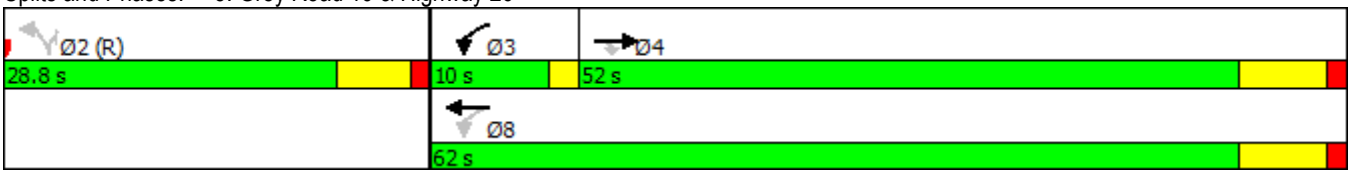
Figure EA-8

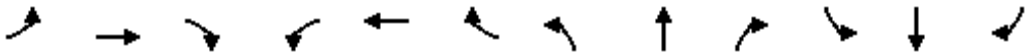
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	422	121	52	338	166	108
Future Volume (vph)	422	121	52	338	166	108
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1724	1507	1785	1740	1674	1555
Flt Permitted			0.387		0.950	
Satd. Flow (perm)	1724	1507	727	1740	1674	1555
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		132				117
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	9%	6%	0%	8%	9%	5%
Adj. Flow (vph)	459	132	57	367	180	117
Shared Lane Traffic (%)						
Lane Group Flow (vph)	459	132	57	367	180	117
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	52.0	52.0	10.0	62.0	28.8	28.8
Total Split (%)	57.3%	57.3%	11.0%	68.3%	31.7%	31.7%
Maximum Green (s)	44.6	44.6	8.0	54.6	22.4	22.4
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	44.6	44.6	60.0	54.6	22.4	22.4

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.49	0.49	0.66	0.60	0.25	0.25
v/c Ratio	0.54	0.16	0.10	0.35	0.44	0.25
Control Delay	19.0	2.9	5.8	10.3	32.9	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	19.0	2.9	5.8	10.3	32.9	7.0
LOS	B	A	A	B	C	A
Approach Delay	15.4			9.7	22.7	
Approach LOS	B			A	C	
Queue Length 50th (m)	53.2	0.0	3.1	29.6	26.6	0.0
Queue Length 95th (m)	80.7	8.5	6.9	45.8	45.7	12.5
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	846	807	573	1046	412	471
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.54	0.16	0.10	0.35	0.44	0.25

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.54			
Intersection Signal Delay: 15.2		Intersection LOS: B	
Intersection Capacity Utilization 61.5%		ICU Level of Service B	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

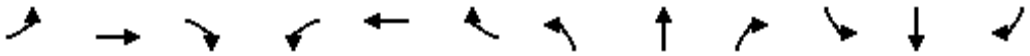




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	1	525	4	9	427	0	17	0	54	0	0	0
Future Volume (Veh/h)	1	525	4	9	427	0	17	0	54	0	0	0
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	571	4	10	464	0	18	0	59	0	0	0
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	464			575			1059	1059	573	1118	1061	464
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	464			575			1059	1059	573	1118	1061	464
tC, single (s)	4.1			4.2			7.1	6.6	6.2	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.3			3.5	4.1	3.3	3.5	4.0	3.3
p0 queue free %	100			99			91	100	89	100	100	100
cM capacity (veh/h)	1108			979			202	215	523	164	223	602

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	576	10	464	77	0
Volume Left	1	10	0	18	0
Volume Right	4	0	0	59	0
cSH	1108	979	1700	381	1700
Volume to Capacity	0.00	0.01	0.27	0.20	0.00
Queue Length 95th (m)	0.0	0.2	0.0	5.7	0.0
Control Delay (s)	0.0	8.7	0.0	16.8	0.0
Lane LOS	A	A		C	A
Approach Delay (s)	0.0	0.2		16.8	0.0
Approach LOS				C	A

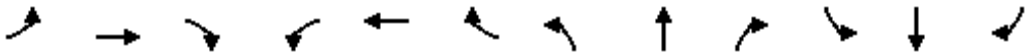
Intersection Summary				
Average Delay	1.2			
Intersection Capacity Utilization	39.6%	ICU Level of Service		A
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	0	28	0	4	0	258	8	8	181	0
Future Volume (Veh/h)	0	0	0	28	0	4	0	258	8	8	181	0
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	30	0	4	0	280	9	9	197	0
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	499	504	197	500	500	284	197			289		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	499	504	197	500	500	284	197			289		
tC, single (s)	7.1	6.5	6.2	7.4	6.5	6.5	4.1			4.3		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.8	4.0	3.5	2.2			2.4		
p0 queue free %	100	100	100	93	100	99	100			99		
cM capacity (veh/h)	480	470	849	433	472	703	1388			1177		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	0	34	0	289	206
Volume Left	0	30	0	0	9
Volume Right	0	4	0	9	0
cSH	1700	453	1700	1700	1177
Volume to Capacity	0.00	0.08	0.00	0.17	0.01
Queue Length 95th (m)	0.0	1.8	0.0	0.0	0.2
Control Delay (s)	0.0	13.6	0.0	0.0	0.4
Lane LOS	A	B			A
Approach Delay (s)	0.0	13.6	0.0		0.4
Approach LOS	A	B			

Intersection Summary				
Average Delay	1.0			
Intersection Capacity Utilization	26.0%	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)	2	0	35	30	0	71	42	154	10	22	162	8
Future Volume (Veh/h)	2	0	35	30	0	71	42	154	10	22	162	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	38	33	0	77	46	167	11	24	176	9
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	570	498	180	531	498	172	185			178		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	570	498	180	531	498	172	185			178		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	99	100	96	92	100	91	97			98		
cM capacity (veh/h)	381	449	867	422	450	871	1326			1398		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	40	110	224	209
Volume Left	2	33	46	24
Volume Right	38	77	11	9
cSH	815	660	1326	1398
Volume to Capacity	0.05	0.17	0.03	0.02
Queue Length 95th (m)	1.2	4.5	0.8	0.4
Control Delay (s)	9.6	11.5	1.8	1.0
Lane LOS	A	B	A	A
Approach Delay (s)	9.6	11.5	1.8	1.0
Approach LOS	A	B		

Intersection Summary				
Average Delay	3.9			
Intersection Capacity Utilization	37.6%	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	0	6	56	0	14	7	185	16	4	218	5
Future Volume (Veh/h)	7	0	6	56	0	14	7	185	16	4	218	5
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	0	7	61	0	15	8	201	17	4	237	5
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	480	482	240	478	476	210	242			218		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	480	482	240	478	476	210	242			218		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	98	100	99	88	100	98	99			100		
cM capacity (veh/h)	486	481	802	492	485	833	1330			1358		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	15	76	8	218	4	242
Volume Left	8	61	8	0	4	0
Volume Right	7	15	0	17	0	5
cSH	595	535	1330	1700	1358	1700
Volume to Capacity	0.03	0.14	0.01	0.13	0.00	0.14
Queue Length 95th (m)	0.6	3.7	0.1	0.0	0.1	0.0
Control Delay (s)	11.2	12.8	7.7	0.0	7.7	0.0
Lane LOS	B	B	A		A	
Approach Delay (s)	11.2	12.8	0.3		0.1	
Approach LOS	B	B				

Intersection Summary				
Average Delay	2.2			
Intersection Capacity Utilization	24.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	57	14	194	17	4	276
Future Volume (Veh/h)	57	14	194	17	4	276
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	65	16	220	19	5	314
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	554	230			239	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	554	230			239	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	87	98			100	
cM capacity (veh/h)	494	812			1334	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	81	239	319
Volume Left	65	0	5
Volume Right	16	19	0
cSH	535	1700	1334
Volume to Capacity	0.15	0.14	0.00
Queue Length 95th (m)	4.0	0.0	0.1
Control Delay (s)	12.9	0.0	0.2
Lane LOS	B		A
Approach Delay (s)	12.9	0.0	0.2
Approach LOS	B		

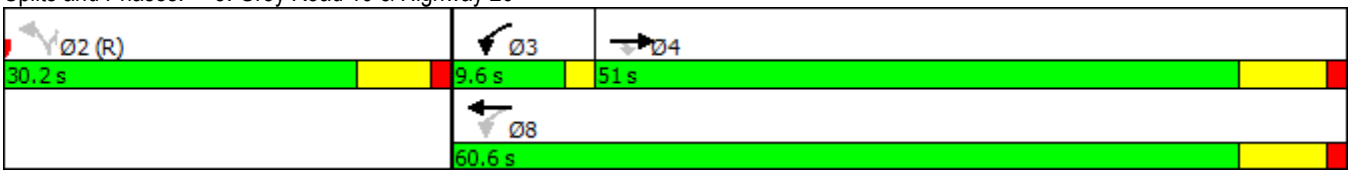
Intersection Summary			
Average Delay	1.7		
Intersection Capacity Utilization	28.4%	ICU Level of Service	A
Analysis Period (min)	15		

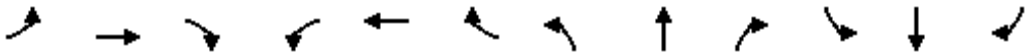
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations						
Traffic Volume (vph)	586	230	113	625	242	107
Future Volume (vph)	586	230	113	625	242	107
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width (m)	3.5	3.5	3.5	3.5	3.7	3.7
Storage Length (m)		80.0	190.0		50.0	0.0
Storage Lanes		1	1		1	1
Taper Length (m)			7.6		7.6	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1824	1551	1785	1842	1772	1601
Flt Permitted			0.233		0.950	
Satd. Flow (perm)	1824	1551	438	1842	1772	1601
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		250				116
Link Speed (k/h)	50			80	80	
Link Distance (m)	533.4			278.7	70.0	
Travel Time (s)	38.4			12.5	3.2	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	3%	3%	0%	2%	3%	2%
Adj. Flow (vph)	637	250	123	679	263	116
Shared Lane Traffic (%)						
Lane Group Flow (vph)	637	250	123	679	263	116
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(m)	3.5			3.5	3.7	
Link Offset(m)	0.0			0.0	0.0	
Crosswalk Width(m)	4.9			4.9	4.9	
Two way Left Turn Lane						
Headway Factor	1.01	1.01	1.01	1.01	0.99	0.99
Turning Speed (k/h)		14	24		24	14
Turn Type	NA	Perm	pm+pt	NA	Perm	Perm
Protected Phases	4		3	8		
Permitted Phases		4	8		2	2
Minimum Split (s)	47.4	47.4	9.5	47.4	16.4	16.4
Total Split (s)	51.0	51.0	9.6	60.6	30.2	30.2
Total Split (%)	56.2%	56.2%	10.6%	66.7%	33.3%	33.3%
Maximum Green (s)	43.6	43.6	7.6	53.2	23.8	23.8
Yellow Time (s)	5.9	5.9	2.0	5.9	5.0	5.0
All-Red Time (s)	1.5	1.5	0.0	1.5	1.4	1.4
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	7.4	7.4	2.0	7.4	6.4	6.4
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?	Yes	Yes	Yes			
Walk Time (s)	35.0	35.0		35.0		
Flash Dont Walk (s)	5.0	5.0		5.0		
Pedestrian Calls (#/hr)	0	0		0		
Act Effct Green (s)	43.6	43.6	58.6	53.2	23.8	23.8

Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Actuated g/C Ratio	0.48	0.48	0.65	0.59	0.26	0.26
v/c Ratio	0.73	0.29	0.31	0.63	0.57	0.23
Control Delay	24.9	2.7	8.3	15.6	34.6	6.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	24.9	2.7	8.3	15.6	34.6	6.6
LOS	C	A	A	B	C	A
Approach Delay	18.6			14.5	26.0	
Approach LOS	B			B	C	
Queue Length 50th (m)	85.2	0.0	7.3	71.8	39.8	0.0
Queue Length 95th (m)	126.3	11.6	13.4	106.5	63.9	12.1
Internal Link Dist (m)	509.4			254.7	46.0	
Turn Bay Length (m)		80.0	190.0		50.0	
Base Capacity (vph)	875	874	395	1079	464	505
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.73	0.29	0.31	0.63	0.57	0.23

Intersection Summary			
Area Type:	Other		
Cycle Length: 90.8			
Actuated Cycle Length: 90.8			
Offset: 0 (0%), Referenced to phase 2:NBL and 6:, Start of Green			
Natural Cycle: 75			
Control Type: Pretimed			
Maximum v/c Ratio: 0.73			
Intersection Signal Delay: 18.4		Intersection LOS: B	
Intersection Capacity Utilization 67.8%		ICU Level of Service C	
Analysis Period (min) 15			

Splits and Phases: 8: Grey Road 19 & Highway 26

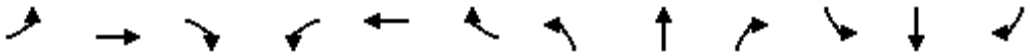




Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	18	675	18	55	779	1	8	0	30	0	0	1
Future Volume (Veh/h)	18	675	18	55	779	1	8	0	30	0	0	1
Sign Control		Free			Free			Stop			Stop	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	20	734	20	60	847	1	9	0	33	0	0	1
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	848			754			1752	1752	744	1784	1762	848
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	848			754			1752	1752	744	1784	1762	848
tC, single (s)	4.1			4.1			7.1	6.5	6.3	7.1	6.5	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.4	3.5	4.0	3.3
p0 queue free %	97			93			86	100	92	100	100	100
cM capacity (veh/h)	798			865			63	78	396	55	77	365

Direction, Lane #	EB 1	WB 1	WB 2	NB 1	SB 1
Volume Total	774	60	848	42	1
Volume Left	20	60	0	9	0
Volume Right	20	0	1	33	1
cSH	798	865	1700	185	365
Volume to Capacity	0.03	0.07	0.50	0.23	0.00
Queue Length 95th (m)	0.6	1.7	0.0	6.4	0.1
Control Delay (s)	0.7	9.5	0.0	30.1	14.9
Lane LOS	A	A		D	B
Approach Delay (s)	0.7	0.6		30.1	14.9
Approach LOS				D	B

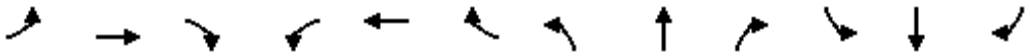
Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	66.8%	ICU Level of Service		C
Analysis Period (min)	15			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (veh/h)	0	0	2	13	0	8	2	342	38	13	331	1
Future Volume (Veh/h)	0	0	2	13	0	8	2	342	38	13	331	1
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	2	14	0	9	2	372	41	14	360	1
Pedestrians												
Lane Width (m)												
Walking Speed (m/s)												
Percent Blockage												
Right turn flare (veh)												
Median type								None			None	
Median storage veh)												
Upstream signal (m)											70	
pX, platoon unblocked												
vC, conflicting volume	774	806	360	787	786	392	361			413		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	774	806	360	787	786	392	361			413		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	100	100	100	95	100	99	100			99		
cM capacity (veh/h)	311	314	689	308	322	661	1209			1157		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1
Volume Total	2	23	2	413	375
Volume Left	0	14	2	0	14
Volume Right	2	9	0	41	1
cSH	689	389	1209	1700	1157
Volume to Capacity	0.00	0.06	0.00	0.24	0.01
Queue Length 95th (m)	0.1	1.4	0.0	0.0	0.3
Control Delay (s)	10.2	14.8	8.0	0.0	0.4
Lane LOS	B	B	A		A
Approach Delay (s)	10.2	14.8	0.0		0.4
Approach LOS	B	B			

Intersection Summary				
Average Delay	0.7			
Intersection Capacity Utilization	42.6%	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)	2	0	42	19	0	45	38	305	33	78	230	8
Future Volume (Veh/h)	2	0	42	19	0	45	38	305	33	78	230	8
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	0	46	21	0	49	41	332	36	85	250	9
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	906	874	254	902	861	350	259			368		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	906	874	254	902	861	350	259			368		
tC, single (s)	7.1	6.5	6.3	7.1	6.5	6.2	4.2			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.4	3.5	4.0	3.3	2.3			2.2		
p0 queue free %	99	100	94	91	100	93	97			93		
cM capacity (veh/h)	222	259	765	224	264	693	1277			1191		

Direction, Lane #	EB 1	WB 1	NB 1	SB 1
Volume Total	48	70	409	344
Volume Left	2	21	41	85
Volume Right	46	49	36	9
cSH	694	426	1277	1191
Volume to Capacity	0.07	0.16	0.03	0.07
Queue Length 95th (m)	1.7	4.4	0.8	1.8
Control Delay (s)	10.6	15.1	1.1	2.6
Lane LOS	B	C	A	A
Approach Delay (s)	10.6	15.1	1.1	2.6
Approach LOS	B	C		

Intersection Summary				
Average Delay	3.3			
Intersection Capacity Utilization	49.8%	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)	4	0	16	30	0	8	12	364	61	16	260	15
Future Volume (Veh/h)	4	0	16	30	0	8	12	364	61	16	260	15
Sign Control		Stop			Stop			Free			Free	
Grade		0%			0%			0%			0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	4	0	17	33	0	9	13	396	66	17	283	16
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	756	813	291	789	788	429	299			462		
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	756	813	291	789	788	429	299			462		
tC, single (s)	7.1	6.5	6.2	7.1	6.5	6.2	4.1			4.1		
tC, 2 stage (s)												
tF (s)	3.5	4.0	3.3	3.5	4.0	3.3	2.2			2.2		
p0 queue free %	99	100	98	89	100	99	99			98		
cM capacity (veh/h)	315	306	751	297	316	628	1268			1104		

Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2
Volume Total	21	42	13	462	17	299
Volume Left	4	33	13	0	17	0
Volume Right	17	9	0	66	0	16
cSH	594	334	1268	1700	1104	1700
Volume to Capacity	0.04	0.13	0.01	0.27	0.02	0.18
Queue Length 95th (m)	0.8	3.2	0.2	0.0	0.4	0.0
Control Delay (s)	11.3	17.3	7.9	0.0	8.3	0.0
Lane LOS	B	C	A		A	
Approach Delay (s)	11.3	17.3	0.2		0.4	
Approach LOS	B	C				

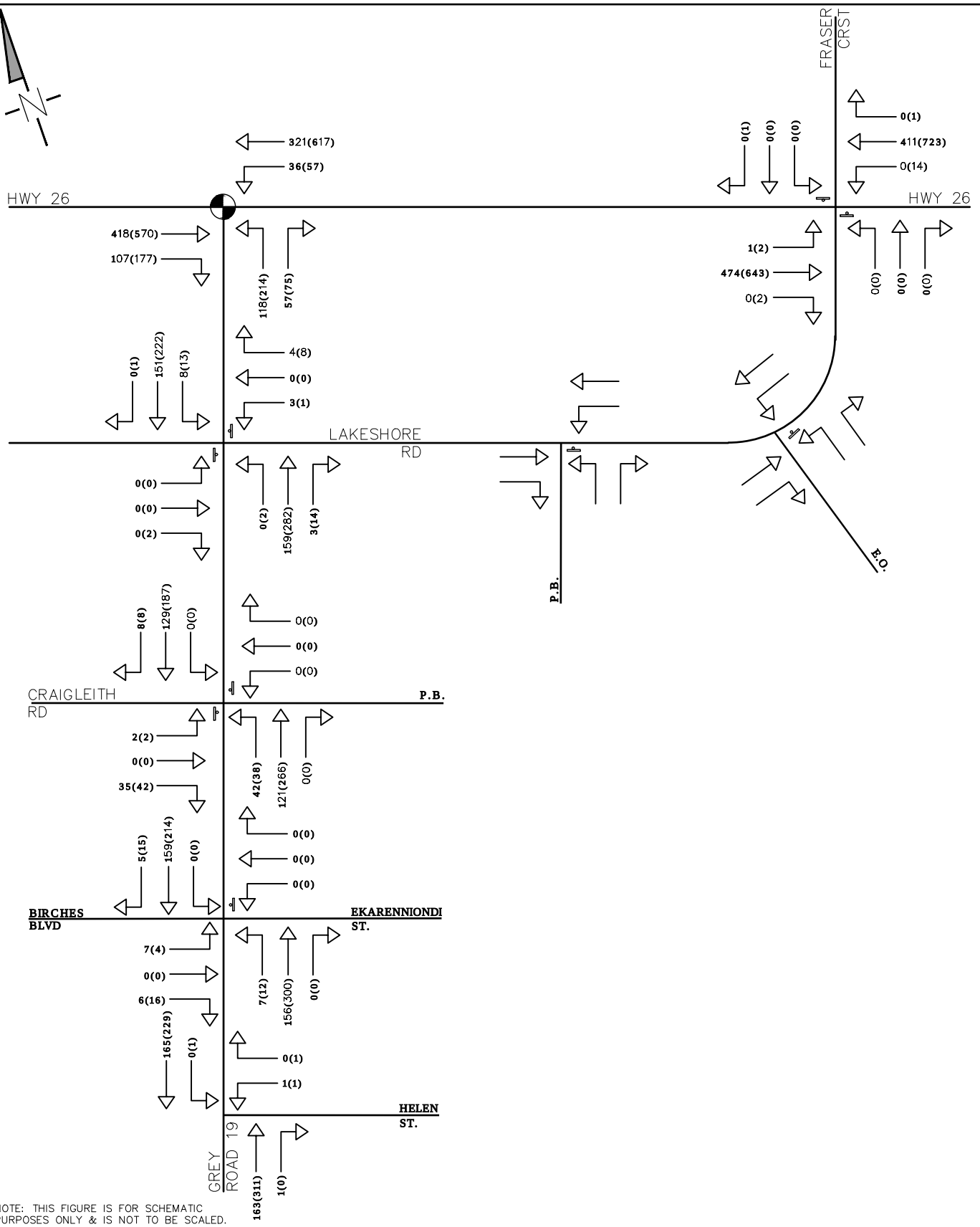
Intersection Summary				
Average Delay	1.4			
Intersection Capacity Utilization	36.2%	ICU Level of Service	A	
Analysis Period (min)	15			

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Volume (veh/h)	31	8	429	61	16	281
Future Volume (Veh/h)	31	8	429	61	16	281
Sign Control	Stop		Free			Free
Grade	0%		0%			0%
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Hourly flow rate (vph)	35	9	488	69	18	319
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	878	522			557	
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	878	522			557	
tC, single (s)	6.4	6.2			4.1	
tC, 2 stage (s)						
tF (s)	3.5	3.3			2.2	
p0 queue free %	89	98			98	
cM capacity (veh/h)	314	556			1019	

Direction, Lane #	WB 1	NB 1	SB 1
Volume Total	44	557	337
Volume Left	35	0	18
Volume Right	9	69	0
cSH	345	1700	1019
Volume to Capacity	0.13	0.33	0.02
Queue Length 95th (m)	3.3	0.0	0.4
Control Delay (s)	17.0	0.0	0.6
Lane LOS	C		A
Approach Delay (s)	17.0	0.0	0.6
Approach LOS	C		

Intersection Summary			
Average Delay	1.0		
Intersection Capacity Utilization	37.9%	ICU Level of Service	A
Analysis Period (min)	15		

List of Figures



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Legend

SIGNAL CONTROL

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

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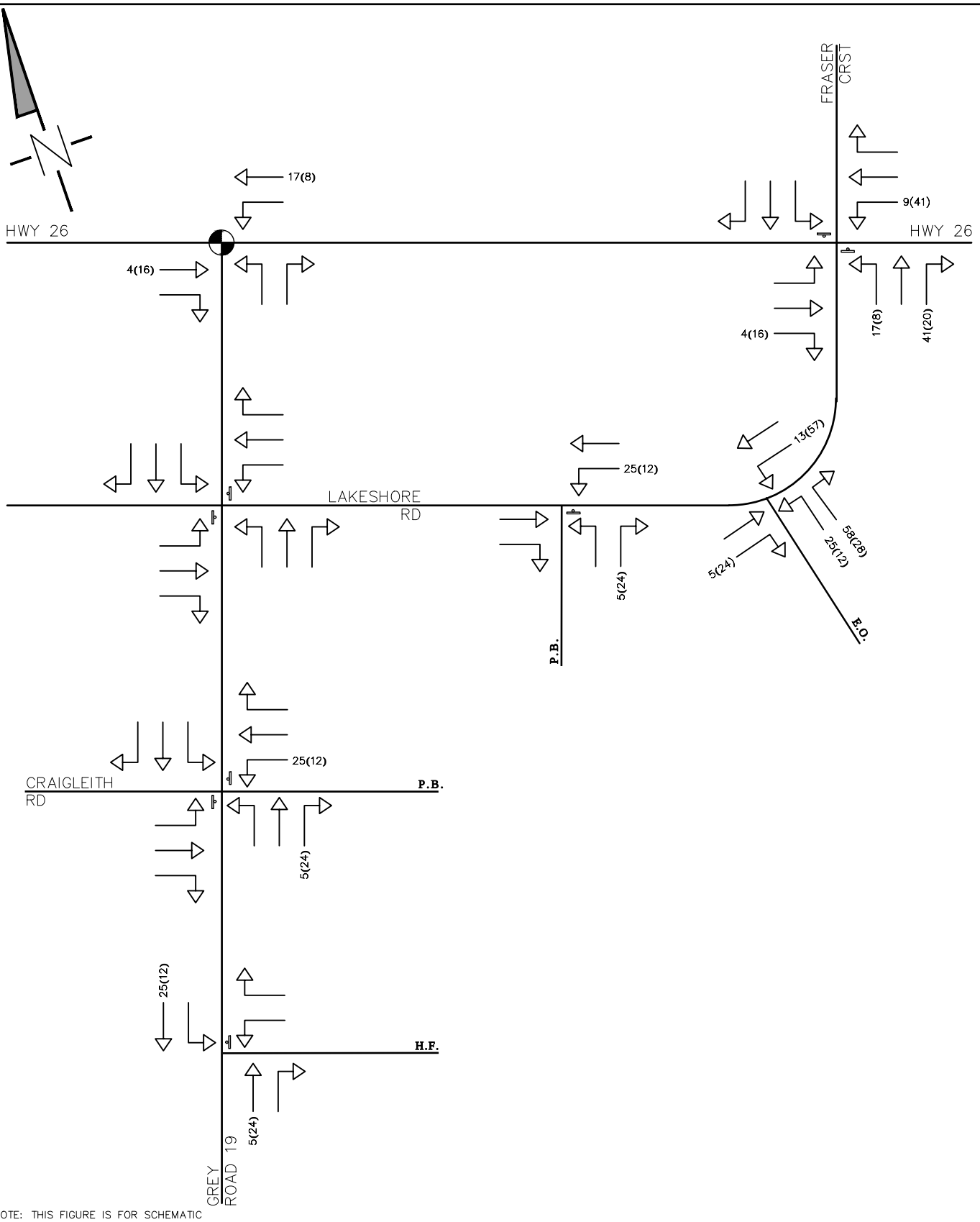
N.T.S.	JAN. 11, 2018	R.M.	FIG. 2



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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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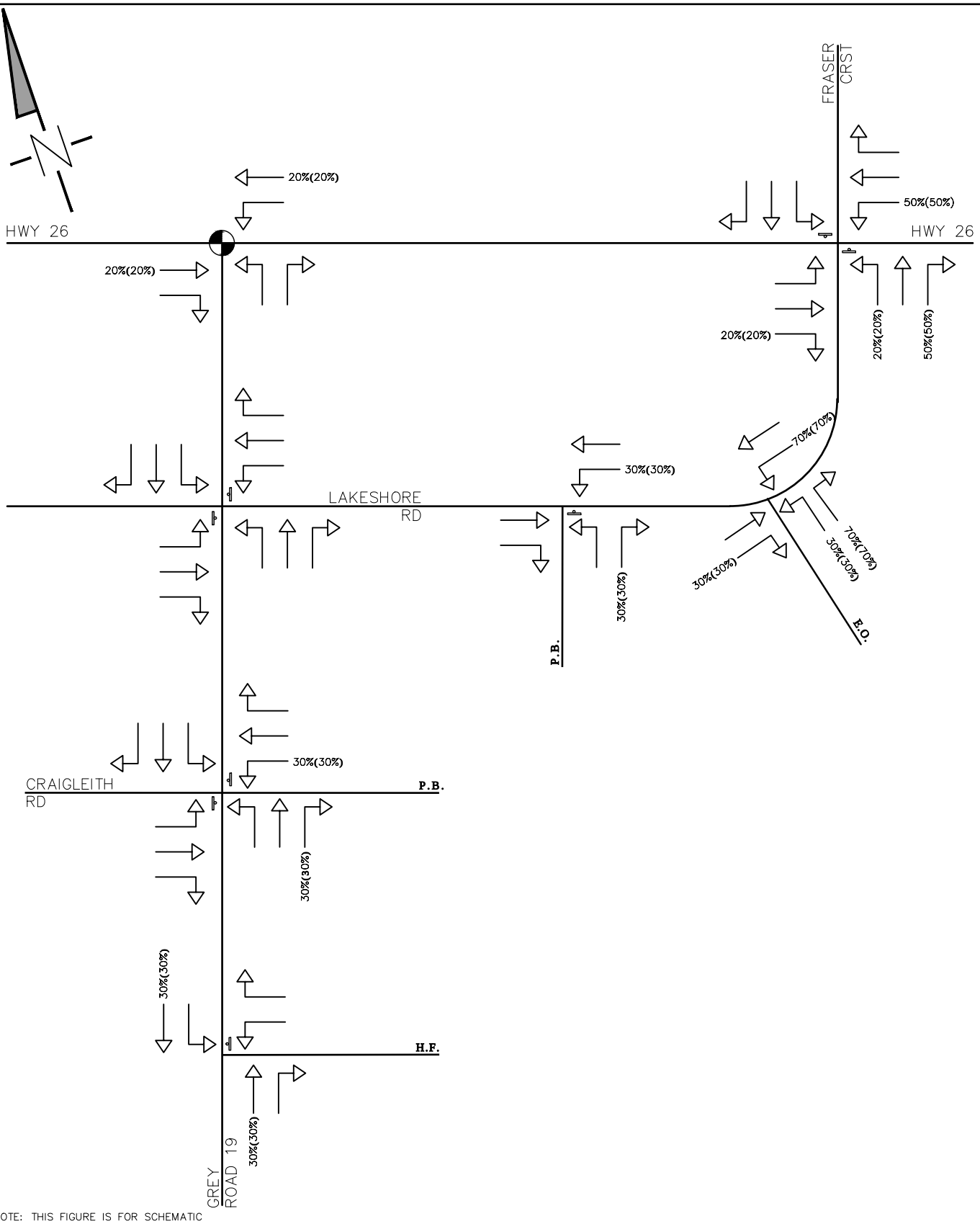
N.T.S.	JAN. 5, 2018	R.M.	FIG. 3



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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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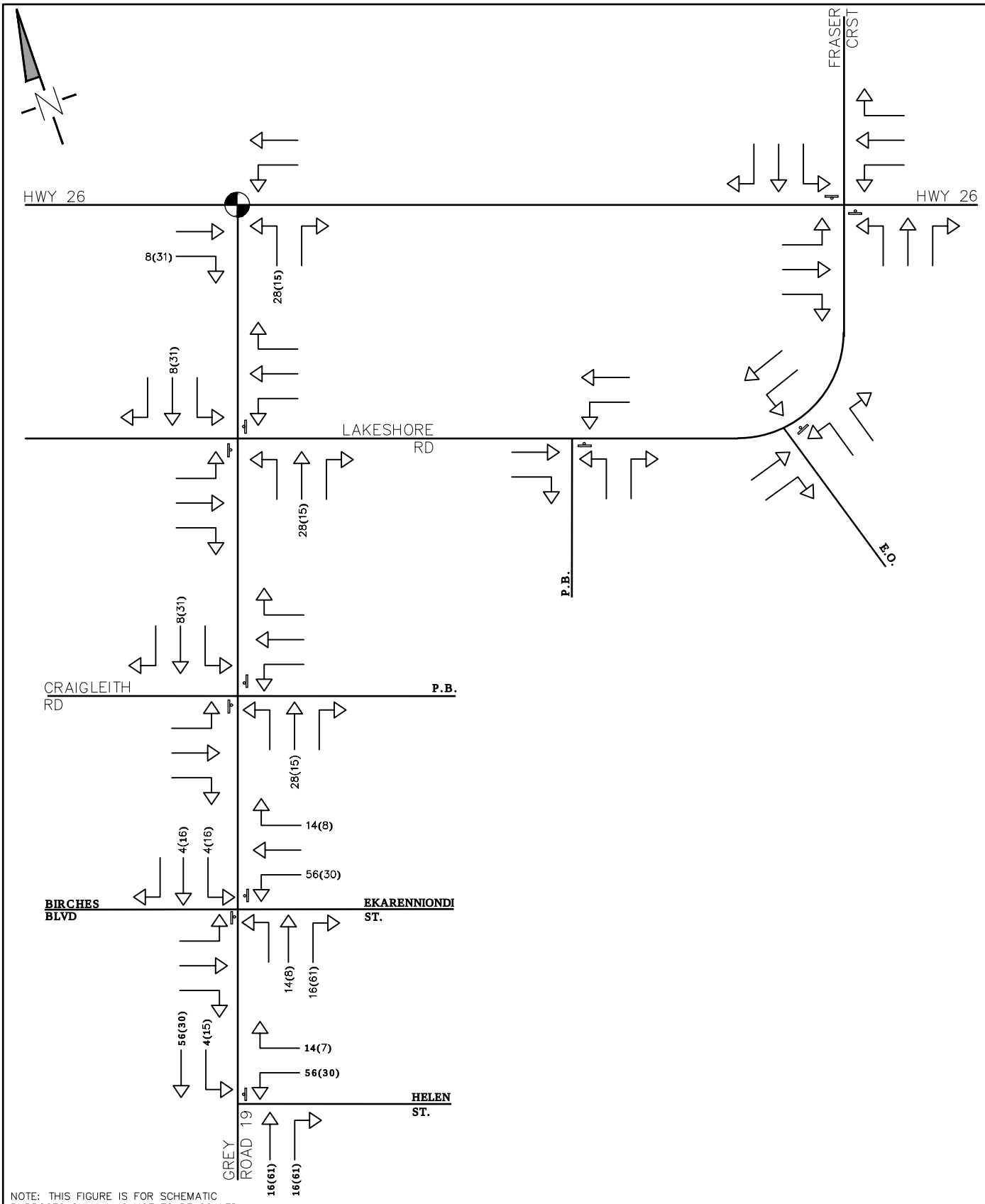
N.T.S.	JAN. 4, 2018	R.M.	FIG. 4



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TOWN OF THE BLUE MOUNTAINS

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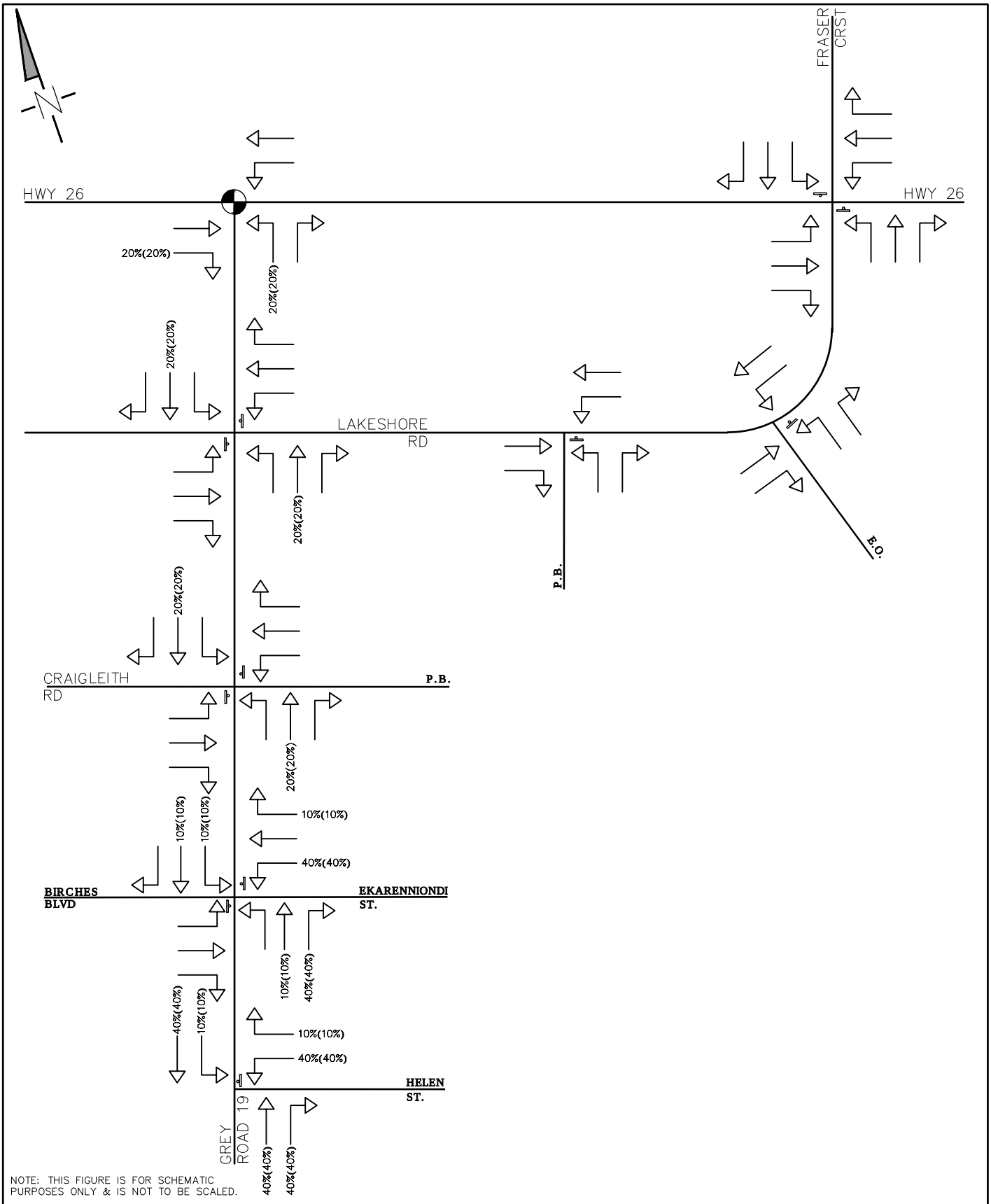
N.T.S.	JAN. 11, 2018	R.M.	FIG. 5



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TOWN OF THE BLUE MOUNTAINS

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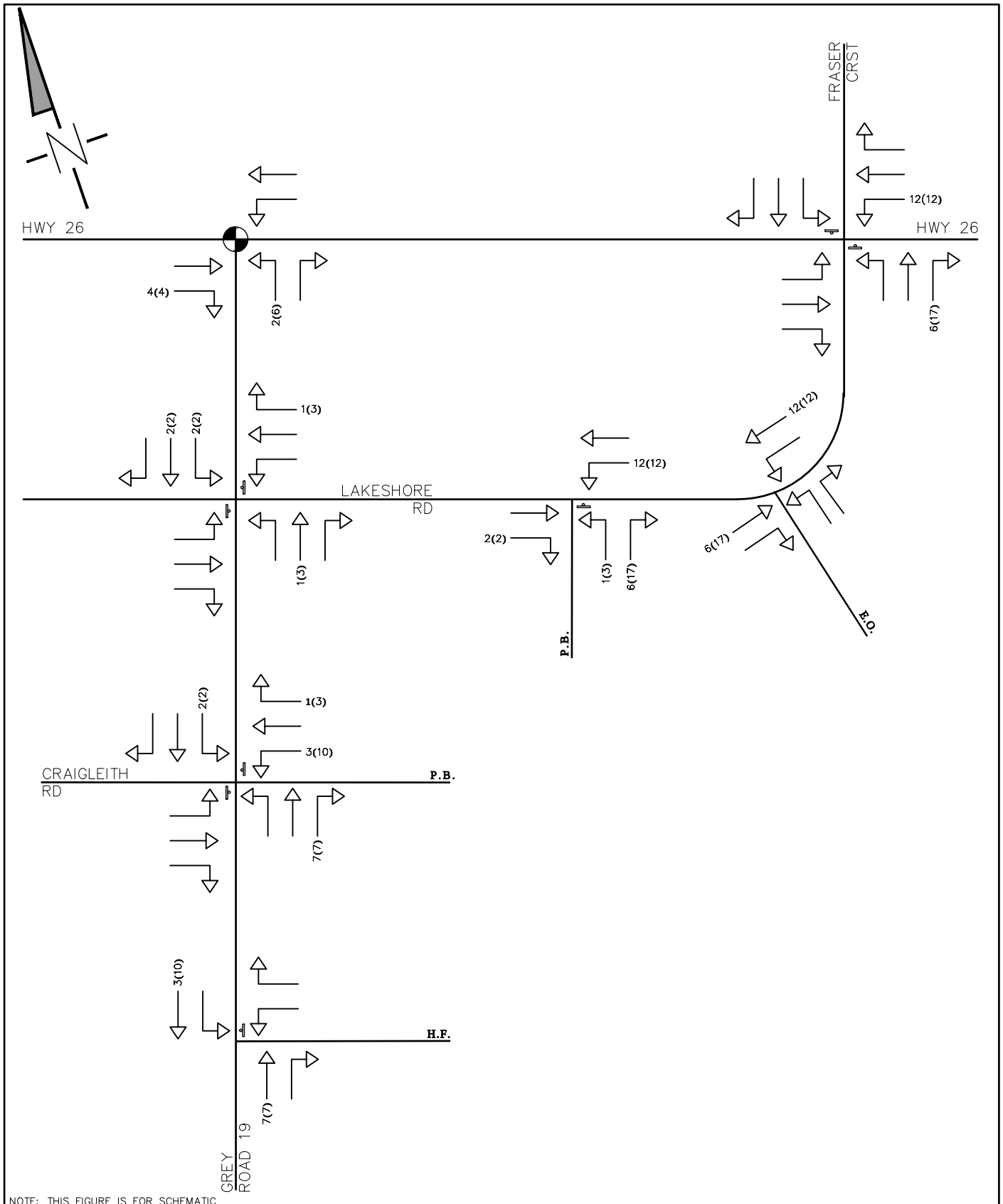
Scale	Date	Check By	Drawing
N.T.S.	JAN. 11, 2018	R.M.	FIG. 6



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TOWN OF THE BLUE MOUNTAINS

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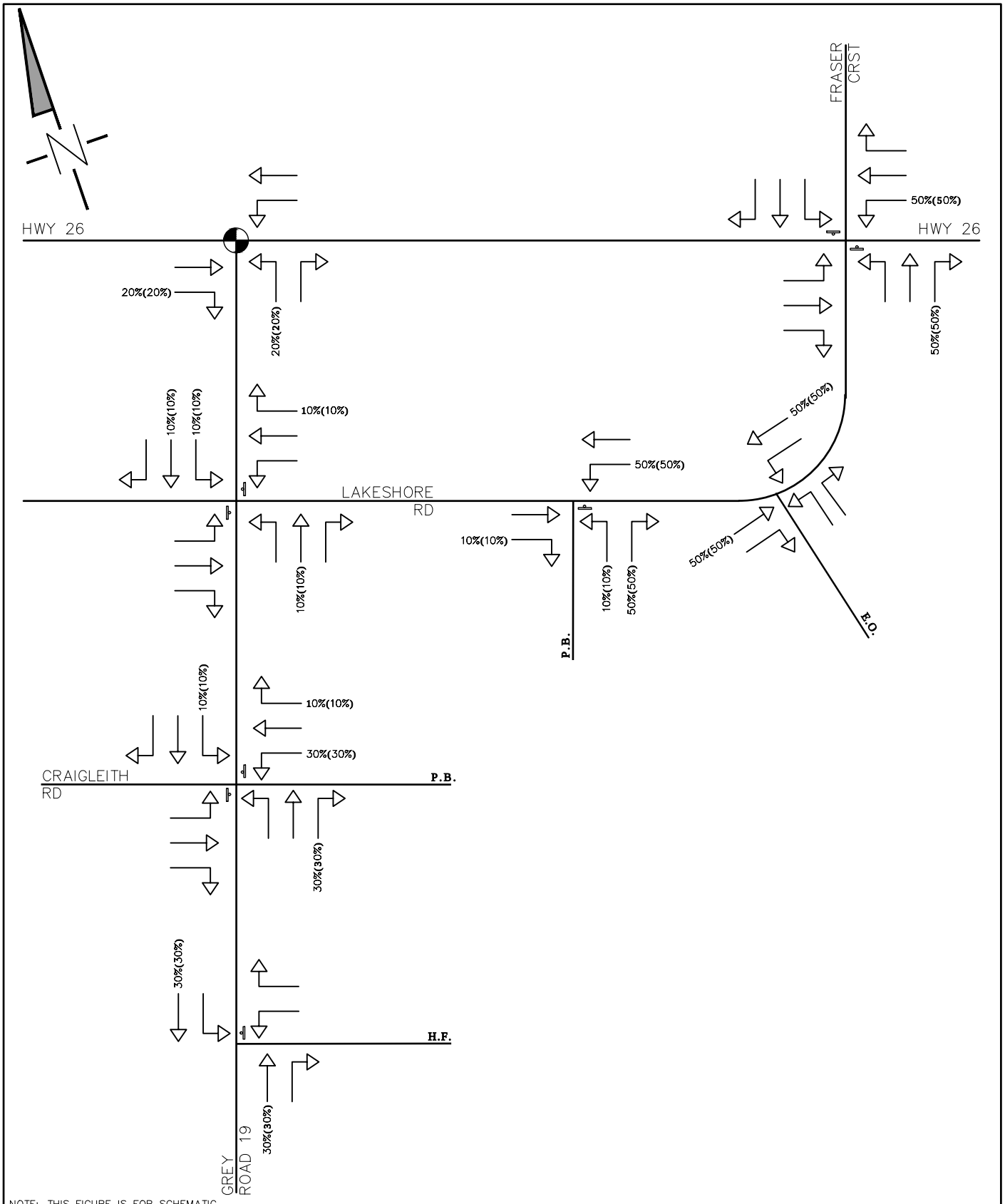
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 7



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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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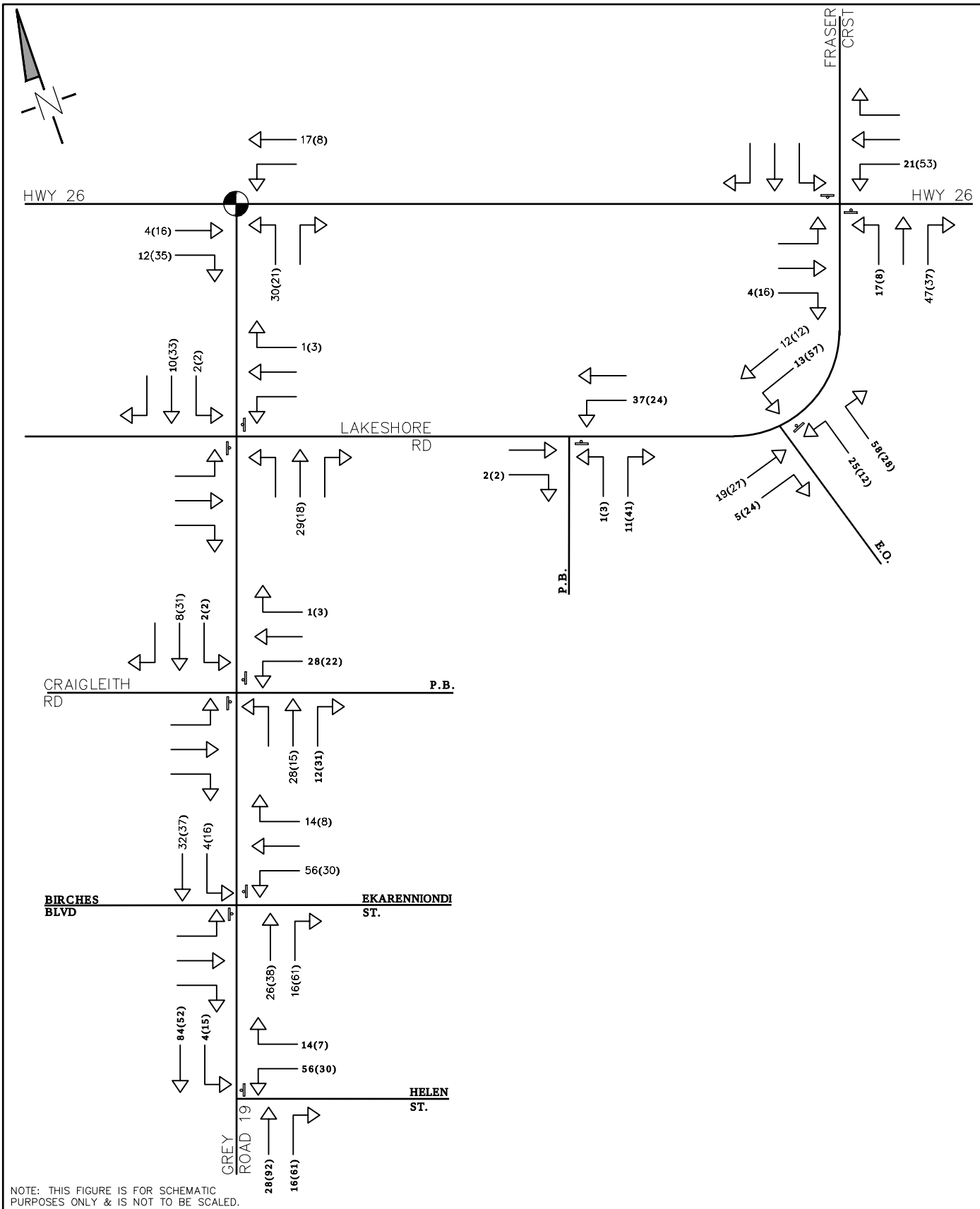
Scale	Date	Check By	Drawing
N.T.S.	JAN. 4, 2018	R.M.	FIG. 8



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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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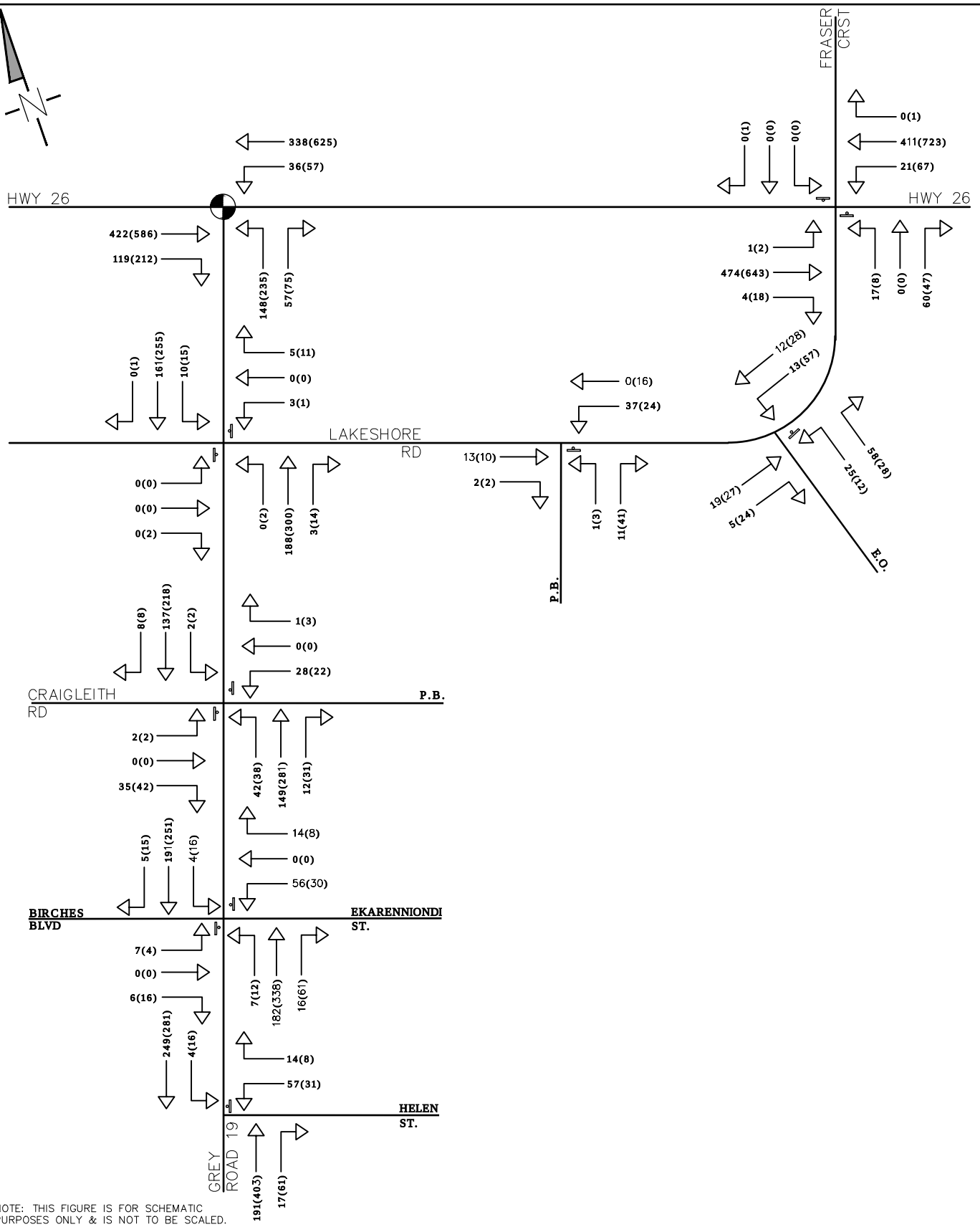
N.T.S.	JAN. 11, 2018	R.M.	FIG. 9



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TOWN OF THE BLUE MOUNTAINS

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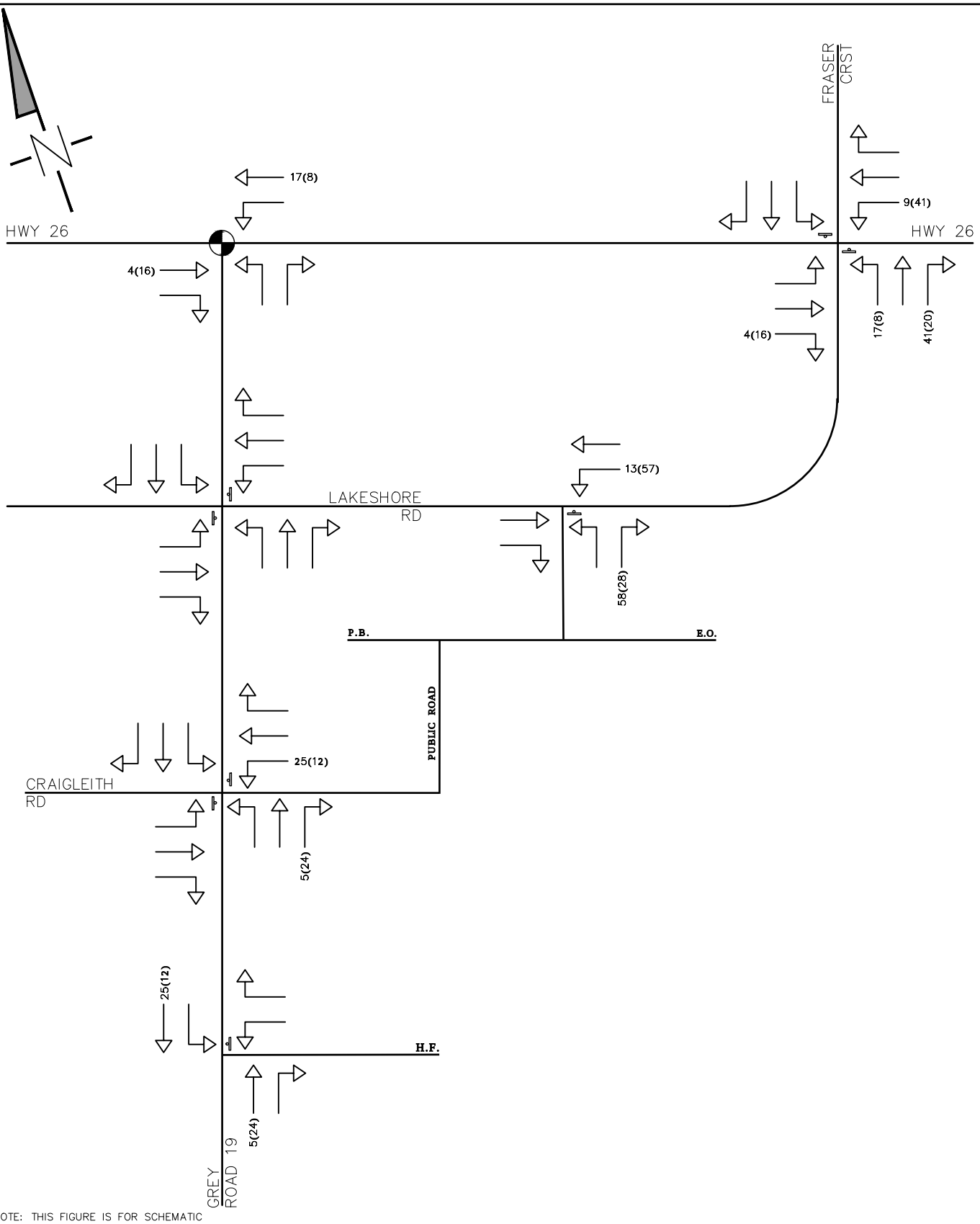
Scale	Date	Check By	Drawing
N.T.S.	JAN. 11, 2018	R.M.	FIG. 10



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SIGNAL CONTROL

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TOWN OF THE BLUE MOUNTAINS

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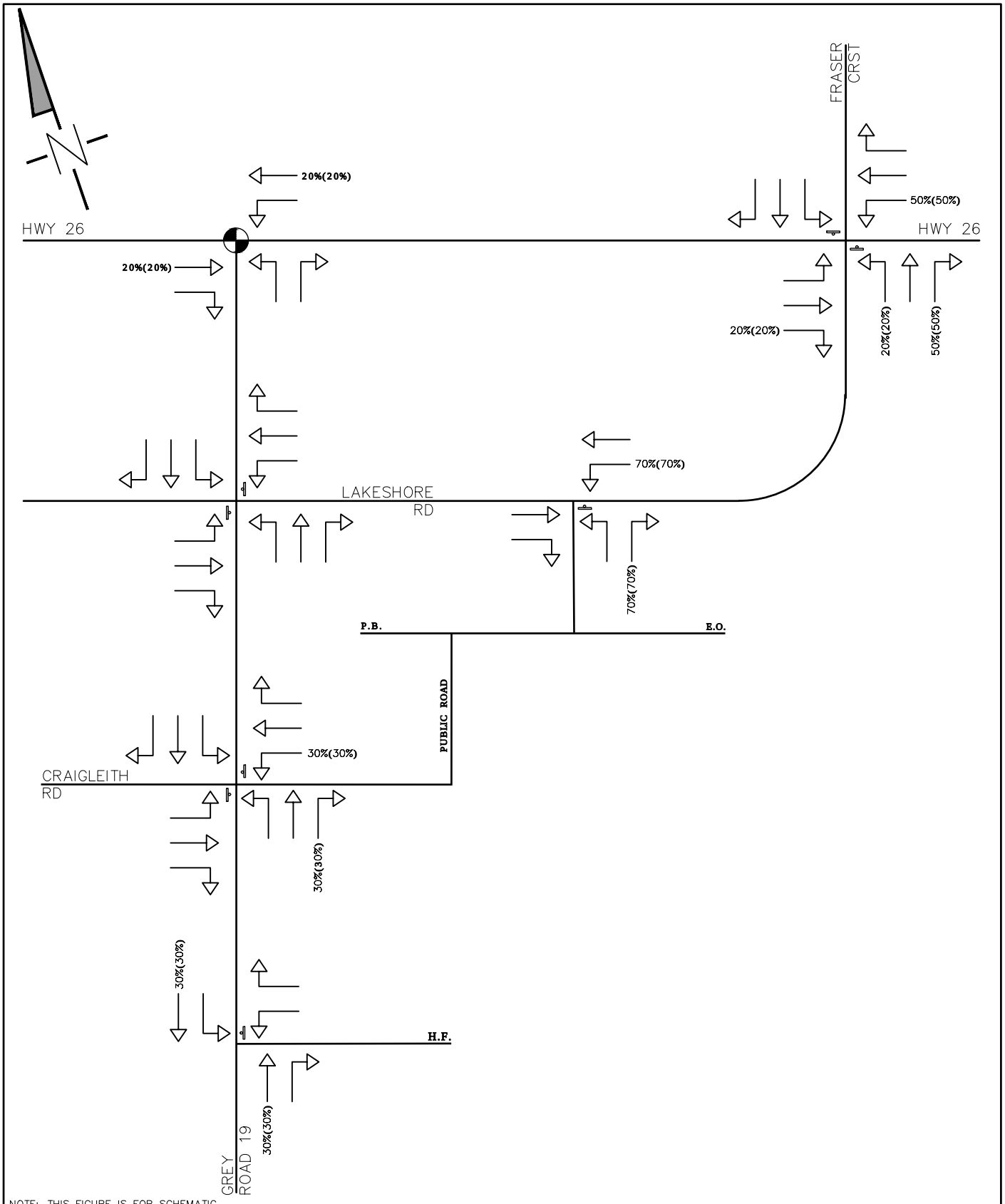
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 11



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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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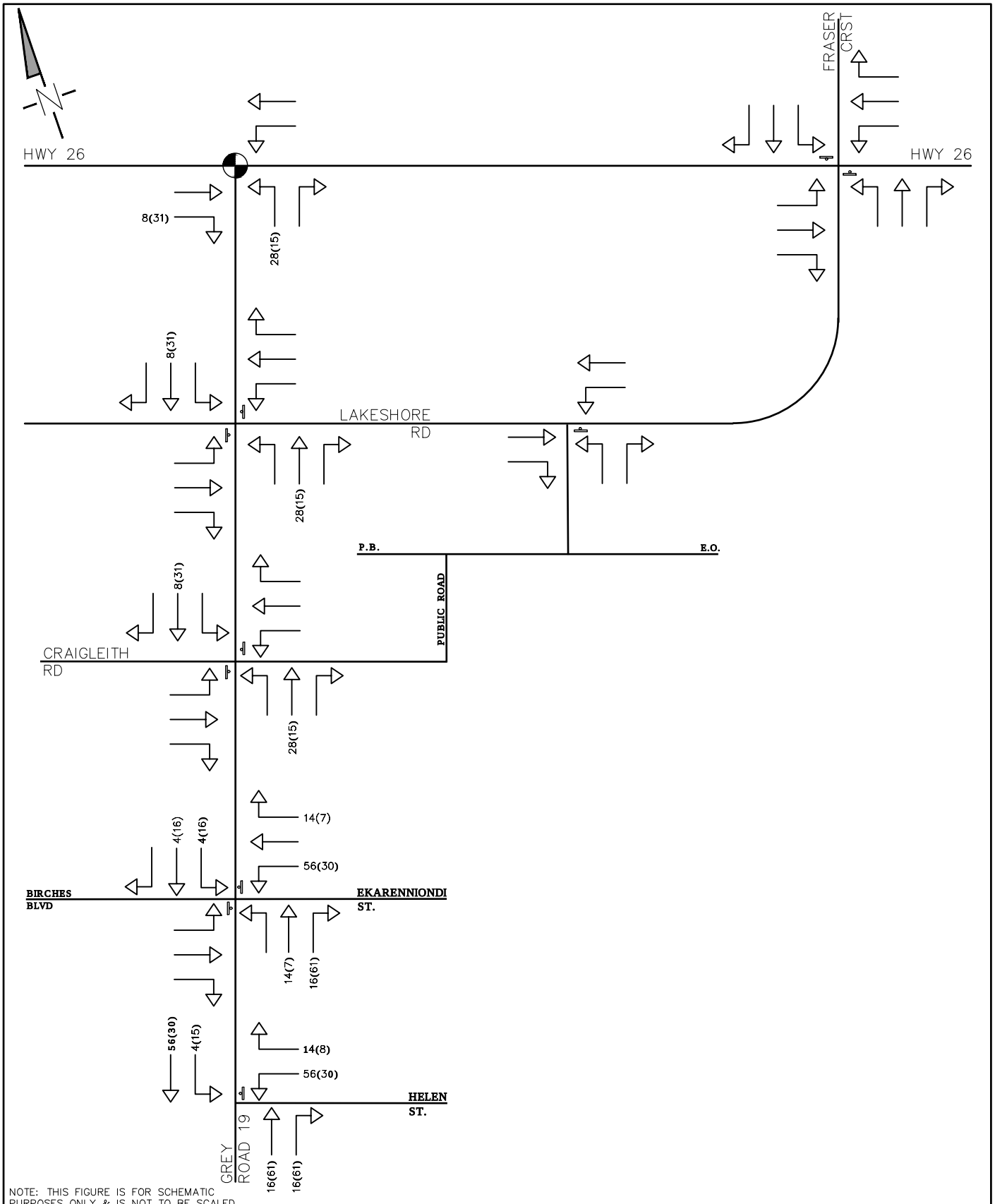
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 12



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TOWN OF THE BLUE MOUNTAINS

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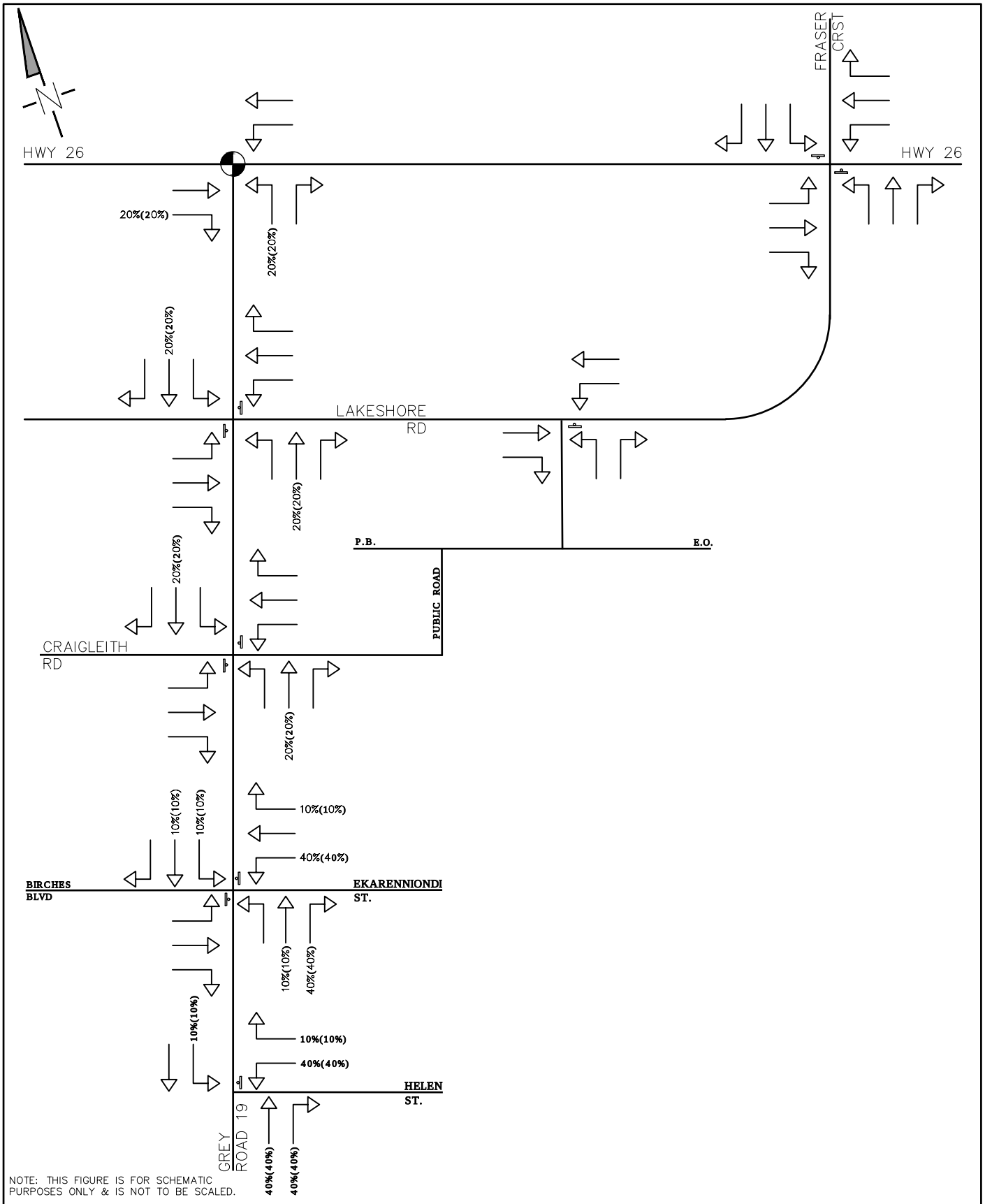
Scale	Date	Check By	Drawing
N.T.S.	JAN. 12, 2018	R.M.	FIG. 13



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Legend

SIGNAL CONTROL

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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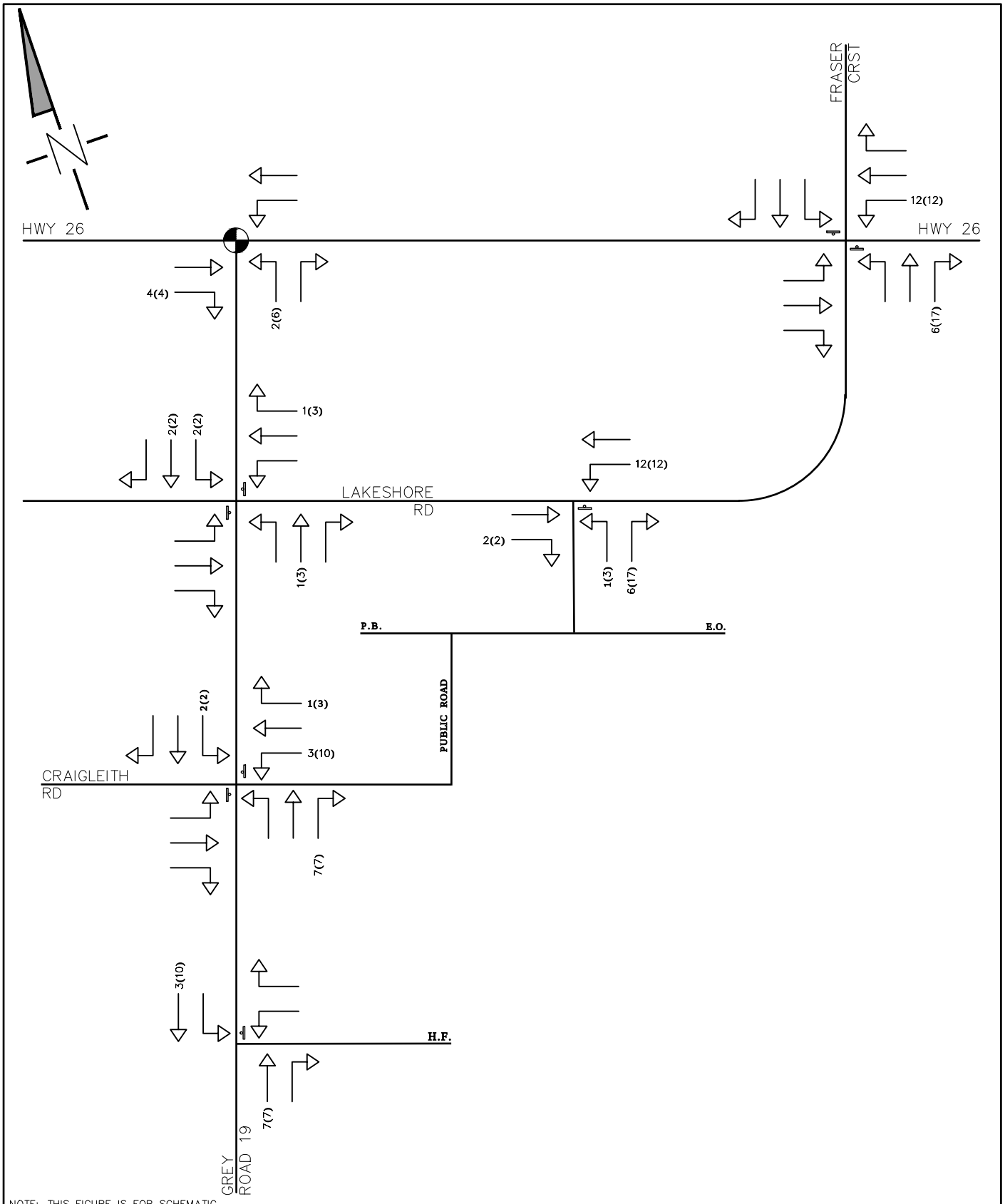
Scale	Date	Check By	Drawing
N.T.S.	JAN. 12, 2018	R.M.	FIG. 14



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

Legend

SIGNAL CONTROL

STOP CONTROL

XX(YY) AM (PM)

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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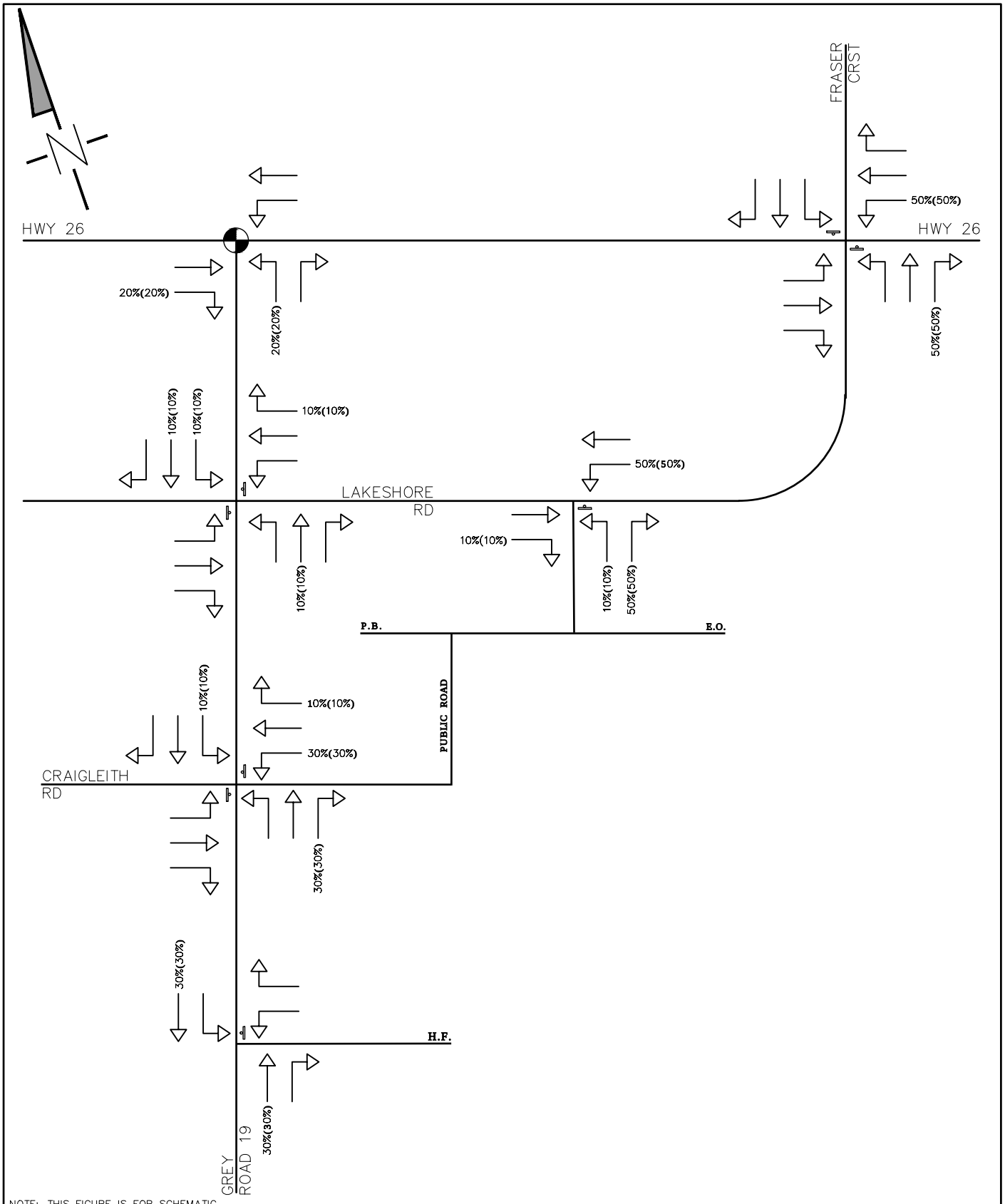
Drawn By	Design By	Project
J.I.M.	M.N.F.	1046-4031

Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 15



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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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Drawn By	Design By	Project
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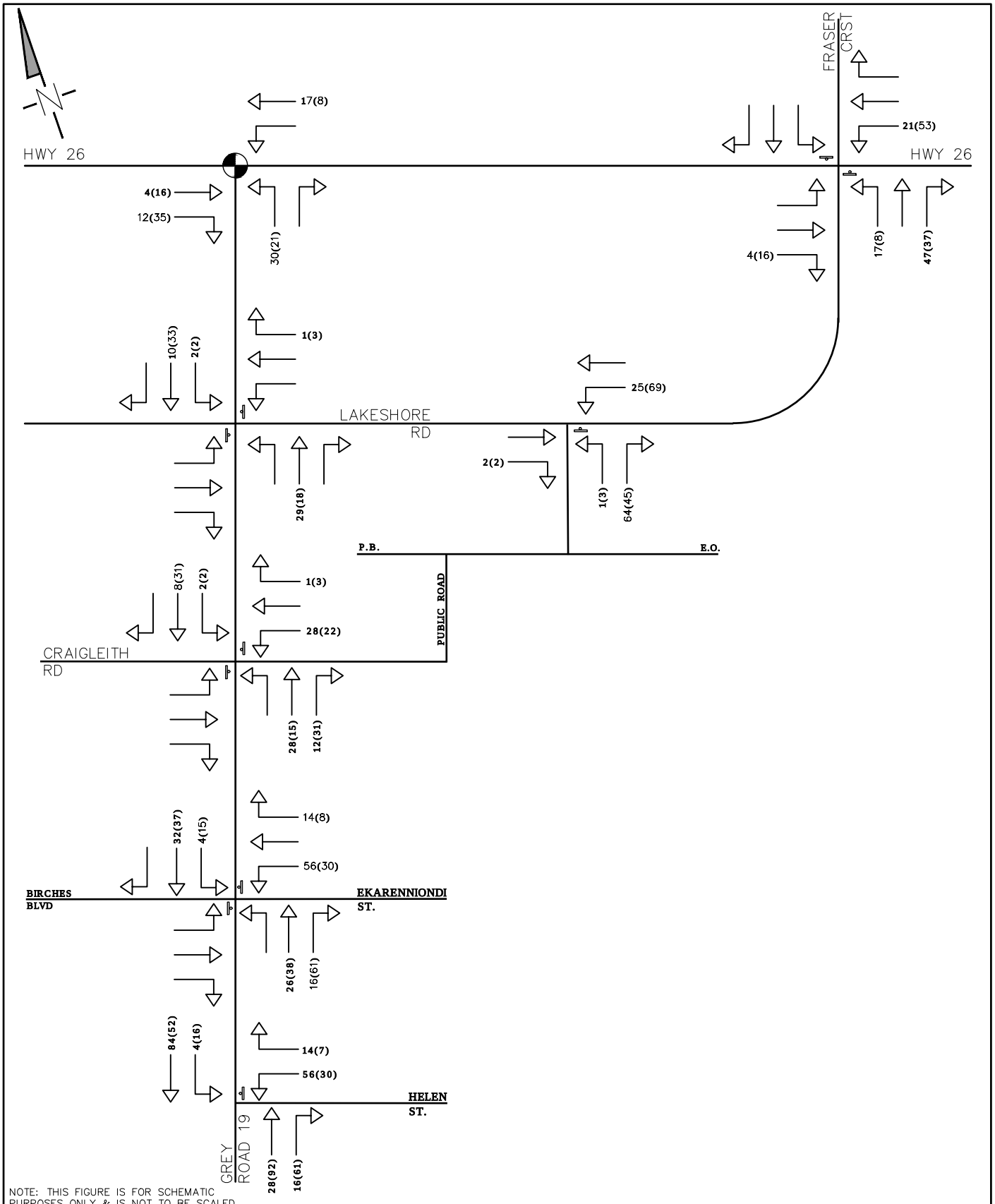
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 16



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SIGNAL CONTROL

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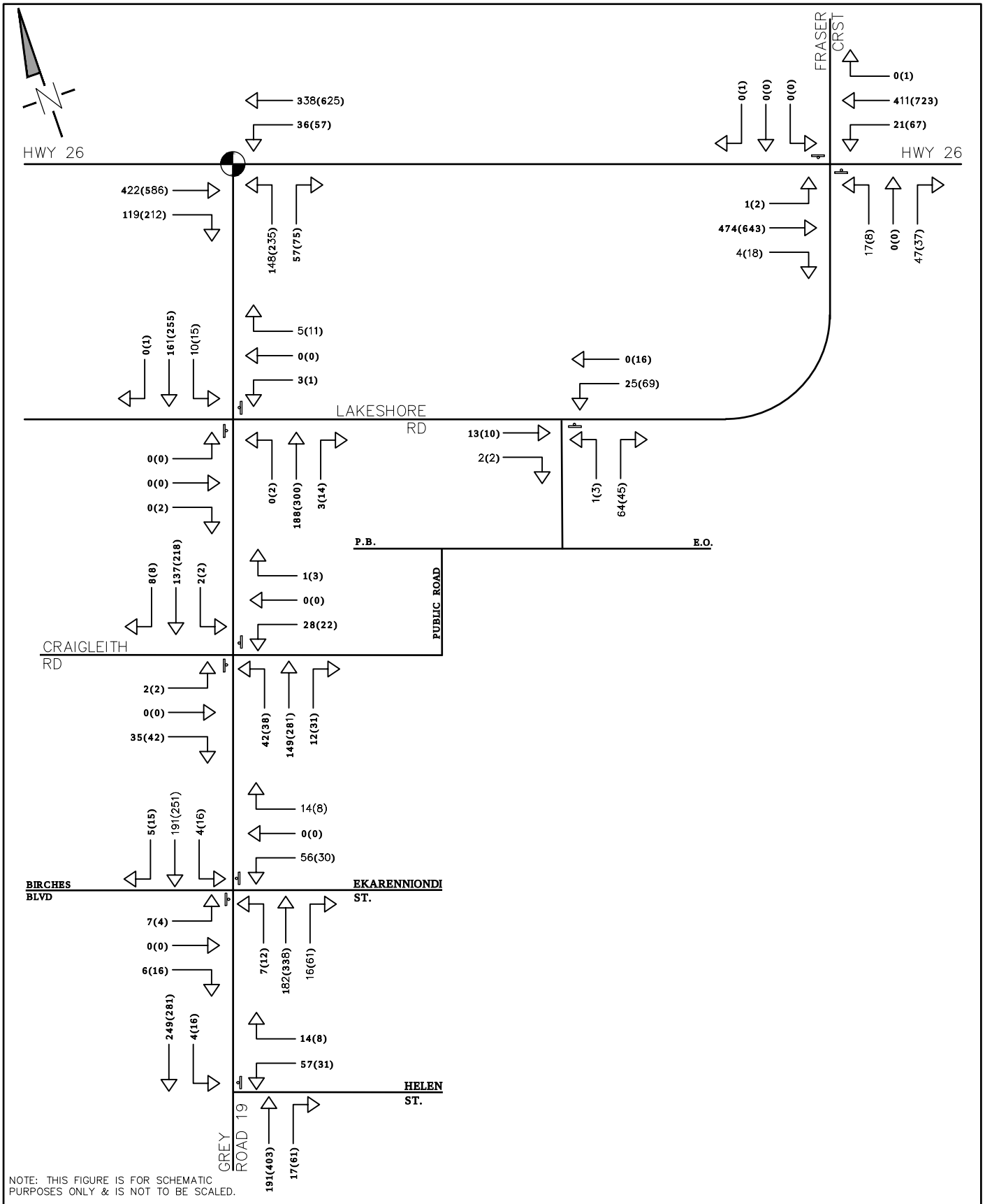
Scale	Date	Check By	Drawing
N.T.S.	JAN. 12, 2018	R.M.	FIG. 17



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

Legend

SIGNAL CONTROL

STOP CONTROL

XX(YY) AM (PM)

Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 2 - FUTURE TOTAL 2031

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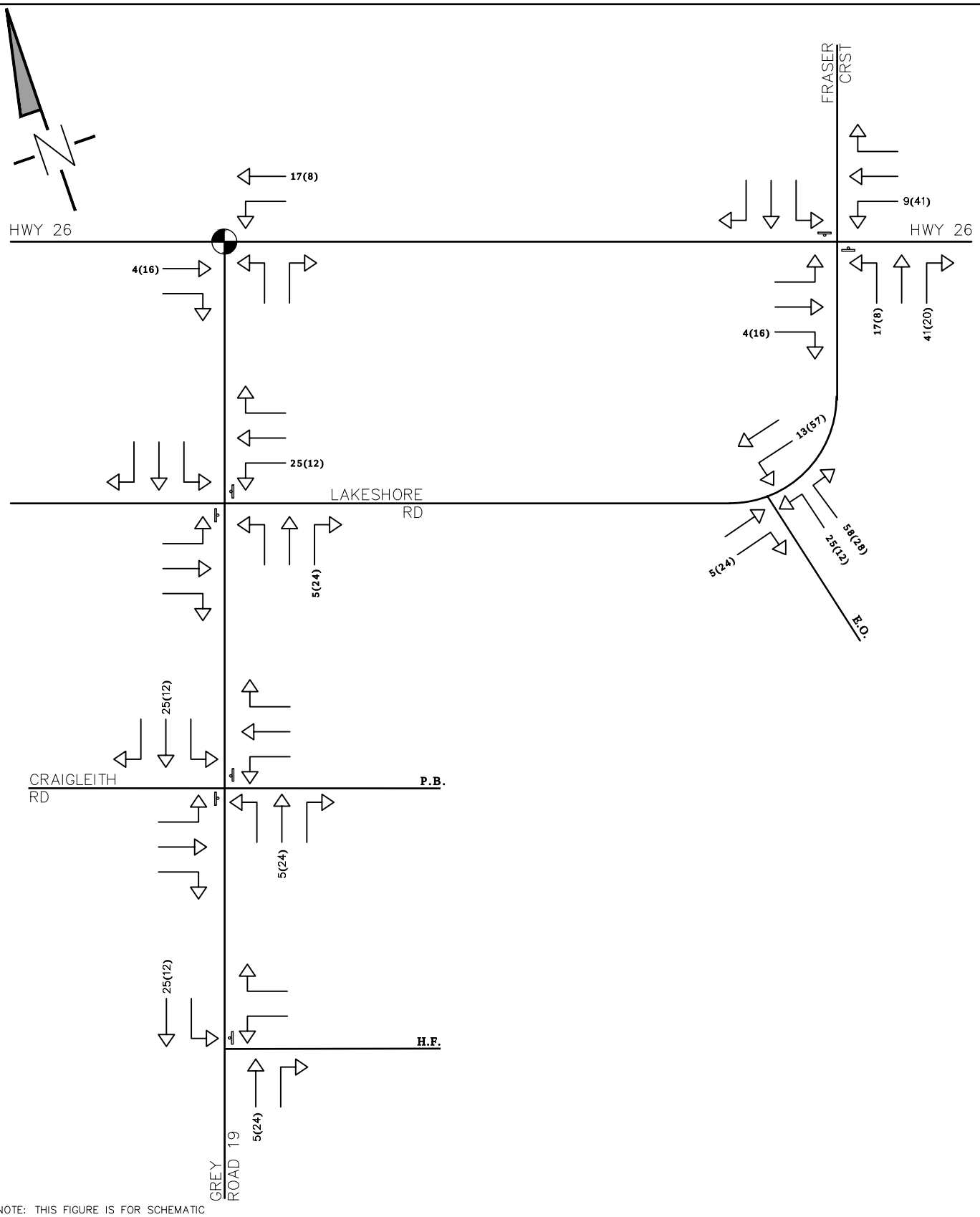
Scale	Date	Check By	Drawing
N.T.S.	JAN. 12, 2018	R.M.	FIG. 18



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

Legend

SIGNAL CONTROL

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - EDEN OAK ASSIGNMENT

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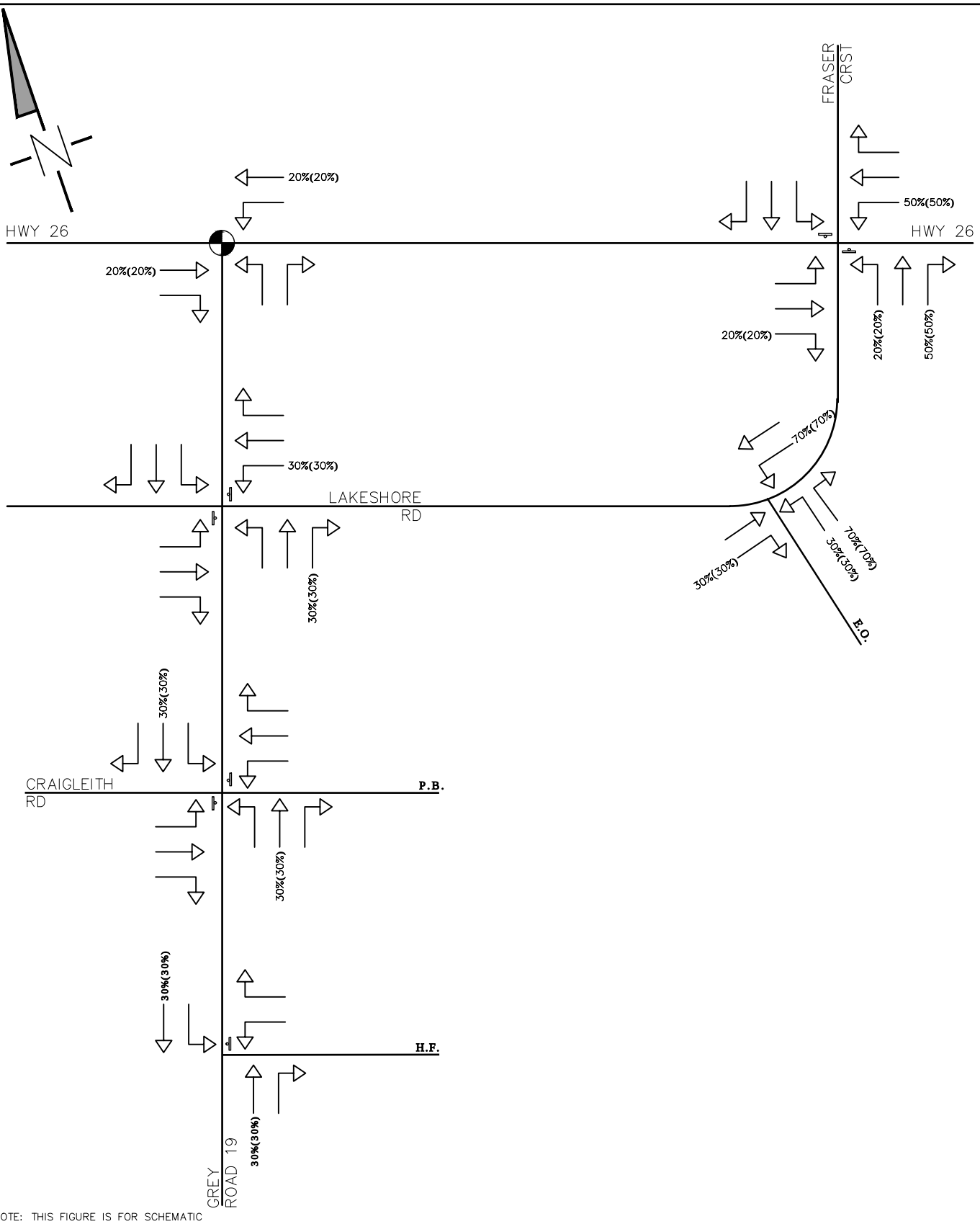
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 19



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

Legend

SIGNAL CONTROL

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Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - EDEN OAK DISTRIBUTION

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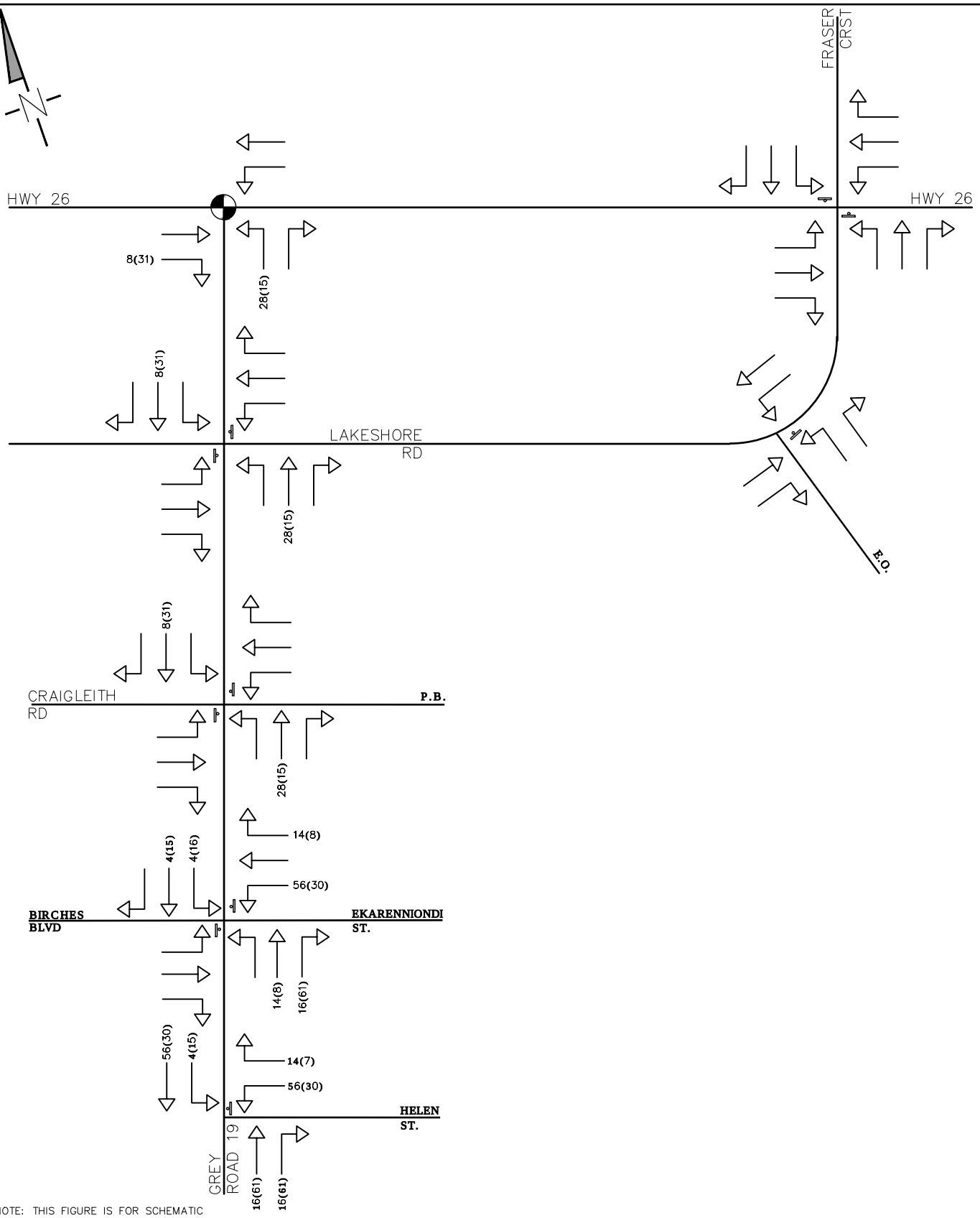
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 20



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

Legend

SIGNAL CONTROL

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Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - HOME FARM ASSIGNMENT

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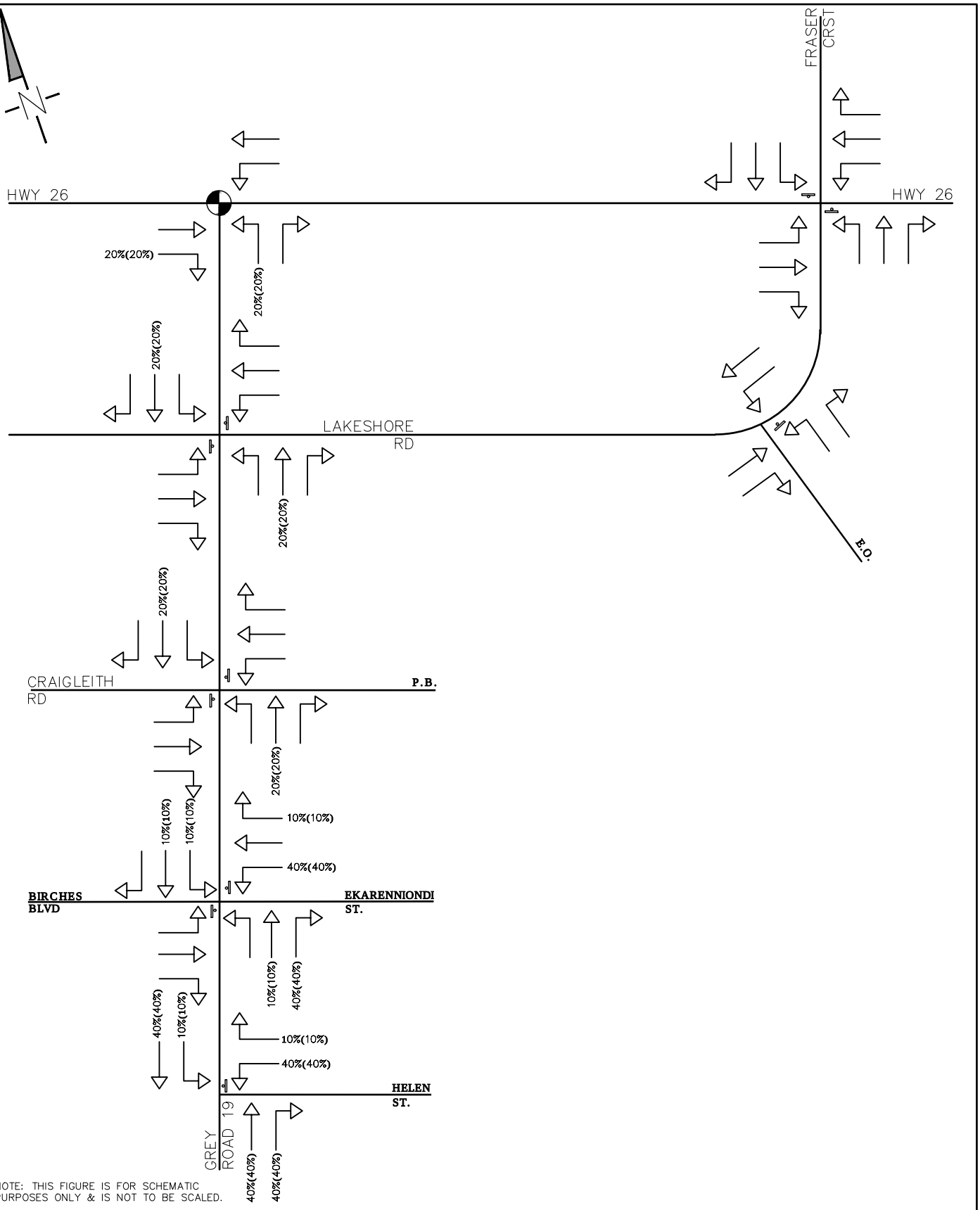
Scale	Date	Check By	Drawing
N.T.S.	JAN. 11, 2018	R.M.	FIG. 21



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

Legend

SIGNAL CONTROL

STOP CONTROL

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Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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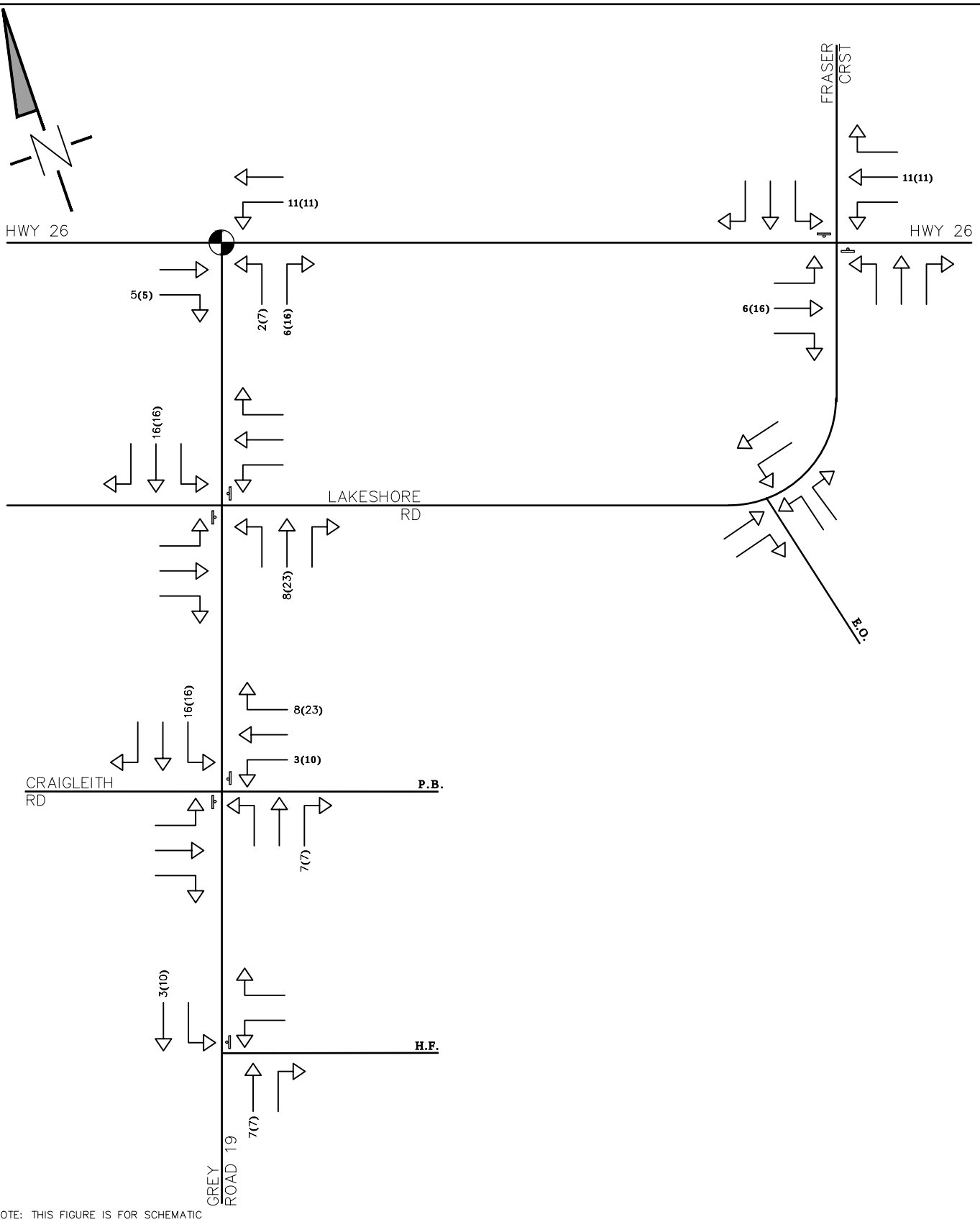
Scale	Date	Check By	Drawing
N.T.S.	JAN. 11, 2018	R.M.	FIG. 22



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

Legend

SIGNAL CONTROL

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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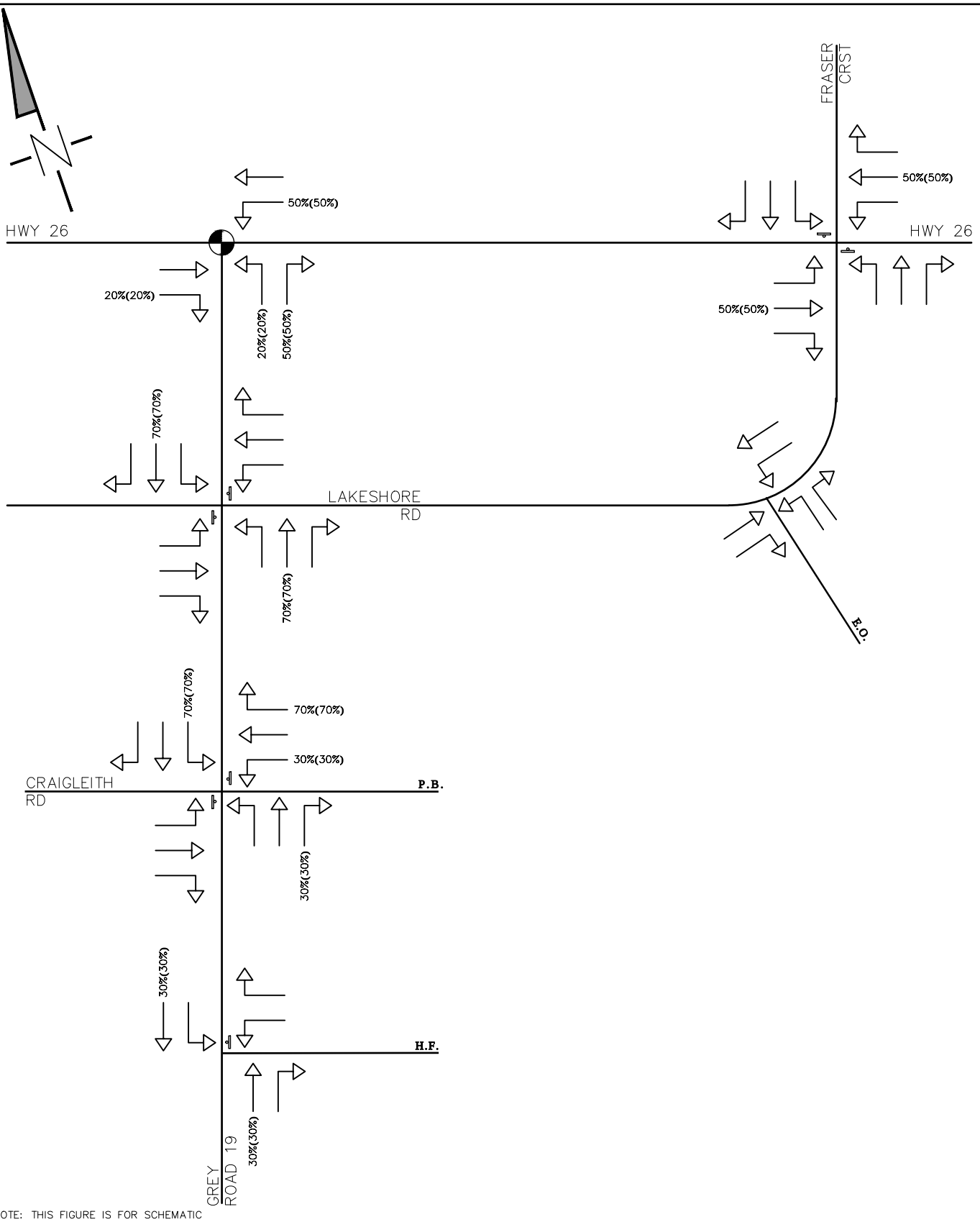
Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 23



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

Legend

SIGNAL CONTROL

STOP CONTROL

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

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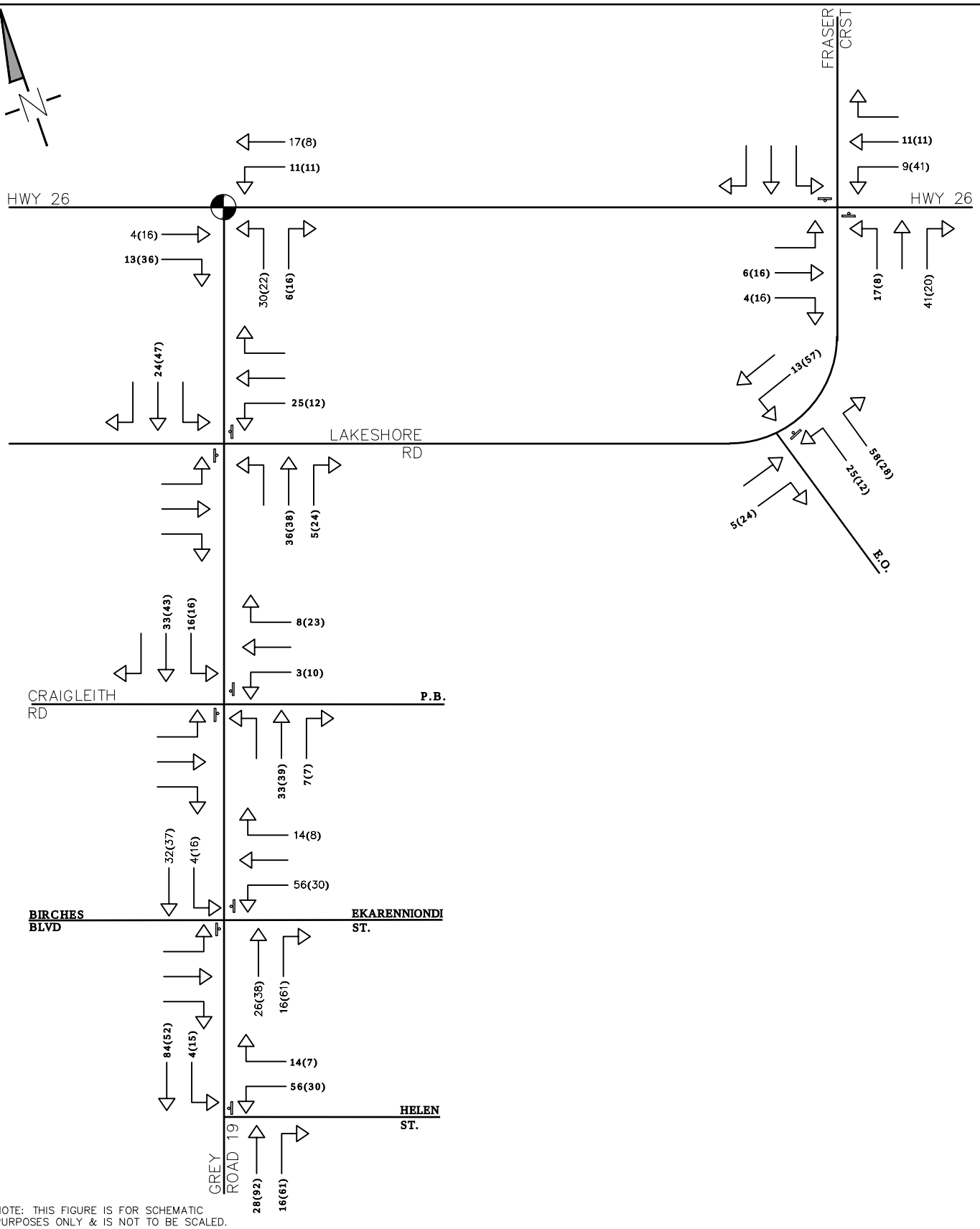
J.I.M.	M.N.F.	1046-4031

Scale	Date	Check By	Drawing
N.T.S.	JAN. 5, 2018	R.M.	FIG. 24



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

Legend

SIGNAL CONTROL

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PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - TOTAL TRIP ASSIGNMENT

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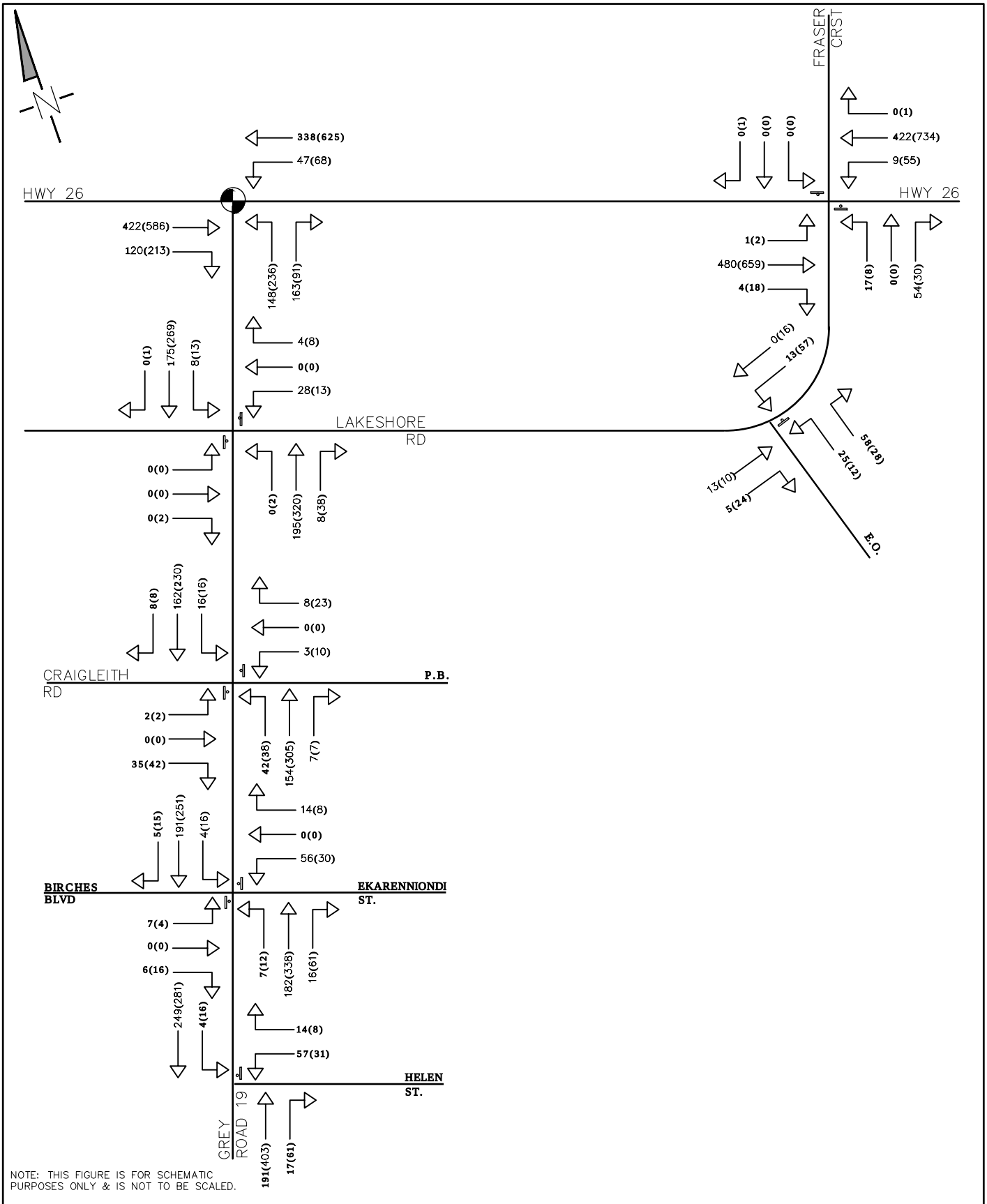
J.I.M.	M.N.F.	1046-4031

Scale	Date	Check By	Drawing
N.T.S.	JAN. 11, 2018	R.M.	FIG. 25



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

Legend

SIGNAL CONTROL

STOP CONTROL

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Project

PARKBRIDGE CRAIGLEITH
TOWN OF THE BLUE MOUNTAINS

Drawing

OPTION 3 - FUTURE TOTAL 2031

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Scale	Date	Check By	Drawing
N.T.S.	JAN. 11, 2018	R.M.	FIG. 26