



140 Lockhart Road

City of Barrie

Traffic Impact Study for 2640085 Ontario Inc.

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Executive Summary

This report summarizes the traffic impact study for the proposed development on a site municipally known as 140 Lockhart Road, located on the north side of Lockhart Road midblock between Bayview Drive and Rawson Avenue, in the City of Barrie [City]. The report assesses the impact of traffic related to the development on the adjacent roadway and provides recommendations to accommodate this traffic in a safe and efficient manner.

The proposed industrial subdivision (28.21 hectare industrial lot area) will include 16.73 hectares of light industrial use and the Ram Iron block which will include a manufacturing facility (153,761 sq.ft. of GFA).

The proposed development will have lots located on both sides of the future Welham Road extension, which will connect the south end of Welham Road onto Lockhart Road [Welham Extension].

A Preliminary Site Concept is available for the Ram Iron block, which is located southeast of the Welham Extension, north of the watercourse. A specific development concept has not been prepared for any other blocks in the proposed development. For the purpose of this analysis, we have assumed that the proposed development will include two local road connections on the northwest side of the Welham Extension [Access 'A' and Access 'B']. The proposed Ram Iron block includes a single full-movement access onto Welham Extension [Ram Access], located directly across from Access 'B'.

The scope of this analysis includes a review of the following intersections:

- Welham Road / Mapleview Drive East;
- Huronia Road / Lockhart Road;
- Bayview Drive / Lockhart Road;
- Welham Road / Saunders Road; and
- Welham Extension / Lockhart Road.

Conclusions

1. Full build-out of the proposed development (2031) is expected to generate 411 AM and 387 PM new peak hour trips in the study area. The build-out of the Ram Iron block in the proposed development (2025) is expected to generate 95 AM and 103 PM new peak hour trips
2. Background traffic and pedestrian counts were obtained from the City at the Welham Road / Mapleview Drive East intersection, completed on Tuesday, December 4th 2018, and at the Huronia Road / Lockhart Road, completed on Wednesday, October 21st, 2015.
3. An intersection operational analysis was completed at the study area intersections, using the existing (2020) and background (2031) traffic volumes, without the proposed development traffic. The background (2031) scenario were assessed with and without the post-2031 infrastructure improvements. This enabled a review of existing and future traffic deficiencies that would be present without the influence of the proposed development. The following improvements were recommended in the study area:

Welham Road / Mapleview Drive East

Existing (2020) traffic volumes

- Signal timing optimization

Background (2031) traffic volumes

- Signal timing optimization

Huronia Road / Lockhart Road

Existing (2020) traffic volumes

- Signal timing optimization

Background (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Huronia Road and Lockhart Road be constructed by this time.
- Right turn lane be constructed at the eastbound, westbound and northbound directions as part of the post-2031 infrastructure improvements with the following dimension:
 - o Eastbound right turn lane with a 50 metre storage and 70 metre taper length.
 - o Westbound right turn lane with a 20 metre storage and 70 metre taper length.
 - o Northbound right turn lane with a 30 metre storage and 70 metre taper length.
 - o Southbound right turn lane with a 20 metre storage and 70 metre taper length.

Bayview Drive / Lockhart Road and Welham Extension / Lockhart Road

Background (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Lockhart Road and Bayview Drive be constructed by this time.

Welham Road / Saunders Road

Total (2025) traffic volumes

- Construct intersection from a two-way stop to an all-way stop traffic controlled intersection.
4. An estimate of the amount of traffic that would be generated by the Subject Site was prepared and assigned to the study area streets and intersections.
 5. An intersection operation analysis was completed under total (2031) traffic volumes with the proposed development operational at the study area intersections. The total (2031) scenario were assessed with and without the post-2031 infrastructure improvements. The following improvements are recommended:

Welham Road / Mapleview Drive East

Total (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Welham Road be constructed by this time.
- A southbound right turn lane be constructed as part of the post-2031 infrastructure improvements with a 35 metre storage and 50 metre taper length.

Welham Road / Saunders Road

Total (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Welham Road be constructed by this time.
6. Access 'A', Access 'B' and Ram Access will operate as a full-movement access, with one-way stop control for southbound movements at Access 'A' and two-way stop control for northbound

and southbound movements at Access 'B' and Ram Access. A single ingress and egress lane at the Access 'A', Access 'B' and Ram Access access driveways will provide the necessary capacity to service the proposed development. The planned Welham Extension will include the construction of a TWLTL on Welham Road at the access driveways.

7. In summary, the proposed development will not cause any operational issues and will not add significant delay or congestion to the local roadway network.

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1 Introduction

1.1 Background

2640085 Ontario Inc. [Client] is proposing to develop a site municipally known as 140 Lockhart Road, located on the north side of Lockhart Road midblock between Bayview Drive and Rawson Avenue, in the City of Barrie [City]. The proposed industrial subdivision (28.21 hectare industrial lot area) will include 16.73 hectares of light industrial use and the Ram Iron block which will include a manufacturing facility (153,761 sq.ft. of GFA).

The proposed development will have lots located on both sides of the future Welham Road extension. The future Welham Road extension will connect the south end of Welham Road onto Lockhart Road [Welham Extension].

A Preliminary Site Concept is available for the Ram Iron block, which is located southeast of the Welham Extension, north of the watercourse. A specific development concept has not been prepared for any other blocks in the proposed development. For the purpose of this analysis, we have assumed that the proposed development will include two local road connections on the northwest side of the Welham Extension [Access 'A' and Access 'B']. The proposed Ram Iron block includes a single full-movement access onto Welham Extension [Ram Access], located directly across from Access 'B'.

The Client has retained **JD Northcote Engineering Inc.** [JD Engineering] to prepare this traffic impact study in support of the proposed development.

1.2 Study Area

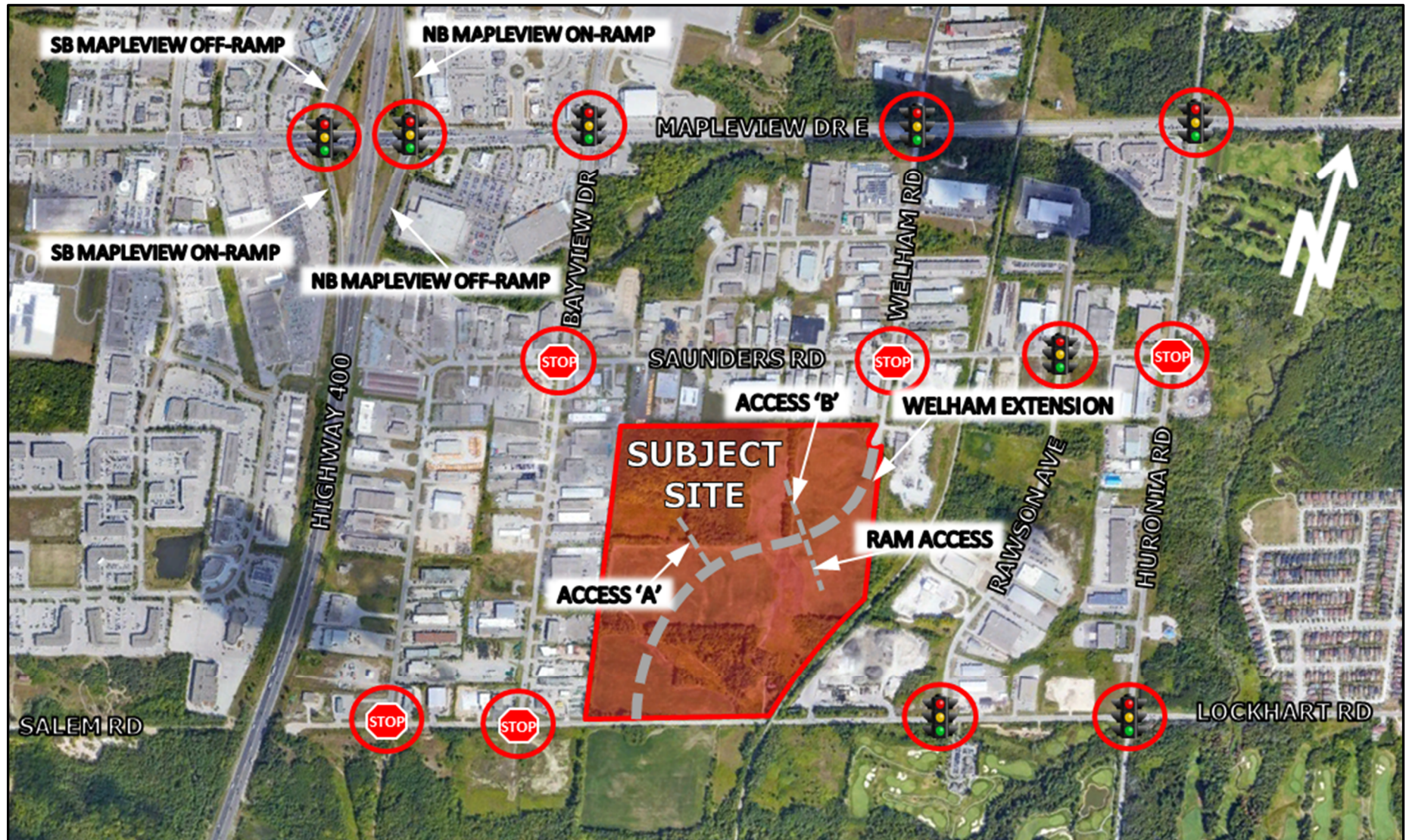
Figure 1 illustrates the location of the subject site and study area intersections in relation to the surrounding area. The Site Plan by Innovative Planning Solutions Inc. is attached in **Appendix A**. The Preliminary Site Concept for the Ram Iron Block is also provided in **Appendix A**.

The subject site is bound by Lockhart Road to the south, existing industrial developments to the north and west and a CN railway track and an existing industrial development to the east.

Based on our experience with similar studies, the following intersections will be analyzed as part of the study:

- Welham Road / Mapleview Drive East;
- Huronia Road / Lockhart Road;
- Bayview Drive / Lockhart Road;
- Welham Road / Saunders Road; and
- Welham Extension / Lockhart Road.

Figure 1 – Proposed Site Location and Study Area



1.3 Study Scope and Objectives

The purpose of this study is to identify the potential impacts to traffic flow at the site access and on the surrounding roadway network. The study analysis includes the following tasks:

- Determine existing traffic volumes and circulation patterns;
- Estimate future traffic volumes if the proposed development was not constructed, including the impact of additional proposed developments in the area;
- Complete level-of-service [LOS] analysis of horizon year (without the proposed development) traffic conditions and identify operational deficiencies;
- Estimate the amount of traffic that would be generated by the proposed development and assign to the roadway network;
- Complete LOS analysis of horizon year (with the proposed development) traffic conditions and identify additional operational deficiencies;
- Provide an assessment of the impact of the additional traffic on the local road network;
- Identify improvement options to address operational deficiencies;
- Review the proposed configuration of the site access driveways; and
- Document findings and recommendations in a final report.

1.4 Horizon Year and Analysis Periods

Traffic operations for the existing (2020)¹ and horizon years (2031) were selected for analysis of traffic operations in the study area. The weekday morning [AM] and weekday afternoon [PM] peak hours have been selected as the analysis periods for this study.

Traffic operations for an interim (2025) condition was also reviewed. For this scenario, we have assumed that only the Ram Iron block will be occupied.

2 Information Gathering

2.1 Street and Intersection Characteristics

Mapleview Drive East is a seven-lane arterial road with an urban cross-section and a sidewalk along both sides of the road within the study area. Mapleview Drive East has a posted speed limit of 60km/h and is under jurisdiction of the City.

Lockhart Road is a two-lane arterial road with a rural cross-section and gravel shoulders within the study area. Lockhart Road has posted speed limit of 60km/h and is under jurisdiction of the City. There is an existing one-lane railway bridge underpass on Lockhart Road, east of the subject site, which is signed "Yield to Oncoming Traffic" in both directions.

Huron Road is a two-lane arterial road with a rural cross-section and gravel shoulders within the study area. Huron Road has a posted speed limit of 60km/h and is under jurisdiction of the City.

Bayview Drive is a two-lane major collector road with a rural cross-section and gravel shoulders within the study area. Bayview Drive has a posted speed limit of 50km/h and is under jurisdiction of the City.

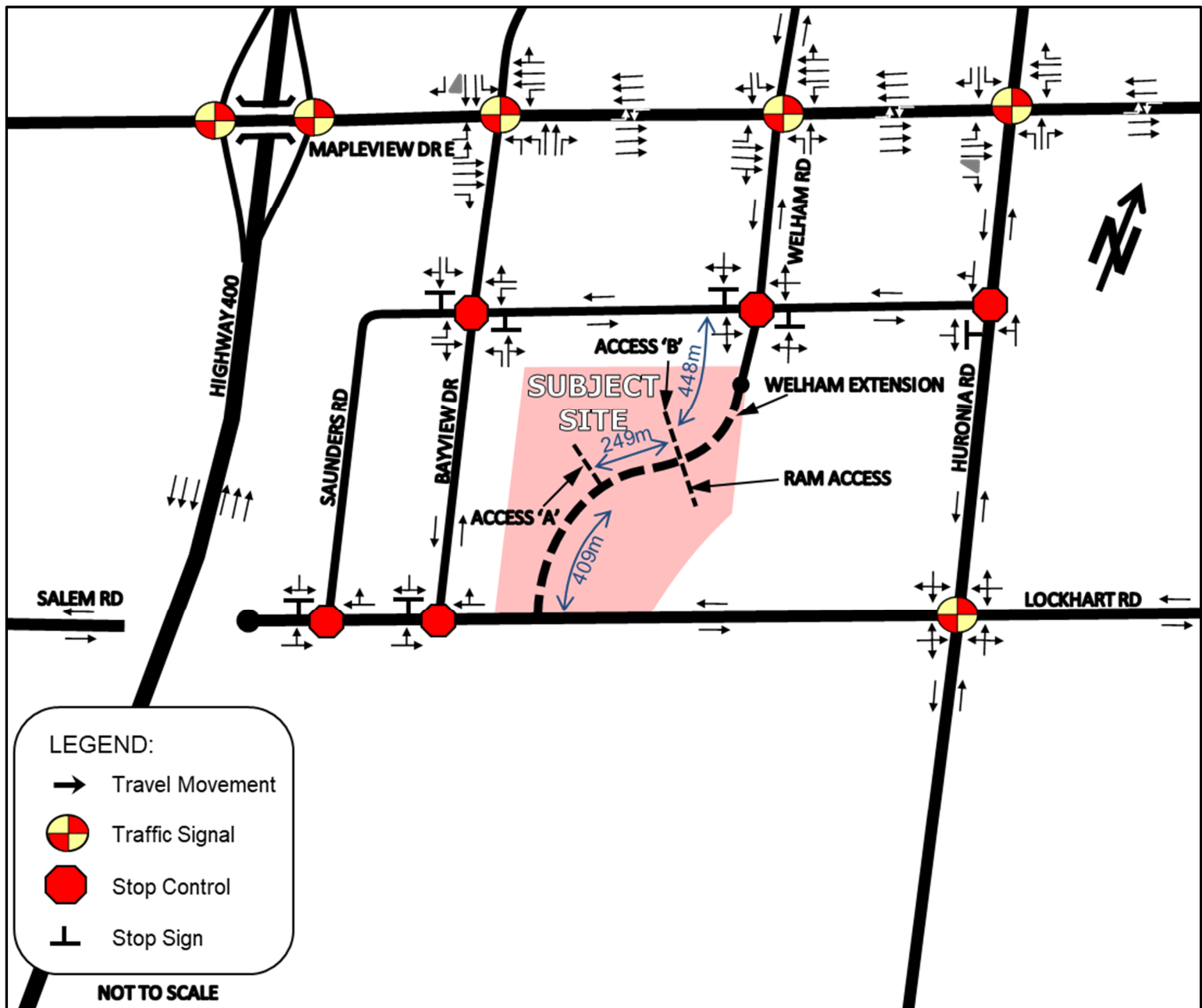
¹ It is noted that 2020 was used for the existing year, rather than 2021, as a significant portion of the analysis was completed in 2020 with the submission of this report in February 2021.

Welham Road is a two-lane minor collector road with a rural cross-section within the study area. Welham Road has gravel shoulders south of Hooper Road and has no sidewalk along the entire road. Welham Road has a posted speed limit of 50km/h and is under jurisdiction of the City.

Saunders Road is a two-lane minor collector road with a rural cross-section and paved shoulders within the study area. Saunders Road has an unposted (assumed) speed limit of 50km/h.

The existing intersection lane configuration within the study area is illustrated in **Figure 2**.

Figure 2 – Existing (2020) Lane Configuration within Study Area



2.2 Local Transportation Infrastructure Improvements

Based on our review of the City's Transportation Master Plan [TMP] (April 2019) and the City's Capital Plan (2019) a number of future road improvements are planned in and near the study area. The timeline of the road improvements was confirmed based on correspondence with the City. The following infrastructure improvements are planned in the study area:

The following improvement is anticipated to start construction by 2025:

- Huronia Road – Road Reconstruction (Lockhart Road to just south of McKay Road)
 - o Construction of paved shoulders;
 - o Reconstruction of the Huronia Road / Lockhart Road intersection to include left-turn lanes at all legs of the intersection.

The following improvement was planned to start construction by 2023, but has recently been bumped back to 2029:

- McKay Road Interchange
 - o Construction of four-lane interchange at Highway 400; and
 - o Construction of sidewalks and bike lanes on each side of the road

The following improvements are planned to be constructed post-2031²:

- Lockhart Road – Bridge Crossing and Road Reconstruction
 - o Construction of a five-lane bridge crossing connecting Salem Road and Lockhart Road [Lockhart Bridge Crossing];
 - o Reconstruction from two-lane to five-lane roadway with a two-way left-turn lane [TWLTL] on Lockhart Road in study area; and
 - o Construction of cycle track and sidewalks along both sides of the road (planned in the Long Term (2032 - 2041)).
- Huronia Road – Road Reconstruction
 - o Reconstruction from a two-lane to three-lane roadway with a TWLTL on Huronia Road in the study area; and
 - o Construction of cycle track and sidewalks along both sides of the road (planned in the Short Term (2019 - 2023) south of Lockhart Road and planned in the Long Term (2032 - 2041) north of Lockhart Road).
- Bayview Drive – Road Reconstruction (Lockhart Road to Mapleview Drive East)
 - o Reconstruction from a two-lane to three-lane roadway with a TWLTL; and
 - o Construction of buffered bike lanes, sidewalks along both sides of the road between Lockhart Road and Saunders Road and along one side between Saunders Road and Mapleview Drive East (planned in the Medium Term (2024 - 2031)).
- Welham Road - Road Reconstruction and Road Extension
 - o Reconstruction from a two-lane to a three-lane roadway with a TWLTL;
 - o Construction of the Welham Extension connecting the south end of Welham Road onto Lockhart Road; and
 - o Construction of bike lanes and sidewalks along both sides of the road (planned in the Medium Term (2024 - 2031)).
- Mapleview Drive West – Active Transportation (west of Huronia Road)
 - o Construction of an in-boulevard pathway (planned in the Long Term (2032 - 2041)).
- Saunders Road – Active Transportation (Bayview Road to Huronia Road)

² Although planned post-2031, the City's TMP identifies these improvements in the 2031 proposed preferred network.

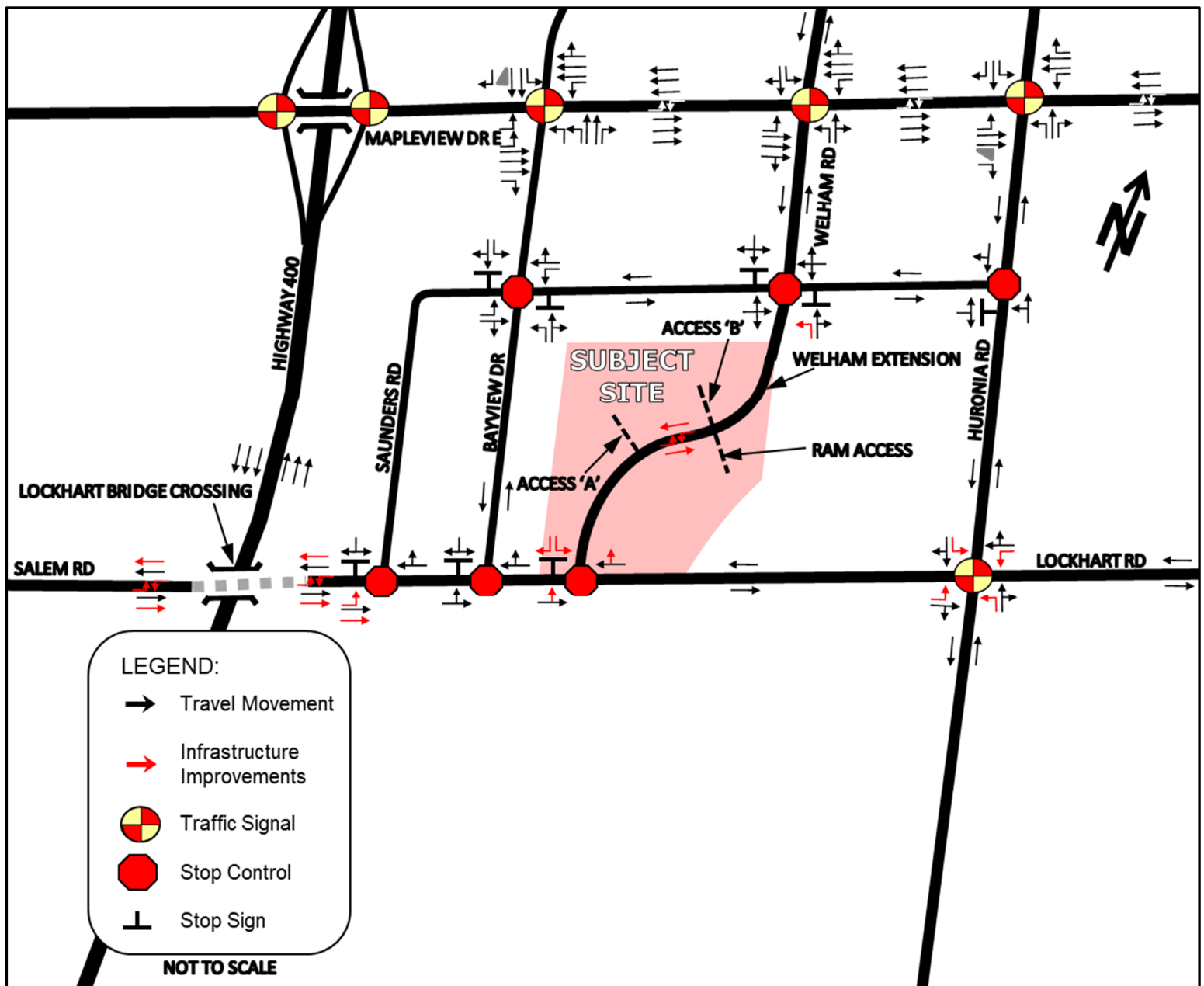
- o Construction of bike lanes, sidewalks along both sides of the road east of Bayview Drive and along one side west of Bayview Drive (planned in the Medium Term (2024 - 2031)).

Since improvements are planned post-2031 are currently pending an exact timeline, for the purposes of this study we have assessed the 2031 scenarios with and without the post-2031 road improvements. It is noted, we have assumed the Lockhart Bridge Crossing and Welham Extension to be constructed by 2031.

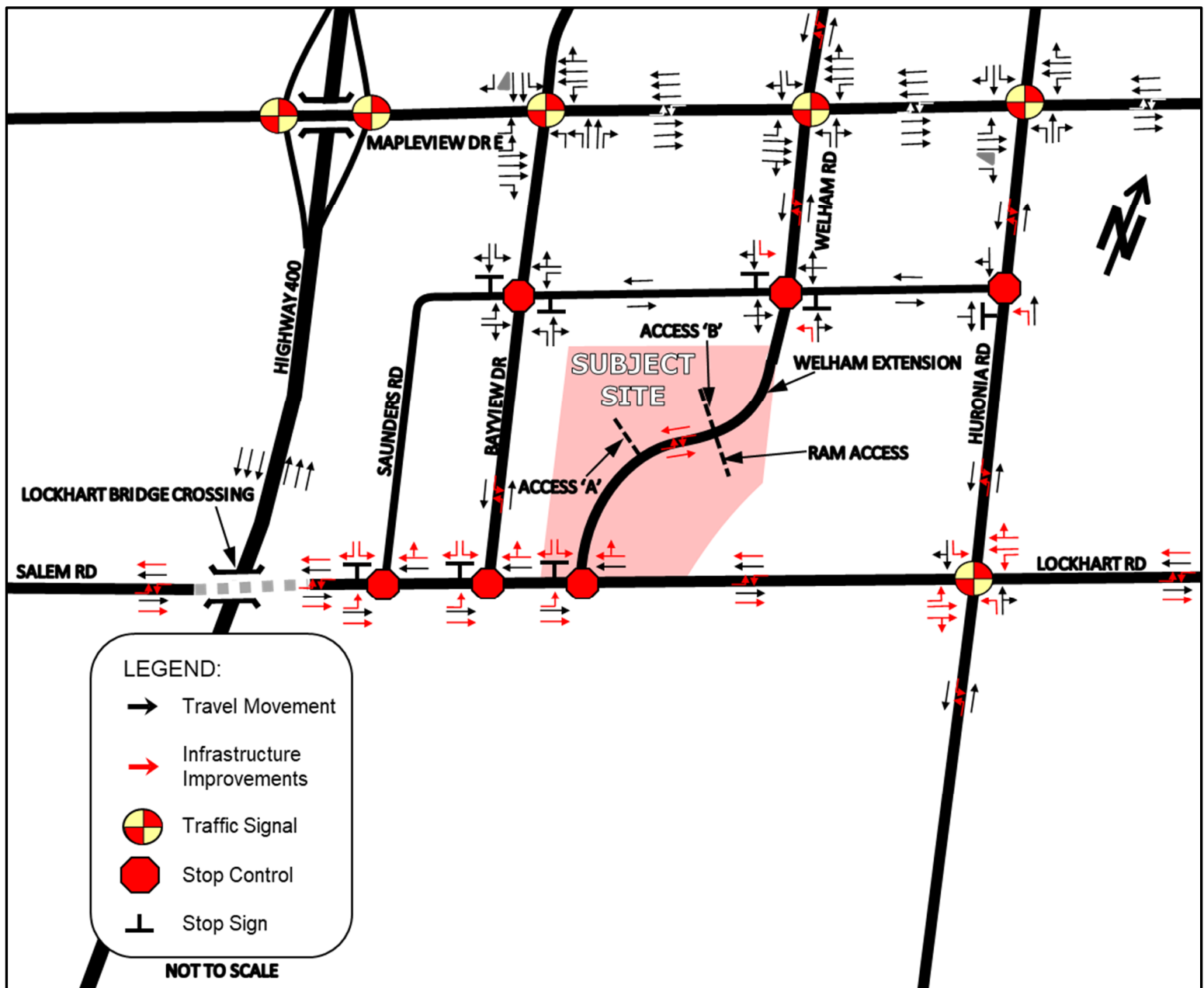
Since the exact lane configuration of the above noted improvements have not been finalized at this time, we have assumed the lane configuration at the study area intersections.

The ultimate (2031) lane configuration with and without the post-2031 infrastructure improvements within the study area, can be seen in **Figures 3** and **4** respectively.

Figure 3 - Future Lane Configuration within Study Area
(Without Post-2031 Infrastructure Improvements)



**Figure 4 - Future Lane Configuration within Study Area
(With Post-2031 Infrastructure Improvements)**



2.3 Transit Access

Barrie Transit currently has four bus routes nearby the study area. The No. 1B (Welham) bus route provides service along Welham Road and Saunders Road. The No. 11A-11B (Allandale Rec. / Lockhart) bus route provides service along Saunders Road and Lockhart Road. The No. 3A-3B (Bayview / Painswick) and No. 8A-8B (Yonge / Crosstown) bus routes provide service along Mapleview Drive East.

The No. 1B bus route operates between 05:05 – 23:35 on weekdays with daytime service every 30 minutes, between 07:05 – 23:35 on Saturday with daytime service every 30 minutes and between 09:05 – 21:05 on Sunday with service every hour.

The No. 11A-11B bus route operates between 06:45 – 17:05 from Monday to Saturday with service every 40 minutes and does not operate on Sunday.

The No. 3A-3B bus route operates between 05:29 – 22:29 from Monday to Saturday with service every hour and between 08:29 – 20:29 on Sunday with service every hour.

The No. 8A (Southbound) & 8B (Northbound) bus routes runs between 04:53 – 22:17 and 05:39 – 00:03 respectively on weekdays with daytime service every 30 minutes. On Saturdays, The No. 8A (Southbound) & 8B (Northbound) bus routes operate between 06:53 - 22:17 and 07:33 – 00:03 respectively with daytime service every 30 minutes. On Sundays, the No. 8A (Southbound) & No. 8B (Northbound) bus routes operate between 08:53 – 20:17 and 10:03 – 22:03 respectively and provides service after every hour.

The closest No. 1B and No. 11A bus stop is located on the northwest corner of the Welham Road / Saunders Road intersection (approximately 550 metres). The closest No.11B bus stop is located at the southwest corner of the Welham Road / Saunders Road intersection (approximately 550 metres). The closest No. 3A / 8A and No. 3B / 8B bus stops are located on the northeast and southwest corners respectively, of the Welham Road / Maplevue Drive East intersection (approximately 1.1km).

The City is planning an adjustment and expansion of transit service in the south end of the City, associated with the planned road improvements and the development of the future Hewitt Secondary Plan Area. The future service (which is subject to change) will provide a core bus route along Lockhart Road via the Lockhart Crossing, a business service bus route along Bayview Drive connecting onto McKay Road East and an optional business bus route along Huronia Road.

2.4 Other Developments within the Study Area

Based on correspondence with the City and a review of the City's TMP and proposed development map online, there are a number of planned developments near the study area that will impact traffic volumes in the study area.

Barrie Lockhart GP Inc. is proposing a mixed-use development on a site municipally at 400 Lockhart Road located northeast of Lockhart Road / Huronia Road intersection [400 Lockhart Development]. The 400 Lockhart Development is anticipated to consist of 470 to 594 residential units in a mix of housing types, along with a public elementary school, mixed-use block, three village squares. The 400 Lockhart Development is subdivision plan approved and is anticipated to start construction by 2023.

Bemp Holdings 2 Inc. is proposing a residential development on a site municipally at 515 Maplevue Drive East located south of the Madelaine Drive / Maplevue Drive East intersection northeast of the subject site [515 Maplevue Development]. The 515 Maplevue Development is anticipated to consist of 8 single-detached dwelling units, 32 street townhouse units and 196 apartment units on two mixed-use blocks. The 515 Maplevue Development is draft plan approved.

The Hewitt Secondary Plan Area will include approximately 2,290 hectares of annexed lands east of the study area, previously under jurisdiction of the Town of Innisfil. There is a significant amount of anticipated development planned within Hewitt Secondary Plan Area with the development of major residential communities, with low, medium and high density residential, and neighbourhood commercial uses. The development will also include schools, parks, recreational centres, open spaces and environmentally protected areas.

The City's TMP completed an Emme traffic model [2019 Emme Model] which accounts for future developments planned within and surrounding the City. Based on our review, the City's 2019 Emme Model accounts for the traffic generated by the 400 Lockhart Development and 515 Maplevue Development in the Hewitt Secondary Plan Area. Consequently, the methodology used to determine the traffic at the study area intersections, which applies the City's 2019 Emme Model for the 2031 horizon year in Section 3.3, will account for the above noted developments.

2.5 Background Traffic Growth

As noted in Section 2.4, there is a significant amount of anticipated development planned within the annexed lands at the south end of the City, as well as intensification developments and infrastructure improvements along the City's major corridors.

The background growth rate in the study area was calculated based on the City's 2019 Emme Model and Emme traffic model in the City's Multi-Modal Active Transportation Master Plan (2013) [2013 Emme Model] [2013 Emme Model]³. **Table 1** illustrates the calculated and assumed background traffic growth rate applied.

Table 1 – Background Traffic Growth Rate

Roadway	Calculated Growth Rate	Assumed Growth Rate
Maplevue Drive East	2.1%	2.1%
Lockhart Road	12.8%	12.8%
Huron Road	7.7%	2.0%
Bayview Drive	2.4%	2.4%
Welham Road	4.9%	2.0%
Saunders Road	5.1%	5.1%

Reduced background traffic growth rates were applied on Huron Road and Welham Road, to align the future traffic projections in this report with the traffic projections in the City's 2019 Emme Model.

The background traffic growth rates noted in Table 1 were used alongside applying the best available traffic data; the methodology to determine the traffic volumes is detailed in Sections 2.6 (for the existing (2020) traffic volumes) and Section 2.7 (for the background (2031) traffic volumes).

For the interim (2025) traffic scenario, we have applied a nominal 2% background traffic growth on all study area roads. The higher growth values on Lockhart Road and Saunders Road are a function of the future Lockhart Road overpass, which is not applicable for this scenario.

2.6 Traffic Counts

It is noted updated traffic counts could not be completed at the study area intersections because of the COVID-19 physical distancing requirements that were implemented in Ontario at the time of this study. The traffic at the study area intersections were estimated by using the City's Emme traffic model in the City's Multi-Modal Active Transportation Master Plan (2013) [2013 Emme Model]⁴ (excerpt of the 2016 scenario in the City's 2013 Emme model provided in **Appendix B**) and any detailed traffic counts available.

³ The 2021 traffic projections in the City's 2013 Emme Model were used as a baseline in the traffic growth calculation, as this best reflects the peak hour traffic volumes observed in the traffic count data noted in Table 2. It is noted that the traffic growth between 2016 scenario and 2031 scenario are consistent with the rates noted in Table 1.

⁴ The 2016 traffic projections in the City's 2013 Emme Model were used to estimate the existing (2020) traffic volumes. The City's 2019 Emme Model does not have a scenario that reflects traffic conditions prior to 2031.

Detailed turning movements traffic and pedestrian counts were retrieved from the City for the Welham Road / Mapleview Drive East and Huronia Road / Lockhart Road intersections.

Table 2 summarizes the traffic count data collection information.

Table 2 - Traffic Count Data

Intersection (N-S Street / E-W Street)	Count Date	AM Peak Hour	PM Peak Hour	Source
Welham Road / Mapleview Drive East	Tuesday, December 4 th 2018	07:45 – 08:45	16:15 – 17:15	City
Huronia Road / Lockhart Road	Wednesday, October 21 st , 2015	07:30 – 08:30	16:30 – 17:30	City

Detailed traffic count data can be found in **Appendix D**. The peak hours of traffic generation for the study area intersections generally aligned with the anticipated peak hour of traffic generation by the proposed development.

To determine the equivalent existing (2020) traffic volumes at Welham Road / Mapleview Drive East and Huronia Road / Lockhart Road intersections, the background traffic growth rate noted in Section 2.5 was applied. Based on our review of the area, the additional traffic generated by developments that were built-out and occupied since the completion of the traffic counts are captured in the background traffic growth rates applied.

Heavy vehicle percentages and pedestrian crossings from the traffic count data have also been included in the Synchro analysis.

To estimate the traffic at the Bayview Drive / Lockhart Road and Welham Road / Saunders Road intersections, the methodology noted in Sections 2.6.1 and 2.6.2 was applied.

2.6.1 Bayview Drive / Lockhart Road

The east leg traffic volumes were estimated using the traffic volumes data from the west leg at the Huronia Road / Lockhart Road intersection.

For the north leg traffic volumes were estimated using the traffic from the 2016 scenario in the City's 2013 Emme Model. To determine the equivalent existing (2020) traffic volumes at this intersection, the background traffic growth rate noted in Section 2.5 was applied.

For the west leg, the City's 2013 Emme Model did not identify the traffic volume on this leg. Consequently, we have estimated the traffic volume on this leg based on a review of the existing developments on Lockhart Road. The traffic generation has been based on the Institute of Transportation Engineers [ITE] *Trip Generation Manual* (10th Edition) [ITE Trip Generation Manual]. The size and land use of the developments were calculated based on aerial photography. The following ITE land uses have been applied to estimate the traffic on the west leg of the Huronia Road / Lockhart Road intersection:

- ITE lane use 110 (General Light Industrial) - General Urban / Suburban Setting
- ITE lane use 140 (Manufacturing) - General Urban / Suburban Setting
- ITE lane use 150 (Warehousing) - General Urban / Suburban Setting

The traffic distribution has been calculated based on the 2016 Transportation Tomorrow Survey [TTS] data for traffic zone 6236, retrieved using the TTS IDRS (output attached as **Appendix J**). TTS data provides historical origin and destination work trip percentages for specific areas within the City and southern Ontario.

Traffic distribution for the trips generated by the west leg during the AM and PM peak hour is expected to generally follow commuter travel patterns. Our analysis is based on egress traffic during the AM peak hour. Logically, the distribution of ingress traffic will follow the inverse of the exiting traffic distribution. For each of the individual areas identified in the TTS data, we have selected the probable route of travel, assuming people will select their route primarily based on travel time. Assumptions for the route of travel were based on the existing infrastructure in the study area.

The distribution of trips is illustrated in **Table 3** using the methodology outlined above.

Table 3 – Industrial Development Traffic Distribution

Travel Direction (to / from)	Percentage of Total Traffic Generation
West via Maplevue Drive East	68%
East via Maplevue Drive East	2%
East via Lockhart Road	4%
North via Huronia Road	4%
South via Huronia Road	13%
North via Bayview Drive	8%
North via Welham Road	3%
TOTAL	100%

2.6.2 Welham Road / Saunders Road

The north leg traffic volumes were estimated using the traffic data at the south leg of the Welham Road / Maplevue Drive East intersection.

The west and east leg traffic volumes were estimated based on the traffic from the 2016 scenario in the City's 2013 Emme Model. To determine the equivalent existing (2020) traffic volumes at this intersection, the background traffic growth rate noted in Section 2.5 was applied.

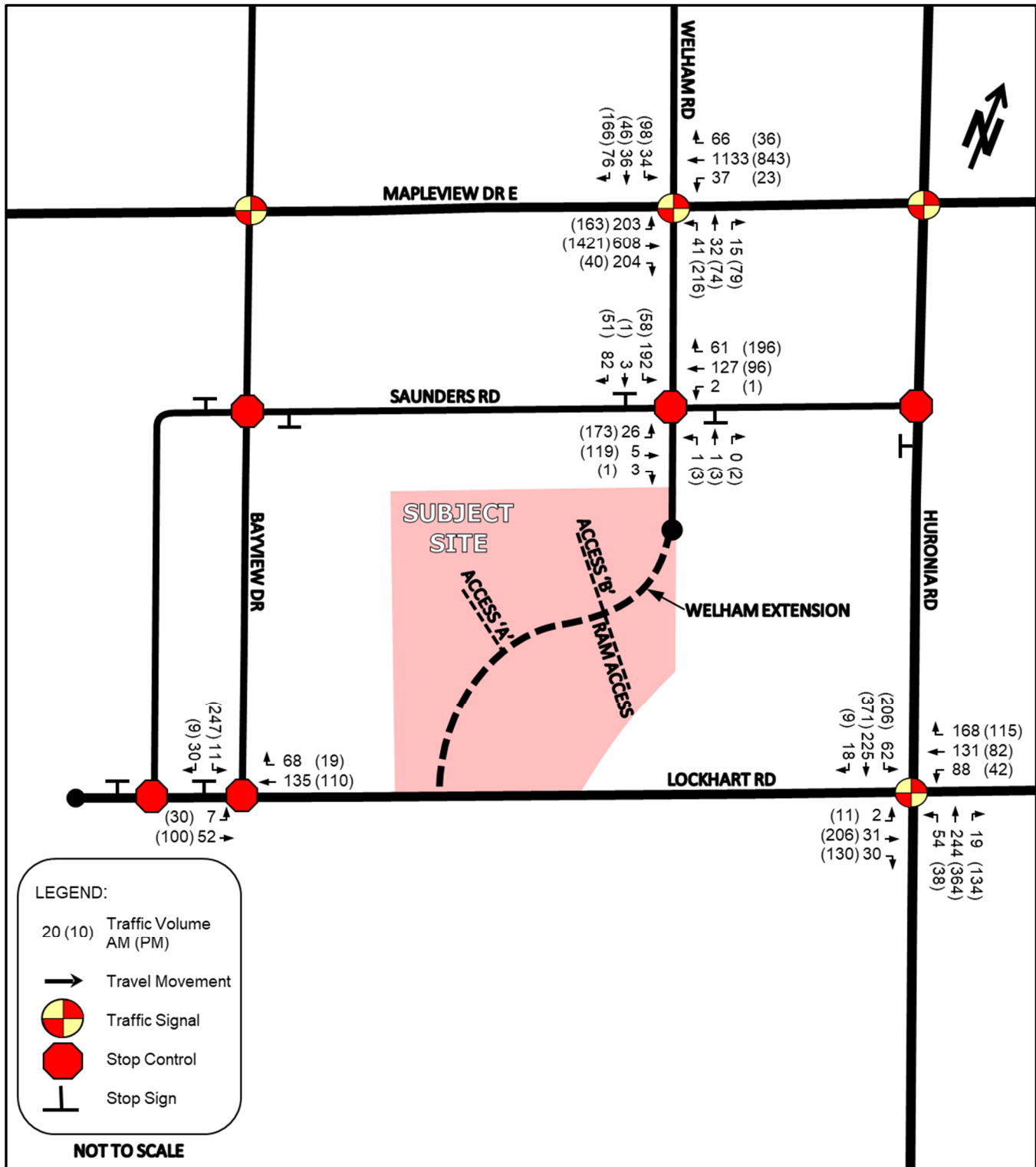
For the south leg, the City's 2013 Emme Model did not identify the traffic volume on this leg. Consequently, we have estimated the traffic volume on this leg based on a review of the existing developments on Saunders Road. The traffic generation for the traffic on the south leg has been based on the ITE Trip Generation Manual. The size and land use of the developments were calculated based on aerial photography. The following ITE land uses have been applied to estimate the traffic on the south leg of the Welham Road / Maplevue Drive East intersection:

- ITE land use 140 (Manufacturing) - General Urban / Suburban Setting

The traffic distribution is assumed to follow the same industrial distribution applying the 2016 TTS data in Table 3.

Figure 5 illustrates the existing (2020) AM and PM peak hour traffic volumes in the study area.

Figure 5 – Existing (2020) Traffic Volumes



2.7 Horizon Year Traffic Volumes

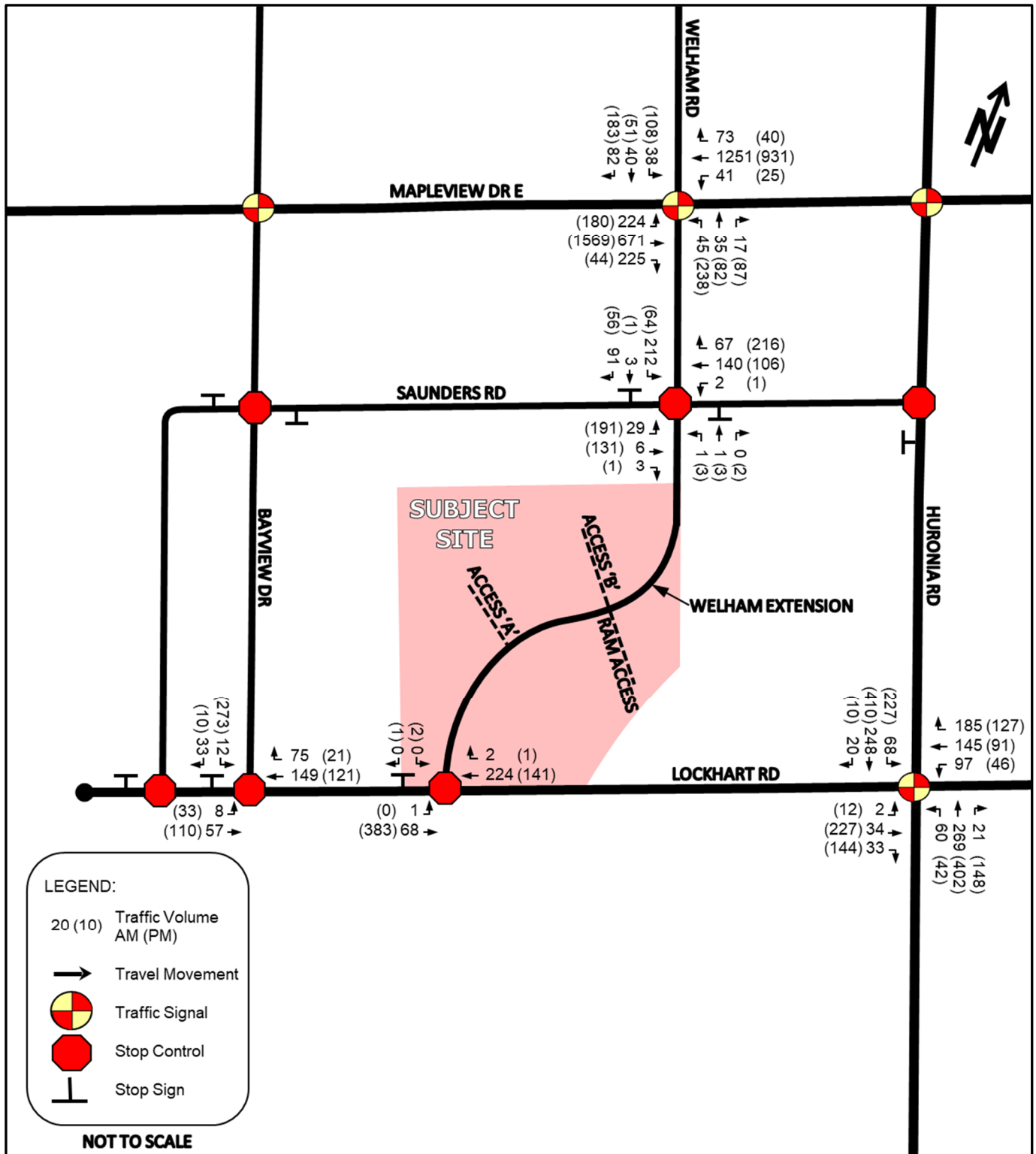
2.7.1 Background (2025) Traffic Volumes

The background (2025) traffic volumes were estimated for the AM and PM peak hour by applying general 2% background traffic growth along all roads in the study area to the existing traffic volumes. Typically, the traffic generated by the adjacent developments would also be added, however, for the purposes of this report we have assumed all of this traffic to be accounted for in the background traffic growth rate.

We have assumed the Welham Extension to be constructed in this scenario. The traffic estimated for the north leg of the Welham Extension / Lockhart Road intersection, was assumed based on the same methodology in the background (2031) scenario at this intersection noted in Section 2.7.2.5. Eastbound and westbound traffic at the Welham Extension / Lockhart Road intersection is assumed from the east leg of the Lockhart Road / Bayview Drive intersection.

Figure 6 illustrates the background (2025) AM and PM peak hour traffic volumes, in the study area.

Figure 6 – Background (2025) Traffic Volumes



2.7.2 Background (2031) Traffic Volumes

For the background (2031) traffic volumes, the traffic count data noted in Section 2.6 and City's 2019 Emme Model (excerpt of the 2031 scenario in the City's 2019 Emme model provided in **Appendix C**) were used to determine the traffic volumes for the background (2031) horizon year.

To estimate the background (2031) traffic volumes at the study area intersections, the methodology noted in Sections 2.7.1 to 2.7.5 were applied.

2.7.2.1 Welham Road / Mapleview Drive East

The west, east and north leg traffic volumes were calculated by applying the background traffic growth rate noted in Section 2.5. The westbound thru volumes were increased to match the 2031 scenario in the City's 2019 Emme model.

The south leg traffic volumes were estimated based on the Emme traffic volumes in the 2031 scenario in the City's 2019 Emme model. The directional distribution of these volumes followed the existing distribution of traffic for the south leg traffic volumes.

2.7.2.2 Huronia Road / Lockhart Road

The north and south leg traffic volumes were calculated by applying the background traffic growth rate noted in Section 2.5.

The eastbound thru and westbound thru traffic were increased to match the 2031 scenario in the City's 2019 Emme model.

2.7.2.3 Bayview Drive / Lockhart Road

The east and north leg traffic volumes utilized the Emme traffic volumes in the 2031 scenario in the City's 2019 Emme model.

The west leg traffic volumes utilized the same methodology noted in Section 2.6.1. The distribution of traffic generated for the existing development on Lockhart Road changed to account for the changes in the road network in the area. The distribution of traffic generated for the existing development will follow the same distribution as the proposed development in Table 11 in Section 4.2.

2.7.2.4 Welham Road / Saunders Road

The north leg traffic volumes were estimated based on the traffic volume at the south leg of the Welham Road / Mapleview Drive East intersection.

The east and west leg traffic volumes used the Emme traffic volumes in the 2031 scenario of the City's 2019 Emme Model. The east and west leg traffic volumes in the 2031 scenario of the City's 2019 Emme Model identified low or no traffic volumes for some of the directions; consequently, we have adjusted the directional distribution to match the north leg traffic volumes to reflect the anticipated traffic at the east and west legs.

The traffic volume for the south leg was estimated using the same methodology noted in Section 2.6.2. The distribution of traffic generated for the existing development on Saunders Road changed to account for the changes in the road network in the area. The distribution of traffic generated for the existing development will follow the same distribution as the proposed development in Table 11 in Section 4.2.

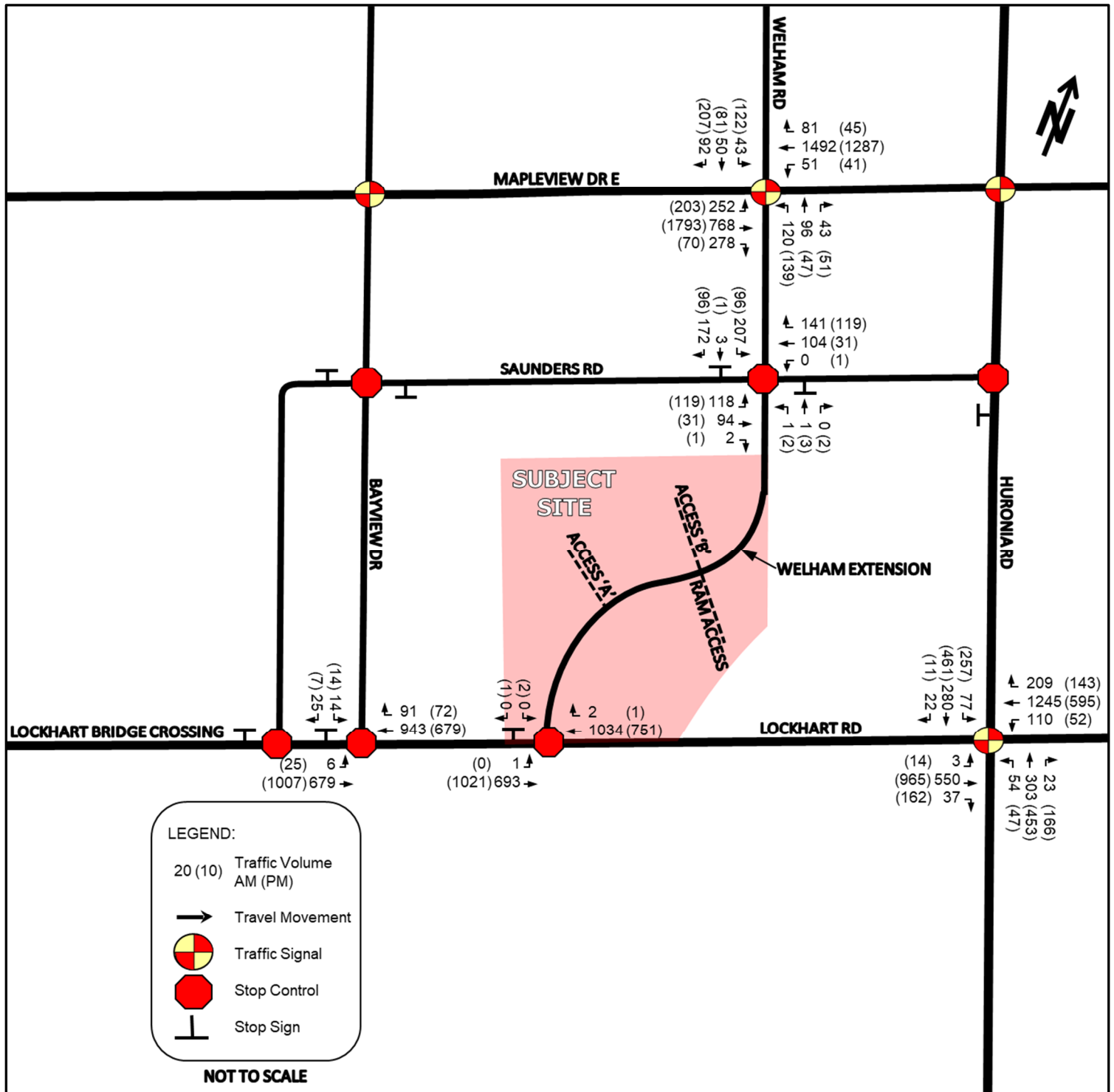
2.7.2.5 Welham Extension / Lockhart Road

The traffic volume for the east and west leg was estimated using the Emme traffic volumes in the 2031 scenario in the City's 2019 Emme model.

The north leg traffic volumes in the 2031 scenario in the City's 2019 Emme model identified low or no traffic volume. We have assumed the existing development on Saunders Road noted in Section 2.6.2 and 2.7.2.4 will travel via the Welham Extension.

Figure 7 illustrates the background (2031) AM and PM peak hour traffic volumes in the study area.

Figure 7 – Background (2031) Traffic Volumes



3 Intersection Operation without Proposed Development

3.1 Intersection Capacity Analysis Criteria

Intersection performance was measured using the traffic analysis software, Synchro 10, a deterministic model that employs Highway Capacity Manual and Intersection Capacity Utilization methodologies for analysing intersection operations. These procedures are accepted by provincial and municipal agencies throughout North America.

Synchro 10 enables the study area to be graphically defined in terms of streets and intersections, along with their geometric and traffic control characteristics. The user is able to evaluate both signalized and unsignalized intersections in relation to each other, thus not only providing level of service for the individual intersections, but also enabling an assessment of the impact the various intersections in a network have on each other in terms of spacing, traffic congestion, delay, and queuing.

Individual turning movements with a volume-to-capacity [V/C] ratio of 0.85 or greater are considered to be critical movements and have been highlighted in the LOS tables.

The intersection operations were also evaluated in terms of the LOS. LOS is a common measure of the quality of performance at an intersection and is defined in terms of vehicular delay. This delay includes deceleration delay, queue move-up time, stopped delay, and acceleration delay. LOS is expressed on a scale of A through F, where LOS A represents very little delay (i.e. less than 10 seconds per vehicle) and LOS F represents very high delay (i.e. greater than 50 seconds per vehicle for a stop sign controlled intersection and greater than 80 seconds per vehicle for a signalized intersection).

The LOS criteria for signalized and stop sign controlled intersections are shown in **Table 4**. A description of traffic performance characteristics is included for each LOS.

Table 4 – Level of Service Criteria for Intersections

LOS	LOS Description	Control Delay (seconds per vehicle)	
		Signalized Intersections	Stop Controlled Intersections
A	Very low delay; most vehicles do not stop (Excellent)	less than 10.0	less than 10.0
B	Higher delay; more vehicles stop (Very Good)	between 10.0 and 20.0	between 10.0 and 15.0
C	Higher level of congestion; number of vehicles stopping is significant, although many still pass through intersection without stopping (Good)	between 20.0 and 35.0	between 15.0 and 25.0
D	Congestion becomes noticeable; vehicles must sometimes wait through more than one red light; many vehicles stop (Satisfactory)	between 35.0 and 55.0	between 25.0 and 35.0
E	Vehicles must often wait through more than one red light; considered by many agencies to be the limit of acceptable delay	between 55.0 and 80.0	between 35.0 and 50.0
F	This level is considered to be unacceptable to most drivers; occurs when arrival flow rates exceed the capacity of the intersection (Unacceptable)	greater than 80.0	greater than 50.0

3.2 Existing (2020) Intersection Operation

The results of the LOS analysis under existing (2020) traffic volumes during the AM and PM peak hours can be found below in **Table 5**. The existing intersection geometry and traffic control has been utilized in this scenario. Detailed output of the Synchro analysis can be found in **Appendix E**.

Table 5 – Existing (2020) LOS

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.61	15.7	B	-	-	0.73	35.2	D	-	-
EBL	0.65	12.2	B	30	80	0.50	9.8	A	31	80
EBTR	0.27	10.0	B	-	-	0.53	15.1	B	-	-
WBL	0.10	8.0	A	7	60	0.16	11.9	B	7	60
WBTR	0.41	13.4	B	-	-	0.35	15.4	B	-	-
NBL	0.24	45.2	D	20	48	1.30	219.8	F	110	48
NBTR	0.20	50.7	D	-	-	0.64	61.3	E	-	-
SBL	0.17	47.8	D	17	42	0.49	47.5	D	40	42
SBTR	0.40	54.9	D	-	-	0.69	65.4	E	-	-
Huronia Road / Lockhart Road (signalized)	0.65	42.0	D	-	-	0.96	35.3	D	-	-
EB	0.13	20.4	C	13	-	0.85	40.6	D	90	-
WB	1.08	95.3	F	108	-	0.76	35.8	D	63	-
NB	0.43	10.9	B	42	-	0.65	14.1	B	85	-
SB	0.45	11.2	B	41	-	1.00	51.4	D	161	-
Bayview Drive / Lockhart Road (unsignalized)	-	1.5	A	-	-	-	7.4	A	-	-
SB	0.05	9.7	A	2	-	0.41	14.0	B	17	-
Welham Road / Saunders Road (unsignalized)	-	7.7	A	-	-	-	5.1	A	-	-
NB	0.00	11.3	B	1	-	0.03	16.6	C	1	-
SB	0.40	13.1	B	16	-	0.28	16.7	C	10	-

The result of the LOS analysis indicates that the highlighted movements noted above are operating outside the typical design limits noted in Section 3.1. It is recommended the signal timing at the signalized intersections in the study area be adjusted to optimize the use of the existing infrastructure.

The results of the LOS analysis with the above noted improvements can be found below in **Table 6**. Detailed output of the Synchro analysis can be found in **Appendix E**.

Table 6 – Existing (2020) LOS with Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	-	-	-	-	-	0.68	28.5	C	-	-
EBL	-	-	-	-	80	0.57	16.2	B	44	80
EBTR	-	-	-	-	-	0.60	22.4	C	-	-
WBL	-	-	-	-	60	0.19	17.8	B	9	60
WBTR	-	-	-	-	-	0.40	21.9	C	-	-
NBL	-	-	-	-	48	0.74	47.1	D	74	48
NBTR	-	-	-	-	-	0.39	46.4	D	-	-
SBL	-	-	-	-	42	0.40	47.3	D	36	42
SBTR	-	-	-	-	-	0.71	67.7	E	-	-
Huronia Road / Lockhart Road (signalized)	0.64	23.4	C	-	-	0.94	35.5	D	-	-
EB	0.11	18.3	B	11	-	0.91	51.8	D	102	-
WB	0.84	36.2	D	84	-	0.87	53.1	D	74	-
NB	0.49	15.7	B	74	-	0.63	13.0	B	83	-
SB	0.50	16.1	B	72	-	0.95	39.2	D	164	-

The results of the LOS analysis indicate that the Huronia Road / Lockhart Road intersection is operating outside the typical design limits noted in Section 3.1. Road improvements are planned at this intersection, the anticipated queuing at this intersection is not causing operational or traffic safety issues and the V/C ratio is not excessive (<1.00). It is recommended the City consider the improvements at this intersection a priority and accelerate the timing, ahead of 2025, if feasible.

The results of the LOS analysis indicate that all other intersections in the study area operate within the typical design limits noted in Section 3.1.

The anticipated queue for northbound left movements at the Welham Road / Mapleview Drive East intersection will extend past the existing storage length; however, the proposed signal timing includes a northbound protected left-turn phase, which will clear the queue in this lane. Consequently, the additional left-turn queue will not impact northbound through movements at this intersection.

There are no other issues with the anticipated queuing in the study area.

An analysis was completed for left turn movements at the unsignalized intersections in the study area, based on the criteria outlined in Appendix 9A of the Ontario Ministry of Transportation Design Supplement for TAC Geometric Design Guide for Canadian Roads June 2017 [MTO DS]. Based on the above noted criteria, a left turn lane is warranted in the eastbound direction of the Welham Road / Saunders Road intersection (results provided in **Appendix H**). Based on our review of the local traffic volume, surrounding development and considering a left turn is not warranted in the background (2031) scenario⁵, a left turn lane is not recommended.

Based on the above noted criteria left-turn lanes are not warranted any other unsignalized intersections in the study area (results provided in **Appendix H**).

⁵ Eastbound and westbound traffic volumes are lower in the background (2031) scenario than the existing (2020) and background (2025) scenario. The reduced volumes are a result of the planned road network improvements in and near the study area, which will change traffic patterns at the study area intersections.

A review of the need for additional auxiliary right turn lanes was completed at the unsignalized intersections in the study area. The results of the Synchro analysis indicate that there is excess capacity for all movements at the intersection; consequently, additional auxiliary right turn lanes are not recommended.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the unsignalized intersections in the study area (results are provided in **Appendix I**).

No additional improvements are recommended for the existing (2020) scenario.

3.3 Background (2025) Intersection Operation

The results of the LOS analysis under background (2025) traffic volumes during the AM and PM peak hours can be found below in **Table 7**. The improvements at the Huronia Road / Lockhart Road intersection noted in Section 2.2 and signal timing improvements noted in Section 3.2, have been utilized in this scenario. Signal timing at the Huronia Road / Lockhart Road intersection have been adjusted to optimize the use of the future road improvements.

As noted in Section 2.2, auxiliary left turn lanes are planned in all directions at the Huronia Road / Lockhart Road intersection. Since details regarding the geometric lane design of left turn lanes have not yet been planned, we have modeled these lanes with no storage and deacceleration lane length for the left turn lanes to illustrate the anticipated queuing for these improvements without the limitations of the geometric design.

Upon build-out of the Welham Extension it is recommended the City review the traffic at the Welham Extension / Saunders Road intersection to determine the exact timing to construct the intersection as an all-way stop. For the purposes of this report, we have modelled the Welham Road / Saunders Road intersection as an all-way stop.

Detailed output of the Synchro analysis can be found in **Appendix E**.

Table 7 – Background (2025) LOS

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.74	15.9	B	-	-	0.78	31.9	C	-	-
EBL	0.79	23.6	C	50	80	0.71	24.2	C	57	80
EBTR	0.29	10.3	B	-	-	0.68	25.9	C	-	-
WBL	0.12	8.1	A	8	60	0.26	21.1	C	10	60
WBTR	0.45	14.0	B	-	-	0.45	24.4	C	-	-
NBL	0.28	46.7	D	21	48	0.80	50.6	D	85	48
NBTR	0.24	52.5	D	-	-	0.41	46.2	D	-	-
SBL	0.17	46.7	D	18	42	0.43	47.9	D	39	42
SBTR	0.50	56.4	E	-	-	0.78	71.2	E	-	-
Huronia Road / Lockhart Road (signalized)	0.49	17.6	B	-	-	0.82	21.7	C	-	-
EBL	0.02	19.6	B	2	-	0.06	20.1	C	6	-
EBTR	0.14	20.4	C	-	-	0.83	36.8	D	-	-
WBL	0.35	22.1	C	24	-	0.43	24.7	C	17	-
WBTR	0.76	31.9	C	-	-	0.42	22.9	C	-	-
NBL	0.13	8.5	A	13	-	0.14	8.9	A	10	-
NBTR	0.35	10.1	B	-	-	0.63	14.5	B	-	-
SBL	0.16	8.8	A	15	-	0.82	34.3	C	78	-
SBTR	0.34	10.0	A	-	-	0.47	11.6	B	-	-
Bayview Drive / Lockhart Road (unsignalized)	-	1.5	A	-	-	-	8.2	A	-	-
SB	0.06	9.8	A	2	-	0.47	15.4	C	21	-
Welham Road / Saunders Road (unsignalized)	-	10.2	A	-	-	-	11.1	B	-	-
EB	0.06	8.5	A	0	-	0.47	12.1	B	0	-
WB	0.29	9.5	A	2	-	0.43	10.6	B	15	-
NB	0.00	8.3	A	8	-	0.01	8.8	A	13	-
SB	0.42	10.8	B	13	-	0.20	9.7	A	5	-
Welham Road / Saunders Road (unsignalized)	-	0.0	A	-	-	-	0.1	A	-	-
SB	0.00	0.0	A	0	-	0.01	11.3	B	1	-

The results of the LOS analysis indicate that all intersections in the study area operate within the typical design limits noted in Section 3.1.

The anticipated queue for northbound left movements at the Welham Road / Mapleview Drive East intersection will extend past the existing storage length; however, the proposed signal timing includes a northbound protected left-turn phase, which will clear the queue in this lane. Consequently, the additional left-turn queue will not impact northbound through movements at this intersection.

There are no other issues with the anticipated queuing in the study area.

An analysis was completed for left turn movements at the Bayview Drive / Lockhart Road intersection, based on the criteria outlined in Appendix 9A of the MTO DS. Based on the above noted criteria left-turn lanes are not warranted at the Bayview Drive / Lockhart Road intersection (results provided in **Appendix H**).

A review of the need for additional auxiliary right turn lanes was completed at the unsignalized intersections in the study area. The results of the Synchro analysis indicate that there is excess capacity

for all movements at the intersection; consequently, additional auxiliary right turn lanes are not recommended.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the unsignalized intersections in the study area (results are provided in **Appendix I**).

No additional improvements are recommended for the background (2025) scenario.

3.4 Background (2031) Intersection Operation

As noted in Section 2.2, a number of road improvements are planned post-2031 in and near the study area. For the purposes of this study, we have assessed the 2031 scenarios with and without the post-2031 road improvements. It is noted, we have assumed the Lockhart Bridge Crossing and Welham Extension to be constructed by 2031 in both scenarios.

3.4.1 Without Post-2031 Road Improvements

The results of the LOS analysis under background (2031) traffic volumes without post-2031 road improvements during the AM and PM peak hours can be found below in **Table 8**. The infrastructure improvements noted in Section 2.2 and 3.3 and the existing traffic control have been utilized in this scenario. The signal timing plan at the signalized intersections in the study area were adjusted to optimize the use of the existing infrastructure and future road improvements.

Detailed output of the Synchro analysis can be found in **Appendix F**.

Table 8 – Background (2031) LOS without Post-2031 Road Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.78	28	C	-	-	0.83	34.7	C	-	-
EBL	0.80	46.4	D	85	80	0.81	50.2	D	90	80
EBTR	0.37	13.8	B	-	-	0.78	27.9	C	-	-
WBL	0.20	15.1	B	11	60	0.38	24.4	C	13	60
WBTR	0.67	26.8	C	-	-	0.67	31.4	C	-	-
NBL	0.59	46.0	D	47	48	0.75	53.6	D	53	48
NBTR	0.56	53.2	D	-	-	0.23	45.5	D	-	-
SBL	0.18	44.6	D	20	42	0.37	40.7	D	46	42
SBTR	0.57	57.1	E	-	-	0.83	69.8	E	-	-
Huronia Road / Lockhart Road (signalized)	1.31	174.9	F	-	-	1.70	220.8	F	-	-
EBL	0.12	14.2	B	3	-	0.38	37.5	D	13	-
EBTR	0.75	24.7	C	-	-	1.77	398.6	F	-	-
WBL	0.51	18.3	B	38	-	1.26	260.4	F	54	-
WBTR	1.62	311.8	F	-	-	1.31	197.3	F	-	-
NBL	0.50	52.9	D	36	-	0.22	22.2	C	19	-
NBTR	0.71	53.3	D	-	-	0.77	35.5	D	-	-
SBL	0.67	67.6	E	45	-	1.64	348.6	F	133	-
SBTR	0.68	52.4	D	-	-	0.57	27.5	C	-	-
Bayview Drive / Lockhart Road (unsignalized)	-	1.0	C	-	-	-	1.2	E	-	-
SB	0.28	38.2	E	9	-	0.23	52.0	F	7	-
Welham Road / Saunders Road (unsignalized)	-	13.4	C	-	-	-	8.9	A	-	-
EB	0.36	11.7	B	0	-	0.22	9.1	A	0	-
WB	0.38	11.2	B	0	-	0.19	8.1	A	0	-
NBL	0.00	8.9	A	10	TWLTL	0.00	7.8	A	5	TWLTL
NBTR	0.00	8.7	A	11	-	0.00	7.3	A	5	-
SB	0.60	15.8	C	24	-	0.27	9.3	A	7	-
Welham Extension / Lockhart Road (unsignalized)	-	0.0	B	-	-	-	0.1	B	-	-
SB	0.26	0.0	A	0	-	0.03	55.6	F	1	-

The results of the LOS analysis indicate that the Huronia Road / Lockhart Road intersection is operating outside the typical design limits noted in Section 3.1.

The results of the LOS analysis indicate that the southbound direction at the Bayview Drive / Lockhart Road and Welham Extension / Lockhart Road intersections are operating outside marginally outside the typical design limits noted in Section 3.1.

It is recommended the City accelerate the post-2031 improvements along Lockhart Road, Huronia Road and Bayview Drive in the study area to accommodate the anticipated 2031 traffic volume.

3.4.2 With Post-2031 Road Improvements

The results of the LOS analysis under background (2031) traffic volumes with post-2031 road improvements during the AM and PM peak hours can be found below in **Table 9**. The infrastructure improvements noted in Section 2.2 and 3.3 have been utilized in this scenario.

Detailed output of the Synchro analysis can be found in **Appendix F**.

Table 9 – Background (2031) LOS with Post-2031 Infrastructure Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.78	27.3	C	-	-	0.83	34.7	C	-	-
EBL	0.80	46.4	D	85	80	0.81	50.2	D	90	80
EBTR	0.37	13.8	B	-	-	0.78	27.9	C	-	-
WBL	0.20	15.1	B	11	60	0.38	24.4	C	13	60
WBTR	0.67	26.8	C	-	-	0.67	31.4	C	-	-
NBL	0.59	46.0	D	47	TWLT	0.75	53.6	D	53	TWLT
NBTR	0.56	53.2	D	-	-	0.23	45.5	D	-	-
SBL	0.18	44.6	D	20	TWLT	0.37	40.7	D	46	TWLT
SBTR	0.57	57.1	E	-	-	0.83	69.8	E	-	-
Huronia Road / Lockhart Road (signalized)	0.81	32.1	C	-	-	1.47	68.8	E	-	-
EBL	0.11	15.1	B	3	TWLT	0.12	28.8	C	9	TWLT
EBTR	0.42	17.2	B	-	-	0.93	54.0	D	-	-
WBL	0.41	17.6	B	32	TWLT	1.26	260.4	F	54	TWLT
WBTR	0.91	33.6	C	-	-	0.68	38.8	D	-	-
NBL	0.39	39.7	D	35	TWLT	0.22	22.2	C	19	TWLT
NBTR	0.64	42.8	D	-	-	0.77	35.5	D	-	-
SBL	0.51	45.6	D	42	TWLT	1.64	348.6	F	133	TWLT
SBTR	0.62	42.2	D	-	-	0.57	27.5	C	-	-
Bayview Drive / Lockhart Road (unsignalized)	-	0.4	A	-	-	-	0.3	A	-	-
SBL	0.06	19.1	C	2	TWLT	0.04	16.3	C	2	TWLT
SBR	0.06	13.1	B	-	-	0.01	11.2	B	-	-
Welham Road / Saunders Road (unsignalized)	-	10.9	A	-	-	-	8.4	A	-	-
EB	0.35	11.4	B	0	-	0.22	9.1	A	0	-
WB	0.37	10.9	B	0	-	0.19	8.2	A	0	-
NBL	0.00	8.9	A	10	TWLT	0.00	7.9	A	5	TWLT
NBTR	0.00	8.7	A	10	-	0.00	7.4	A	5	-
SBL	0.40	12.3	B	12	TWLT	0.17	8.8	A	4	TWLT
SBTR	0.27	8.9	A	8	-	0.13	7.1	A	3	-
Welham Extension / Lockhart Road (unsignalized)	-	0.0	A	-	-	-	0.0	A	-	-
SBL	0.06	0.0	A	0	TWLT	0.01	15.8	C	1	TWLT
SBR	0.01	0.0	A	-	-	0.00	11.1	B	-	-

The results of the LOS analysis indicate that the Huronia Road / Lockhart Road operates outside the typical design limits noted in Section 3.1. It is recommended the post-2031 capital works at this intersection include the construction of right turn lanes for the eastbound, westbound, northbound and southbound approaches. These improvements are recommended with the following geometric dimensions:

- Eastbound right turn lane with a 50 metre storage and 70 metre taper length.
- Westbound right turn lane with a 20 metre storage and 70 metre taper length.
- Northbound right turn lane with a 30 metre storage and 70 metre taper length.
- Southbound right turn lane with a 20 metre storage and 70 metre taper length.

It is recommended that all traffic signal heads include provisions for an advanced left turn signal. Furthermore, it is also recommended the control type of the intersection be changed to actuated-uncoordinated signal control as priority at this intersection will vary depending on the time of day.

The results of the LOS analysis with the above noted improvements can be found below in **Table 10**. Detailed output of the Synchro analysis can be found in **Appendix F**.

Table 10 – Background (2031) LOS with Post-2031 and Recommended Infrastructure Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Huronia Road / Lockhart Road (signalized)	0.75	29.2	C	-	-	0.91	41.5	D	-	-
EBL	0.10	18.3	B	3	TWLTL	0.08	30.7	C	10	TWLTL
EBT	0.45	21.1	C	-	-	0.92	54.1	D	-	-
EBR	0.04	16.6	B	3	50	0.24	32.5	C	41	50
WBL	0.46	22.2	C	36	TWLTL	0.50	34.6	C	20	TWLTL
WBT	0.87	33.4	C	-	-	0.54	31.1	C	-	-
WBR	0.30	19.3	B	41	20	0.20	26.1	C	35	20
NBL	0.28	25.7	C	25	TWLTL	0.23	33.4	C	24	TWLTL
NBT	0.49	28.8	C	-	-	0.84	51.8	D	-	-
NBR	0.02	22.9	C	7	30	0.26	33.5	C	45	30
SBL	0.33	33.9	C	36	TWLTL	0.89	53.2	D	103	TWLTL
SBT	0.60	38.6	D	-	-	0.57	25.0	C	-	-
SBR	0.02	29.9	C	1	20	0.01	17.5	B	0	20

The results of the LOS analysis indicate that the Huronia Road / Lockhart Road intersection is operating outside the typical design limits noted in Section 3.1; however, the anticipated queuing at this intersection is not an issue and the V/C ratio is not excessive (<1.00), consequently, no additional improvements are recommended.

The results of the LOS analysis indicate that all other intersections in the study area is operating within the typical design limits noted in Section 3.1.

The anticipated queue for the highlighted auxiliary turning movements will extend past the existing storage length; however, the excess queue can be accommodated by the taper length consequently there are no issues with the excess queue.

There are no other issues with the anticipated queuing in the study area.

An analysis was completed for left turn movements at the Welham Road / Saunders Road intersection, based on the criteria outlined in Appendix 9A of the MTO DS. Based on the above noted criteria, left-turn lanes are not warranted at the Welham Road / Saunders Road intersection (results provided in **Appendix H**).

A review of the need for additional auxiliary right turn lanes was completed at the unsignalized intersections in the study area. The results of the Synchro analysis indicate that there is excess capacity for all movements at the intersection; consequently, additional auxiliary right turn lanes are not recommended.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the unsignalized intersections in the study area (results are provided in **Appendix I**).

No additional improvements are required for the background (2031) scenario with post-2031 infrastructure improvements.

4 Proposed Development Traffic Generation and Assignment

4.1 Traffic Generation

The traffic generation for the proposed development has been based on the ITE Trip Generation Manual. The following ITE land uses have been applied to estimate the traffic from the proposed development:

- ITE lane use 110 (General Light Industrial) - General Urban / Suburban Setting
- ITE lane use 140 (Manufacturing) - General Urban / Suburban Setting

The estimated trip generation of the proposed development is illustrated below in **Table 11**. The AM and PM peak traffic generation for the proposed development is not expected to exactly align with the AM and PM peak hour in the traffic counts; consequently, we have applied the peak hour of adjacent street traffic values provided in the ITE Trip Generation Manual.

Table 11 – Estimated Traffic Generation for the Proposed Development

Horizon Year	Land Use	Size	AM Peak Hour			PM Peak Hour		
			IN	OUT	TOTAL	IN	OUT	TOTAL
2025 (Ram Iron Block Build-out)	Manufacturing ITE Land Use: 140	153,761 sq.ft.	73	22	95	32	71	103
2031 (Full Build-Out)	General Light Industrial ITE Land Use: 110	16.73 hectares (450,201 sq.ft.)*	278	38	316	37	247	284
TOTAL TRAFFIC GENERATION (2031)			351	60	411	69	318	387

* The analysis was based on a previous version of the Site Plan that had a higher lot area for the light industrial land use 18.15 hectares. A 25% lot coverage of the proposed development industrial lot area (18.15 hectares) was assumed. The 25% lot coverage is consistent with City's Draft Municipal Comprehensive Review Long-Term Urban Land Needs Study (2019) and the target job density of 35 jobs per hectare for new employment lands in the City.

In order to be conservative, no transportation modal split reduction has been applied to the above-noted traffic generation calculation.

4.2 Traffic Assignment

For the purposes of this study, it has been assumed that all traffic generated by the proposed development will be new traffic and would not be in the study area if the development was not constructed. It is noted, the methodology applied to determine the background (2031) traffic volumes utilized the 2031 scenario in the City's 2019 Emme Model; however, based on our review, the City's 2019 Emme Model did not specifically account for the traffic generated by the proposed development. Consequently, we have added the additional traffic to the entire study area.

The ITE data provides the anticipated percentage of new traffic entering and exiting during the peak hour. The distribution of traffic has been calculated based on the 2016 TTS data for traffic zone 8590, retrieved using the TTS IDRS (output attached as **Appendix J**). TTS data provides historical origin and destination work trip percentages for specific areas within the City and southern Ontario.

Traffic distribution for the trips generated by the proposed development during the AM and PM peak hour is expected to generally follow commuter travel patterns. Our analysis is based on egress traffic during the AM peak hour. Logically, the distribution of ingress traffic will follow the inverse of the exiting traffic distribution. For each of the individual areas identified in the TTS data, we have selected the probable route of travel, assuming people will select their route primarily based on travel time. Assumptions for the route of travel were based on the anticipated infrastructure improvements to be built-out in and near the study area by 2031.

The distribution of traffic for the proposed development to the external road network has been based on the proposed parking layout.

The distribution of trips is illustrated in **Table 12** using the methodology outlined above.

Table 12 – Industrial Development Traffic Distribution

Travel Direction (to / from)	Percentage of Total Traffic Generation
West via Mapleview Drive East	55%
East via Mapleview Drive East	2%
East via Lockhart Road	4%
West via Lockhart Road-Salem Road	8%
North via Huronia Road	4%
South via Huronia Road	18%
North via Bayview Drive	8%
North via Welham Road	3%
TOTAL	100%

Figure 8 and **9** illustrates the traffic assignment for the proposed development for the Ram Iron block build-out (2025) and full build-out (2031) respectively, in the AM and PM peak hour.

Figure 8 – Proposed Development Traffic Assignment (2025)

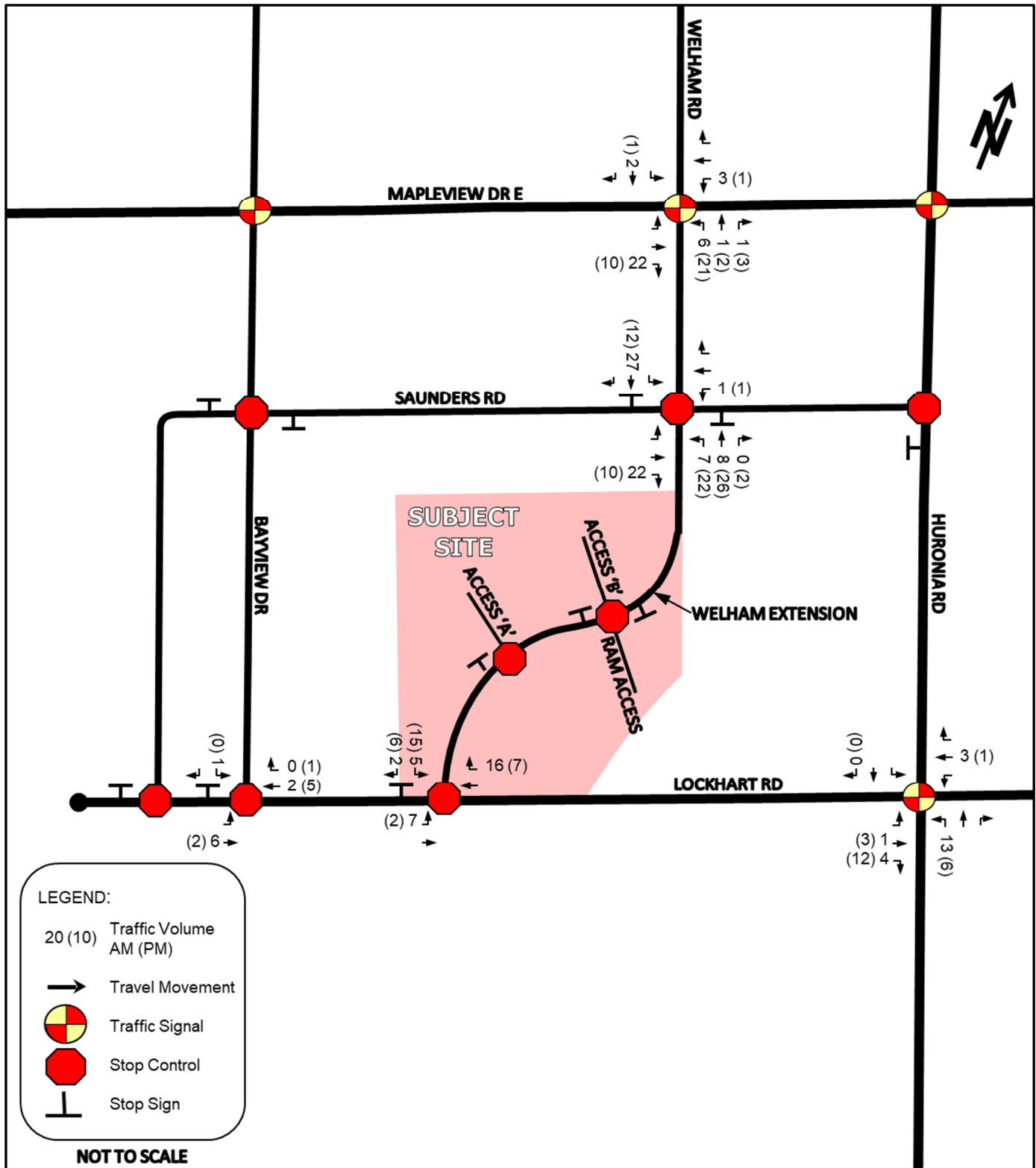
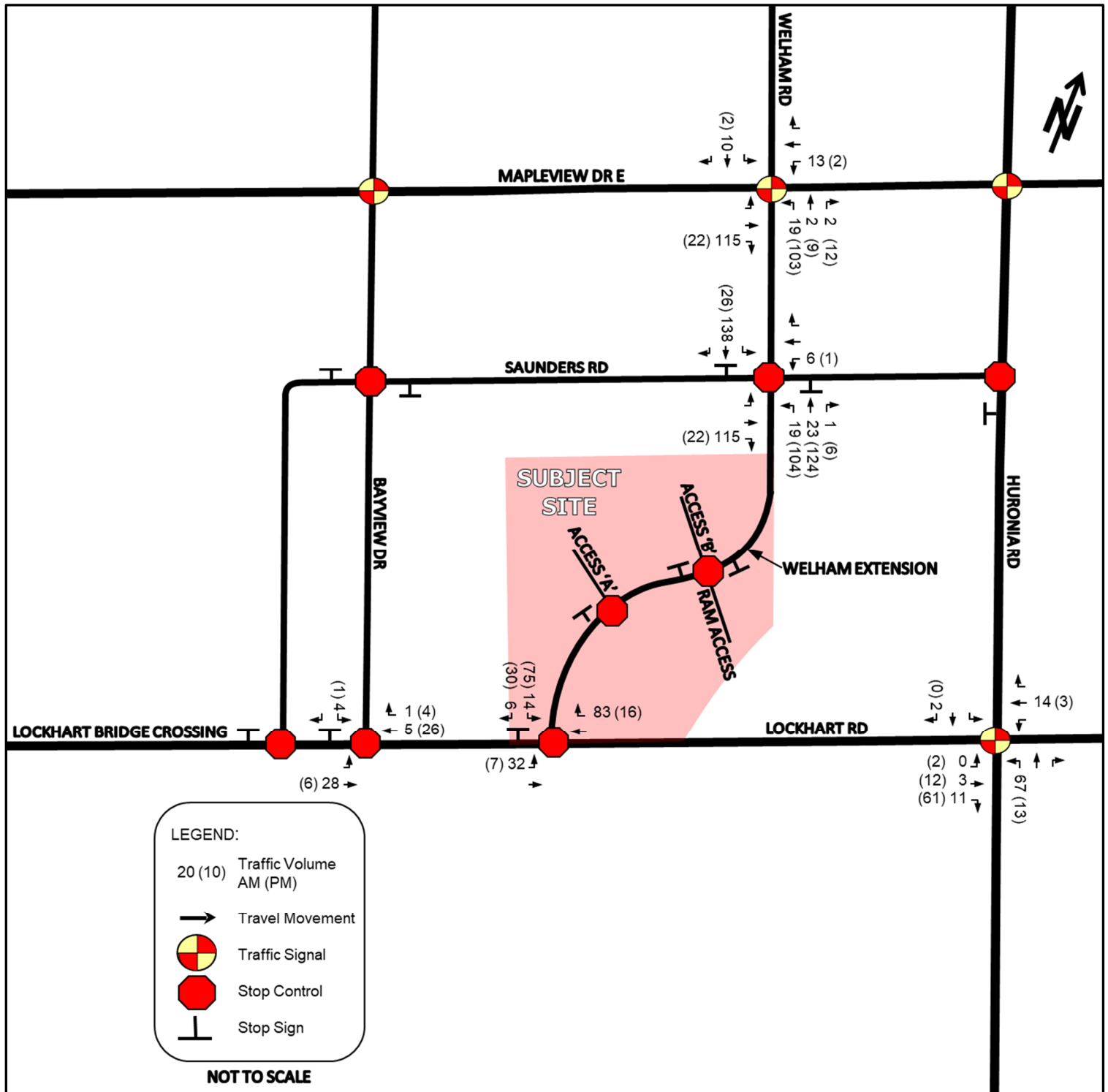


Figure 9 – Proposed Development Traffic Assignment (2031)



4.3 Total Horizon Year Traffic Volumes with the Proposed Development

For the total (2025 & 2031) horizon year traffic volumes, the proposed development traffic was added to the background (2025 & 2031) traffic volumes. The resulting total (2025 & 2031) horizon year traffic volumes for the AM and PM peak hour is illustrated in **Figures 10** and **11** respectively.

Figure 10 – Total (2025) Traffic Volumes

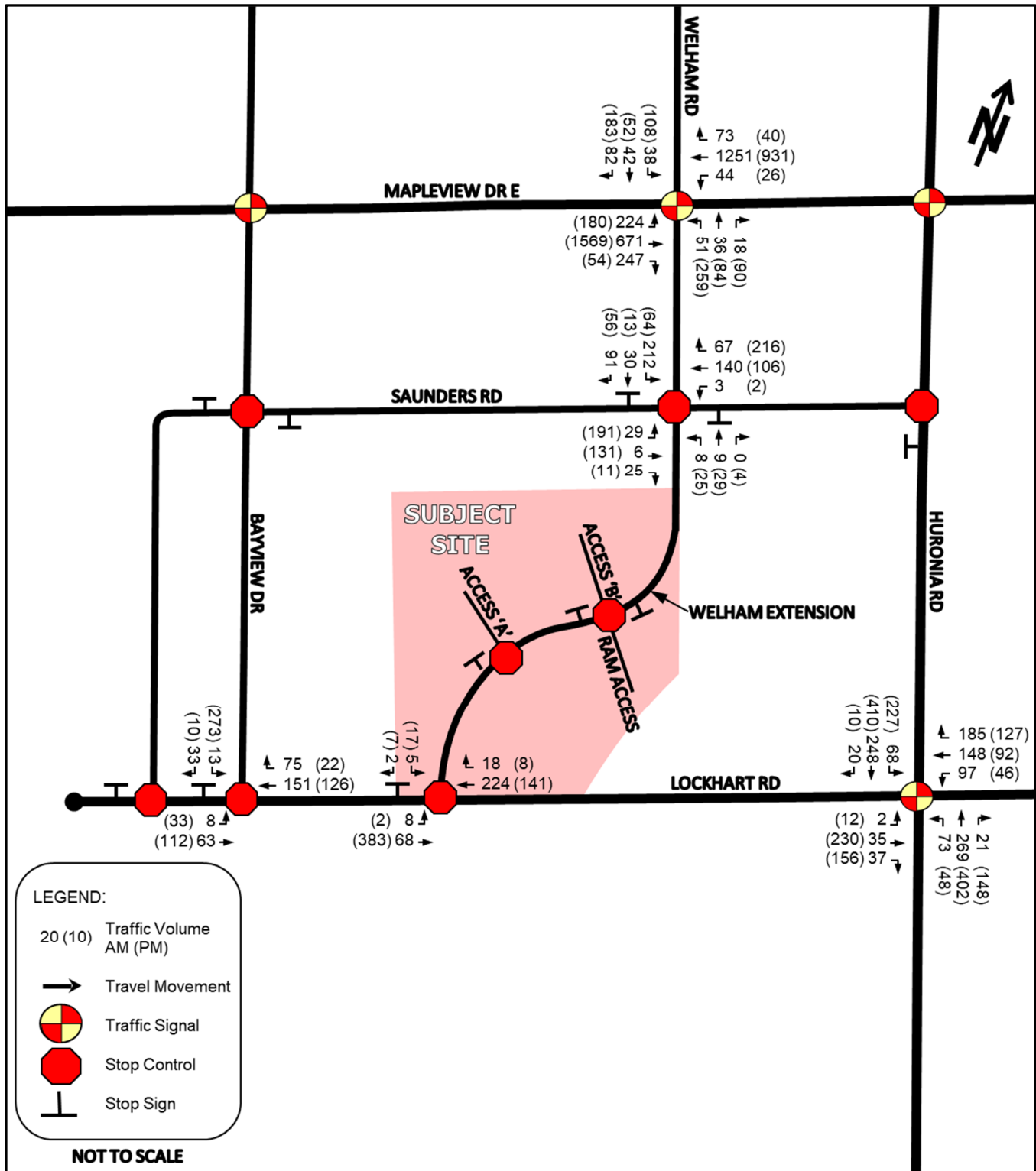
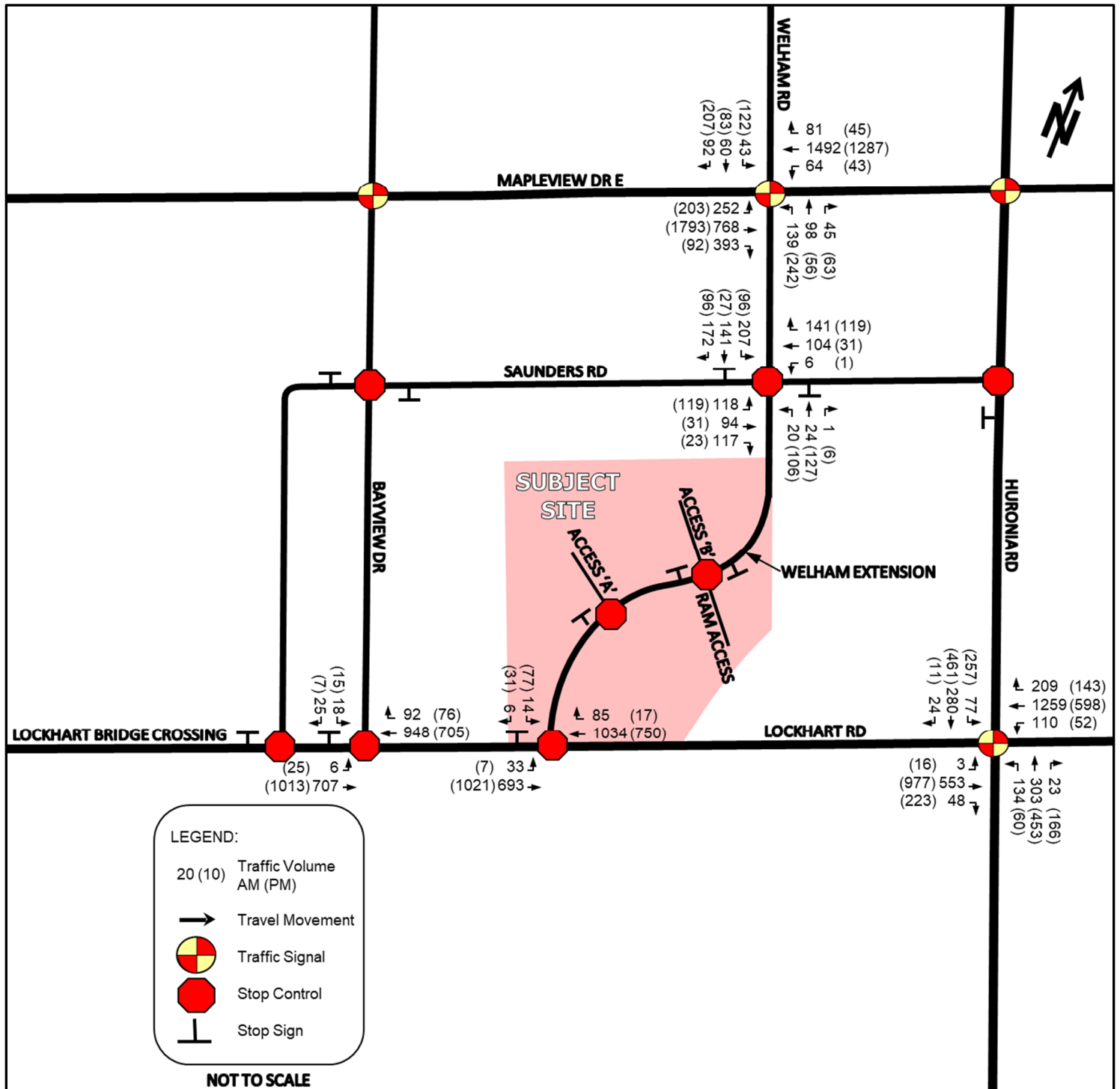


Figure 11 – Total (2031) Traffic Volumes



5 Intersection Operation with Proposed Development

5.1 Total (2025) Intersection Operation

The results of the LOS analysis under total (2025) traffic volumes during the AM and PM peak hours can be found below in **Table 13**. The improvements at the Huronia Road / Lockhart Road intersection noted in Section 2.2 and signal timing and intersection improvements noted in Section 3.2 and 3.3, have been utilized in this scenario.

Detailed output of the Synchro analysis can be found in **Appendix E**.

Table 13 – Total (2025) LOS

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.75	17.4	B	-	-	0.80	33.1	C	-	-
EBL	0.80	24.3	C	51	80	0.73	25.8	C	58	80
EBTR	0.30	10.6	B	-	-	0.70	27.0	C	-	-
WBL	0.13	8.3	A	9	60	0.29	22.3	C	10	60
WBTR	0.45	14.2	B	-	-	0.46	25.3	C	-	-
NBL	0.31	46.7	D	24	48	0.84	54.2	D	96	48
NBTR	0.25	52.3	D	-	-	0.41	45.5	D	-	-
SBL	0.17	46.6	D	18	42	0.43	48.4	D	39	42
SBTR	0.52	57.0	E	-	-	0.79	75.0	E	-	-
Huronia Road / Lockhart Road (signalized)	0.49	17.6	B	-	-	0.84	22.5	C	-	-
EBL	0.02	19.6	B	2	-	0.06	20.0	B	6	-
EBTR	0.14	20.3	C	-	-	0.84	38.4	D	-	-
WBL	0.35	22.0	C	24	-	0.46	25.2	C	18	-
WBTR	0.76	31.9	C	-	-	0.42	22.8	C	-	-
NBL	0.17	8.9	A	16	-	0.16	9.4	A	11	-
NBTR	0.35	10.2	B	-	-	0.63	14.8	B	-	-
SBL	0.16	8.9	A	15	-	0.83	36.3	D	78	-
SBTR	0.34	10.1	A	-	-	0.47	11.9	B	-	-
Bayview Drive / Lockhart Road (unsignalized)	-	1.5	A	-	-	-	8.2	A	-	-
SB	0.06	9.9	A	2	-	0.48	15.6	C	21	-
Welham Road / Saunders Road (unsignalized)	-	10.7	A	-	-	-	11.9	B	-	-
EB	0.09	8.6	A	1	-	0.51	13.4	B	3	-
WB	0.30	9.9	A	2	-	0.46	11.5	B	18	-
NB	0.03	8.6	A	8	-	0.11	9.7	A	15	-
SB	0.47	11.8	B	15	-	0.23	10.3	B	6	-
Welham Road / Saunders Road (unsignalized)	-	0.4	A	-	-	-	0.5	A	-	-
SB	0.01	10.3	B	1	-	0.05	11.8	B	2	-

The results of the LOS analysis indicate that all intersections in the study area operate within the typical design limits noted in Section 3.1.

The anticipated queue for northbound left movements at the Welham Road / Maplevue Drive East intersection will extend past the existing storage length; however, the proposed signal timing includes a northbound protected left-turn phase, which will clear the queue in this lane. Consequently, the additional left-turn queue will not impact northbound through movements at this intersection.

There are no other issues with the anticipated queuing in the study area.

An analysis was completed for left turn movements at the unsignalized intersections in the study area, based on the criteria outlined in Appendix 9A of the MTO DS. Based on the above noted criteria, a left turn lane is warranted in the eastbound direction of the Welham Road / Saunders Road intersection (results provided in **Appendix H**). Based on our review of the local traffic volume, surrounding development and considering a left turn is not warranted in the background (2031) scenario⁴, a left turn lane is not recommended.

Based on the above noted criteria left-turn lanes are not warranted any other unsignalized intersections in the study area (results provided in **Appendix H**).

A review of the need for additional auxiliary right turn lanes was completed at the unsignalized intersections in the study area. The results of the Synchro analysis indicate that there is excess capacity for all movements at the intersection; consequently, additional auxiliary right turn lanes are not recommended.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the unsignalized intersections in the study area (results are provided in **Appendix I**).

No additional improvements are recommended for the background (2025) scenario.

5.2 Total (2031) Intersection Operation

As noted in Section 3.3, we have assessed the 2031 scenarios with and without the post-2031 road improvements. It is noted, we have assumed the Lockhart Bridge Crossing and Welham Extension to be constructed by 2031 in both scenarios.

5.2.1 Without Post-2031 Road Improvements

The results of the LOS analysis under total (2031) traffic volumes without post-2031 road improvements during the AM and PM peak hours can be found below in **Table 14**. The infrastructure improvements noted in Section 2.2 and 3.3 and signal timing improvements noted in Section 3.4.1 have been utilized in this scenario.

As noted in Section 2.2, auxiliary left turn lanes are planned at all legs of the Huronia Road / Lockhart Road intersection. Since details regarding the geometric lane design of left turn lanes are yet to be planned, we have assumed no storage and deceleration lane length for the left turn lanes to illustrate the anticipated queuing for these improvements without the limitations of the geometric design.

Detailed output of the Synchro analysis can be found in **Appendix G**.

Table 14 – Total (2031) LOS without Post-2031 Infrastructure Improvements

Location (N-S Street / E- W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.81	28.3	C	-	-	0.93	44.0	D	-	-
EBL	0.80	48.2	D	87	80	0.88	68.3	E	96	80
EBTR	0.42	15.1	B	-	-	0.85	35.6	D	-	-
WBL	0.27	15.8	B	13	60	0.40	30.3	C	13	60
WBTR	0.68	27.7	C	-	-	0.72	37.6	D	-	-
NBL	0.67	50.3	D	54	48	0.91	72.2	E	115	48
NBTR	0.55	52.4	D	-	-	0.24	43.4	D	-	-
SBL	0.17	44.4	D	20	42	0.40	45.5	D	46	42
SBTR	0.63	60.0	E	-	-	0.91	89.0	F	-	-
Huronia Road / Lockhart Road (signalized)	1.42	178.9	F	-	-	1.75	243.5	F	-	-
EBL	0.12	14.2	B	3	-	0.45	39.5	D	17	-
EBTR	0.77	25.7	C	-	-	1.90	453.5	F	-	-
WBL	0.53	18.9	B	39	-	1.26	260.4	F	54	-
WBTR	1.63	318.6	F	-	-	1.32	200.0	F	-	-
NBL	1.01	123.9	F	89	-	0.28	23.8	C	24	-
NBTR	0.71	53.3	D	-	-	0.77	35.5	D	-	-
SBL	0.67	67.6	E	45	-	1.64	348.6	F	133	-
SBTR	0.69	52.8	D	-	-	0.57	27.5	C	-	-
Bayview Drive / Lockhart Road (unsignalized)	-	1.2	C	-	-	-	1.3	E	-	-
SB	0.35	46.2	E	12	-	0.26	56.9	F	8	-
Welham Road / Saunders Road (unsignalized)	-	33.4	D	-	-	-	10.3	A	-	-
EB	0.64	19.9	C	2	-	0.29	10.9	B	5	-
WB	0.49	15.4	C	2	-	0.23	9.7	A	6	-
NBL	0.05	10.6	B	27	TWLTL	0.20	9.7	A	8	TWLTL
NBTR	0.06	10.5	B	16	-	0.23	9.3	A	6	-
SB	0.96	52.6	F	77	-	0.35	11.1	B	15	-
Welham Extension / Lockhart Road (unsignalized)	-	1.3	D	-	-	-	11.4	C	-	-
SB	0.23	79.0	F	7	-	1.19	271.4	F	53	-

The results of the LOS analysis indicate that the Welham Road / Mapleview Drive East and Huronia Road / Lockhart Road intersections are operating outside the typical design limits noted in Section 3.1.

The results of the LOS analysis indicate that the side street traffic operations at the unsignalized intersections in the study area are operating outside the typical design limits noted in Section 3.1.

It is recommended the City accelerate the construction of the post-2031 transportation improvements in the study to be completed by the 2031, in anticipation of the total (2031) traffic volumes.

5.2.2 With Post-2031 Road Improvements

The results of the LOS analysis under total (2031) traffic volumes with post-2031 road improvements during the AM and PM peak hours can be found below in **Table 15**. The infrastructure improvements

noted in Section 2.2, 3.3 and 3.4.2 and signal timing improvements noted in Section 3.3.2 have been utilized in this scenario.

Detailed output of the Synchro analysis can be found in **Appendix G**.

Table 15 – Total (2031) LOS with Post-2031 Infrastructure Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.81	28.3	C	-	-	0.93	44.0	D	-	-
EBL	0.80	48.2	D	87	80	0.88	68.3	E	96	80
EBTR	0.42	15.1	B	-	-	0.85	35.6	D	-	-
WBL	0.27	15.8	B	13	60	0.40	30.5	C	13	60
WBTR	0.68	27.7	C	-	-	0.72	37.6	D	-	-
NBL	0.67	50.3	D	54	TWLTL	0.91	72.2	E	115	TWLTL
NBTR	0.55	52.4	D	-	-	0.24	43.4	D	-	-
SBL	0.17	44.4	D	20	TWLTL	0.40	45.5	D	46	TWLTL
SBTR	0.63	60.0	E	-	-	0.91	89.0	F	-	-
Huronia Road / Lockhart Road (signalized)	0.76	29.5	C	-	-	0.92	41.8	D	-	-
EBL	0.10	18.1	B	3	TWLTL	0.09	30.7	C	11	TWLTL
EBT	0.45	21.0	C	-	-	0.92	54.8	D	-	-
EBR	0.05	16.5	B	6	50	0.33	33.7	C	55	50
WBL	0.45	21.9	C	37	TWLTL	0.50	34.8	C	20	TWLTL
WBT	0.87	33.5	C	-	-	0.54	31.1	C	-	-
WBR	0.30	19.2	B	41	20	0.20	26.0	C	35	20
NBL	0.56	31.4	D	45	TWLTL	0.30	34.6	C	30	TWLTL
NBT	0.50	29.4	C	-	-	0.84	52.4	D	-	-
NBR	0.02	23.4	C	7	30	0.26	33.7	C	45	30
SBL	0.34	34.5	C	36	TWLTL	0.90	54.5	E	105	TWLTL
SBTR	0.61	39.2	D	-	-	0.57	25.3	C	-	-
SBR	0.02	30.4	C	2	20	0.01	17.7	B	0	20
Bayview Drive / Lockhart Road (unsignalized)	-	0.4	A	-	-	-	0.3	A	-	-
SBL	0.07	19.5	C	2	TWLTL	0.05	16.7	C	2	TWLTL
SBR	0.06	13.2	B	-	-	0.01	11.3	B	-	-
Welham Road / Saunders Road (unsignalized)	-	15.3	B	-	-	-	9.7	A	-	-
EB	0.59	16.9	C	2	-	0.29	10.8	B	5	-
WB	0.45	13.5	B	2	-	0.23	9.6	A	6	-
NBL	0.05	10.2	B	23	TWLTL	0.20	9.8	A	8	TWLTL
NBTR	0.06	10.1	B	14	-	0.23	9.4	A	6	-
SBL	0.44	14.2	C	14	TWLTL	0.19	9.7	A	5	TWLTL
SBTR	0.59	16.6	C	24	-	0.20	8.5	A	5	-
Welham Extension / Lockhart Road (unsignalized)	-	0.4	A	-	-	-	1.0	A	-	-
SBL	0.06	20.3	C	2	TWLTL	0.26	19.7	C	8	TWLTL
SBR	0.01	12.8	B	-	-	0.06	11.5	B	-	-

The results of the LOS analysis indicate that the delay for southbound thru-right movements at the Welham Road / Mapleview Drive East intersection is operating outside the typical design limits noted in Section 3.1. It is recommended the City review the option to include a southbound right turn lane with a 35 metre storage and 50 metre taper length as part of the 2031 capital works at this intersection.

The results of the LOS analysis with the above noted improvements can be found below in **Table 16**. Detailed output of the Synchro analysis can be found in **Appendix G**.

Table 16 – Total (2031) LOS with Post-2031 and Recommended Infrastructure Improvements

Location (N-S Street / E-W Street)	Weekday AM Peak Hour					Weekday PM Peak Hour				
	V/C	Delay (s)	LOS	95% Queue (m)		V/C	Delay (s)	LOS	95% Queue (m)	
				Model	Storage				Model	Storage
Welham Road / Mapleview Drive East (signalized)	0.78	27.1	C	-	-	0.82	32.1	D	-	-
EBL	0.80	46.5	D	85	79	0.77	42.1	D	75	79
EBTR	0.43	14.8	B	-	-	0.76	25.0	D	-	-
WBL	0.29	15.5	B	13	60	0.38	22.1	C	11	60
WBTR	0.67	27.0	C	-	-	0.65	28.6	C	-	-
NBL	0.57	45.2	D	54	TWLT	0.78	50.8	D	101	TWLT
NBTR	0.58	53.6	D	-	-	0.36	48.2	D	-	-
SBL	0.18	44.7	D	20	TWLT	0.55	51.3	D	46	TWLT
SBT	0.32	51.7	D	-	-	0.56	60.6	E	-	-
SBR	0.08	49.5	D	17	35	0.19	55.2	E	26	35

The results of the LOS analysis indicate that the Huronia Road / Lockhart Road intersection is operating marginally outside the typical design limits as noted in Section 3.1; however, since there are no issues regarding the anticipated queueing and the delay for all movements are within typical design limits, no further improvements are recommended.

The results of the LOS analysis indicate that all other intersections in the study area is operating within the typical design limits noted in Section 3.1.

The anticipated queue for the highlighted auxiliary turning movements will extend past the existing storage length; however, the excess queue can be accommodated by the taper length consequently there are no issues with the excess queue.

There are no other issues with the anticipated queueing in the study area.

A review of the need for additional auxiliary right turn lanes was completed at the unsignalized intersections in the study area. The results of the Synchro analysis indicate that there is excess capacity for all movements at the intersection; consequently, additional auxiliary right turn lanes are not recommended.

Based on the Ontario Traffic Manual Book 12 *Signal Justification*, traffic signals are not warranted at the unsignalized intersections in the study area (results are provided in **Appendix I**).

No additional improvements are required for the total (2031) scenario with post-2031 infrastructure improvements.

5.3 Site Access

Given the anticipated volume of traffic on the Welham Extension, it is anticipated that Access 'A', Access 'B' and Ram Access will operate efficiently as full-movement access driveways, with stop control for egress movements. The traffic operation at each access will need to be reviewed once the specific development has been identified.

The proposed spacing between Access 'A' and Lockhart Road (355 metres – measured edge of driveway to edge of roadway) and Access 'B' – Ram Access and Saunders Road (408 metres – measured edge of driveway to edge of roadway) is greater than the minimum intersection spacing along

a collector road, as identified in the Transportation Association of Canada Design Guide for Canadian Roads (2017) [TAC Guidelines] Section 9.4.2.2 (60 metres).

The proposed spacing between Access 'A' and Access 'B' – Ram Access (215 metres - measured edge to edge of driveway) is greater than the minimum intersection spacing requirements along a collector road, as identified in the TAC Guidelines Section 9.4.2.2 (60 metres).

Consequently, there are no issues with the location of the proposed Access 'A', Access 'B' and Ram Access driveways.

5.4 Sight Distance Review

A review of the available sight distance will be required for the Access 'A', Access 'B', Access 'C' and Access 'D' intersections, once the specific locations are confirmed.

The sight distance for the Ram Access is greater than 200 metres in both directions, which is greater than the minimum stopping and intersection sight distance requirements as identified in the TAC Guidelines for a design speed of 60 km/h (85 metres and 130 metres respectively).

The sight distance north and south of Access A is greater than 200 metres in both directions, which is greater than the minimum stopping and intersection sight distance requirements as identified in the TAC Guidelines for a design speed of 60 km/h (85 metres and 130 metres respectively).

The sight distance south of Access B is greater than 200 metres, which is greater than the minimum stopping and intersection sight distance requirements as identified in the TAC Guidelines for a design speed of 60 km/h (85 metres and 130 metres respectively).

The sight distance north of Access B is 115 metres, which is greater than the minimum stopping requirements as identified in the TAC Guidelines for a design speed of 60 km/h (85 metres) and slightly less than the intersection sight distance requirements for a design speed of 60 km/h (130 metres). The sight distance for this direction should be reviewed again once the specifics of the development are known for this area.

The sight distance east at the Welham Extension / Lockhart Road intersection is 162 metres and 173 metres, which is greater than the minimum stopping and intersection sight distance requirements as identified in the TAC Guidelines for a design speed of 80 km/h (130 metres and 145 metres respectively).

The sight distance west at the Welham Extension / Lockhart Road intersection is 173 metres, which is greater than the minimum stopping and intersection sight distance requirements as identified in the TAC Guidelines for a design speed of 80 km/h (130 metres and 170 metres respectively).

5.5 Active Transportation Review

There is currently no dedicated cycling infrastructure to the proposed development. Huronia Road, in the study area, is part of The Great Trail (formerly the Trans Canada Trail) trail system which stretches across Canada. The Great Trail provides connections to key destinations within the City of Barrie including the downtown, Allandale Waterfront GO Station, waterfront parks, commercial areas and residential areas. Cyclists from the subject site would be required to share the existing road network with all other users.

As noted in Section 2.2, a number of dedicated bicycle infrastructure is planned in the study area. The cycling network will connect to the existing and proposed major active transportation pathways on Maplevue Drive, Bayview Drive, Huronia Road, Lockhart Road and Huronia Road. As noted in Section

5.1 the proposed road network is approaching design capacity in 2031, based on the existing transportation modal split. It is recommended that the City continue to prioritize active transportation along these corridors, in order to provide the necessary transportation network capacity to accommodate the anticipated future transportation demands in the study area.

Also noted in Section 2.2, sidewalks are planned along the roadways in the study area. With these improvements the proposed development will connect into the sidewalk network on the adjacent streets and provide pedestrian access throughout the City.

6 Summary

2640085 Ontario Inc. retained **JD Engineering** to prepare this traffic impact study in support of the proposed development a site municipally known as 140 Lockhart Road located on the north side of Lockhart Road midblock between Bayview Drive and Rawson Avenue, in the City of Barrie [City]. The proposed Site Plan is shown in **Appendix A**. This chapter summarizes the conclusions and recommendations from the study.

The proposed industrial subdivision (28.21 hectare industrial lot area) will include 16.73 hectares of light industrial use and the Ram Iron block which will include a manufacturing facility (153,761 sq.ft. of GFA).

1. Full build-out of the proposed development (2031) is expected to generate 411 AM and 387 PM new peak hour trips in the study area. The build-out of the Ram Iron block in the proposed development (2025) is expected to generate 95 AM and 103 PM new peak hour trips
2. Background traffic and pedestrian counts were obtained from the City at the Welham Road / Mapleview Drive East intersection, completed on Tuesday, December 4th 2018, and at the Huronia Road / Lockhart Road, completed on Wednesday, October 21st, 2015.
3. An intersection operational analysis was completed at the study area intersections, using the existing (2020) and background (2031) traffic volumes, without the proposed development traffic. The background (2031) scenario were assessed with and without the post-2031 infrastructure improvements. This enabled a review of existing and future traffic deficiencies that would be present without the influence of the proposed development. The following improvements were recommended in the study area:

Welham Road / Mapleview Drive East

Existing (2020) traffic volumes

- Signal timing optimization

Background (2031) traffic volumes

- Signal timing optimization

Huronia Road / Lockhart Road

Existing (2020) traffic volumes

- Signal timing optimization

Background (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Huronia Road and Lockhart Road be constructed by this time.

- Right turn lane be constructed at the eastbound, westbound and northbound directions as part of the post-2031 infrastructure improvements with the following dimension:
 - o Eastbound right turn lane with a 50 metre storage and 70 metre taper length.
 - o Westbound right turn lane with a 20 metre storage and 70 metre taper length.
 - o Northbound right turn lane with a 30 metre storage and 70 metre taper length.
 - o Southbound right turn lane with a 20 metre storage and 70 metre taper length.

Bayview Drive / Lockhart Road and Welham Extension / Lockhart Road

Background (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Lockhart Road and Bayview Drive be constructed by this time.

Welham Road / Saunders Road

Total (2025) traffic volumes

- Construct intersection from a two-way stop to an all-way stop traffic controlled intersection.
4. An estimate of the amount of traffic that would be generated by the Subject Site was prepared and assigned to the study area streets and intersections.
 5. An intersection operation analysis was completed under total (2031) traffic volumes with the proposed development operational at the study area intersections. The total (2031) scenario were assessed with and without the post-2031 infrastructure improvements. The following improvements are recommended:

Welham Road / Maplevue Drive East

Total (2031) traffic volumes

- The post-2031 infrastructure improvements planned on Welham Road be constructed by this time.
- A southbound right turn lane be constructed as part of the post-2031 infrastructure improvements with a 35 metre storage and 50 metre taper length.

Welham Road / Saunders Road

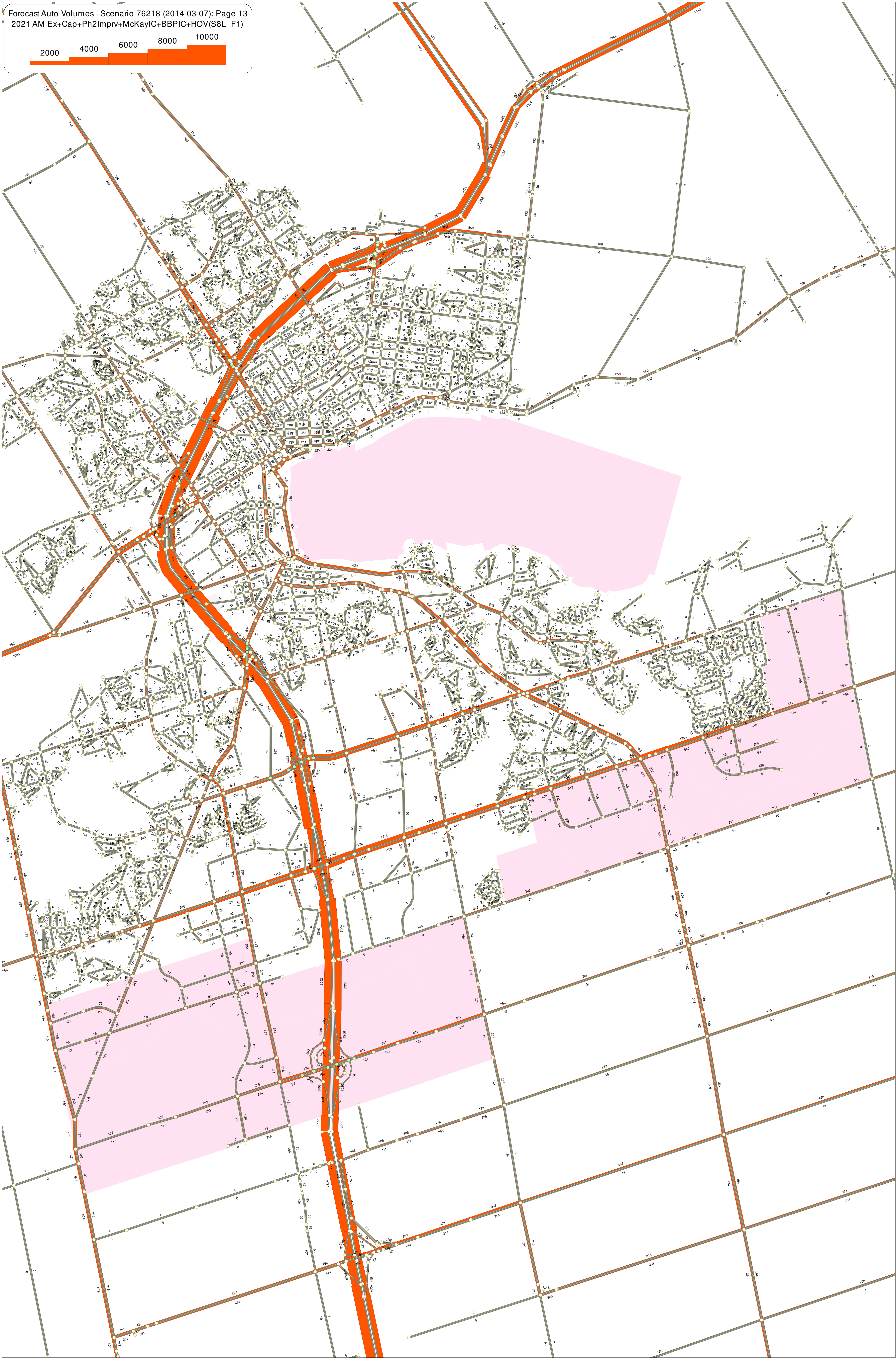
Total (2031) traffic volumes

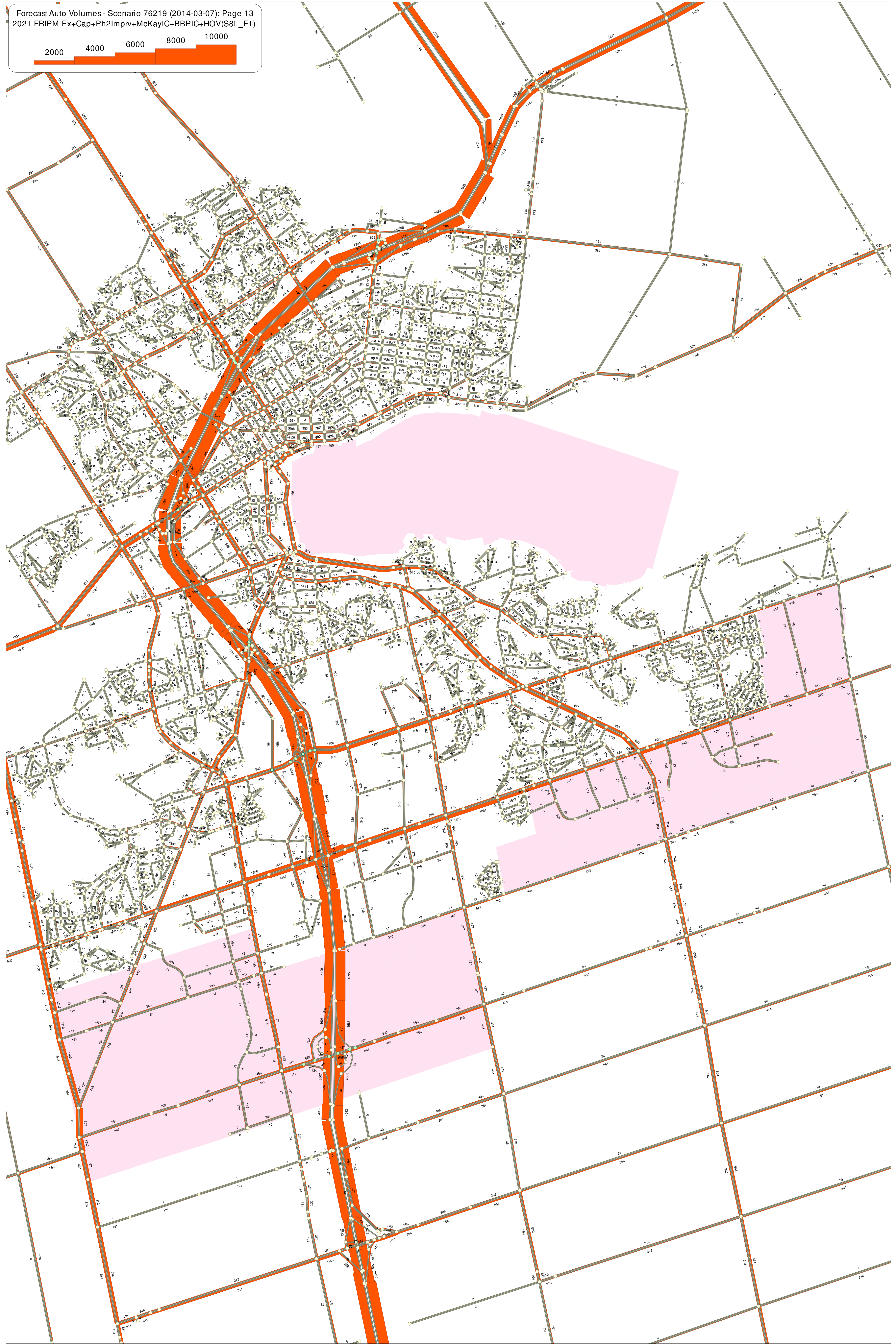
- The post-2031 infrastructure improvements planned on Welham Road be constructed by this time.
6. Access 'A', Access 'B' and Ram Access will operate as a full-movement access, with one-way stop control for southbound movements at Access 'A' and two-way stop control for northbound and southbound movements at Access 'B' and Ram Access. A single ingress and egress lane at the Access 'A', Access 'B' and Ram Access access driveways will provide the necessary capacity to service the proposed development. The planned Welham Extension will include the construction of a TWLTL on Welham Road at the access driveways.
 7. In summary, the proposed development will not cause any operational issues and will not add significant delay or congestion to the local roadway network.

Appendix A – Site Plan



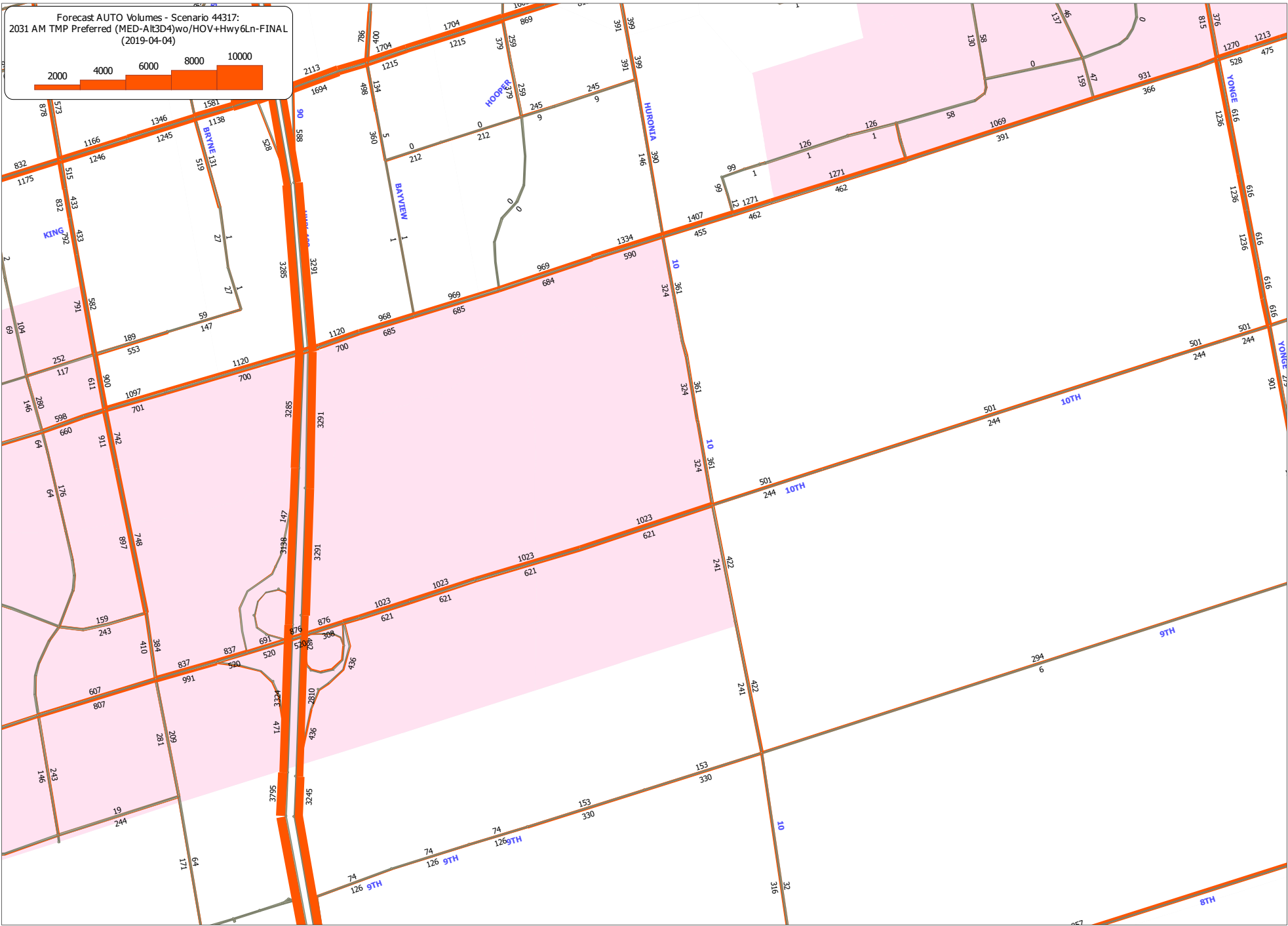
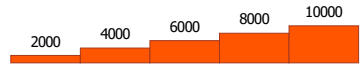
Appendix B – City of Barrie's 2013 Emme Models

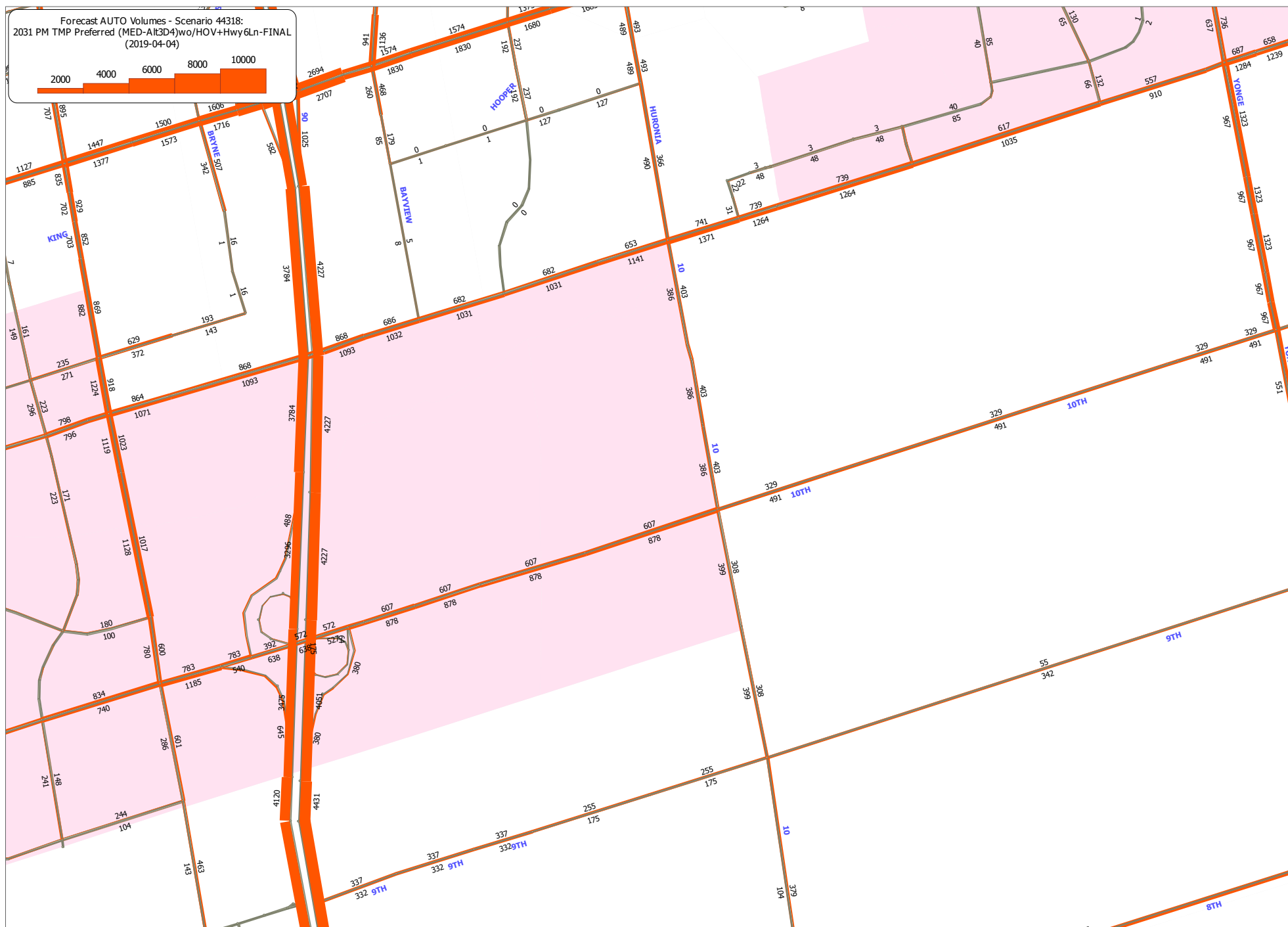




Appendix C – City of Barrie's 2019 Emme Models

Forecast AUTO Volumes - Scenario 44317:
2031 AM TMP Preferred (MED-Alt3D4)wo/HOV+Hwy6Ln-FINAL
(2019-04-04)





Appendix D – Traffic Count Data

Trans-Plan Transportation Inc.

Site ID Code:
Intersection Location:
Municipality:
Count Date:
Weather and Temperature:
Surveyor:

Mapleview Drive at Welham Road
Barrie, Ontario
Tuesday, December 4, 2018
Overcast, -5 Degrees
TP

AM	NORTH APPROACH										Total	EAST APPROACH										Total	SOUTH APPROACH										Total	WEST APPROACH										Total	Grand Total						
	CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds		CAR			TRUCKS			CYCLISTS			Peds																			
	L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R			L	T	R	L	T	R	L	T	R																				
7:00	3	5	5	1	3	3	0	0	0	0	20	8	175	3	0	1	0	0	0	0	0	187	5	1	2	5	0	5	0	0	0	0	18	13	86	34	0	11	1	0	0	0	0	145	370						
7:15	2	8	22	1	0	4	0	0	0	0	37	6	218	13	0	8	0	0	0	0	0	245	3	4	0	1	1	1	0	0	0	1	11	43	92	38	2	14	0	0	0	0	0	189	482						
7:30	4	9	17	0	2	1	0	0	0	0	33	5	257	19	0	9	1	0	0	0	0	291	4	5	0	4	3	1	0	0	0	0	17	55	118	58	1	4	2	0	0	0	0	238	579						
7:45	6	10	17	1	1	4	0	0	0	0	39	15	280	28	1	10	0	0	0	0	0	334	7	4	3	1	2	0	0	0	0	0	17	63	131	90	8	4	2	0	0	0	0	298	688						
8:00	8	2	18	0	1	5	0	0	0	0	34	10	250	8	0	5	0	0	0	0	0	273	7	6	4	2	1	1	0	0	0	0	21	42	150	38	3	8	0	0	0	0	0	241	569						
8:15	9	12	8	0	0	4	0	0	0	0	33	4	226	17	0	6	0	0	0	0	1	254	9	5	3	2	1	0	0	0	0	0	20	40	139	35	4	9	1	0	0	0	0	228	535						
8:30	9	7	11	0	2	4	0	0	0	0	33	5	303	10	1	6	0	0	0	0	0	325	9	9	3	2	3	0	0	0	0	0	26	32	137	27	3	5	3	0	0	0	0	207	591						
8:45	4	7	9	0	2	8	0	0	0	0	30	6	242	16	4	11	0	0	0	0	0	279	5	4	1	3	1	0	0	0	0	0	14	37	182	32	6	10	1	0	0	0	0	268	591						
9:00	1	10	16	0	3	9	0	0	0	0	39	4	252	8	7	13	0	0	0	0	0	284	6	6	4	4	0	1	0	0	0	0	21	31	134	28	7	12	2	0	0	0	0	214	558						
9:15	10	9	29	1	0	5	0	0	0	0	54	4	244	11	1	8	0	0	0	0	0	268	6	5	4	2	3	0	0	0	0	0	20	30	118	22	3	6	0	0	0	0	0	179	521						
MD																																																			
11:00	11	5	15	1	2	9	0	0	0	0	43	0	198	6	1	5	1	0	0	0	0	211	10	5	2	2	0	0	0	0	0	0	19	23	211	13	9	6	1	0	0	0	0	0	263	536					
11:15	9	6	22	1	2	5	0	0	0	0	45	4	194	7	1	7	0	0	0	0	0	213	10	1	1	7	3	0	0	0	0	1	23	21	171	14	2	8	4	0	0	0	0	0	220	501					
11:30	4	8	22	1	1	6	0	0	0	0	42	3	180	2	0	4	1	0	0	0	0	190	14	8	3	3	1	1	0	0	0	1	31	21	161	16	6	12	4	0	0	0	0	0	220	483					
11:45	12	8	25	0	1	3	0	0	0	0	49	5	222	7	0	9	0	0	0	0	0	243	13	4	8	2	0	1	0	0	0	0	28	21	188	20	5	6	1	0	0	0	0	0	241	561					
12:00	6	6	30	0	1	5	0	0	0	1	49	5	176	9	0	10	0	0	0	0	1	201	20	10	9	1	2	0	0	0	0	0	42	25	195	16	2	8	2	0	0	0	0	0	248	540					
12:15	6	10	14	0	3	2	0	0	0	0	35	5	149	6	1	7	1	0	0	0	0	169	14	8	4	4	3	0	0	0	0	0	33	31	177	32	0	6	1	0	0	0	0	0	247	484					
12:30	3	4	11	0	3	2	0	0	0	0	23	6	187	8	0	11	0	0	0	0	0	212	7	10	8	4	0	0	0	0	0	0	29	23	207	13	5	9	0	0	0	0	0	0	257	521					
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13:00	9	9	20	1	1	2	0	0	0	0	42	4	197	10	0	8	1	0	0	0	0	220	8	6	8	1	1	1	0	0	0	0	25	27	229	18	4	7	0	0	0	0	0	0	285	572					
13:15	9	12	22	0	2	4	0	0	0	1	50	2	175	5	0	8	0	0	0	0	0	190	6	3	5	3	2	1	0	0	0	0	20	25	206	19	5	4	1	0	0	0	0	0	260	520					
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PM																																																			
15:00	7	7	23	0	1	2	0	0	0	0	40	2	172	6	1	7	0	0	0	0	0	188	20	2	1	3	1	0	0	0	0	0	27	28	250	16	3	7	4	0	0	0	0	0	308	563					
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15:30	9	8	44	0	3	1	0	0	0	0	65	3	200	5	1	4	0	0	0	0	0	213	14	6	5	1	3	0	0	0	0	0	29	24	258	9	5	6	1	0	0	0	0	0	303	610					
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16:30	25	10	50	0	1	1	0	0	0	0	87	2	239	4	0	7	3	0	0	0	0	255	82	33	26	2	0	1	0	0	0	0	144	30	333	12	3	5	1	0	0	0	0	0	384	870					
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17:45	11	2	18	1	0	1	0	0	0	0	33	4	192	5	0	0	2	0	0	0	0	203	12	1	2	0	0	0	0	0	0	0	15	32	280	9	6	3	0	0	0	0	0	0	330	581					
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18:15	1	0	12	0	0	0	0	0	0	0	13	2	210	7	0	3	0	0	0	0	0	222	7	2	1	0	0	0	0	0	0	0	10	32	329	5	6	2	1	0	0	0	0	0	375	620					



Turning Movement Count Diagram

Intersection: Mapleview Drive at Welham Road

Municipality: Barrie, Ontario

Intersection ID:

Date: Tuesday, December 4, 2018

AM Peak Hour: 7:45 to 8:45

Welham Road												
North Total 428							East Total 1815					
North Entering 139		Cyclists	0	0	0	East Entering 1185						
North Receiving 289		Truck	17	4	1	East Receiving 630						
North Peds 0		Cars	54	31	32	East Peds 1						
			↙	↓	↘							
Mapleview Drive	0	18	177	↖	↖					63	0	0
	0	26	557	→	←					1059	27	0
	0	6	190	↘	↘					34	2	0
			↙	↑	↘							
West Total 2170				32	24	13	South Total 351					
West Entering 974				7	7	1	South Entering 84					
West Receiving 1196				0	0	0	South Receiving 267					
West Peds 0				South Peds 0								

MD Peak Hour: 12:30 to 13:30

Welham Road										
North Total 353						East Total 1777				
North Entering 162	Cyclists	0 0 0				East Entering 851				
North Receiving 191	Truck	9 6 2				East Receiving 926				
North Peds 1	Cars	79 34 32				East Peds 0				
			↙	↓	↘					
Mapleview Drive	0 20 105	↗				↖	35 1 0			
	0 22 842	→				←	766 34 0			
	0 3 65	↘				↙	15 0 0			
			↖	↑	↗					
West Total 1985			30 27 26				South Total 221			
West Entering 1057		10 3 2				South Entering 98				
West Receiving 928		0 0 0				South Receiving 123				
West Peds 0						South Peds 0				

PM Peak Hour: 16:15 to 17:15

Welham Road									
North Total 561						East Total 2398			
North Entering 298	Cyclists	0 0 0				East Entering 865			
North Receiving 263	Truck	5 5 4				East Receiving 1533			
North Peds 0	Cars	155 39 90				East Peds 0			
Mapleview Drive			↙	↓	↘				
	0 10 147	↗				↖	31 4 0		
	0 13 1349	→				←	787 21 0		
	0 3 35	↘				↙	19 3 0		
			↙	↑	↘				
West Total 2733			202	71	76	South Total 460			
West Entering 1557		6 0 1				South Entering 356			
West Receiving 1176		0 0 0				South Receiving 104			
West Peds 0						South Peds 0			

Total 9-Hour Count

Welham Road													
North Total 3367						East Total 15875							
North Entering 1566		Cyclists	0	0	0	East Entering 7698							
North Receiving 1801		Truck	114	53	14	East Receiving 8177							
North Peds 2		Cars	809	254	322	East Peds 2							
			↙	↓	↘								
Mapleview Drive	0	130	1080	↗						↖	289	23	0
	0	219	7398	→						←	6989	216	0
	0	42	718	↘						↙	154	27	0
			↙	↑	↘								
West Total 18313				525	244	205	South Total 2349						
West Entering 9587			73	35	19	South Entering 1101							
West Receiving 8726			0	0	0	South Receiving 1248							
West Peds 0						South Peds 3							

Accu-Traffic Inc.

Morning Peak Diagram	Specified Period From: 7:00:00 To: 9:00:00	One Hour Peak From: 7:30:00 To: 8:30:00
Municipality: Barrie Site #: 1500200063 Intersection: Huronia Rd & Lockhart Rd TFR File #: 1 Count date: 21-Oct-15	Weather conditions: Person counted: Person prepared: Person checked:	
** Signalized Intersection **		Major Road: Huronia Rd runs N/S

North Leg Total: 651 North Entering: 276 North Peds: 0 Peds Cross:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Cyclists</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Trucks</td> <td style="text-align: right;">3</td> <td style="text-align: right;">10</td> <td style="text-align: right;">10</td> <td style="text-align: right;">23</td> </tr> <tr> <td style="text-align: right;">Cars</td> <td style="text-align: right;">13</td> <td style="text-align: right;">194</td> <td style="text-align: right;">46</td> <td style="text-align: right;">253</td> </tr> <tr> <td style="text-align: right;">Totals</td> <td style="text-align: right;">16</td> <td style="text-align: right;">204</td> <td style="text-align: right;">56</td> <td style="text-align: right;"></td> </tr> </table>	Cyclists	0	0	0	0	Trucks	3	10	10	23	Cars	13	194	46	253	Totals	16	204	56		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Cyclists</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Trucks</td> <td style="text-align: right;">14</td> </tr> <tr> <td style="text-align: right;">Cars</td> <td style="text-align: right;">361</td> </tr> <tr> <td style="text-align: right;">Totals</td> <td style="text-align: right;">375</td> </tr> </table>	Cyclists	0	Trucks	14	Cars	361	Totals	375	East Leg Total: 394 East Entering: 304 East Peds: 0 Peds Cross:
Cyclists	0	0	0	0																											
Trucks	3	10	10	23																											
Cars	13	194	46	253																											
Totals	16	204	56																												
Cyclists	0																														
Trucks	14																														
Cars	361																														
Totals	375																														

Cyclists	Trucks	Cars	Totals
0	7	130	137

Huronia Rd

Lockhart Rd

Cars	Trucks	Cyclists	Totals
142	10	0	152
71	1	0	72
76	4	0	80
289	15	0	

Cyclists	Trucks	Cars	Totals
0	1	1	2
0	3	14	17
0	8	19	27
0	12	34	

10 Sideroad

Cars	289
Trucks	22
Cyclists	0
Totals	311

Cars	46	218	15	279
Trucks	3	3	2	8
Cyclists	0	0	0	0
Totals	49	221	17	

Cars	Trucks	Cyclists	Totals
75	15	0	90

Peds Cross: West Peds: 0 West Entering: 46 West Leg Total: 183	Peds Cross: South Peds: 0 South Entering: 287 South Leg Total: 598
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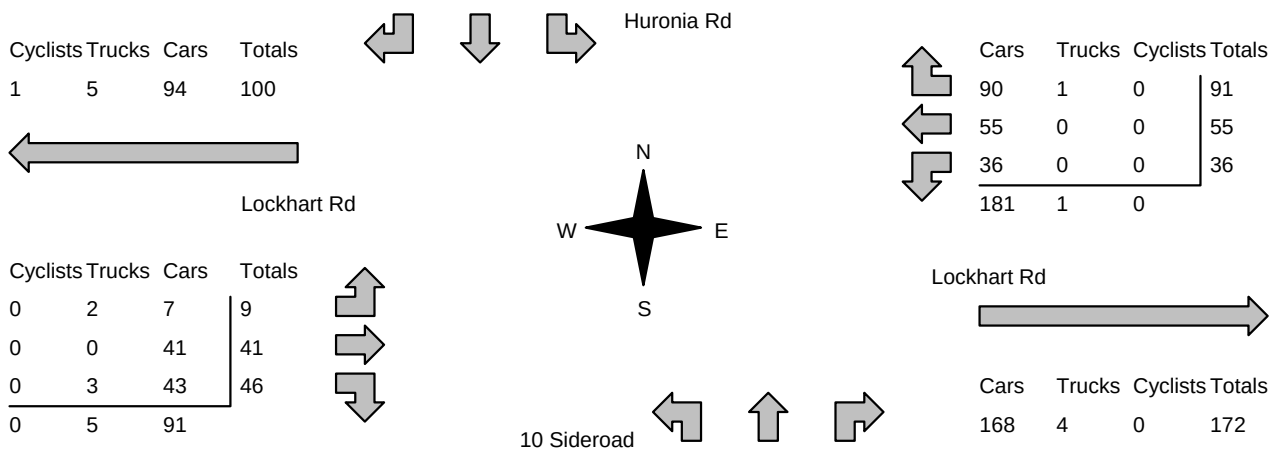
Comments

Accu-Traffic Inc.

Mid-day Peak Diagram	Specified Period From: 11:00:00 To: 14:00:00	One Hour Peak From: 13:00:00 To: 14:00:00
Municipality: Barrie Site #: 1500200063 Intersection: Huronia Rd & Lockhart Rd TFR File #: 1 Count date: 21-Oct-15	Weather conditions: Person counted: Person prepared: Person checked:	
** Signalized Intersection **	Major Road: Huronia Rd runs N/S	

North Leg Total: 620 North Entering: 324 North Peds: 0 Peds Cross:	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Cyclists</td> <td style="text-align: right;">1</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> <td style="text-align: right;">1</td> </tr> <tr> <td style="text-align: right;">Trucks</td> <td style="text-align: right;">4</td> <td style="text-align: right;">14</td> <td style="text-align: right;">2</td> <td style="text-align: right;">20</td> </tr> <tr> <td style="text-align: right;">Cars</td> <td style="text-align: right;">14</td> <td style="text-align: right;">193</td> <td style="text-align: right;">96</td> <td style="text-align: right;">303</td> </tr> <tr> <td style="text-align: right;">Totals</td> <td style="text-align: right;">19</td> <td style="text-align: right;">207</td> <td style="text-align: right;">98</td> <td></td> </tr> </table>	Cyclists	1	0	0	1	Trucks	4	14	2	20	Cars	14	193	96	303	Totals	19	207	98		<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Cyclists</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Trucks</td> <td style="text-align: right;">16</td> </tr> <tr> <td style="text-align: right;">Cars</td> <td style="text-align: right;">280</td> </tr> <tr> <td style="text-align: right;">Totals</td> <td style="text-align: right;">296</td> </tr> </table>	Cyclists	0	Trucks	16	Cars	280	Totals	296	East Leg Total: 354 East Entering: 182 East Peds: 0 Peds Cross:
Cyclists	1	0	0	1																											
Trucks	4	14	2	20																											
Cars	14	193	96	303																											
Totals	19	207	98																												
Cyclists	0																														
Trucks	16																														
Cars	280																														
Totals	296																														

Cyclists	Trucks	Cars	Totals
1	5	94	100



Huronia Rd

Lockhart Rd

10 Sideroad

Cars	Trucks	Cyclists	Totals
90	1	0	91
55	0	0	55
36	0	0	36
181	1	0	

Peds Cross: West Peds: 0 West Entering: 96 West Leg Total: 196	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Cars</td> <td style="text-align: right;">272</td> </tr> <tr> <td style="text-align: right;">Trucks</td> <td style="text-align: right;">17</td> </tr> <tr> <td style="text-align: right;">Cyclists</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Totals</td> <td style="text-align: right;">289</td> </tr> </table>	Cars	272	Trucks	17	Cyclists	0	Totals	289	<table style="width: 100%; border-collapse: collapse;"> <tr> <td style="text-align: right;">Cars</td> <td style="text-align: right;">25</td> <td style="text-align: right;">183</td> <td style="text-align: right;">31</td> <td style="text-align: right;">239</td> </tr> <tr> <td style="text-align: right;">Trucks</td> <td style="text-align: right;">1</td> <td style="text-align: right;">13</td> <td style="text-align: right;">2</td> <td style="text-align: right;">16</td> </tr> <tr> <td style="text-align: right;">Cyclists</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> <td style="text-align: right;">0</td> </tr> <tr> <td style="text-align: right;">Totals</td> <td style="text-align: right;">26</td> <td style="text-align: right;">196</td> <td style="text-align: right;">33</td> <td></td> </tr> </table>	Cars	25	183	31	239	Trucks	1	13	2	16	Cyclists	0	0	0	0	Totals	26	196	33		Peds Cross: South Peds: 0 South Entering: 255 South Leg Total: 544
Cars	272																														
Trucks	17																														
Cyclists	0																														
Totals	289																														
Cars	25	183	31	239																											
Trucks	1	13	2	16																											
Cyclists	0	0	0	0																											
Totals	26	196	33																												

Comments

Accu-Traffic Inc.

Afternoon Peak Diagram		Specified Period From: 15:00:00 To: 18:00:00	One Hour Peak From: 16:30:00 To: 17:30:00
Municipality: Barrie Site #: 1500200063 Intersection: Huronia Rd & Lockhart Rd TFR File #: 1 Count date: 21-Oct-15		Weather conditions: Person counted: Person prepared: Person checked:	
** Signalized Intersection **		Major Road: Huronia Rd runs N/S	

North Leg Total: 975 North Entering: 531 North Peds: 0 Peds Cross:	<table style="width: 100%; border-collapse: collapse;"> <tr><td>Cyclists</td><td>0</td><td>0</td><td>0</td><td>0</td></tr> <tr><td>Trucks</td><td>0</td><td>7</td><td>2</td><td>9</td></tr> <tr><td>Cars</td><td>8</td><td>329</td><td>185</td><td>522</td></tr> <tr><td>Totals</td><td>8</td><td>336</td><td>187</td><td></td></tr> </table>	Cyclists	0	0	0	0	Trucks	0	7	2	9	Cars	8	329	185	522	Totals	8	336	187		<table style="width: 100%; border-collapse: collapse;"> <tr><td>Cyclists</td><td>0</td></tr> <tr><td>Trucks</td><td>14</td></tr> <tr><td>Cars</td><td>430</td></tr> <tr><td>Totals</td><td>444</td></tr> </table>	Cyclists	0	Trucks	14	Cars	430	Totals	444	East Leg Total: 608 East Entering: 187 East Peds: 0 Peds Cross:
Cyclists	0	0	0	0																											
Trucks	0	7	2	9																											
Cars	8	329	185	522																											
Totals	8	336	187																												
Cyclists	0																														
Trucks	14																														
Cars	430																														
Totals	444																														

Cyclists	0
Trucks	6
Cars	81
Totals	87

Huronia Rd

Cars	102
Trucks	2
Cyclists	0
Totals	104

Lockhart Rd

Lockhart Rd

Cyclists	0
Trucks	0
Cars	10
Totals	10

Cars	43
Trucks	2
Cyclists	0
Totals	45

Cars	36
Trucks	2
Cyclists	0
Totals	38

Cyclists	0
Trucks	0
Cars	113
Totals	113

Cyclists	0
Trucks	1
Cars	117
Totals	118

Cyclists	0
Trucks	1
Cars	240
Totals	

Cars	482
Trucks	10
Cyclists	0
Totals	492

10 Sideroad

Cars	30
Trucks	4
Cyclists	0
Totals	34

Cars	318
Trucks	12
Cyclists	0
Totals	330

Cars	119
Trucks	2
Cyclists	0
Totals	121

Peds Cross:	
West Peds:	0
West Entering:	241
West Leg Total:	328

Cars	467
Trucks	18
Cyclists	0
Totals	

Peds Cross:	
South Peds:	0
South Entering:	485
South Leg Total:	977

Comments

Accu-Traffic Inc.

Total Count Diagram

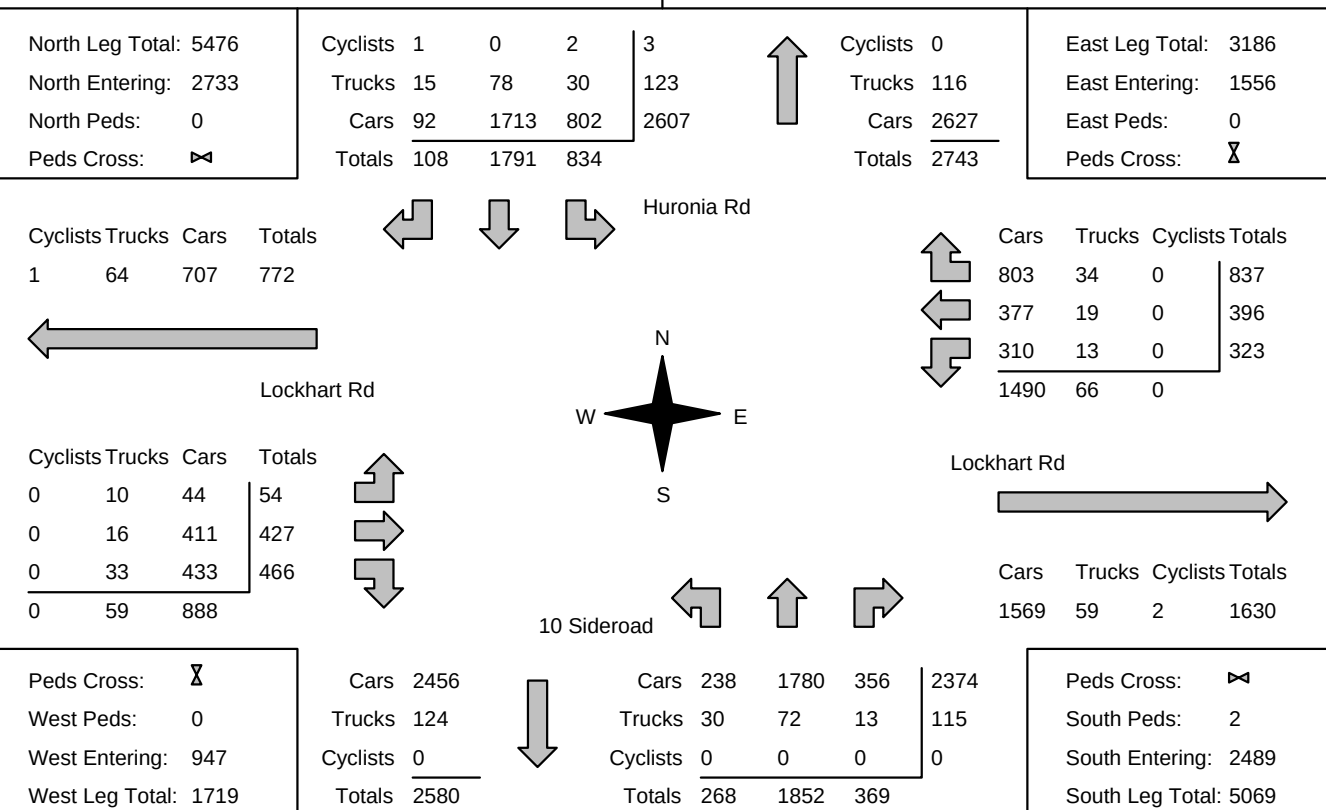
Municipality: Barrie
Site #: 1500200063
Intersection: Huronia Rd & Lockhart Rd
TFR File #: 1
Count date: 21-Oct-15

Weather conditions:

Person counted:
Person prepared:
Person checked:

**** Signalized Intersection ****

Major Road: Huronia Rd runs N/S



Comments

Accu-Traffic Inc.

Traffic Count Summary

Intersection: Huronia Rd & Lockhart Rd					Count Date: 21-Oct-15		Municipality: Barrie					
North Approach Totals						North/South Total Approaches	South Approach Totals					
Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds		Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0	0	7:00:00	0	0	0	0	0
8:00:00	38	224	10	272	0	533	8:00:00	43	205	13	261	0
9:00:00	73	181	15	269	0	521	9:00:00	47	186	19	252	0
11:00:00	0	0	0	0	0	0	11:00:00	0	0	0	0	0
12:00:00	87	149	12	248	0	449	12:00:00	22	163	16	201	1
13:00:00	74	169	24	267	0	504	13:00:00	47	170	20	237	0
14:00:00	98	207	19	324	0	579	14:00:00	26	196	33	255	0
15:00:00	0	0	0	0	0	0	15:00:00	0	0	0	0	0
16:00:00	146	254	11	411	0	780	16:00:00	26	285	58	369	0
17:00:00	146	326	10	482	0	961	17:00:00	40	331	108	479	0
18:00:00	172	281	7	460	0	895	18:00:00	17	316	102	435	1
Totals:	834	1791	108	2733	0	5222	S Totals:	268	1852	369	2489	2
East Approach Totals						East/West Total Approaches	West Approach Totals					
Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds		Hour Ending	Includes Cars, Trucks, & Cyclists				Total Peds
	Left	Thru	Right	Grand Total				Left	Thru	Right	Grand Total	
7:00:00	0	0	0	0	0	0	7:00:00	0	0	0	0	0
8:00:00	70	61	146	277	0	315	8:00:00	2	17	19	38	0
9:00:00	67	63	148	278	0	327	9:00:00	1	21	27	49	0
11:00:00	0	0	0	0	0	0	11:00:00	0	0	0	0	0
12:00:00	25	39	92	156	0	265	12:00:00	10	52	47	109	0
13:00:00	29	43	83	155	0	266	13:00:00	6	50	55	111	0
14:00:00	36	55	91	182	0	278	14:00:00	9	41	46	96	0
15:00:00	0	0	0	0	0	0	15:00:00	0	0	0	0	0
16:00:00	22	48	84	154	0	279	16:00:00	11	45	69	125	0
17:00:00	31	54	107	192	0	389	17:00:00	7	98	92	197	0
18:00:00	43	33	86	162	0	384	18:00:00	8	103	111	222	0
Totals:	323	396	837	1556	0	2503	W Totals:	54	427	466	947	0
Calculated Values for Traffic Crossing Major Street												
Hours Ending:	8:00	9:00	12:00	13:00			14:00	16:00	17:00	18:00		
Crossing Values:	133	131	88	85			100	81	136	155		

Accu-Traffic Inc.

Count Date: 21-Oct-15 Site #: 1500200063

Interval Time	Passenger Cars - North Approach						Trucks - North Approach						Cyclists - North Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		North Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	9	9	38	38	0	0	1	1	3	3	0	0	0	0	0	0	0	0	0	0
7:30:00	19	10	93	55	2	2	3	2	5	2	0	0	0	0	0	0	0	0	0	0
7:45:00	26	7	156	63	3	1	3	0	7	2	1	1	0	0	0	0	0	0	0	0
8:00:00	35	9	212	56	8	5	3	0	12	5	2	1	0	0	0	0	0	0	0	0
8:15:00	47	12	249	37	13	5	8	5	14	2	3	1	0	0	0	0	0	0	0	0
8:30:00	65	18	287	38	15	2	13	5	15	1	3	0	0	0	0	0	0	0	0	0
8:45:00	77	12	336	49	18	3	14	1	21	6	3	0	0	0	0	0	0	0	0	0
9:00:00	96	19	380	44	22	4	15	1	25	4	3	0	0	0	0	0	0	0	0	0
9:15:00	96	0	380	0	22	0	15	0	25	0	3	0	0	0	0	0	0	0	0	0
11:00:00	96	0	380	0	22	0	15	0	25	0	3	0	0	0	0	0	0	0	0	0
11:15:00	118	22	418	38	23	1	16	1	26	1	3	0	0	0	0	0	0	0	0	0
11:30:00	140	22	459	41	25	2	16	0	26	0	4	1	0	0	0	0	0	0	0	0
11:45:00	162	22	491	32	30	5	16	0	27	1	4	0	0	0	0	0	0	0	0	0
12:00:00	182	20	524	33	32	2	16	0	30	3	5	1	0	0	0	0	0	0	0	0
12:15:00	204	22	565	41	36	4	16	0	33	3	5	0	0	0	0	0	0	0	0	0
12:30:00	225	21	599	34	38	2	17	1	40	7	6	1	0	0	0	0	0	0	0	0
12:45:00	238	13	642	43	44	6	17	0	41	1	7	1	0	0	0	0	0	0	0	0
13:00:00	255	17	679	37	54	10	17	0	44	3	7	0	0	0	0	0	0	0	0	0
13:15:00	275	20	718	39	58	4	17	0	46	2	8	1	0	0	0	0	0	0	0	0
13:30:00	307	32	768	50	61	3	18	1	48	2	9	1	0	0	0	0	0	0	0	0
13:45:00	328	21	813	45	63	2	18	0	53	5	9	0	0	0	0	0	0	0	0	0
14:00:00	351	23	872	59	68	5	19	1	58	5	11	2	0	0	0	0	1	1	0	0
14:15:00	351	0	872	0	68	0	19	0	58	0	11	0	0	0	0	0	1	0	0	0
15:00:00	351	0	872	0	68	0	19	0	58	0	11	0	0	0	0	0	1	0	0	0
15:15:00	380	29	945	73	72	4	20	1	63	5	13	2	0	0	0	0	1	0	0	0
15:30:00	411	31	995	50	73	1	21	1	65	2	13	0	0	0	0	0	1	0	0	0
15:45:00	451	40	1050	55	74	1	23	2	66	1	13	0	0	0	0	0	1	0	0	0
16:00:00	490	39	1115	65	76	2	26	3	69	3	14	1	0	0	0	0	1	0	0	0
16:15:00	530	40	1192	77	80	4	28	2	70	1	14	0	0	0	0	0	1	0	0	0
16:30:00	555	25	1266	74	82	2	28	0	70	0	15	1	0	0	0	0	1	0	0	0
16:45:00	578	23	1360	94	83	1	29	1	73	3	15	0	0	0	0	0	1	0	0	0
17:00:00	632	54	1436	76	85	2	30	1	74	1	15	0	0	0	0	0	1	0	0	0
17:15:00	681	49	1533	97	86	1	30	0	76	2	15	0	0	0	0	0	1	0	0	0
17:30:00	740	59	1595	62	90	4	30	0	77	1	15	0	0	0	0	0	1	0	0	0
17:45:00	772	32	1665	70	91	1	30	0	78	1	15	0	0	0	0	0	1	0	0	0
18:00:00	802	30	1713	48	92	1	30	0	78	0	15	0	2	2	0	0	1	0	0	0
18:15:00	802	0	1713	0	92	0	30	0	78	0	15	0	2	0	0	0	1	0	0	0
18:15:15	802	0	1713	0	92	0	30	0	78	0	15	0	2	0	0	0	1	0	0	0



Interval Time	Passenger Cars - East Approach						Trucks - East Approach						Cyclists - East Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		East Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	17	17	12	12	26	26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30:00	30	13	22	10	54	28	0	0	0	0	1	1	0	0	0	0	0	0	0	0
7:45:00	51	21	40	18	97	43	1	1	1	1	3	2	0	0	0	0	0	0	0	0
8:00:00	68	17	60	20	141	44	2	1	1	0	5	2	0	0	0	0	0	0	0	0
8:15:00	91	23	73	13	174	33	3	1	1	0	7	2	0	0	0	0	0	0	0	0
8:30:00	106	15	93	20	196	22	4	1	1	0	11	4	0	0	0	0	0	0	0	0
8:45:00	121	15	105	12	232	36	5	1	1	0	15	4	0	0	0	0	0	0	0	0
9:00:00	132	11	122	17	278	46	5	0	2	1	16	1	0	0	0	0	0	0	0	0
9:15:00	132	0	122	0	278	0	5	0	2	0	16	0	0	0	0	0	0	0	0	0
11:00:00	132	0	122	0	278	0	5	0	2	0	16	0	0	0	0	0	0	0	0	0
11:15:00	143	11	126	4	297	19	6	1	2	0	16	0	0	0	0	0	0	0	0	0
11:30:00	147	4	133	7	320	23	6	0	2	0	17	1	0	0	0	0	0	0	0	0
11:45:00	153	6	147	14	339	19	6	0	3	1	17	0	0	0	0	0	0	0	0	0
12:00:00	156	3	160	13	369	30	6	0	3	0	17	0	0	0	0	0	0	0	0	0
12:15:00	159	3	167	7	392	23	7	1	4	1	18	1	0	0	0	0	0	0	0	0
12:30:00	168	9	182	15	410	18	7	0	6	2	19	1	0	0	0	0	0	0	0	0
12:45:00	174	6	189	7	427	17	7	0	6	0	20	1	0	0	0	0	0	0	0	0
13:00:00	184	10	200	11	448	21	7	0	6	0	21	1	0	0	0	0	0	0	0	0
13:15:00	194	10	209	9	471	23	7	0	6	0	21	0	0	0	0	0	0	0	0	0
13:30:00	199	5	228	19	492	21	7	0	6	0	21	0	0	0	0	0	0	0	0	0
13:45:00	210	11	238	10	514	22	7	0	6	0	21	0	0	0	0	0	0	0	0	0
14:00:00	220	10	255	17	538	24	7	0	6	0	22	1	0	0	0	0	0	0	0	0
14:15:00	220	0	255	0	538	0	7	0	6	0	22	0	0	0	0	0	0	0	0	0
15:00:00	220	0	255	0	538	0	7	0	6	0	22	0	0	0	0	0	0	0	0	0
15:15:00	223	3	269	14	556	18	7	0	7	1	26	4	0	0	0	0	0	0	0	0
15:30:00	224	1	276	7	5															

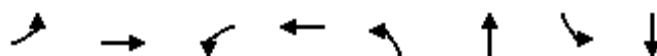


Interval Time	Passenger Cars - West Approach						Trucks - West Approach						Cyclists - West Approach						Pedestrians	
	Left		Thru		Right		Left		Thru		Right		Left		Thru		Right		West Cross	
	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr	Cum	Incr
7:00:00	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15:00	0	0	0	0	3	3	0	0	3	3	1	1	0	0	0	0	0	0	0	0
7:30:00	0	0	3	3	5	2	0	0	5	2	2	1	0	0	0	0	0	0	0	0
7:45:00	0	0	6	3	6	1	0	0	5	0	4	2	0	0	0	0	0	0	0	0
8:00:00	1	1	12	6	13	7	1	1	5	0	6	2	0	0	0	0	0	0	0	0
8:15:00	1	0	14	2	16	3	1	0	6	1	9	3	0	0	0	0	0	0	0	0
8:30:00	1	0	17	3	24	8	1	0	8	2	10	1	0	0	0	0	0	0	0	0
8:45:00	1	0	26	9	31	7	1	0	9	1	11	1	0	0	0	0	0	0	0	0
9:00:00	2	1	28	2	35	4	1	0	10	1	11	0	0	0	0	0	0	0	0	0
9:15:00	2	0	28	0	35	0	1	0	10	0	11	0	0	0	0	0	0	0	0	0
11:00:00	2	0	28	0	35	0	1	0	10	0	11	0	0	0	0	0	0	0	0	0
11:15:00	5	3	37	9	40	5	1	0	10	0	15	4	0	0	0	0	0	0	0	0
11:30:00	6	1	49	12	48	8	1	0	10	0	15	0	0	0	0	0	0	0	0	0
11:45:00	7	1	62	13	59	11	2	1	11	1	18	3	0	0	0	0	0	0	0	0
12:00:00	9	2	79	17	75	16	4	2	11	0	18	0	0	0	0	0	0	0	0	0
12:15:00	11	2	93	14	91	16	5	1	12	1	18	0	0	0	0	0	0	0	0	0
12:30:00	11	0	107	14	105	14	5	0	12	0	19	1	0	0	0	0	0	0	0	0
12:45:00	12	1	120	13	116	11	5	0	12	0	23	4	0	0	0	0	0	0	0	0
13:00:00	14	2	128	8	125	9	5	0	12	0	23	0	0	0	0	0	0	0	0	0
13:15:00	15	1	137	9	134	9	6	1	12	0	23	0	0	0	0	0	0	0	0	0
13:30:00	17	2	143	6	145	11	6	0	12	0	25	2	0	0	0	0	0	0	0	0
13:45:00	20	3	158	15	154	9	7	1	12	0	25	0	0	0	0	0	0	0	0	0
14:00:00	21	1	169	11	168	14	7	0	12	0	26	1	0	0	0	0	0	0	0	0
14:15:00	21	0	169	0	168	0	7	0	12	0	26	0	0	0	0	0	0	0	0	0
15:00:00	21	0	169	0	168	0	7	0	12	0	26	0	0	0	0	0	0	0	0	0
15:15:00	27	6	181	12	182	14	8	1	13	1	28	2	0	0	0	0	0	0	0	0
15:30:00	28	1	191	10	197	15	9	1	13	0	28	0	0	0	0	0				

Appendix E – Synchro Analysis Output – Existing Traffic Volumes

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Existing (2020) AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	203	608	37	1133	41	32	34	36
Future Volume (vph)	203	608	37	1133	41	32	34	36
Lane Group Flow (vph)	209	837	38	1236	42	48	35	113
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	29.0	81.0	14.0	35.0	14.0	35.0
Total Split (%)	9.7%	45.8%	20.1%	56.3%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.64	0.27	0.09	0.40	0.22	0.24	0.14	0.60
Control Delay	15.4	9.6	6.2	13.5	42.7	42.2	40.7	39.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	15.4	9.6	6.2	13.5	42.7	42.2	40.7	39.5
Queue Length 50th (m)	14.1	29.3	2.3	56.1	9.0	8.2	7.4	12.1
Queue Length 95th (m)	29.4	44.7	6.8	78.9	19.4	20.9	16.6	32.7
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	330	3138	597	3058	200	377	277	369
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.63	0.27	0.06	0.40	0.21	0.13	0.13	0.31

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 123.3

Natural Cycle: 125

Control Type: Semi Act-Uncoord

Splits and Phases: 1: Welham Rd & Maplview Drive E

Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
Ø5	Ø6	Ø7	Ø8
14 s	35 s	14 s	81 s

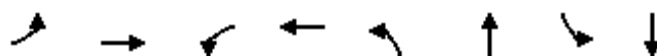
140 Lockhart Road
1: Welham Rd & Mapview Drive E

HCM Signalized Intersection Capacity Analysis
Existing (2020) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	608	204	37	1133	66	41	32	15	34	36	74
Future Volume (vph)	203	608	204	37	1133	66	41	32	15	34	36	74
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.99		1.00	0.95		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4765		1543	5002		1467	1551		1803	1358	
Flt Permitted	0.18	1.00		0.32	1.00		0.52	1.00		0.73	1.00	
Satd. Flow (perm)	302	4765		527	5002		802	1551		1378	1358	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	209	627	210	38	1168	68	42	33	15	35	37	76
RTOR Reduction (vph)	0	26	0	0	4	0	0	12	0	0	57	0
Lane Group Flow (vph)	209	811	0	38	1232	0	42	36	0	35	56	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	90.2	80.6		81.8	76.2		21.7	14.8		17.7	12.8	
Effective Green, g (s)	90.2	80.6		81.8	76.2		21.7	14.8		17.7	12.8	
Actuated g/C Ratio	0.72	0.64		0.65	0.61		0.17	0.12		0.14	0.10	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	322	3050		387	3027		174	182		210	138	
v/s Ratio Prot	c0.05	0.17		0.00	0.25		c0.01	0.02		0.01	c0.04	
v/s Ratio Perm	c0.41			0.06			0.03			0.02		
v/c Ratio	0.65	0.27		0.10	0.41		0.24	0.20		0.17	0.40	
Uniform Delay, d1	7.8	9.8		7.9	13.0		44.4	50.2		47.4	53.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.5	0.2		0.1	0.4		0.7	0.5		0.4	1.9	
Delay (s)	12.2	10.0		8.0	13.4		45.2	50.7		47.8	54.9	
Level of Service	B	B		A	B		D	D		D	D	
Approach Delay (s)		10.5			13.3			48.1			53.2	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay	15.7			HCM 2000 Level of Service			B					
HCM 2000 Volume to Capacity ratio	0.61											
Actuated Cycle Length (s)	125.9			Sum of lost time (s)			20.0					
Intersection Capacity Utilization	84.0%			ICU Level of Service			E					
Analysis Period (min)	15											
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Existing (2020) AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔		↔		↔
Traffic Volume (vph)	2	31	88	131	54	244	62	225
Future Volume (vph)	2	31	88	131	54	244	62	225
Lane Group Flow (vph)	0	77	0	478	0	391	0	377
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (%)	34.7%	34.7%	34.7%	34.7%	65.3%	65.3%	65.3%	65.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0
Total Lost Time (s)		6.0		6.0		7.0		7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio		0.19		1.08		0.43		0.45
Control Delay		14.0		91.2		11.1		11.5
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		14.0		91.2		11.1		11.5
Queue Length 50th (m)		4.3		~71.5		29.2		28.5
Queue Length 95th (m)		12.2		#107.3		41.5		41.0
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)		399		444		899		837
Starvation Cap Reductn		0		0		0		0
Spillback Cap Reductn		0		0		0		0
Storage Cap Reductn		0		0		0		0
Reduced v/c Ratio		0.19		1.08		0.43		0.45

Intersection Summary

Cycle Length: 72

Actuated Cycle Length: 72

Natural Cycle: 75

Control Type: Semi Act-Uncoord

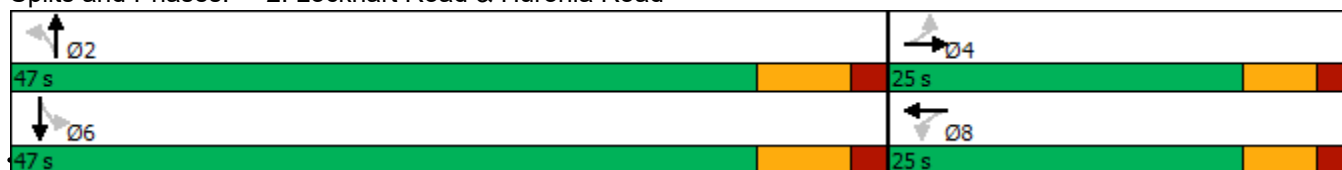
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



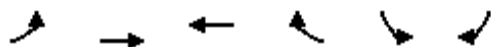
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Existing (2020) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	31	30	88	131	168	54	244	19	62	225	18
Future Volume (vph)	2	31	30	88	131	168	54	244	19	62	225	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			7.0			7.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.94			0.94			0.99			0.99	
Flt Protected		1.00			0.99			0.99			0.99	
Satd. Flow (prot)		1424			1692			1823			1753	
Flt Permitted		0.99			0.90			0.88			0.85	
Satd. Flow (perm)		1412			1539			1612			1502	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	2	38	37	109	162	207	67	301	23	77	278	22
RTOR Reduction (vph)	0	27	0	0	38	0	0	3	0	0	3	0
Lane Group Flow (vph)	0	50	0	0	440	0	0	388	0	0	374	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		19.0			19.0			40.0			40.0	
Effective Green, g (s)		19.0			19.0			40.0			40.0	
Actuated g/C Ratio		0.26			0.26			0.56			0.56	
Clearance Time (s)		6.0			6.0			7.0			7.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		372			406			895			834	
v/s Ratio Prot												
v/s Ratio Perm		0.04			0.29			0.24			0.25	
v/c Ratio		0.13			1.08			0.43			0.45	
Uniform Delay, d1		20.2			26.5			9.4			9.5	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.2			68.8			1.5			1.7	
Delay (s)		20.4			95.3			10.9			11.2	
Level of Service		C			F			B			B	
Approach Delay (s)		20.4			95.3			10.9			11.2	
Approach LOS		C			F			B			B	
Intersection Summary												
HCM 2000 Control Delay		42.0			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.65										
Actuated Cycle Length (s)		72.0			Sum of lost time (s)			13.0				
Intersection Capacity Utilization		72.9%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Existing (2020) AM Peak Hour

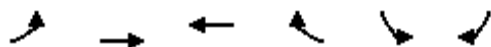


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	7	52	135	68	11	30
Future Volume (Veh/h)	7	52	135	68	11	30
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	8	57	147	74	12	33
Pedestrians						
Lane Width (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	221				257	184
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	221				257	184
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	96
cM capacity (veh/h)	1348				727	858
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	65	221	45			
Volume Left	8	0	12			
Volume Right	0	74	33			
cSH	1348	1700	819			
Volume to Capacity	0.01	0.13	0.05			
Queue Length 95th (m)	0.1	0.0	1.4			
Control Delay (s)	1.0	0.0	9.7			
Lane LOS	A		A			
Approach Delay (s)	1.0	0.0	9.7			
Approach LOS			A			
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization		21.2%		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)	26	5	3	2	127	61	1	1	0	192	3	82
Future Volume (Veh/h)	26	5	3	2	127	61	1	1	0	192	3	82
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)	28	5	3	2	138	66	1	1	0	209	3	89
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	204			8			328	270	6	238	239	171
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	204			8			328	270	6	238	239	171
tC, single (s)	4.1			4.1			7.1	6.7	6.2	7.1	6.7	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.2	3.3	3.5	4.1	3.3
p0 queue free %	98			100			100	100	100	70	100	90
cM capacity (veh/h)	1368			1612			550	593	1076	704	626	873
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	36	206	2	301								
Volume Left	28	2	1	209								
Volume Right	3	66	0	89								
cSH	1368	1612	571	745								
Volume to Capacity	0.02	0.00	0.00	0.40								
Queue Length 95th (m)	0.5	0.0	0.1	15.7								
Control Delay (s)	6.0	0.1	11.3	13.1								
Lane LOS	A	A	B	B								
Approach Delay (s)	6.0	0.1	11.3	13.1								
Approach LOS			B	B								
Intersection Summary												
Average Delay			7.7									
Intersection Capacity Utilization			46.3%		ICU Level of Service				A			
Analysis Period (min)			15									

140 Lockhart Road
5: Lockhart Road & Welham Extension

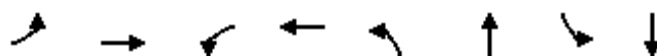
HCM Unsignalized Intersection Capacity Analysis
Existing (2020) AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Volume (veh/h)	0	0	0	0	0	0
Future Volume (Veh/h)	0	0	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	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	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1623				1023	1085
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		0.0%		ICU Level of Service		A
Analysis Period (min)		15				

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Existing (2020) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	163	1421	23	843	216	74	98	46
Future Volume (vph)	163	1421	23	843	216	74	98	46
Lane Group Flow (vph)	185	1660	26	999	245	174	111	241
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	29.0	81.0	14.0	35.0	14.0	35.0
Total Split (%)	9.7%	45.8%	20.1%	56.3%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.49	0.52	0.13	0.35	1.24	0.67	0.46	0.79
Control Delay	12.6	15.9	9.3	16.2	182.9	56.8	45.8	47.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	12.6	15.9	9.3	16.2	182.9	56.8	45.8	47.0
Queue Length 50th (m)	15.8	94.5	2.0	50.6	~66.3	37.2	24.5	34.4
Queue Length 95th (m)	30.6	125.7	6.2	69.5	#109.9	60.3	39.9	62.5
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	378	3192	422	2852	197	407	246	443
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.52	0.06	0.35	1.24	0.43	0.45	0.54

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 132.1

Natural Cycle: 125

Control Type: Semi Act-Uncoord

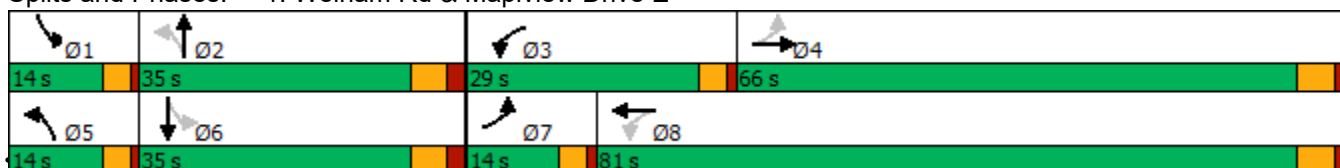
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



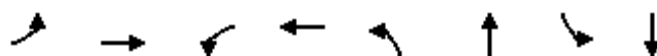
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Existing (2020) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  							
Traffic Volume (vph)	163	1421	40	23	843	36	216	74	79	98	46	166
Future Volume (vph)	163	1421	40	23	843	36	216	74	79	98	46	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5105		1703	5008		1770	1735		1770	1613	
Flt Permitted	0.23	1.00		0.11	1.00		0.23	1.00		0.42	1.00	
Satd. Flow (perm)	412	5105		199	5008		428	1735		778	1613	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	185	1615	45	26	958	41	245	84	90	111	52	189
RTOR Reduction (vph)	0	1	0	0	3	0	0	30	0	0	99	0
Lane Group Flow (vph)	185	1659	0	26	996	0	245	144	0	111	142	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	90.6	82.5		80.9	76.8		27.4	17.4		26.6	17.0	
Effective Green, g (s)	90.6	82.5		80.9	76.8		27.4	17.4		26.6	17.0	
Actuated g/C Ratio	0.68	0.62		0.61	0.57		0.21	0.13		0.20	0.13	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	372	3152		166	2878		188	225		226	205	
v/s Ratio Prot	c0.04	c0.32		0.00	0.20		c0.10	0.08		0.04	0.09	
v/s Ratio Perm	0.30			0.09			c0.17			0.06		
v/c Ratio	0.50	0.53		0.16	0.35		1.30	0.64		0.49	0.69	
Uniform Delay, d1	8.7	14.5		11.4	15.1		50.3	55.1		45.9	55.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.0	0.6		0.4	0.3		169.6	6.1		1.7	9.6	
Delay (s)	9.8	15.1		11.9	15.4		219.8	61.3		47.5	65.4	
Level of Service	A	B		B	B		F	E		D	E	
Approach Delay (s)		14.6			15.3			154.0			59.8	
Approach LOS		B			B			F			E	
Intersection Summary												
HCM 2000 Control Delay		35.2			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.73										
Actuated Cycle Length (s)		133.6			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		100.3%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Existing (2020) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕		↕		↕
Traffic Volume (vph)	11	206	42	82	38	364	206	371
Future Volume (vph)	11	206	42	82	38	364	206	371
Lane Group Flow (vph)	0	395	0	272	0	609	0	666
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (%)	34.7%	34.7%	34.7%	34.7%	65.3%	65.3%	65.3%	65.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0
Total Lost Time (s)		6.0		6.0		7.0		7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio		0.86		0.80		0.66		1.00
Control Delay		43.5		38.1		14.5		55.5
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		43.5		38.1		14.5		55.5
Queue Length 50th (m)		47.4		27.3		52.4		~95.1
Queue Length 95th (m)		#89.7		#62.2		84.2		#160.4
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)		490		364		928		663
Starvation Cap Reductn		0		0		0		0
Spillback Cap Reductn		0		0		0		0
Storage Cap Reductn		0		0		0		0
Reduced v/c Ratio		0.81		0.75		0.66		1.00

Intersection Summary

Cycle Length: 72

Actuated Cycle Length: 70.7

Natural Cycle: 75

Control Type: Semi Act-Uncoord

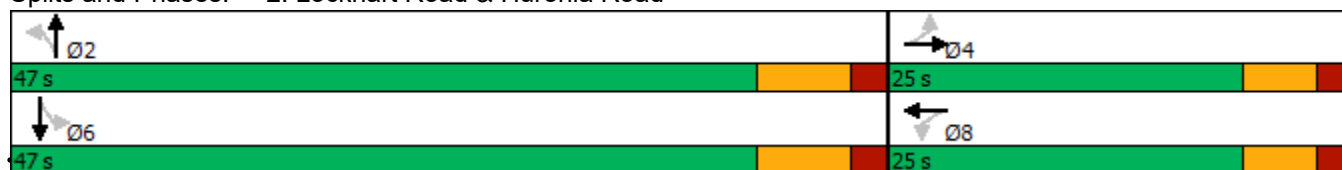
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



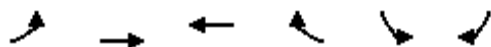
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Existing (2020) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	206	130	42	82	115	38	364	134	206	371	9
Future Volume (vph)	11	206	130	42	82	115	38	364	134	206	371	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			7.0			7.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.95			0.93			0.97			1.00	
Flt Protected		1.00			0.99			1.00			0.98	
Satd. Flow (prot)		1733			1599			1740			1804	
Flt Permitted		0.98			0.73			0.92			0.64	
Satd. Flow (perm)		1710			1182			1612			1169	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	12	234	148	48	93	131	43	414	152	234	422	10
RTOR Reduction (vph)	0	31	0	0	47	0	0	16	0	0	1	0
Lane Group Flow (vph)	0	364	0	0	225	0	0	593	0	0	665	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		17.6			17.6			40.0			40.0	
Effective Green, g (s)		17.6			17.6			40.0			40.0	
Actuated g/C Ratio		0.25			0.25			0.57			0.57	
Clearance Time (s)		6.0			6.0			7.0			7.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		426			294			913			662	
v/s Ratio Prot												
v/s Ratio Perm		c0.21			0.19			0.37			c0.57	
v/c Ratio		0.85			0.76			0.65			1.00	
Uniform Delay, d1		25.3			24.6			10.5			15.3	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		15.3			11.2			3.6			36.1	
Delay (s)		40.6			35.8			14.1			51.4	
Level of Service		D			D			B			D	
Approach Delay (s)		40.6			35.8			14.1			51.4	
Approach LOS		D			D			B			D	
Intersection Summary												
HCM 2000 Control Delay		35.3			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.96										
Actuated Cycle Length (s)		70.6			Sum of lost time (s)			13.0				
Intersection Capacity Utilization		116.0%			ICU Level of Service			H				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Existing (2020) PM Peak Hour

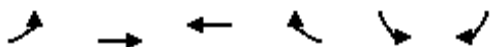


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Volume (veh/h)	30	100	110	19	247	9
Future Volume (Veh/h)	30	100	110	19	247	9
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	33	109	120	21	268	10
Pedestrians						
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	141				306	130
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	141				306	130
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	98				60	99
cM capacity (veh/h)	1442				671	919
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	142	141	278			
Volume Left	33	0	268			
Volume Right	0	21	10			
cSH	1442	1700	677			
Volume to Capacity	0.02	0.08	0.41			
Queue Length 95th (m)	0.6	0.0	16.1			
Control Delay (s)	1.9	0.0	14.0			
Lane LOS	A		B			
Approach Delay (s)	1.9	0.0	14.0			
Approach LOS			B			
Intersection Summary						
Average Delay			7.4			
Intersection Capacity Utilization		38.1%		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)	173	119	1	1	96	196	3	3	2	58	1	51
Future Volume (Veh/h)	173	119	1	1	96	196	3	3	2	58	1	51
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)	188	129	1	1	104	213	3	3	2	63	1	55
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	317			130			774	824	130	722	718	210
vC1, stage 1 conf vol												
vC2, stage 2 conf vol												
vCu, unblocked vol	317			130			774	824	130	722	718	210
tC, single (s)	4.1			4.1			7.1	6.5	6.2	7.1	6.6	6.2
tC, 2 stage (s)												
tF (s)	2.2			2.2			3.5	4.0	3.3	3.5	4.1	3.3
p0 queue free %	85			100			99	99	100	79	100	93
cM capacity (veh/h)	1243			1455			260	262	920	299	292	830
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total	318	318	8	119								
Volume Left	188	1	3	63								
Volume Right	1	213	2	55								
cSH	1243	1455	318	425								
Volume to Capacity	0.15	0.00	0.03	0.28								
Queue Length 95th (m)	4.3	0.0	0.6	9.1								
Control Delay (s)	5.5	0.0	16.6	16.7								
Lane LOS	A	A	C	C								
Approach Delay (s)	5.5	0.0	16.6	16.7								
Approach LOS			C	C								
Intersection Summary												
Average Delay			5.1									
Intersection Capacity Utilization			52.7%		ICU Level of Service				A			
Analysis Period (min)			15									

140 Lockhart Road
5: Lockhart Road & Welham Extension

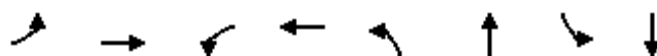
HCM Unsignalized Intersection Capacity Analysis
Existing (2020) PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Volume (veh/h)	0	0	0	0	0	0
Future Volume (Veh/h)	0	0	0	0	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	0	0	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	0				0	0
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	0				0	0
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1623				1023	1085
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	0	0	0			
Volume Left	0	0	0			
Volume Right	0	0	0			
cSH	1700	1700	1700			
Volume to Capacity	0.00	0.00	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.0	0.0	0.0			
Lane LOS			A			
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay		0.0				
Intersection Capacity Utilization		0.0%		ICU Level of Service		A
Analysis Period (min)		15				

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Existing (2020) AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↔		↔		↔		↔
Traffic Volume (vph)	2	31	88	131	54	244	62	225
Future Volume (vph)	2	31	88	131	54	244	62	225
Lane Group Flow (vph)	0	77	0	478	0	391	0	377
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	60.0	60.0	60.0	60.0	47.0	47.0	47.0	47.0
Total Split (%)	56.1%	56.1%	56.1%	56.1%	43.9%	43.9%	43.9%	43.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0
Total Lost Time (s)		6.0		6.0		7.0		7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio		0.15		0.85		0.49		0.51
Control Delay		10.9		36.9		18.1		18.7
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		10.9		36.9		18.1		18.7
Queue Length 50th (m)		4.3		63.5		39.3		38.2
Queue Length 95th (m)		10.9		84.0		73.3		72.0
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)		958		1049		798		746
Starvation Cap Reductn		0		0		0		0
Spillback Cap Reductn		0		0		0		0
Storage Cap Reductn		0		0		0		0
Reduced v/c Ratio		0.08		0.46		0.49		0.51

Intersection Summary

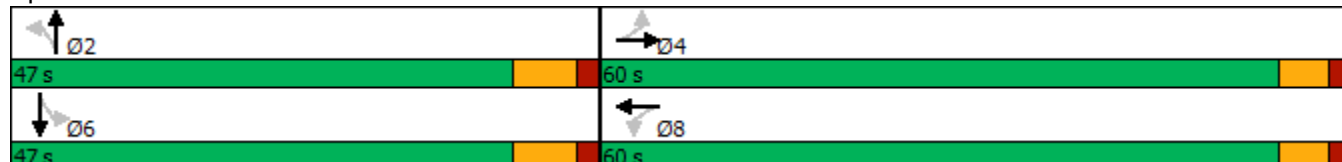
Cycle Length: 107

Actuated Cycle Length: 81.4

Natural Cycle: 75

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Lockhart Road & Huronia Road



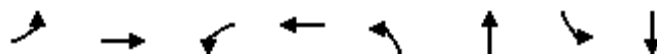
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Existing (2020) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	31	30	88	131	168	54	244	19	62	225	18
Future Volume (vph)	2	31	30	88	131	168	54	244	19	62	225	18
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			7.0			7.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.94			0.94			0.99			0.99	
Flt Protected		1.00			0.99			0.99			0.99	
Satd. Flow (prot)		1424			1692			1823			1753	
Flt Permitted		0.99			0.90			0.87			0.85	
Satd. Flow (perm)		1411			1540			1605			1503	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	2	38	37	109	162	207	67	301	23	77	278	22
RTOR Reduction (vph)	0	24	0	0	34	0	0	2	0	0	2	0
Lane Group Flow (vph)	0	53	0	0	444	0	0	389	0	0	375	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		27.9			27.9			40.4			40.4	
Effective Green, g (s)		27.9			27.9			40.4			40.4	
Actuated g/C Ratio		0.34			0.34			0.50			0.50	
Clearance Time (s)		6.0			6.0			7.0			7.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		484			528			797			746	
v/s Ratio Prot												
v/s Ratio Perm		0.04			0.29			0.24			0.25	
v/c Ratio		0.11			0.84			0.49			0.50	
Uniform Delay, d1		18.2			24.6			13.6			13.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		0.1			11.5			2.1			2.4	
Delay (s)		18.3			36.2			15.7			16.1	
Level of Service		B			D			B			B	
Approach Delay (s)		18.3			36.2			15.7			16.1	
Approach LOS		B			D			B			B	
Intersection Summary												
HCM 2000 Control Delay		23.4			HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio		0.64										
Actuated Cycle Length (s)		81.3			Sum of lost time (s)			13.0				
Intersection Capacity Utilization		72.9%			ICU Level of Service			C				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Existing (2020) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	163	1421	23	843	216	74	98	46
Future Volume (vph)	163	1421	23	843	216	74	98	46
Lane Group Flow (vph)	185	1660	26	999	245	174	111	241
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	19.0	71.0	31.0	52.0	14.0	35.0
Total Split (%)	9.3%	43.7%	12.6%	47.0%	20.5%	34.4%	9.3%	23.2%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.57	0.60	0.15	0.41	0.72	0.43	0.37	0.80
Control Delay	21.5	24.4	15.6	23.7	46.6	37.7	35.6	50.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	21.5	24.4	15.6	23.7	46.6	37.7	35.6	50.7
Queue Length 50th (m)	21.5	119.0	2.7	63.2	52.4	33.0	21.9	37.1
Queue Length 95th (m)	43.1	166.3	8.6	90.6	73.7	53.0	35.2	67.5
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	328	2782	277	2451	404	624	308	435
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.56	0.60	0.09	0.41	0.61	0.28	0.36	0.55

Intersection Summary

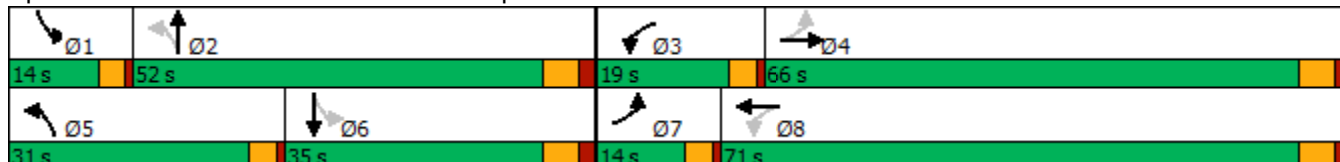
Cycle Length: 151

Actuated Cycle Length: 133.9

Natural Cycle: 125

Control Type: Semi Act-Uncoord

Splits and Phases: 1: Welham Rd & Maplview Drive E



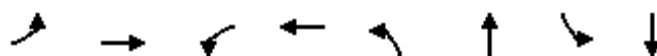
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Existing (2020) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	163	1421	40	23	843	36	216	74	79	98	46	166
Future Volume (vph)	163	1421	40	23	843	36	216	74	79	98	46	166
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5105		1703	5008		1770	1735		1770	1613	
Flt Permitted	0.22	1.00		0.10	1.00		0.19	1.00		0.65	1.00	
Satd. Flow (perm)	382	5105		171	5008		348	1735		1206	1613	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	185	1615	45	26	958	41	245	84	90	111	52	189
RTOR Reduction (vph)	0	1	0	0	3	0	0	29	0	0	93	0
Lane Group Flow (vph)	185	1659	0	26	996	0	245	145	0	111	148	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	81.0	72.9		71.3	67.2		42.4	28.9		26.9	17.4	
Effective Green, g (s)	81.0	72.9		71.3	67.2		42.4	28.9		26.9	17.4	
Actuated g/C Ratio	0.60	0.54		0.53	0.50		0.31	0.21		0.20	0.13	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	322	2748		136	2485		329	370		279	207	
v/s Ratio Prot	c0.04	c0.32		0.01	0.20		c0.12	0.08		0.03	0.09	
v/s Ratio Perm	0.30			0.09			c0.12			0.05		
v/c Ratio	0.57	0.60		0.19	0.40		0.74	0.39		0.40	0.71	
Uniform Delay, d1	13.7	21.4		17.1	21.4		38.2	45.7		46.4	56.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	2.5	1.0		0.7	0.5		8.8	0.7		0.9	11.1	
Delay (s)	16.2	22.4		17.8	21.9		47.1	46.4		47.3	67.7	
Level of Service	B	C		B	C		D	D		D	E	
Approach Delay (s)		21.7			21.8			46.8			61.3	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			28.5	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.68									
Actuated Cycle Length (s)			135.4	Sum of lost time (s)			20.0					
Intersection Capacity Utilization			100.3%	ICU Level of Service			G					
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Existing (2020) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations		↕		↕		↕		↕
Traffic Volume (vph)	11	206	42	82	38	364	206	371
Future Volume (vph)	11	206	42	82	38	364	206	371
Lane Group Flow (vph)	0	395	0	272	0	609	0	666
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	25.0	25.0	25.0	25.0	53.0	53.0	53.0	53.0
Total Split (%)	32.1%	32.1%	32.1%	32.1%	67.9%	67.9%	67.9%	67.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)		0.0		0.0		0.0		0.0
Total Lost Time (s)		6.0		6.0		7.0		7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio		0.91		0.89		0.63		0.96
Control Delay		54.3		54.8		13.1		42.5
Queue Delay		0.0		0.0		0.0		0.0
Total Delay		54.3		54.8		13.1		42.5
Queue Length 50th (m)		54.2		32.6		52.4		88.9
Queue Length 95th (m)		#101.5		#73.6		82.1		#163.9
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)		448		315		974		697
Starvation Cap Reductn		0		0		0		0
Spillback Cap Reductn		0		0		0		0
Storage Cap Reductn		0		0		0		0
Reduced v/c Ratio		0.88		0.86		0.63		0.96

Intersection Summary

Cycle Length: 78

Actuated Cycle Length: 77.3

Natural Cycle: 75

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



140 Lockhart Road
2: Lockhart Road & Huronia Road

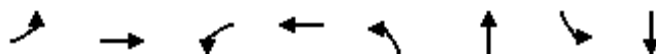
HCM Signalized Intersection Capacity Analysis
Existing (2020) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	11	206	130	42	82	115	38	364	134	206	371	9
Future Volume (vph)	11	206	130	42	82	115	38	364	134	206	371	9
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)		6.0			6.0			7.0			7.0	
Lane Util. Factor		1.00			1.00			1.00			1.00	
Frt		0.95			0.93			0.97			1.00	
Flt Protected		1.00			0.99			1.00			0.98	
Satd. Flow (prot)		1733			1599			1740			1804	
Flt Permitted		0.99			0.69			0.92			0.64	
Satd. Flow (perm)		1711			1111			1613			1172	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	12	234	148	48	93	131	43	414	152	234	422	10
RTOR Reduction (vph)	0	28	0	0	44	0	0	15	0	0	1	0
Lane Group Flow (vph)	0	367	0	0	228	0	0	594	0	0	665	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)		18.3			18.3			46.0			46.0	
Effective Green, g (s)		18.3			18.3			46.0			46.0	
Actuated g/C Ratio		0.24			0.24			0.60			0.60	
Clearance Time (s)		6.0			6.0			7.0			7.0	
Vehicle Extension (s)		3.0			3.0			3.0			3.0	
Lane Grp Cap (vph)		405			263			959			697	
v/s Ratio Prot												
v/s Ratio Perm		c0.21			0.21			0.37			c0.57	
v/c Ratio		0.91			0.87			0.62			0.95	
Uniform Delay, d1		28.7			28.3			10.0			14.7	
Progression Factor		1.00			1.00			1.00			1.00	
Incremental Delay, d2		23.2			24.8			3.0			24.6	
Delay (s)		51.8			53.1			13.0			39.2	
Level of Service		D			D			B			D	
Approach Delay (s)		51.8			53.1			13.0			39.2	
Approach LOS		D			D			B			D	
Intersection Summary												
HCM 2000 Control Delay		35.5			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.94										
Actuated Cycle Length (s)		77.3			Sum of lost time (s)			13.0				
Intersection Capacity Utilization		116.0%			ICU Level of Service			H				
Analysis Period (min)		15										
c Critical Lane Group												

Appendix F – Synchro Analysis Output – Background Traffic Volumes

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Background (2025) AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	224	671	41	1251	45	35	38	40
Future Volume (vph)	224	671	41	1251	45	35	38	40
Lane Group Flow (vph)	231	924	42	1365	46	54	39	126
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	29.0	81.0	14.0	35.0	14.0	35.0
Total Split (%)	9.7%	45.8%	20.1%	56.3%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.78	0.30	0.11	0.45	0.24	0.30	0.15	0.64
Control Delay	29.3	10.3	6.8	14.6	42.8	43.7	40.4	42.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.3	10.3	6.8	14.6	42.8	43.7	40.4	42.9
Queue Length 50th (m)	16.7	34.8	2.7	66.5	9.8	9.2	8.2	15.3
Queue Length 95th (m)	#50.0	52.4	7.6	92.6	20.8	22.9	18.0	37.4
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	297	3115	568	3035	202	375	283	368
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.30	0.07	0.45	0.23	0.14	0.14	0.34

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 124.3

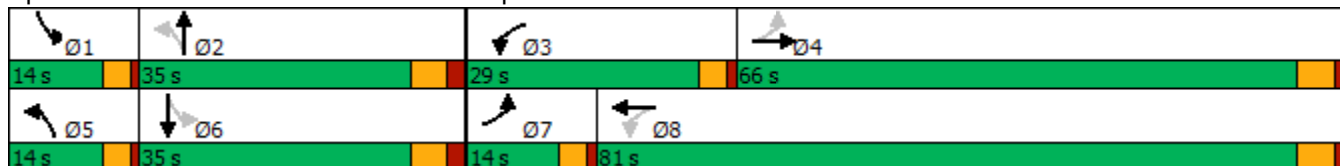
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



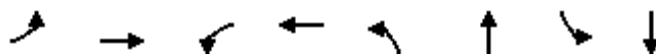
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Background (2025) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	224	671	225	41	1251	73	45	35	17	38	40	82
Future Volume (vph)	224	671	225	41	1251	73	45	35	17	38	40	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.99		1.00	0.95		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4765		1543	5002		1467	1549		1803	1358	
Flt Permitted	0.15	1.00		0.30	1.00		0.52	1.00		0.72	1.00	
Satd. Flow (perm)	254	4765		482	5002		799	1549		1370	1358	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	231	692	232	42	1290	75	46	36	18	39	41	85
RTOR Reduction (vph)	0	26	0	0	4	0	0	14	0	0	58	0
Lane Group Flow (vph)	231	898	0	42	1361	0	46	40	0	39	68	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	90.2	80.6		81.8	76.2		20.3	13.3		19.1	12.7	
Effective Green, g (s)	90.2	80.6		81.8	76.2		20.3	13.3		19.1	12.7	
Actuated g/C Ratio	0.72	0.64		0.65	0.61		0.16	0.11		0.15	0.10	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	292	3050		360	3027		165	163		229	136	
v/s Ratio Prot	c0.06	0.19		0.01	0.27		c0.02	0.03		0.01	c0.05	
v/s Ratio Perm	c0.50			0.07			0.03			0.02		
v/c Ratio	0.79	0.29		0.12	0.45		0.28	0.24		0.17	0.50	
Uniform Delay, d1	10.0	10.0		7.9	13.5		45.8	51.7		46.3	53.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.6	0.2		0.1	0.5		0.9	0.8		0.4	2.8	
Delay (s)	23.6	10.3		8.1	14.0		46.7	52.5		46.7	56.4	
Level of Service	C	B		A	B		D	D		D	E	
Approach Delay (s)		12.9			13.8			49.8			54.1	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay		17.1					HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio		0.74										
Actuated Cycle Length (s)		125.9					Sum of lost time (s)		20.0			
Intersection Capacity Utilization		93.8%					ICU Level of Service		F			
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Background (2025) AM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	2	34	97	145	60	269	68	248
Future Volume (vph)	2	34	97	145	60	269	68	248
Lane Group Flow (vph)	2	83	120	407	74	358	84	331
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	60.0	60.0	60.0	60.0	47.0	47.0	47.0	47.0
Total Split (%)	56.1%	56.1%	56.1%	56.1%	43.9%	43.9%	43.9%	43.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.02	0.20	0.35	0.79	0.14	0.35	0.16	0.34
Control Delay	18.5	12.5	23.7	30.8	10.8	11.6	11.1	11.5
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	12.5	23.7	30.8	10.8	11.6	11.1	11.5
Queue Length 50th (m)	0.2	4.5	13.9	42.7	4.7	25.8	5.4	23.7
Queue Length 95th (m)	1.5	12.0	23.9	61.4	12.8	49.2	14.4	45.8
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	253	1065	945	1261	547	1017	515	977
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.08	0.13	0.32	0.14	0.35	0.16	0.34

Intersection Summary

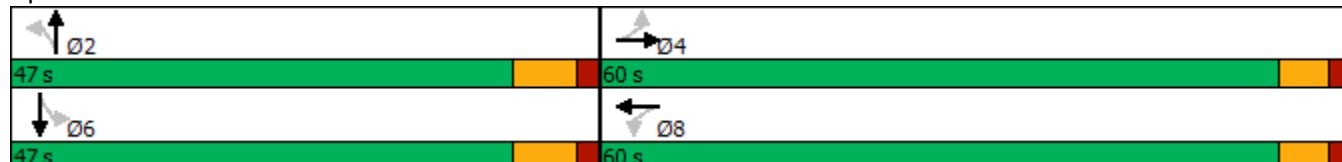
Cycle Length: 107

Actuated Cycle Length: 73.2

Natural Cycle: 75

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Lockhart Road & Huronia Road



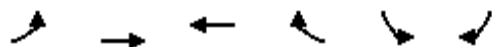
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Background (2025) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	34	33	97	145	185	60	269	21	68	248	20
Future Volume (vph)	2	34	33	97	145	185	60	269	21	68	248	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.93		1.00	0.92		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1203	1420		1719	1668		1703	1846		1671	1771	
Flt Permitted	0.27	1.00		0.70	1.00		0.56	1.00		0.53	1.00	
Satd. Flow (perm)	342	1420		1272	1668		996	1846		935	1771	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	2	42	41	120	179	228	74	332	26	84	306	25
RTOR Reduction (vph)	0	30	0	0	63	0	0	2	0	0	2	0
Lane Group Flow (vph)	2	53	0	120	344	0	74	356	0	84	329	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	19.8	19.8		19.8	19.8		40.3	40.3		40.3	40.3	
Effective Green, g (s)	19.8	19.8		19.8	19.8		40.3	40.3		40.3	40.3	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.55	0.55		0.55	0.55	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	92	384		344	451		549	1017		515	976	
v/s Ratio Prot		0.04			c0.21			c0.19			0.19	
v/s Ratio Perm	0.01			0.09			0.07			0.09		
v/c Ratio	0.02	0.14		0.35	0.76		0.13	0.35		0.16	0.34	
Uniform Delay, d1	19.5	20.2		21.5	24.5		7.9	9.1		8.1	9.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.2		0.6	7.4		0.5	1.0		0.7	0.9	
Delay (s)	19.6	20.4		22.1	31.9		8.5	10.1		8.8	10.0	
Level of Service	B	C		C	C		A	B		A	A	
Approach Delay (s)		20.3			29.7			9.8			9.7	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			17.6			HCM 2000 Level of Service			B			
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			73.1			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			86.3%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Background (2025) AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	
Traffic Volume (veh/h)	8	57	149	75	12	33
Future Volume (Veh/h)	8	57	149	75	12	33
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	62	162	82	13	36
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	244				283	203
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	244				283	203
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	96
cM capacity (veh/h)	1322				702	838
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	71	244	49			
Volume Left	9	0	13			
Volume Right	0	82	36			
cSH	1322	1700	797			
Volume to Capacity	0.01	0.14	0.06			
Queue Length 95th (m)	0.2	0.0	1.6			
Control Delay (s)	1.0	0.0	9.8			
Lane LOS	A		A			
Approach Delay (s)	1.0	0.0	9.8			
Approach LOS			A			
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization		22.4%		ICU Level of Service		A
Analysis Period (min)		15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	29	6	3	2	140	67	1	1	0	212	3	91
Future Volume (vph)	29	6	3	2	140	67	1	1	0	212	3	91
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)	32	7	3	2	152	73	1	1	0	230	3	99
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	42	227	2	332								
Volume Left (vph)	32	2	1	230								
Volume Right (vph)	3	73	0	99								
Hadj (s)	0.14	-0.16	0.29	0.00								
Departure Headway (s)	5.2	4.6	5.3	4.6								
Degree Utilization, x	0.06	0.29	0.00	0.42								
Capacity (veh/h)	638	730	625	753								
Control Delay (s)	8.5	9.5	8.3	10.8								
Approach Delay (s)	8.5	9.5	8.3	10.8								
Approach LOS	A	A	A	B								
Intersection Summary												
Delay			10.2									
Level of Service			B									
Intersection Capacity Utilization			49.0%	ICU Level of Service		A						
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 10.1
Intersection LOS B

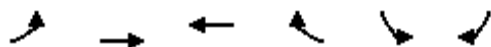
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	29	6	3	2	140	67	1	1	0	212	3	91
Future Vol, veh/h	29	6	3	2	140	67	1	1	0	212	3	91
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	20	2	2	15	2
Mvmt Flow	32	7	3	2	152	73	1	1	0	230	3	99
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.5	9.5	8.1	10.8
HCM LOS	A	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	50%	76%	1%	69%
Vol Thru, %	50%	16%	67%	1%
Vol Right, %	0%	8%	32%	30%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	2	38	209	306
LT Vol	1	29	2	212
Through Vol	1	6	140	3
RT Vol	0	3	67	91
Lane Flow Rate	2	41	227	333
Geometry Grp	1	1	1	1
Degree of Util (X)	0.003	0.059	0.29	0.419
Departure Headway (Hd)	5.071	5.114	4.593	4.533
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	702	698	781	792
Service Time	3.127	3.162	2.629	2.569
HCM Lane V/C Ratio	0.003	0.059	0.291	0.42
HCM Control Delay	8.1	8.5	9.5	10.8
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	0	0.2	1.2	2.1

140 Lockhart Road
5: Lockhart Road & Welham Extension

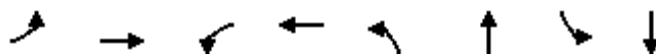
HCM Unsignalized Intersection Capacity Analysis
Background (2025) AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	
Traffic Volume (veh/h)	1	68	224	2	0	0
Future Volume (Veh/h)	1	68	224	2	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	74	243	2	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	245				320	244
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	245				320	244
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1321				673	795
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	75	245	0			
Volume Left	1	0	0			
Volume Right	0	2	0			
cSH	1321	1700	1700			
Volume to Capacity	0.00	0.14	0.00			
Queue Length 95th (m)	0.0	0.0	0.0			
Control Delay (s)	0.1	0.0	0.0			
Lane LOS	A		A			
Approach Delay (s)	0.1	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization		15.2%		ICU Level of Service		A
Analysis Period (min)		15				

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Background (2025) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	180	1569	25	931	238	82	108	51
Future Volume (vph)	180	1569	25	931	238	82	108	51
Lane Group Flow (vph)	205	1833	28	1103	270	192	123	266
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	19.0	71.0	31.0	52.0	14.0	35.0
Total Split (%)	9.3%	43.7%	12.6%	47.0%	20.5%	34.4%	9.3%	23.2%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.71	0.68	0.19	0.46	0.77	0.44	0.40	0.84
Control Delay	31.3	27.9	17.8	26.1	50.4	38.5	36.1	57.3
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.3	27.9	17.8	26.1	50.4	38.5	36.1	57.3
Queue Length 50th (m)	26.9	150.5	3.3	77.6	58.8	38.1	24.4	46.5
Queue Length 95th (m)	#57.0	194.6	9.2	102.9	84.9	59.5	38.6	78.2
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	288	2715	245	2388	397	608	313	426
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.71	0.68	0.11	0.46	0.68	0.32	0.39	0.62

Intersection Summary

Cycle Length: 151

Actuated Cycle Length: 137.4

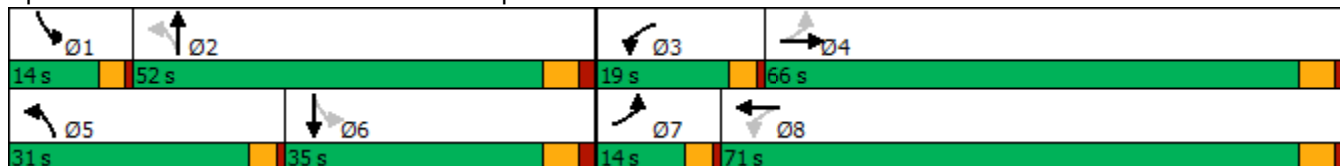
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



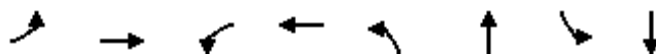
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Background (2025) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	180	1569	44	25	931	40	238	82	87	108	51	183
Future Volume (vph)	180	1569	44	25	931	40	238	82	87	108	51	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5105		1703	5008		1770	1736		1770	1613	
Flt Permitted	0.18	1.00		0.07	1.00		0.17	1.00		0.64	1.00	
Satd. Flow (perm)	322	5105		121	5008		320	1736		1186	1613	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	205	1783	50	28	1058	45	270	93	99	123	58	208
RTOR Reduction (vph)	0	1	0	0	3	0	0	28	0	0	91	0
Lane Group Flow (vph)	205	1832	0	28	1100	0	270	164	0	123	175	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	81.3	73.1		71.4	67.2		45.8	32.1		29.0	19.3	
Effective Green, g (s)	81.3	73.1		71.4	67.2		45.8	32.1		29.0	19.3	
Actuated g/C Ratio	0.58	0.53		0.51	0.48		0.33	0.23		0.21	0.14	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	287	2682		109	2419		339	400		287	223	
v/s Ratio Prot	c0.05	0.36		0.01	0.22		c0.13	0.09		0.03	0.11	
v/s Ratio Perm	c0.37			0.12			c0.13			0.06		
v/c Ratio	0.71	0.68		0.26	0.45		0.80	0.41		0.43	0.78	
Uniform Delay, d1	16.1	24.4		19.9	23.8		38.4	45.5		46.8	57.9	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	8.2	1.4		1.3	0.6		12.2	0.7		1.0	16.3	
Delay (s)	24.2	25.9		21.1	24.4		50.6	46.2		47.9	74.2	
Level of Service	C	C		C	C		D	D		D	E	
Approach Delay (s)		25.7			24.4			48.8			65.9	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay		31.9			HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio		0.78										
Actuated Cycle Length (s)		139.1			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		103.8%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Background (2025) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	12	227	46	91	42	402	227	410
Future Volume (vph)	12	227	46	91	42	402	227	410
Lane Group Flow (vph)	14	422	52	247	48	625	258	477
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	30.0	30.0	30.0	30.0	48.0	48.0	48.0	48.0
Total Split (%)	38.5%	38.5%	38.5%	38.5%	61.5%	61.5%	61.5%	61.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.06	0.84	0.43	0.50	0.14	0.63	0.82	0.47
Control Delay	20.1	39.0	34.3	17.3	10.6	15.1	39.8	12.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	39.0	34.3	17.3	10.6	15.1	39.8	12.7
Queue Length 50th (m)	1.5	52.9	6.3	18.2	3.4	58.9	30.7	41.9
Queue Length 95th (m)	5.5	#87.3	17.0	37.5	9.2	94.4	#77.2	66.3
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	270	587	142	568	346	990	315	1021
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.72	0.37	0.43	0.14	0.63	0.82	0.47

Intersection Summary

Cycle Length: 78

Actuated Cycle Length: 74.5

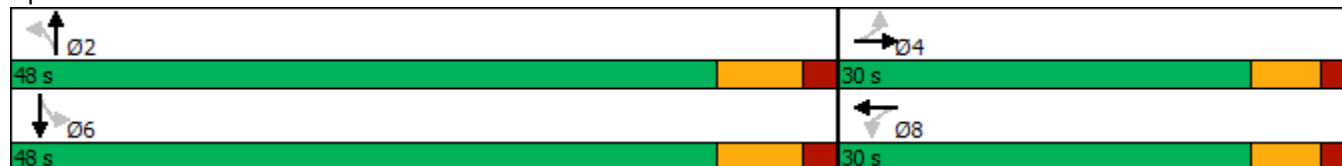
Natural Cycle: 75

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



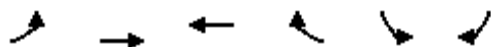
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Background (2025) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	227	144	46	91	127	42	402	148	227	410	10
Future Volume (vph)	12	227	144	46	91	127	42	402	148	227	410	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.91		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1504	1731		1687	1564		1388	1766		1719	1850	
Flt Permitted	0.53	1.00		0.25	1.00		0.43	1.00		0.32	1.00	
Satd. Flow (perm)	837	1731		442	1564		629	1766		571	1850	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	14	258	164	52	103	144	48	457	168	258	466	11
RTOR Reduction (vph)	0	30	0	0	68	0	0	16	0	0	1	0
Lane Group Flow (vph)	14	392	0	52	179	0	48	609	0	258	476	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	20.4	20.4		20.4	20.4		41.1	41.1		41.1	41.1	
Effective Green, g (s)	20.4	20.4		20.4	20.4		41.1	41.1		41.1	41.1	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.55	0.55		0.55	0.55	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	229	473		121	428		347	974		315	1020	
v/s Ratio Prot		c0.23			0.11			0.34			0.26	
v/s Ratio Perm	0.02			0.12			0.08			c0.45		
v/c Ratio	0.06	0.83		0.43	0.42		0.14	0.63		0.82	0.47	
Uniform Delay, d1	20.0	25.4		22.3	22.2		8.1	11.4		13.7	10.1	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	11.4		2.4	0.7		0.8	3.0		20.6	1.5	
Delay (s)	20.1	36.8		24.7	22.9		8.9	14.5		34.3	11.6	
Level of Service	C	D		C	C		A	B		C	B	
Approach Delay (s)		36.2			23.2			14.1			19.6	
Approach LOS		D			C			B			B	
Intersection Summary												
HCM 2000 Control Delay			21.7			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.82									
Actuated Cycle Length (s)			74.5			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			119.1%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Background (2025) PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	
Traffic Volume (veh/h)	33	110	121	21	273	10
Future Volume (Veh/h)	33	110	121	21	273	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	120	132	23	297	11
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	155				336	144
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	155				336	144
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				54	99
cM capacity (veh/h)	1425				643	904
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	156	155	308			
Volume Left	36	0	297			
Volume Right	0	23	11			
cSH	1425	1700	650			
Volume to Capacity	0.03	0.09	0.47			
Queue Length 95th (m)	0.6	0.0	20.4			
Control Delay (s)	1.9	0.0	15.4			
Lane LOS	A		C			
Approach Delay (s)	1.9	0.0	15.4			
Approach LOS			C			
Intersection Summary						
Average Delay			8.2			
Intersection Capacity Utilization		41.0%		ICU Level of Service		A
Analysis Period (min)		15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	191	131	1	1	106	216	3	3	2	64	1	56
Future Volume (vph)	191	131	1	1	106	216	3	3	2	64	1	56
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)	208	142	1	1	115	235	3	3	2	70	1	61
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	351	351	8	132								
Volume Left (vph)	208	1	3	70								
Volume Right (vph)	1	235	2	61								
Hadj (s)	0.15	-0.37	-0.05	-0.14								
Departure Headway (s)	4.8	4.4	5.7	5.4								
Degree Utilization, x	0.47	0.43	0.01	0.20								
Capacity (veh/h)	713	792	523	597								
Control Delay (s)	12.1	10.6	8.8	9.7								
Approach Delay (s)	12.1	10.6	8.8	9.7								
Approach LOS	B	B	A	A								
Intersection Summary												
Delay			11.1									
Level of Service			B									
Intersection Capacity Utilization			57.1%	ICU Level of Service	B							
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 11
Intersection LOS B

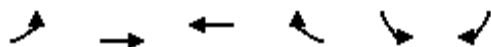
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	191	131	1	1	106	216	3	3	2	64	1	56
Future Vol, veh/h	191	131	1	1	106	216	3	3	2	64	1	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	1	2	2	11	2
Mvmt Flow	208	142	1	1	115	235	3	3	2	70	1	61
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	12	10.5	8.8	9.7
HCM LOS	B	B	A	A

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	38%	59%	0%	53%
Vol Thru, %	38%	41%	33%	1%
Vol Right, %	25%	0%	67%	46%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	8	323	323	121
LT Vol	3	191	1	64
Through Vol	3	131	106	1
RT Vol	2	1	216	56
Lane Flow Rate	9	351	351	132
Geometry Grp	1	1	1	1
Degree of Util (X)	0.014	0.467	0.421	0.194
Departure Headway (Hd)	5.736	4.789	4.315	5.303
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	628	748	829	671
Service Time	3.736	2.847	2.369	3.385
HCM Lane V/C Ratio	0.014	0.469	0.423	0.197
HCM Control Delay	8.8	12	10.5	9.7
HCM Lane LOS	A	B	B	A
HCM 95th-tile Q	0	2.5	2.1	0.7

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Background (2025) PM Peak Hour

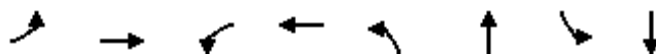


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	0	383	141	1	2	1
Future Volume (Veh/h)	0	383	141	1	2	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	416	153	1	2	1
Pedestrians						
Lane Width (m)						
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	154				570	154
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	154				570	154
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	1426				483	892
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	416	154	3			
Volume Left	0	0	2			
Volume Right	0	1	1			
cSH	1426	1700	570			
Volume to Capacity	0.00	0.09	0.01			
Queue Length 95th (m)	0.0	0.0	0.1			
Control Delay (s)	0.0	0.0	11.3			
Lane LOS			B			
Approach Delay (s)	0.0	0.0	11.3			
Approach LOS			B			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization		30.2%		ICU Level of Service	A	
Analysis Period (min)			15			

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Background (2031) AM Peak Hour w/out Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	252	768	51	1492	120	96	43	50
Future Volume (vph)	252	768	51	1492	120	96	43	50
Lane Group Flow (vph)	260	1079	53	1622	124	143	44	147
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	29.0	66.0	29.0	66.0	14.0	35.0	14.0	35.0
Total Split (%)	20.1%	45.8%	20.1%	45.8%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.78	0.37	0.18	0.67	0.58	0.58	0.15	0.69
Control Delay	46.1	13.1	10.4	27.9	52.1	56.4	38.6	49.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	13.1	10.4	27.9	52.1	56.4	38.6	49.7
Queue Length 50th (m)	44.5	46.9	3.9	116.5	27.1	32.6	9.0	22.9
Queue Length 95th (m)	84.2	69.8	10.2	160.4	46.5	57.6	19.6	47.4
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	392	2894	504	2408	214	371	314	361
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.37	0.11	0.67	0.58	0.39	0.14	0.41

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 125.6

Natural Cycle: 125

Control Type: Semi Act-Uncoord

Splits and Phases: 1: Welham Rd & Maplview Drive E

Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
Ø5	Ø6	Ø7	Ø8
14 s	35 s	29 s	66 s

140 Lockhart Road
1: Welham Rd & Maplview Drive E

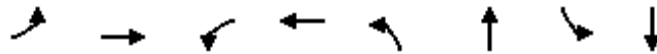
HCM Signalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	252	768	278	51	1492	81	120	96	43	43	50	92
Future Volume (vph)	252	768	278	51	1492	81	120	96	43	43	50	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.99		1.00	0.95		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4755		1543	5004		1467	1552		1804	1369	
Flt Permitted	0.08	1.00		0.25	1.00		0.41	1.00		0.66	1.00	
Satd. Flow (perm)	131	4755		410	5004		640	1552		1262	1369	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	260	792	287	53	1538	84	124	99	44	44	52	95
RTOR Reduction (vph)	0	32	0	0	4	0	0	12	0	0	50	0
Lane Group Flow (vph)	260	1047	0	53	1618	0	124	131	0	44	97	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	85.5	75.6		67.2	61.3		29.1	19.2		22.5	15.9	
Effective Green, g (s)	85.5	75.6		67.2	61.3		29.1	19.2		22.5	15.9	
Actuated g/C Ratio	0.67	0.59		0.53	0.48		0.23	0.15		0.18	0.12	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	327	2823		268	2409		210	234		251	170	
v/s Ratio Prot	c0.13	0.22		0.01	0.32		c0.05	0.08		0.01	0.07	
v/s Ratio Perm	c0.41			0.09			c0.09			0.02		
v/c Ratio	0.80	0.37		0.20	0.67		0.59	0.56		0.18	0.57	
Uniform Delay, d1	33.8	13.5		14.7	25.3		41.6	50.1		44.2	52.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.5	0.4		0.4	1.5		4.4	3.1		0.3	4.6	
Delay (s)	46.4	13.8		15.1	26.8		46.0	53.2		44.6	57.1	
Level of Service	D	B		B	C		D	D		D	E	
Approach Delay (s)		20.2			26.4			49.8			54.2	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			27.3	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			127.3	Sum of lost time (s)			20.0					
Intersection Capacity Utilization			95.6%	ICU Level of Service			F					
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues

Background (2031) AM Peak Hour w/out Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	→	↰	→	↰	→	↰	→
Traffic Volume (vph)	3	550	110	1245	67	303	77	280
Future Volume (vph)	3	550	110	1245	67	303	77	280
Lane Group Flow (vph)	4	725	136	1795	83	402	95	373
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	97.0	97.0	97.0	97.0	53.0	53.0	53.0	53.0
Total Split (%)	64.7%	64.7%	64.7%	64.7%	35.3%	35.3%	35.3%	35.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.12	0.75	0.51	1.62	0.50	0.71	0.67	0.68
Control Delay	22.7	27.5	25.0	307.2	54.9	53.7	69.9	52.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.7	27.5	25.0	307.2	54.9	53.7	69.9	52.8
Queue Length 50th (m)	0.5	156.7	23.1	~809.4	21.3	111.0	26.0	102.0
Queue Length 95th (m)	2.6	172.3	37.8	#766.7	35.8	131.4	44.1	122.0
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	33	962	268	1110	166	568	142	545
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.75	0.51	1.62	0.50	0.71	0.67	0.68

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Natural Cycle: 150

Control Type: Semi Act-Uncoord

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



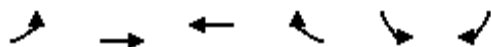
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Future Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1203	1585		1719	1825		1703	1848		1671	1773	
Flt Permitted	0.04	1.00		0.25	1.00		0.30	1.00		0.26	1.00	
Satd. Flow (perm)	56	1585		443	1825		543	1848		464	1773	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	4	679	46	136	1537	258	83	374	28	95	346	27
RTOR Reduction (vph)	0	2	0	0	4	0	0	2	0	0	2	0
Lane Group Flow (vph)	4	723	0	136	1791	0	83	400	0	95	371	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	91.0	91.0		91.0	91.0		46.0	46.0		46.0	46.0	
Effective Green, g (s)	91.0	91.0		91.0	91.0		46.0	46.0		46.0	46.0	
Actuated g/C Ratio	0.61	0.61		0.61	0.61		0.31	0.31		0.31	0.31	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	33	961		268	1107		166	566		142	543	
v/s Ratio Prot		0.46			c0.98			c0.22			0.21	
v/s Ratio Perm	0.07			0.31			0.15			0.20		
v/c Ratio	0.12	0.75		0.51	1.62		0.50	0.71		0.67	0.68	
Uniform Delay, d1	12.5	21.4		16.8	29.5		42.6	46.0		45.4	45.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	3.4		1.5	282.3		10.4	7.3		22.3	6.8	
Delay (s)	14.2	24.7		18.3	311.8		52.9	53.3		67.6	52.4	
Level of Service	B	C		B	F		D	D		E	D	
Approach Delay (s)		24.7			291.1			53.2			55.5	
Approach LOS		C			F			D			E	
Intersection Summary												
HCM 2000 Control Delay		174.9					HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio		1.31										
Actuated Cycle Length (s)		150.0					Sum of lost time (s)		13.0			
Intersection Capacity Utilization		166.2%					ICU Level of Service		H			
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/out Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	679	943	91	14	25
Future Volume (Veh/h)	6	679	943	91	14	25
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	738	1025	99	15	27
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	1124				1826	1074
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1124				1826	1074
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				82	90
cM capacity (veh/h)	621				84	267
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	745	1124	42			
Volume Left	7	0	15			
Volume Right	0	99	27			
cSH	621	1700	150			
Volume to Capacity	0.01	0.66	0.28			
Queue Length 95th (m)	0.3	0.0	8.7			
Control Delay (s)	0.3	0.0	38.2			
Lane LOS	A		E			
Approach Delay (s)	0.3	0.0	38.2			
Approach LOS			E			
Intersection Summary						
Average Delay			1.0			
Intersection Capacity Utilization		65.1%		ICU Level of Service	C	
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	118	94	2	0	104	141	1	1	0	207	3	172
Future Volume (vph)	118	94	2	0	104	141	1	1	0	207	3	172
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)	128	102	2	0	113	153	1	1	0	225	3	187
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total (vph)	232	266	1	1	415							
Volume Left (vph)	128	0	1	0	225							
Volume Right (vph)	2	153	0	0	187							
Hadj (s)	0.14	-0.31	0.53	0.34	-0.13							
Departure Headway (s)	5.6	5.1	7.0	6.8	5.2							
Degree Utilization, x	0.36	0.38	0.00	0.00	0.60							
Capacity (veh/h)	600	655	433	437	657							
Control Delay (s)	11.7	11.2	8.9	8.7	15.8							
Approach Delay (s)	11.7	11.2	8.8		15.8							
Approach LOS	B	B	A		C							
Intersection Summary												
Delay			13.4									
Level of Service			B									
Intersection Capacity Utilization			64.5%	ICU Level of Service		C						
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 13.5

Intersection LOS B

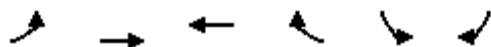
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	118	94	2	0	104	141	1	1	0	207	3	172
Future Vol, veh/h	118	94	2	0	104	141	1	1	0	207	3	172
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	20	2	2	15	2
Mvmt Flow	128	102	2	0	113	153	1	1	0	225	3	187
Number of Lanes	0	1	0	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	11.8	11.3	9.7	15.8
HCM LOS	B	B	A	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	100%	0%	55%	0%	54%
Vol Thru, %	0%	100%	44%	42%	1%
Vol Right, %	0%	0%	1%	58%	45%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	1	1	214	245	382
LT Vol	1	0	118	0	207
Through Vol	0	1	94	104	3
RT Vol	0	0	2	141	172
Lane Flow Rate	1	1	233	266	415
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.002	0.002	0.361	0.379	0.601
Departure Headway (Hd)	7.019	6.821	5.593	5.119	5.21
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	509	524	642	703	693
Service Time	4.773	4.575	3.631	3.155	3.241
HCM Lane V/C Ratio	0.002	0.002	0.363	0.378	0.599
HCM Control Delay	9.8	9.6	11.8	11.3	15.8
HCM Lane LOS	A	A	B	B	C
HCM 95th-tile Q	0	0	1.6	1.8	4

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/out Post-2031 Imp.

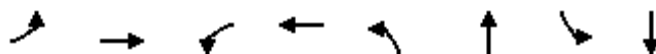


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	↰
Traffic Volume (veh/h)	1	693	1034	2	0	0
Future Volume (Veh/h)	1	693	1034	2	0	0
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	1	753	1124	2	0	0
Pedestrians						
Lane 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	1126				1880	1125
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1126				1880	1125
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				100	100
cM capacity (veh/h)	620				78	250
Direction, Lane #	EB 1	WB 1	SB 1	SB 2		
Volume Total	754	1126	0	0		
Volume Left	1	0	0	0		
Volume Right	0	2	0	0		
cSH	620	1700	1700	1700		
Volume to Capacity	0.00	0.66	0.00	0.00		
Queue Length 95th (m)	0.0	0.0	0.0	0.0		
Control Delay (s)	0.0	0.0	0.0	0.0		
Lane LOS	A		A	A		
Approach Delay (s)	0.0	0.0	0.0			
Approach LOS			A			
Intersection Summary						
Average Delay			0.0			
Intersection Capacity Utilization			57.9%		ICU Level of Service	B
Analysis Period (min)			15			

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Background (2031) PM Peak Hour w/out Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	203	1793	41	1287	139	47	122	81
Future Volume (vph)	203	1793	41	1287	139	47	122	81
Lane Group Flow (vph)	231	2118	47	1514	158	111	139	327
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	23.0	71.0	18.0	66.0	16.0	46.0	14.0	44.0
Total Split (%)	15.4%	47.7%	12.1%	44.3%	10.7%	30.9%	9.4%	29.5%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.80	0.78	0.32	0.68	0.73	0.29	0.35	0.86
Control Delay	51.7	29.7	20.0	33.2	54.4	31.5	36.4	60.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.7	29.7	20.0	33.2	54.4	31.5	36.4	60.6
Queue Length 50th (m)	42.4	176.5	5.1	126.6	33.6	18.0	29.2	70.0
Queue Length 95th (m)	#89.8	228.0	12.3	159.6	#52.2	34.0	45.1	103.1
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	306	2730	230	2232	222	538	397	515
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.78	0.20	0.68	0.71	0.21	0.35	0.63

Intersection Summary

Cycle Length: 149

Actuated Cycle Length: 135.9

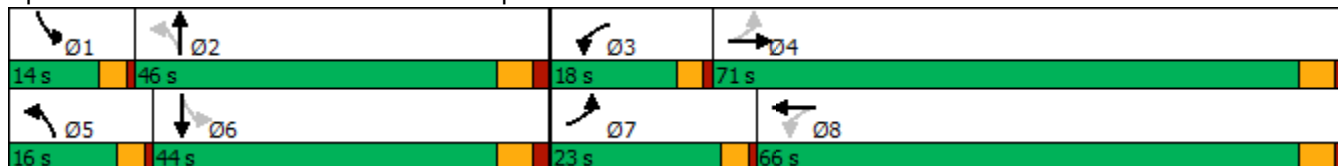
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



140 Lockhart Road
1: Welham Rd & Maplview Drive E

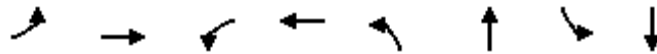
HCM Signalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	1793	70	41	1287	45	139	47	51	122	81	207
Future Volume (vph)	203	1793	70	41	1287	45	139	47	51	122	81	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5093		1703	5021		1770	1734		1770	1622	
Flt Permitted	0.08	1.00		0.07	1.00		0.16	1.00		0.69	1.00	
Satd. Flow (perm)	146	5093		117	5021		294	1734		1277	1622	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	231	2038	80	47	1462	51	158	53	58	139	92	235
RTOR Reduction (vph)	0	2	0	0	2	0	0	29	0	0	67	0
Lane Group Flow (vph)	231	2116	0	47	1512	0	158	82	0	139	260	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.7	72.8		67.2	61.3		39.8	28.2		36.2	26.4	
Effective Green, g (s)	82.7	72.8		67.2	61.3		39.8	28.2		36.2	26.4	
Actuated g/C Ratio	0.60	0.53		0.49	0.45		0.29	0.21		0.26	0.19	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	284	2712		125	2251		210	357		373	313	
v/s Ratio Prot	c0.10	0.42		0.02	0.30		c0.06	0.05		0.03	c0.16	
v/s Ratio Perm	c0.39			0.17			0.15			0.07		
v/c Ratio	0.81	0.78		0.38	0.67		0.75	0.23		0.37	0.83	
Uniform Delay, d1	34.1	25.5		22.5	29.8		39.5	45.2		40.1	53.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	16.1	2.3		1.9	1.6		14.1	0.3		0.6	16.8	
Delay (s)	50.2	27.9		24.4	31.4		53.6	45.5		40.7	69.8	
Level of Service	D	C		C	C		D	D		D	E	
Approach Delay (s)		30.1			31.2			50.3			61.2	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay		34.7			HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		136.7			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		102.6%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues

Background (2031) PM Peak Hour w/out Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	14	965	52	595	47	453	257	461
Future Volume (vph)	14	965	52	595	47	453	257	461
Lane Group Flow (vph)	16	1281	59	839	53	704	292	537
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	66.0	66.0	66.0	66.0	84.0	84.0	84.0	84.0
Total Split (%)	44.0%	44.0%	44.0%	44.0%	56.0%	56.0%	56.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.38	1.77	1.26	1.31	0.22	0.77	1.64	0.57
Control Delay	62.6	379.7	254.3	187.5	23.2	35.5	339.9	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	62.6	379.7	254.3	187.5	23.2	35.5	339.9	27.9
Queue Length 50th (m)	3.5	~599.7	~22.9	~336.4	8.9	169.4	~131.7	112.6
Queue Length 95th (m)	13.0	#665.5	#53.4	#404.8	18.7	216.4	#133.0	144.6
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	42	725	47	640	239	915	178	949
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.38	1.77	1.26	1.31	0.22	0.77	1.64	0.57

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Natural Cycle: 150

Control Type: Semi Act-Uncoord

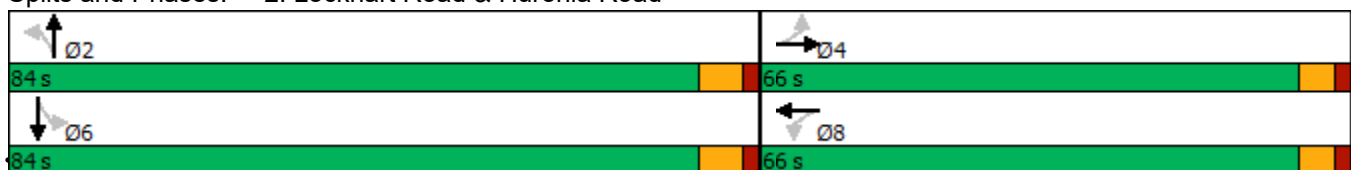
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



JD Engineering

Synchro 10 Report
02-04-2021

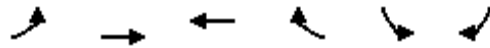
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Future Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1504	1802		1687	1586		1388	1766		1719	1849	
Flt Permitted	0.07	1.00		0.07	1.00		0.32	1.00		0.19	1.00	
Satd. Flow (perm)	106	1802		118	1586		466	1766		347	1849	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	16	1097	184	59	676	162	53	515	189	292	524	12
RTOR Reduction (vph)	0	4	0	0	6	0	0	9	0	0	0	0
Lane Group Flow (vph)	16	1277	0	59	833	0	53	695	0	292	537	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	60.0	60.0		60.0	60.0		77.0	77.0		77.0	77.0	
Effective Green, g (s)	60.0	60.0		60.0	60.0		77.0	77.0		77.0	77.0	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.51	0.51		0.51	0.51	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	42	720		47	634		239	906		178	949	
v/s Ratio Prot		c0.71			0.53			0.39			0.29	
v/s Ratio Perm	0.15			0.50			0.11			c0.84		
v/c Ratio	0.38	1.77		1.26	1.31		0.22	0.77		1.64	0.57	
Uniform Delay, d1	31.9	45.0		45.0	45.0		20.0	29.3		36.5	25.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	5.7	353.6		215.4	152.3		2.1	6.2		312.1	2.4	
Delay (s)	37.5	398.6		260.4	197.3		22.2	35.5		348.6	27.5	
Level of Service	D	F		F	F		C	D		F	C	
Approach Delay (s)		394.2			201.4			34.6			140.6	
Approach LOS		F			F			C			F	
Intersection Summary												
HCM 2000 Control Delay		220.8					HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio		1.70										
Actuated Cycle Length (s)		150.0					Sum of lost time (s)		13.0			
Intersection Capacity Utilization		144.6%					ICU Level of Service		H			
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/out Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	
Traffic Volume (veh/h)	25	1007	679	72	14	7
Future Volume (Veh/h)	25	1007	679	72	14	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	1095	738	78	15	8
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	816				1926	777
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	816				1926	777
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				79	98
cM capacity (veh/h)	812				71	397
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	1122	816	23			
Volume Left	27	0	15			
Volume Right	0	78	8			
cSH	812	1700	99			
Volume to Capacity	0.03	0.48	0.23			
Queue Length 95th (m)	0.8	0.0	6.7			
Control Delay (s)	1.1	0.0	52.0			
Lane LOS	A		F			
Approach Delay (s)	1.1	0.0	52.0			
Approach LOS			F			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization		83.1%		ICU Level of Service	E	
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	119	31	1	0	31	119	2	3	0	96	1	96
Future Volume (vph)	119	31	1	0	31	119	2	3	0	96	1	96
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)	129	34	1	0	34	129	2	3	0	104	1	104
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total (vph)	164	163	2	3	209							
Volume Left (vph)	129	0	2	0	104							
Volume Right (vph)	1	129	0	0	104							
Hadj (s)	0.19	-0.44	0.53	0.02	-0.16							
Departure Headway (s)	4.8	4.2	6.0	5.5	4.6							
Degree Utilization, x	0.22	0.19	0.00	0.00	0.27							
Capacity (veh/h)	710	808	550	598	732							
Control Delay (s)	9.1	8.1	7.8	7.3	9.3							
Approach Delay (s)	9.1	8.1	7.5		9.3							
Approach LOS	A	A	A		A							
Intersection Summary												
Delay			8.9									
Level of Service			A									
Intersection Capacity Utilization			45.2%			ICU Level of Service			A			
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 8.9

Intersection LOS A

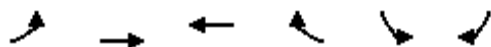
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	119	31	1	0	31	119	2	3	0	96	1	96
Future Vol, veh/h	119	31	1	0	31	119	2	3	0	96	1	96
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	1	2	2	11	2
Mvmt Flow	129	34	1	0	34	129	2	3	0	104	1	104
Number of Lanes	0	1	0	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	9.1	8.2	8.4	9.3
HCM LOS	A	A	A	A

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	100%	0%	79%	0%	50%
Vol Thru, %	0%	100%	21%	21%	1%
Vol Right, %	0%	0%	1%	79%	50%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	2	3	151	150	193
LT Vol	2	0	119	0	96
Through Vol	0	3	31	31	1
RT Vol	0	0	1	119	96
Lane Flow Rate	2	3	164	163	210
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.004	0.005	0.217	0.189	0.267
Departure Headway (Hd)	5.99	5.468	4.769	4.165	4.582
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	596	653	752	861	782
Service Time	3.736	3.214	2.803	2.196	2.616
HCM Lane V/C Ratio	0.003	0.005	0.218	0.189	0.269
HCM Control Delay	8.8	8.2	9.1	8.2	9.3
HCM Lane LOS	A	A	A	A	A
HCM 95th-tile Q	0	0	0.8	0.7	1.1

140 Lockhart Road
5: Lockhart Road & Welham Extension

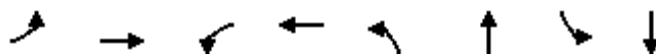
HCM Unsignalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/out Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	↰
Traffic Volume (veh/h)	0	1021	751	1	2	1
Future Volume (Veh/h)	0	1021	751	1	2	1
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	0	1110	816	1	2	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	817				1926	816
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	817				1926	816
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				97	100
cM capacity (veh/h)	811				73	377
Direction, Lane #	EB 1	WB 1	SB 1	SB 2		
Volume Total	1110	817	2	1		
Volume Left	0	0	2	0		
Volume Right	0	1	0	1		
cSH	811	1700	73	377		
Volume to Capacity	0.00	0.48	0.03	0.00		
Queue Length 95th (m)	0.0	0.0	0.7	0.1		
Control Delay (s)	0.0	0.0	55.6	14.6		
Lane LOS			F	B		
Approach Delay (s)	0.0	0.0	41.9			
Approach LOS			E			
Intersection Summary						
Average Delay			0.1			
Intersection Capacity Utilization			63.7%		ICU Level of Service	B
Analysis Period (min)			15			

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Background (2031) AM Peak Hour w/ Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	252	768	51	1492	120	96	43	50
Future Volume (vph)	252	768	51	1492	120	96	43	50
Lane Group Flow (vph)	260	1079	53	1622	124	143	44	147
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	29.0	66.0	29.0	66.0	14.0	35.0	14.0	35.0
Total Split (%)	20.1%	45.8%	20.1%	45.8%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.78	0.37	0.18	0.67	0.58	0.58	0.15	0.69
Control Delay	46.1	13.1	10.4	27.9	52.1	56.4	38.6	49.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.1	13.1	10.4	27.9	52.1	56.4	38.6	49.7
Queue Length 50th (m)	44.5	46.9	3.9	116.5	27.1	32.6	9.0	22.9
Queue Length 95th (m)	84.2	69.8	10.2	160.4	46.5	57.6	19.6	47.4
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	392	2894	504	2408	214	371	314	361
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.37	0.11	0.67	0.58	0.39	0.14	0.41

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 125.6

Natural Cycle: 125

Control Type: Semi Act-Uncoord

Splits and Phases: 1: Welham Rd & Maplview Drive E

Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
Ø5	Ø6	Ø7	Ø8
14 s	35 s	29 s	66 s

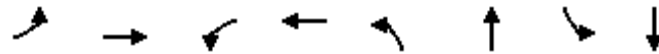
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	252	768	278	51	1492	81	120	96	43	43	50	92
Future Volume (vph)	252	768	278	51	1492	81	120	96	43	43	50	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.99		1.00	0.95		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4755		1543	5004		1467	1552		1804	1369	
Flt Permitted	0.08	1.00		0.25	1.00		0.41	1.00		0.66	1.00	
Satd. Flow (perm)	131	4755		410	5004		640	1552		1262	1369	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	260	792	287	53	1538	84	124	99	44	44	52	95
RTOR Reduction (vph)	0	32	0	0	4	0	0	12	0	0	50	0
Lane Group Flow (vph)	260	1047	0	53	1618	0	124	131	0	44	97	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	85.5	75.6		67.2	61.3		29.1	19.2		22.5	15.9	
Effective Green, g (s)	85.5	75.6		67.2	61.3		29.1	19.2		22.5	15.9	
Actuated g/C Ratio	0.67	0.59		0.53	0.48		0.23	0.15		0.18	0.12	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	327	2823		268	2409		210	234		251	170	
v/s Ratio Prot	c0.13	0.22		0.01	0.32		c0.05	0.08		0.01	0.07	
v/s Ratio Perm	c0.41			0.09			c0.09			0.02		
v/c Ratio	0.80	0.37		0.20	0.67		0.59	0.56		0.18	0.57	
Uniform Delay, d1	33.8	13.5		14.7	25.3		41.6	50.1		44.2	52.5	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	12.5	0.4		0.4	1.5		4.4	3.1		0.3	4.6	
Delay (s)	46.4	13.8		15.1	26.8		46.0	53.2		44.6	57.1	
Level of Service	D	B		B	C		D	D		D	E	
Approach Delay (s)		20.2			26.4			49.8			54.2	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			27.3	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			127.3	Sum of lost time (s)			20.0					
Intersection Capacity Utilization			95.6%	ICU Level of Service			F					
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Background (2031) AM Peak Hour w/ Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	3	550	110	1245	67	303	77	280
Future Volume (vph)	3	550	110	1245	67	303	77	280
Lane Group Flow (vph)	4	725	136	1795	83	402	95	373
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	97.0	97.0	97.0	97.0	53.0	53.0	53.0	53.0
Total Split (%)	64.7%	64.7%	64.7%	64.7%	35.3%	35.3%	35.3%	35.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.11	0.43	0.41	0.91	0.39	0.64	0.51	0.62
Control Delay	20.7	17.3	20.5	34.2	45.1	45.5	51.5	45.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.7	17.3	20.5	34.2	45.1	45.5	51.5	45.0
Queue Length 50th (m)	0.5	58.5	20.8	227.7	18.3	97.1	21.9	89.2
Queue Length 95th (m)	2.5	62.6	32.0	211.1	34.4	131.4	41.3	122.0
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)	100.0		100.0		100.0		100.0	
Base Capacity (vph)	44	2025	398	2338	211	630	186	604
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.36	0.34	0.77	0.39	0.64	0.51	0.62

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 136.5

Natural Cycle: 100

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Lockhart Road & Huronia Road



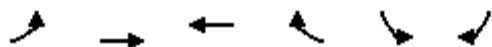
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Future Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1203	3011		1719	3468		1703	1848		1671	1773	
Flt Permitted	0.05	1.00		0.33	1.00		0.35	1.00		0.31	1.00	
Satd. Flow (perm)	66	3011		592	3468		623	1848		548	1773	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	4	679	46	136	1537	258	83	374	28	95	346	27
RTOR Reduction (vph)	0	3	0	0	10	0	0	2	0	0	2	0
Lane Group Flow (vph)	4	722	0	136	1785	0	83	400	0	95	371	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	77.0	77.0		77.0	77.0		46.4	46.4		46.4	46.4	
Effective Green, g (s)	77.0	77.0		77.0	77.0		46.4	46.4		46.4	46.4	
Actuated g/C Ratio	0.56	0.56		0.56	0.56		0.34	0.34		0.34	0.34	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	37	1699		334	1957		211	628		186	603	
v/s Ratio Prot		0.24			c0.51			c0.22			0.21	
v/s Ratio Perm	0.06			0.23			0.13			0.17		
v/c Ratio	0.11	0.42		0.41	0.91		0.39	0.64		0.51	0.62	
Uniform Delay, d1	13.8	17.0		16.8	26.7		34.3	37.9		35.9	37.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.3	0.2		0.8	6.9		5.4	4.9		9.7	4.6	
Delay (s)	15.1	17.2		17.6	33.6		39.7	42.8		45.6	42.2	
Level of Service	B	B		B	C		D	D		D	D	
Approach Delay (s)		17.2			32.5			42.3			42.9	
Approach LOS		B			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			32.1			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			136.4			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			130.9%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/ Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	6	679	943	91	14	25	
Future Volume (Veh/h)	6	679	943	91	14	25	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	7	738	1025	99	15	27	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		TWLT	LT	TWLT			
Median storage (veh)		2	2				
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	1124				1458	562	
vC1, stage 1 conf vol					1074		
vC2, stage 2 conf vol					383		
vCu, unblocked vol	1124				1458	562	
tC, single (s)	4.1				6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)	2.2				3.5	3.3	
p0 queue free %	99				94	94	
cM capacity (veh/h)	617				270	470	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	7	369	369	683	441	15	27
Volume Left	7	0	0	0	0	15	0
Volume Right	0	0	0	0	99	0	27
cSH	617	1700	1700	1700	1700	270	470
Volume to Capacity	0.01	0.22	0.22	0.40	0.26	0.06	0.06
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.4	1.5
Control Delay (s)	10.9	0.0	0.0	0.0	0.0	19.1	13.1
Lane LOS	B					C	B
Approach Delay (s)	0.1			0.0		15.3	
Approach LOS						C	
Intersection Summary							
Average Delay			0.4				
Intersection Capacity Utilization			39.0%		ICU Level of Service		A
Analysis Period (min)			15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	118	94	2	0	104	141	1	1	0	207	3	172
Future Volume (vph)	118	94	2	0	104	141	1	1	0	207	3	172
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)	128	102	2	0	113	153	1	1	0	225	3	187
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	232	266	1	1	225	190						
Volume Left (vph)	128	0	1	0	225	0						
Volume Right (vph)	2	153	0	0	0	187						
Hadj (s)	0.14	-0.31	0.53	0.34	0.53	-0.65						
Departure Headway (s)	5.5	5.0	7.0	6.8	6.4	5.2						
Degree Utilization, x	0.35	0.37	0.00	0.00	0.40	0.27						
Capacity (veh/h)	625	683	445	463	539	663						
Control Delay (s)	11.4	10.9	8.9	8.7	12.3	8.9						
Approach Delay (s)	11.4	10.9	8.8		10.8							
Approach LOS	B	B	A		B							
Intersection Summary												
Delay			10.9									
Level of Service			B									
Intersection Capacity Utilization			53.8%		ICU Level of Service		A					
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 11.6

Intersection LOS B

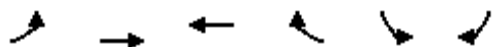
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	118	94	2	0	104	141	1	1	0	207	3	172
Future Vol, veh/h	118	94	2	0	104	141	1	1	0	207	3	172
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	20	2	2	15	2
Mvmt Flow	128	102	2	0	113	153	1	1	0	225	3	187
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	11.6	11.1	9.7	11.9
HCM LOS	B	B	A	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	55%	0%	100%	0%
Vol Thru, %	0%	100%	44%	42%	0%	2%
Vol Right, %	0%	0%	1%	58%	0%	98%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	1	1	214	245	207	175
LT Vol	1	0	118	0	207	0
Through Vol	0	1	94	104	0	3
RT Vol	0	0	2	141	0	172
Lane Flow Rate	1	1	233	266	225	190
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.002	0.002	0.358	0.375	0.399	0.285
Departure Headway (Hd)	7.05	6.852	5.54	5.067	6.378	5.397
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	507	522	651	714	565	666
Service Time	4.799	4.601	3.55	3.076	4.107	3.126
HCM Lane V/C Ratio	0.002	0.002	0.358	0.373	0.398	0.285
HCM Control Delay	9.8	9.6	11.6	11.1	13.3	10.3
HCM Lane LOS	A	A	B	B	B	B
HCM 95th-tile Q	0	0	1.6	1.7	1.9	1.2

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Background (2031) AM Peak Hour w/ Post-2031 Imp.

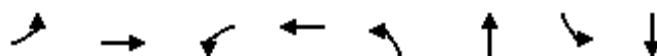


Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	1	693	1034	2	0	0		
Future Volume (Veh/h)	1	693	1034	2	0	0		
Sign Control		Free	Free		Stop			
Grade		0%	0%		0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	1	753	1124	2	0	0		
Pedestrians								
Lane Width (m)								
Walking Speed (m/s)								
Percent Blockage								
Right turn flare (veh)								
Median type		TWLT	LT	TWLT				
Median storage veh)		2	2					
Upstream signal (m)								
pX, platoon unblocked								
vC, conflicting volume	1126				1502	562		
vC1, stage 1 conf vol					1124			
vC2, stage 2 conf vol					378			
vCu, unblocked vol	1126				1502	562		
tC, single (s)	4.1				6.8	6.9		
tC, 2 stage (s)					5.8			
tF (s)	2.2				3.5	3.3		
p0 queue free %	100				100	100		
cM capacity (veh/h)	616				256	470		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	1	376	376	562	562	2	0	0
Volume Left	1	0	0	0	0	0	0	0
Volume Right	0	0	0	0	0	2	0	0
cSH	616	1700	1700	1700	1700	1700	1700	1700
Volume to Capacity	0.00	0.22	0.22	0.33	0.33	0.00	0.00	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Control Delay (s)	10.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Lane LOS	B						A	A
Approach Delay (s)	0.0			0.0			0.0	
Approach LOS							A	
Intersection Summary								
Average Delay			0.0					
Intersection Capacity Utilization			31.9%		ICU Level of Service		A	
Analysis Period (min)			15					

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Background (2031) PM Peak Hour w/ Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	203	1793	41	1287	139	47	122	81
Future Volume (vph)	203	1793	41	1287	139	47	122	81
Lane Group Flow (vph)	231	2118	47	1514	158	111	139	327
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	23.0	71.0	18.0	66.0	16.0	46.0	14.0	44.0
Total Split (%)	15.4%	47.7%	12.1%	44.3%	10.7%	30.9%	9.4%	29.5%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.80	0.78	0.32	0.68	0.73	0.29	0.35	0.86
Control Delay	51.7	29.7	20.0	33.2	54.4	31.5	36.4	60.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	51.7	29.7	20.0	33.2	54.4	31.5	36.4	60.6
Queue Length 50th (m)	42.4	176.5	5.1	126.6	33.6	18.0	29.2	70.0
Queue Length 95th (m)	#89.8	228.0	12.3	159.6	#52.2	34.0	45.1	103.1
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	306	2730	230	2232	222	538	397	515
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.75	0.78	0.20	0.68	0.71	0.21	0.35	0.63

Intersection Summary

Cycle Length: 149

Actuated Cycle Length: 135.9

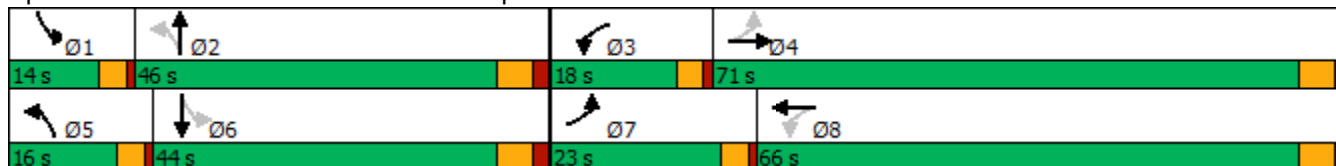
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



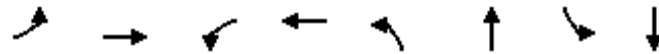
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	1793	70	41	1287	45	139	47	51	122	81	207
Future Volume (vph)	203	1793	70	41	1287	45	139	47	51	122	81	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5093		1703	5021		1770	1734		1770	1622	
Flt Permitted	0.08	1.00		0.07	1.00		0.16	1.00		0.69	1.00	
Satd. Flow (perm)	146	5093		117	5021		294	1734		1277	1622	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	231	2038	80	47	1462	51	158	53	58	139	92	235
RTOR Reduction (vph)	0	2	0	0	2	0	0	29	0	0	67	0
Lane Group Flow (vph)	231	2116	0	47	1512	0	158	82	0	139	260	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.7	72.8		67.2	61.3		39.8	28.2		36.2	26.4	
Effective Green, g (s)	82.7	72.8		67.2	61.3		39.8	28.2		36.2	26.4	
Actuated g/C Ratio	0.60	0.53		0.49	0.45		0.29	0.21		0.26	0.19	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	284	2712		125	2251		210	357		373	313	
v/s Ratio Prot	c0.10	0.42		0.02	0.30		c0.06	0.05		0.03	c0.16	
v/s Ratio Perm	c0.39			0.17			0.15			0.07		
v/c Ratio	0.81	0.78		0.38	0.67		0.75	0.23		0.37	0.83	
Uniform Delay, d1	34.1	25.5		22.5	29.8		39.5	45.2		40.1	53.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	16.1	2.3		1.9	1.6		14.1	0.3		0.6	16.8	
Delay (s)	50.2	27.9		24.4	31.4		53.6	45.5		40.7	69.8	
Level of Service	D	C		C	C		D	D		D	E	
Approach Delay (s)		30.1			31.2			50.3			61.2	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay		34.7			HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio		0.83										
Actuated Cycle Length (s)		136.7			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		102.6%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Background (2031) PM Peak Hour w/ Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	←	↑↓	←	↑↓	←	↑	←	↑
Traffic Volume (vph)	14	965	52	595	47	453	257	461
Future Volume (vph)	14	965	52	595	47	453	257	461
Lane Group Flow (vph)	16	1281	59	839	53	704	292	537
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	66.0	66.0	66.0	66.0	84.0	84.0	84.0	84.0
Total Split (%)	44.0%	44.0%	44.0%	44.0%	56.0%	56.0%	56.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.12	0.93	1.26	0.69	0.22	0.77	1.64	0.57
Control Delay	31.7	55.0	254.3	39.7	23.2	35.5	339.9	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	31.7	55.0	254.3	39.7	23.2	35.5	339.9	27.9
Queue Length 50th (m)	3.2	198.5	~22.9	110.8	8.9	169.4	~131.7	112.6
Queue Length 95th (m)	9.0	#225.7	#53.4	131.3	18.7	216.4	#133.0	144.6
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)	100.0		100.0		100.0		100.0	
Base Capacity (vph)	130	1378	47	1219	239	915	178	949
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.93	1.26	0.69	0.22	0.77	1.64	0.57

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Natural Cycle: 150

Control Type: Semi Act-Uncoord

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



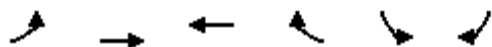
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Future Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	0.95		1.00	0.95		1.00	1.00		1.00	1.00	
Frt	1.00	0.98		1.00	0.97		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1504	3425		1687	3014		1388	1766		1719	1849	
Flt Permitted	0.21	1.00		0.07	1.00		0.32	1.00		0.19	1.00	
Satd. Flow (perm)	326	3425		118	3014		466	1766		347	1849	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	16	1097	184	59	676	162	53	515	189	292	524	12
RTOR Reduction (vph)	0	9	0	0	14	0	0	9	0	0	0	0
Lane Group Flow (vph)	16	1272	0	59	825	0	53	695	0	292	537	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	60.0	60.0		60.0	60.0		77.0	77.0		77.0	77.0	
Effective Green, g (s)	60.0	60.0		60.0	60.0		77.0	77.0		77.0	77.0	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.51	0.51		0.51	0.51	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	130	1370		47	1205		239	906		178	949	
v/s Ratio Prot		0.37			0.27			0.39			0.29	
v/s Ratio Perm	0.05			c0.50			0.11			c0.84		
v/c Ratio	0.12	0.93		1.26	0.68		0.22	0.77		1.64	0.57	
Uniform Delay, d1	28.4	43.0		45.0	37.2		20.0	29.3		36.5	25.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	11.1		215.4	1.6		2.1	6.2		312.1	2.4	
Delay (s)	28.8	54.0		260.4	38.8		22.2	35.5		348.6	27.5	
Level of Service	C	D		F	D		C	D		F	C	
Approach Delay (s)		53.7			53.4			34.6			140.6	
Approach LOS		D			D			C			F	
Intersection Summary												
HCM 2000 Control Delay			68.8			HCM 2000 Level of Service				E		
HCM 2000 Volume to Capacity ratio			1.47									
Actuated Cycle Length (s)			150.0			Sum of lost time (s)				13.0		
Intersection Capacity Utilization			127.2%			ICU Level of Service				H		
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/ Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	25	1007	679	72	14	7	
Future Volume (Veh/h)	25	1007	679	72	14	7	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	27	1095	738	78	15	8	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		TWLT	LT	TWLT			
Median storage (veh)		2	2				
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	816				1378	408	
vC1, stage 1 conf vol					777		
vC2, stage 2 conf vol					602		
vCu, unblocked vol	816				1378	408	
tC, single (s)	4.1				6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)	2.2				3.5	3.3	
p0 queue free %	97				96	99	
cM capacity (veh/h)	807				334	593	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	27	548	548	492	324	15	8
Volume Left	27	0	0	0	0	15	0
Volume Right	0	0	0	0	78	0	8
cSH	807	1700	1700	1700	1700	334	593
Volume to Capacity	0.03	0.32	0.32	0.29	0.19	0.04	0.01
Queue Length 95th (m)	0.8	0.0	0.0	0.0	0.0	1.1	0.3
Control Delay (s)	9.6	0.0	0.0	0.0	0.0	16.3	11.2
Lane LOS	A					C	B
Approach Delay (s)	0.2			0.0		14.5	
Approach LOS						B	
Intersection Summary							
Average Delay			0.3				
Intersection Capacity Utilization			37.8%		ICU Level of Service		A
Analysis Period (min)			15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	119	31	1	0	31	119	2	3	0	96	1	96
Future Volume (vph)	119	31	1	0	31	119	2	3	0	96	1	96
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)	129	34	1	0	34	129	2	3	0	104	1	104
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	164	163	2	3	104	105						
Volume Left (vph)	129	0	2	0	104	0						
Volume Right (vph)	1	129	0	0	0	104						
Hadj (s)	0.19	-0.44	0.53	0.02	0.53	-0.66						
Departure Headway (s)	4.8	4.2	6.1	5.5	5.8	4.6						
Degree Utilization, x	0.22	0.19	0.00	0.00	0.17	0.13						
Capacity (veh/h)	713	813	550	599	586	735						
Control Delay (s)	9.1	8.2	7.9	7.4	8.8	7.1						
Approach Delay (s)	9.1	8.2	7.6		8.0							
Approach LOS	A	A	A		A							
Intersection Summary												
Delay			8.4									
Level of Service			A									
Intersection Capacity Utilization			39.2%		ICU Level of Service		A					
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 8.8

Intersection LOS A

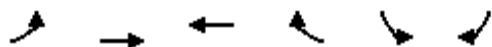
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	119	31	1	0	31	119	2	3	0	96	1	96
Future Vol, veh/h	119	31	1	0	31	119	2	3	0	96	1	96
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	1	2	2	11	2
Mvmt Flow	129	34	1	0	34	129	2	3	0	104	1	104
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	9.2	8.2	8.5	9
HCM LOS	A	A	A	A

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	79%	0%	100%	0%
Vol Thru, %	0%	100%	21%	21%	0%	1%
Vol Right, %	0%	0%	1%	79%	0%	99%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	2	3	151	150	96	97
LT Vol	2	0	119	0	96	0
Through Vol	0	3	31	31	0	1
RT Vol	0	0	1	119	0	96
Lane Flow Rate	2	3	164	163	104	105
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.004	0.005	0.219	0.19	0.168	0.139
Departure Headway (Hd)	6.023	5.5	4.797	4.193	5.785	4.737
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	592	648	748	854	619	755
Service Time	3.78	3.257	2.831	2.226	3.529	2.481
HCM Lane V/C Ratio	0.003	0.005	0.219	0.191	0.168	0.139
HCM Control Delay	8.8	8.3	9.2	8.2	9.7	8.3
HCM Lane LOS	A	A	A	A	A	A
HCM 95th-tile Q	0	0	0.8	0.7	0.6	0.5

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Background (2031) PM Peak Hour w/ Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	0	1021	751	1	2	1	
Future Volume (Veh/h)	0	1021	751	1	2	1	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	0	1110	816	1	2	1	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		TWLT	LT	TWLT			
Median storage (veh)		2		2			
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	817				1372	408	
vC1, stage 1 conf vol					816		
vC2, stage 2 conf vol					555		
vCu, unblocked vol	817				1372	408	
tC, single (s)	4.1				6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)	2.2				3.5	3.3	
p0 queue free %	100				99	100	
cM capacity (veh/h)	807				335	592	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	0	555	555	544	273	2	1
Volume Left	0	0	0	0	0	2	0
Volume Right	0	0	0	0	1	0	1
cSH	1700	1700	1700	1700	1700	335	592
Volume to Capacity	0.00	0.33	0.33	0.32	0.16	0.01	0.00
Queue Length 95th (m)	0.0	0.0	0.0	0.0	0.0	0.1	0.0
Control Delay (s)	0.0	0.0	0.0	0.0	0.0	15.8	11.1
Lane LOS						C	B
Approach Delay (s)	0.0			0.0		14.2	
Approach LOS						B	
Intersection Summary							
Average Delay			0.0				
Intersection Capacity Utilization			38.2%		ICU Level of Service		A
Analysis Period (min)			15				

2: Lockhart Road & Huronia Road Background (2031) AM Peak Hour w/ Post-2031 & Recommended Imp.

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Future Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Lane Group Flow (vph)	4	679	46	136	1537	258	83	374	28	95	346	27
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	12.0	12.0	12.0	12.0	12.0	12.0	7.0	40.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	25.0	25.0	11.0	47.0	47.0	47.0	47.0	47.0
Total Split (s)	82.0	82.0	82.0	82.0	82.0	82.0	11.0	58.0	58.0	47.0	47.0	47.0
Total Split (%)	58.6%	58.6%	58.6%	58.6%	58.6%	58.6%	7.9%	41.4%	41.4%	33.6%	33.6%	33.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	4.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
v/c Ratio	0.10	0.45	0.07	0.46	0.87	0.33	0.26	0.49	0.05	0.33	0.60	0.06
Control Delay	23.0	21.6	2.2	26.3	34.5	15.0	27.1	33.1	12.3	40.4	44.2	1.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	21.6	2.2	26.3	34.5	15.0	27.1	33.1	12.3	40.4	44.2	1.8
Queue Length 50th (m)	0.6	59.2	0.0	22.7	182.8	29.3	13.1	73.3	0.8	19.2	77.6	0.0
Queue Length 95th (m)	2.8	64.6	2.8	35.6	177.4	40.6	24.9	103.8	6.6	35.5	109.4	0.4
Internal Link Dist (m)		1115.0			505.2			596.6			662.8	
Turn Bay Length (m)	100.0		50.0	100.0		20.0	100.0		30.0	100.0		20.0
Base Capacity (vph)	48	1837	770	359	2146	931	315	757	594	285	572	466
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.37	0.06	0.38	0.72	0.28	0.26	0.49	0.05	0.33	0.60	0.06

Intersection Summary

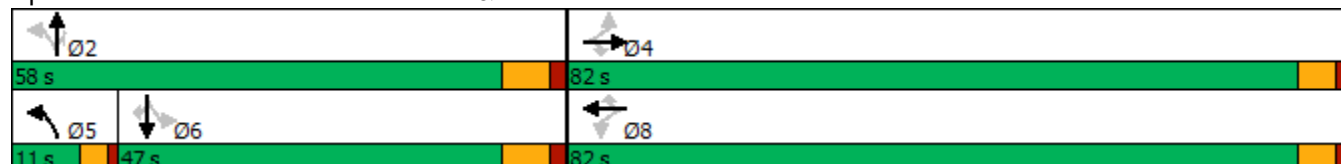
Cycle Length: 140

Actuated Cycle Length: 127.4

Natural Cycle: 105

Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Lockhart Road & Huronia Road



												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Future Volume (vph)	3	550	37	110	1245	209	67	303	23	77	280	22
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	4.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1203	3059	1242	1719	3574	1509	1703	1881	1442	1671	1810	1357
Flt Permitted	0.06	1.00	1.00	0.33	1.00	1.00	0.33	1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)	80	3059	1242	600	3574	1509	595	1881	1442	903	1810	1357
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	4	679	46	136	1537	258	83	374	28	95	346	27
RTOR Reduction (vph)	0	0	23	0	0	32	0	0	14	0	0	18
Lane Group Flow (vph)	4	679	23	136	1537	226	83	374	14	95	346	9
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	63.0	63.0	63.0	63.0	63.0	63.0	51.3	51.3	51.3	40.3	40.3	40.3
Effective Green, g (s)	63.0	63.0	63.0	63.0	63.0	63.0	51.3	51.3	51.3	40.3	40.3	40.3
Actuated g/C Ratio	0.49	0.49	0.49	0.49	0.49	0.49	0.40	0.40	0.40	0.32	0.32	0.32
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	4.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	39	1513	614	296	1768	746	300	758	581	285	573	429
v/s Ratio Prot		0.22			c0.43		0.02	c0.20			c0.19	
v/s Ratio Perm	0.05		0.02	0.23		0.15	0.10		0.01	0.11		0.01
v/c Ratio	0.10	0.45	0.04	0.46	0.87	0.30	0.28	0.49	0.02	0.33	0.60	0.02
Uniform Delay, d1	17.1	20.9	16.5	21.0	28.5	19.1	25.2	28.3	22.9	33.2	36.8	29.9
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	1.1	4.9	0.2	0.5	0.5	0.0	0.7	1.8	0.0
Delay (s)	18.3	21.1	16.6	22.2	33.4	19.3	25.7	28.8	22.9	33.9	38.6	29.9
Level of Service	B	C	B	C	C	B	C	C	C	C	D	C
Approach Delay (s)		20.8			30.7			27.9			37.1	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			29.2	HCM 2000 Level of Service				C				
HCM 2000 Volume to Capacity ratio			0.75									
Actuated Cycle Length (s)			127.3	Sum of lost time (s)				17.0				
Intersection Capacity Utilization			124.2%	ICU Level of Service				H				
Analysis Period (min)			15									
c Critical Lane Group												

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Future Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Lane Group Flow (vph)	16	1097	184	59	676	163	53	515	189	292	524	13
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	12.0	12.0	12.0	7.0	12.0	12.0	40.0	40.0	40.0	7.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	11.0	25.0	25.0	47.0	47.0	47.0	11.0	47.0	47.0
Total Split (s)	57.0	57.0	57.0	11.0	68.0	68.0	57.0	57.0	57.0	23.0	80.0	80.0
Total Split (%)	38.5%	38.5%	38.5%	7.4%	45.9%	45.9%	38.5%	38.5%	38.5%	15.5%	54.1%	54.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	5.0	5.0	5.0	3.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	7.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lag	Lag	Lead			Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
v/c Ratio	0.08	0.91	0.31	0.42	0.55	0.25	0.23	0.83	0.33	0.87	0.57	0.02
Control Delay	33.9	55.4	19.1	33.4	32.9	16.4	38.9	56.4	21.9	50.4	28.0	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.9	55.4	19.1	33.4	32.9	16.4	38.9	56.4	21.9	50.4	28.0	0.1
Queue Length 50th (m)	3.2	163.1	19.9	10.1	77.5	17.4	11.7	146.1	23.9	53.5	111.9	0.0
Queue Length 95th (m)	9.2	194.7	40.1	19.6	98.4	34.2	23.7	188.7	44.1	#102.7	144.2	0.0
Internal Link Dist (m)		1115.0			505.2			596.6			662.8	
Turn Bay Length (m)	100.0		50.0	100.0		20.0	100.0		30.0	100.0		20.0
Base Capacity (vph)	215	1336	646	139	1406	749	257	689	631	349	1016	770
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.07	0.82	0.28	0.42	0.48	0.22	0.21	0.75	0.30	0.84	0.52	0.02

Intersection Summary

Cycle Length: 148

Actuated Cycle Length: 135.9

Natural Cycle: 105

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road

			
Ø1	Ø2	Ø3	Ø4
23 s	57 s	11 s	57 s
			
Ø6		Ø8	
80 s		68 s	

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Future Volume (vph)	14	965	162	52	595	143	47	453	166	257	461	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	7.0	7.0	7.0	4.0	7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1504	3505	1553	1687	3034	1538	1388	1845	1553	1719	1863	1369
Flt Permitted	0.36	1.00	1.00	0.08	1.00	1.00	0.47	1.00	1.00	0.15	1.00	1.00
Satd. Flow (perm)	564	3505	1553	140	3034	1538	686	1845	1553	278	1863	1369
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	16	1097	184	59	676	162	53	515	189	292	524	12
RTOR Reduction (vph)	0	0	58	0	0	40	0	0	54	0	0	7
Lane Group Flow (vph)	16	1097	126	59	676	123	53	515	135	292	524	6
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	46.7	46.7	46.7	56.0	56.0	56.0	45.6	45.6	45.6	67.7	67.7	67.7
Effective Green, g (s)	46.7	46.7	46.7	56.0	56.0	56.0	45.6	45.6	45.6	67.7	67.7	67.7
Actuated g/C Ratio	0.34	0.34	0.34	0.41	0.41	0.41	0.33	0.33	0.33	0.50	0.50	0.50
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	7.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	192	1197	530	117	1242	630	228	615	518	328	922	677
v/s Ratio Prot		c0.31		0.02	c0.22			0.28		c0.12	0.28	
v/s Ratio Perm	0.03		0.08	0.19		0.08	0.08		0.09	c0.32		0.00
v/c Ratio	0.08	0.92	0.24	0.50	0.54	0.20	0.23	0.84	0.26	0.89	0.57	0.01
Uniform Delay, d1	30.5	43.1	32.2	31.2	30.7	25.9	32.9	42.1	33.2	28.7	24.2	17.5
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	10.9	0.2	3.4	0.5	0.2	0.5	9.7	0.3	24.5	0.8	0.0
Delay (s)	30.7	54.1	32.5	34.6	31.1	26.1	33.4	51.8	33.5	53.2	25.0	17.5
Level of Service	C	D	C	C	C	C	C	D	C	D	C	B
Approach Delay (s)		50.7			30.5			46.0			34.8	
Approach LOS		D			C			D			C	

Intersection Summary

HCM 2000 Control Delay	41.5	HCM 2000 Level of Service	D
HCM 2000 Volume to Capacity ratio	0.91		
Actuated Cycle Length (s)	136.7	Sum of lost time (s)	21.0
Intersection Capacity Utilization	119.2%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			

Appendix G – Synchro Analysis Output – Total Traffic Volumes

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Total (2025) AM Peak Hour

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	224	671	44	1251	51	36	38	42
Future Volume (vph)	224	671	44	1251	51	36	38	42
Lane Group Flow (vph)	231	947	45	1365	53	56	39	128
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	29.0	81.0	14.0	35.0	14.0	35.0
Total Split (%)	9.7%	45.8%	20.1%	56.3%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.78	0.31	0.12	0.45	0.28	0.30	0.15	0.65
Control Delay	29.9	10.6	7.0	14.8	43.3	43.8	40.2	44.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	29.9	10.6	7.0	14.8	43.3	43.8	40.2	44.6
Queue Length 50th (m)	17.3	36.5	3.0	68.3	11.4	9.7	8.2	16.7
Queue Length 95th (m)	#50.7	54.4	8.2	93.5	23.1	23.8	18.0	38.9
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	295	3097	557	3023	203	373	285	365
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.78	0.31	0.08	0.45	0.26	0.15	0.14	0.35

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 124.8

Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E

			
Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
			
Ø5	Ø6	Ø7	Ø8
14 s	35 s	14 s	81 s

140 Lockhart Road
1: Welham Rd & Mapview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2025) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	224	671	247	44	1251	73	51	36	18	38	42	82
Future Volume (vph)	224	671	247	44	1251	73	51	36	18	38	42	82
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.96		1.00	0.99		1.00	0.95		1.00	0.90	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4753		1543	5002		1467	1549		1803	1362	
Flt Permitted	0.15	1.00		0.29	1.00		0.51	1.00		0.72	1.00	
Satd. Flow (perm)	253	4753		467	5002		781	1549		1368	1362	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	231	692	255	45	1290	75	53	37	19	39	43	85
RTOR Reduction (vph)	0	29	0	0	4	0	0	14	0	0	56	0
Lane Group Flow (vph)	231	918	0	45	1361	0	53	42	0	39	72	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	90.3	80.6		82.0	76.3		21.1	13.9		19.5	13.1	
Effective Green, g (s)	90.3	80.6		82.0	76.3		21.1	13.9		19.5	13.1	
Actuated g/C Ratio	0.71	0.64		0.65	0.60		0.17	0.11		0.15	0.10	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	290	3026		350	3014		169	170		232	140	
v/s Ratio Prot	c0.06	0.19		0.01	0.27		c0.02	0.03		0.01	c0.05	
v/s Ratio Perm	c0.50			0.08			0.03			0.02		
v/c Ratio	0.80	0.30		0.13	0.45		0.31	0.25		0.17	0.52	
Uniform Delay, d1	10.2	10.4		8.1	13.7		45.7	51.6		46.3	53.8	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	14.0	0.3		0.2	0.5		1.1	0.8		0.3	3.2	
Delay (s)	24.3	10.6		8.3	14.2		46.7	52.3		46.6	57.0	
Level of Service	C	B		A	B		D	D		D	E	
Approach Delay (s)		13.3			14.0			49.6			54.6	
Approach LOS		B			B			D			D	
Intersection Summary												
HCM 2000 Control Delay		17.4					HCM 2000 Level of Service		B			
HCM 2000 Volume to Capacity ratio		0.75										
Actuated Cycle Length (s)		126.6					Sum of lost time (s)		20.0			
Intersection Capacity Utilization		93.8%					ICU Level of Service		F			
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Total (2025) AM Peak Hour

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	2	35	97	148	73	269	68	248
Future Volume (vph)	2	35	97	148	73	269	68	248
Lane Group Flow (vph)	2	89	120	411	90	358	84	331
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	60.0	60.0	60.0	60.0	47.0	47.0	47.0	47.0
Total Split (%)	56.1%	56.1%	56.1%	56.1%	43.9%	43.9%	43.9%	43.9%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.02	0.21	0.35	0.79	0.17	0.35	0.16	0.34
Control Delay	18.5	12.2	23.6	31.0	11.2	11.7	11.3	11.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	18.5	12.2	23.6	31.0	11.2	11.7	11.3	11.7
Queue Length 50th (m)	0.2	4.6	13.9	43.8	5.9	26.2	5.5	24.0
Queue Length 95th (m)	1.5	12.4	23.8	62.4	15.4	49.7	14.6	46.3
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	250	1055	936	1258	545	1014	512	973
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.01	0.08	0.13	0.33	0.17	0.35	0.16	0.34

Intersection Summary

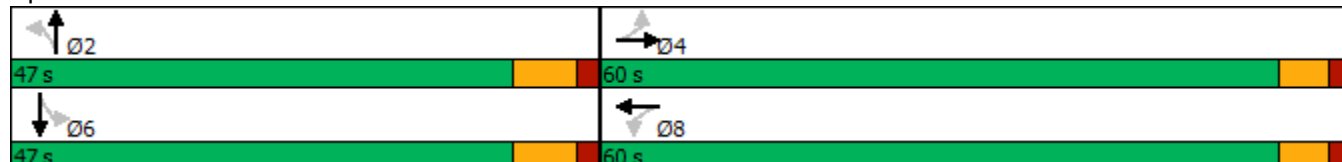
Cycle Length: 107

Actuated Cycle Length: 73.5

Natural Cycle: 75

Control Type: Semi Act-Uncoord

Splits and Phases: 2: Lockhart Road & Huronia Road



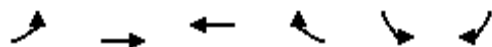
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Total (2025) AM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	2	35	37	97	148	185	73	269	21	68	248	20
Future Volume (vph)	2	35	37	97	148	185	73	269	21	68	248	20
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.92		1.00	0.92		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1203	1411		1719	1670		1703	1846		1671	1771	
Flt Permitted	0.27	1.00		0.70	1.00		0.55	1.00		0.53	1.00	
Satd. Flow (perm)	339	1411		1265	1670		994	1846		934	1771	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	2	43	46	120	183	228	90	332	26	84	306	25
RTOR Reduction (vph)	0	33	0	0	62	0	0	2	0	0	2	0
Lane Group Flow (vph)	2	56	0	120	349	0	90	356	0	84	329	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	20.1	20.1		20.1	20.1		40.3	40.3		40.3	40.3	
Effective Green, g (s)	20.1	20.1		20.1	20.1		40.3	40.3		40.3	40.3	
Actuated g/C Ratio	0.27	0.27		0.27	0.27		0.55	0.55		0.55	0.55	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	92	386		346	457		545	1013		512	972	
v/s Ratio Prot		0.04			c0.21			c0.19			0.19	
v/s Ratio Perm	0.01			0.09			0.09			0.09		
v/c Ratio	0.02	0.14		0.35	0.76		0.17	0.35		0.16	0.34	
Uniform Delay, d1	19.5	20.1		21.4	24.5		8.2	9.2		8.2	9.2	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	0.2		0.6	7.4		0.7	1.0		0.7	0.9	
Delay (s)	19.6	20.3		22.0	31.9		8.9	10.2		8.9	10.1	
Level of Service	B	C		C	C		A	B		A	B	
Approach Delay (s)		20.3			29.7			9.9			9.9	
Approach LOS		C			C			A			A	
Intersection Summary												
HCM 2000 Control Delay			17.6			HCM 2000 Level of Service				B		
HCM 2000 Volume to Capacity ratio			0.49									
Actuated Cycle Length (s)			73.4			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			90.6%			ICU Level of Service			E			
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Total (2025) AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	8	63	151	75	13	33
Future Volume (Veh/h)	8	63	151	75	13	33
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	68	164	82	14	36
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	246				291	205
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	246				291	205
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				98	96
cM capacity (veh/h)	1320				695	836
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	77	246	50			
Volume Left	9	0	14			
Volume Right	0	82	36			
cSH	1320	1700	791			
Volume to Capacity	0.01	0.14	0.06			
Queue Length 95th (m)	0.2	0.0	1.6			
Control Delay (s)	1.0	0.0	9.9			
Lane LOS	A		A			
Approach Delay (s)	1.0	0.0	9.9			
Approach LOS			A			
Intersection Summary						
Average Delay			1.5			
Intersection Capacity Utilization		22.5%		ICU Level of Service		A
Analysis Period (min)		15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	29	6	25	3	140	67	8	9	0	212	30	91
Future Volume (vph)	29	6	25	3	140	67	8	9	0	212	30	91
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)	32	7	27	3	152	73	9	10	0	230	33	99
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	66	228	19	362								
Volume Left (vph)	32	3	9	230								
Volume Right (vph)	27	73	0	99								
Hadj (s)	-0.11	-0.16	0.29	0.02								
Departure Headway (s)	5.1	4.8	5.4	4.7								
Degree Utilization, x	0.09	0.30	0.03	0.47								
Capacity (veh/h)	644	700	604	733								
Control Delay (s)	8.6	9.9	8.6	11.8								
Approach Delay (s)	8.6	9.9	8.6	11.8								
Approach LOS	A	A	A	B								
Intersection Summary												
Delay				10.7								
Level of Service				B								
Intersection Capacity Utilization				50.6%	ICU Level of Service	A						
Analysis Period (min)				15								

Intersection

Intersection Delay, s/veh 10.7

Intersection LOS B

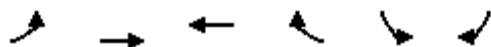
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	29	6	25	3	140	67	8	9	0	212	30	91
Future Vol, veh/h	29	6	25	3	140	67	8	9	0	212	30	91
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	20	2	2	15	2
Mvmt Flow	32	7	27	3	152	73	9	10	0	230	33	99
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	8.6	9.8	8.4	11.7
HCM LOS	A	A	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	47%	48%	1%	64%
Vol Thru, %	53%	10%	67%	9%
Vol Right, %	0%	42%	32%	27%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	17	60	210	333
LT Vol	8	29	3	212
Through Vol	9	6	140	30
RT Vol	0	25	67	91
Lane Flow Rate	18	65	228	362
Geometry Grp	1	1	1	1
Degree of Util (X)	0.027	0.09	0.301	0.465
Departure Headway (Hd)	5.183	4.987	4.744	4.626
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	685	713	753	775
Service Time	3.256	3.054	2.795	2.673
HCM Lane V/C Ratio	0.026	0.091	0.303	0.467
HCM Control Delay	8.4	8.6	9.8	11.7
HCM Lane LOS	A	A	A	B
HCM 95th-tile Q	0.1	0.3	1.3	2.5

140 Lockhart Road
5: Lockhart Road & Welham Extension

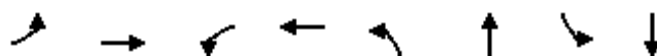
HCM Unsignalized Intersection Capacity Analysis
Total (2025) AM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Volume (veh/h)	8	68	224	18	5	2
Future Volume (Veh/h)	8	68	224	18	5	2
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	9	74	243	20	5	2
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	263				345	253
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	263				345	253
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				99	100
cM capacity (veh/h)	1301				647	786
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	83	263	7			
Volume Left	9	0	5			
Volume Right	0	20	2			
cSH	1301	1700	681			
Volume to Capacity	0.01	0.15	0.01			
Queue Length 95th (m)	0.2	0.0	0.2			
Control Delay (s)	0.9	0.0	10.3			
Lane LOS	A		B			
Approach Delay (s)	0.9	0.0	10.3			
Approach LOS			B			
Intersection Summary						
Average Delay			0.4			
Intersection Capacity Utilization		22.9%		ICU Level of Service	A	
Analysis Period (min)			15			

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues
Total (2025) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	180	1569	26	931	259	84	108	52
Future Volume (vph)	180	1569	26	931	259	84	108	52
Lane Group Flow (vph)	205	1844	30	1103	294	197	123	267
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	14.0	66.0	19.0	71.0	31.0	52.0	14.0	35.0
Total Split (%)	9.3%	43.7%	12.6%	47.0%	20.5%	34.4%	9.3%	23.2%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.72	0.69	0.21	0.47	0.82	0.44	0.40	0.84
Control Delay	32.6	28.9	18.5	26.8	54.3	38.1	36.0	58.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.6	28.9	18.5	26.8	54.3	38.1	36.0	58.4
Queue Length 50th (m)	28.4	158.7	3.7	80.9	65.0	39.2	24.4	48.5
Queue Length 95th (m)	#57.2	196.7	9.6	102.9	95.7	61.1	38.6	79.3
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	284	2679	239	2360	396	602	311	420
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.69	0.13	0.47	0.74	0.33	0.40	0.64

Intersection Summary

Cycle Length: 151

Actuated Cycle Length: 138.9

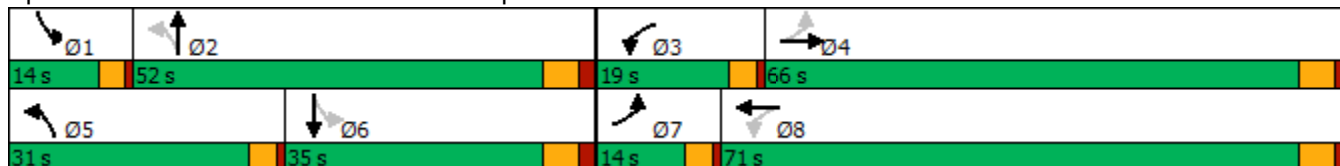
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



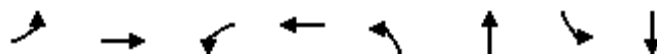
140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2025) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	180	1569	54	26	931	40	259	84	90	108	52	183
Future Volume (vph)	180	1569	54	26	931	40	259	84	90	108	52	183
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	1.00		1.00	0.99		1.00	0.92		1.00	0.88	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5098		1703	5008		1770	1735		1770	1614	
Flt Permitted	0.18	1.00		0.06	1.00		0.17	1.00		0.63	1.00	
Satd. Flow (perm)	319	5098		115	5008		316	1735		1181	1614	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	205	1783	61	30	1058	45	294	95	102	123	59	208
RTOR Reduction (vph)	0	2	0	0	3	0	0	28	0	0	89	0
Lane Group Flow (vph)	205	1842	0	30	1100	0	294	169	0	123	178	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	81.1	72.9		71.2	67.0		47.4	33.8		29.2	19.6	
Effective Green, g (s)	81.1	72.9		71.2	67.0		47.4	33.8		29.2	19.6	
Actuated g/C Ratio	0.58	0.52		0.51	0.48		0.34	0.24		0.21	0.14	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	282	2645		105	2388		352	417		285	225	
v/s Ratio Prot	c0.05	0.36		0.01	0.22		c0.14	0.10		0.03	0.11	
v/s Ratio Perm	c0.37			0.14			c0.14			0.06		
v/c Ratio	0.73	0.70		0.29	0.46		0.84	0.41		0.43	0.79	
Uniform Delay, d1	16.8	25.5		20.8	24.6		38.6	44.9		47.4	58.4	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.0	1.5		1.5	0.6		15.6	0.6		1.1	16.6	
Delay (s)	25.8	27.0		22.3	25.3		54.2	45.5		48.4	75.0	
Level of Service	C	C		C	C		D	D		D	E	
Approach Delay (s)		26.9			25.2			50.7			66.7	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay		33.1			HCM 2000 Level of Service			C				
HCM 2000 Volume to Capacity ratio		0.80										
Actuated Cycle Length (s)		140.5			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		105.0%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Total (2025) PM Peak Hour



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	12	230	46	92	48	402	227	410
Future Volume (vph)	12	230	46	92	48	402	227	410
Lane Group Flow (vph)	14	438	52	249	55	625	258	477
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	30.0	30.0	30.0	30.0	48.0	48.0	48.0	48.0
Total Split (%)	38.5%	38.5%	38.5%	38.5%	61.5%	61.5%	61.5%	61.5%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.06	0.85	0.46	0.50	0.16	0.64	0.83	0.47
Control Delay	20.1	40.2	36.5	17.5	11.0	15.4	42.1	12.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	20.1	40.2	36.5	17.5	11.0	15.4	42.1	12.9
Queue Length 50th (m)	1.5	55.4	6.4	18.7	4.1	61.3	32.3	43.6
Queue Length 95th (m)	5.5	#96.9	17.5	38.2	10.4	94.4	#77.8	66.3
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	267	583	131	563	342	983	309	1013
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.05	0.75	0.40	0.44	0.16	0.64	0.83	0.47

Intersection Summary

Cycle Length: 78

Actuated Cycle Length: 75.1

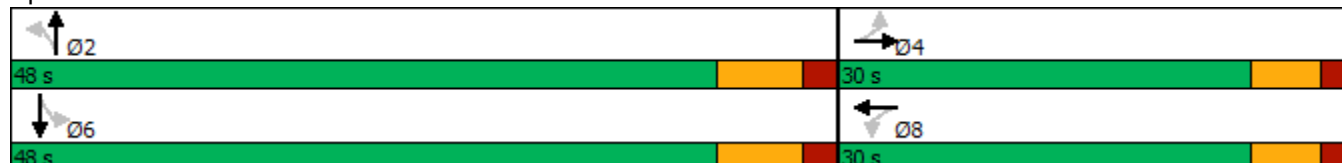
Natural Cycle: 75

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



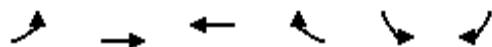
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Total (2025) PM Peak Hour

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	12	230	156	46	92	127	48	402	148	227	410	10
Future Volume (vph)	12	230	156	46	92	127	48	402	148	227	410	10
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.94		1.00	0.91		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1504	1726		1687	1565		1388	1766		1719	1850	
Flt Permitted	0.53	1.00		0.23	1.00		0.43	1.00		0.31	1.00	
Satd. Flow (perm)	834	1726		410	1565		626	1766		566	1850	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	14	261	177	52	105	144	55	457	168	258	466	11
RTOR Reduction (vph)	0	32	0	0	66	0	0	16	0	0	1	0
Lane Group Flow (vph)	14	406	0	52	183	0	55	609	0	258	476	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	20.9	20.9		20.9	20.9		41.1	41.1		41.1	41.1	
Effective Green, g (s)	20.9	20.9		20.9	20.9		41.1	41.1		41.1	41.1	
Actuated g/C Ratio	0.28	0.28		0.28	0.28		0.55	0.55		0.55	0.55	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	232	480		114	436		343	967		310	1013	
v/s Ratio Prot		c0.23			0.12			0.34			0.26	
v/s Ratio Perm	0.02			0.13			0.09			c0.46		
v/c Ratio	0.06	0.84		0.46	0.42		0.16	0.63		0.83	0.47	
Uniform Delay, d1	19.8	25.5		22.4	22.1		8.4	11.7		14.1	10.3	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.1	12.8		2.9	0.7		1.0	3.1		22.3	1.6	
Delay (s)	20.0	38.4		25.2	22.8		9.4	14.8		36.3	11.9	
Level of Service	B	D		C	C		A	B		D	B	
Approach Delay (s)		37.8			23.2			14.4			20.5	
Approach LOS		D			C			B			C	
Intersection Summary												
HCM 2000 Control Delay			22.5			HCM 2000 Level of Service				C		
HCM 2000 Volume to Capacity ratio			0.84									
Actuated Cycle Length (s)			75.0			Sum of lost time (s)			13.0			
Intersection Capacity Utilization			120.0%			ICU Level of Service			H			
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Total (2025) PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	
Traffic Volume (veh/h)	33	112	126	22	273	10
Future Volume (Veh/h)	33	112	126	22	273	10
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	122	137	24	297	11
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	161				343	149
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	161				343	149
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				53	99
cM capacity (veh/h)	1418				637	898
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	158	161	308			
Volume Left	36	0	297			
Volume Right	0	24	11			
cSH	1418	1700	643			
Volume to Capacity	0.03	0.09	0.48			
Queue Length 95th (m)	0.6	0.0	20.8			
Control Delay (s)	1.9	0.0	15.6			
Lane LOS	A		C			
Approach Delay (s)	1.9	0.0	15.6			
Approach LOS			C			
Intersection Summary						
Average Delay		8.2				
Intersection Capacity Utilization		41.4%	ICU Level of Service	A		
Analysis Period (min)		15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	191	131	11	2	106	216	25	29	4	64	13	56
Future Volume (vph)	191	131	11	2	106	216	25	29	4	64	13	56
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)	208	142	12	2	115	235	27	32	4	70	14	61
Direction, Lane #	EB 1	WB 1	NB 1	SB 1								
Volume Total (vph)	362	352	63	145								
Volume Left (vph)	208	2	27	70								
Volume Right (vph)	12	235	4	61								
Hadj (s)	0.13	-0.37	0.07	-0.11								
Departure Headway (s)	5.1	4.7	6.0	5.7								
Degree Utilization, x	0.51	0.46	0.11	0.23								
Capacity (veh/h)	674	734	505	561								
Control Delay (s)	13.4	11.5	9.7	10.3								
Approach Delay (s)	13.4	11.5	9.7	10.3								
Approach LOS	B	B	A	B								
Intersection Summary												
Delay				11.9								
Level of Service				B								
Intersection Capacity Utilization				57.3%	ICU Level of Service	B						
Analysis Period (min)				15								

Intersection

Intersection Delay, s/veh 11.9

Intersection LOS B

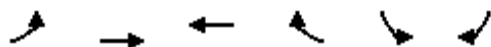
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕			↕			↕			↕	
Traffic Vol, veh/h	191	131	11	2	106	216	25	29	4	64	13	56
Future Vol, veh/h	191	131	11	2	106	216	25	29	4	64	13	56
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	1	2	2	11	2
Mvmt Flow	208	142	12	2	115	235	27	32	4	70	14	61
Number of Lanes	0	1	0	0	1	0	0	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	1
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	1	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	1	1	1	1
HCM Control Delay	13.4	11.5	9.8	10.3
HCM LOS	B	B	A	B

Lane	NBLn1	EBLn1	WBLn1	SBLn1
Vol Left, %	43%	57%	1%	48%
Vol Thru, %	50%	39%	33%	10%
Vol Right, %	7%	3%	67%	42%
Sign Control	Stop	Stop	Stop	Stop
Traffic Vol by Lane	58	333	324	133
LT Vol	25	191	2	64
Through Vol	29	131	106	13
RT Vol	4	11	216	56
Lane Flow Rate	63	362	352	145
Geometry Grp	1	1	1	1
Degree of Util (X)	0.105	0.514	0.456	0.226
Departure Headway (Hd)	6.007	5.109	4.665	5.63
Convergence, Y/N	Yes	Yes	Yes	Yes
Cap	596	709	775	638
Service Time	4.054	3.119	2.677	3.67
HCM Lane V/C Ratio	0.106	0.511	0.454	0.227
HCM Control Delay	9.8	13.4	11.5	10.3
HCM Lane LOS	A	B	B	B
HCM 95th-tile Q	0.4	3	2.4	0.9

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Total (2025) PM Peak Hour



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Volume (veh/h)	2	383	141	8	17	7
Future Volume (Veh/h)	2	383	141	8	17	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	2	416	153	9	18	8
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	162				578	158
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	162				578	158
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	100				96	99
cM capacity (veh/h)	1417				477	888
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	418	162	26			
Volume Left	2	0	18			
Volume Right	0	9	8			
cSH	1417	1700	557			
Volume to Capacity	0.00	0.10	0.05			
Queue Length 95th (m)	0.0	0.0	1.2			
Control Delay (s)	0.1	0.0	11.8			
Lane LOS	A		B			
Approach Delay (s)	0.1	0.0	11.8			
Approach LOS			B			
Intersection Summary						
Average Delay			0.5			
Intersection Capacity Utilization		31.7%		ICU Level of Service		A
Analysis Period (min)		15				

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Total (2031) AM Peak Hour w/out Post-2031 Imp.

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	252	768	64	1492	139	98	43	60
Future Volume (vph)	252	768	64	1492	139	98	43	60
Lane Group Flow (vph)	260	1197	66	1622	143	147	44	157
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	29.0	66.0	29.0	66.0	14.0	35.0	14.0	35.0
Total Split (%)	20.1%	45.8%	20.1%	45.8%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.79	0.42	0.24	0.68	0.67	0.56	0.15	0.72
Control Delay	48.1	14.0	11.6	28.9	57.4	55.3	38.2	56.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.1	14.0	11.6	28.9	57.4	55.3	38.2	56.0
Queue Length 50th (m)	46.3	55.1	5.2	120.8	31.8	33.8	9.1	28.3
Queue Length 95th (m)	#86.8	80.7	12.5	162.8	53.2	58.9	19.4	54.2
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	386	2838	476	2380	213	366	321	354
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.42	0.14	0.68	0.67	0.40	0.14	0.44

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 127.1

Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E

			
Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
			
Ø5	Ø6	Ø7	Ø8
14 s	35 s	29 s	66 s

140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	252	768	393	64	1492	81	139	98	45	43	60	92
Future Volume (vph)	252	768	393	64	1492	81	139	98	45	43	60	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.99		1.00	0.95		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4704		1543	5004		1467	1551		1804	1386	
Flt Permitted	0.07	1.00		0.22	1.00		0.39	1.00		0.66	1.00	
Satd. Flow (perm)	128	4704		363	5004		610	1551		1250	1386	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	260	792	405	66	1538	84	143	101	46	44	62	95
RTOR Reduction (vph)	0	46	0	0	4	0	0	12	0	0	42	0
Lane Group Flow (vph)	260	1151	0	66	1618	0	143	135	0	44	115	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	85.7	75.5		67.5	61.3		30.6	20.5		23.6	17.0	
Effective Green, g (s)	85.7	75.5		67.5	61.3		30.6	20.5		23.6	17.0	
Actuated g/C Ratio	0.67	0.59		0.52	0.48		0.24	0.16		0.18	0.13	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	324	2757		247	2381		212	246		257	182	
v/s Ratio Prot	c0.13	0.24		0.01	0.32		c0.05	0.09		0.01	0.08	
v/s Ratio Perm	c0.41			0.13			c0.11			0.02		
v/c Ratio	0.80	0.42		0.27	0.68		0.67	0.55		0.17	0.63	
Uniform Delay, d1	34.8	14.6		15.2	26.1		42.1	49.9		44.0	53.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.3	0.5		0.6	1.6		8.2	2.5		0.3	7.0	
Delay (s)	48.2	15.1		15.8	27.7		50.3	52.4		44.4	60.0	
Level of Service	D	B		B	C		D	D		D	E	
Approach Delay (s)		21.0			27.3			51.4			56.6	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			28.3	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			128.8	Sum of lost time (s)			20.0					
Intersection Capacity Utilization			97.1%	ICU Level of Service			F					
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues

Total (2031) AM Peak Hour w/out Post-2031 Imp.

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	3	552	110	1259	134	303	77	280
Future Volume (vph)	3	552	110	1259	134	303	77	280
Lane Group Flow (vph)	4	740	136	1812	165	402	95	376
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	97.0	97.0	97.0	97.0	53.0	53.0	53.0	53.0
Total Split (%)	64.7%	64.7%	64.7%	64.7%	35.3%	35.3%	35.3%	35.3%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.12	0.77	0.53	1.63	1.01	0.71	0.67	0.69
Control Delay	22.7	28.6	26.1	313.3	123.0	53.7	69.9	53.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	22.7	28.6	26.1	313.3	123.0	53.7	69.9	53.2
Queue Length 50th (m)	0.5	162.9	23.5	~820.2	~52.3	111.0	26.0	103.1
Queue Length 95th (m)	2.6	179.0	38.8	#776.8	#88.2	131.4	44.1	123.2
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	33	959	259	1111	164	568	142	544
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.12	0.77	0.53	1.63	1.01	0.71	0.67	0.69

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Natural Cycle: 150

Control Type: Semi Act-Uncoord

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



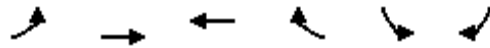
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	552	48	110	1259	209	134	303	23	77	280	24
Future Volume (vph)	3	552	48	110	1259	209	134	303	23	77	280	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.98		1.00	0.99		1.00	0.99	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1203	1578		1719	1826		1703	1848		1671	1769	
Flt Permitted	0.04	1.00		0.24	1.00		0.30	1.00		0.26	1.00	
Satd. Flow (perm)	56	1578		427	1826		536	1848		464	1769	
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	4	681	59	136	1554	258	165	374	28	95	346	30
RTOR Reduction (vph)	0	2	0	0	4	0	0	2	0	0	2	0
Lane Group Flow (vph)	4	738	0	136	1808	0	165	400	0	95	374	0
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	91.0	91.0		91.0	91.0		46.0	46.0		46.0	46.0	
Effective Green, g (s)	91.0	91.0		91.0	91.0		46.0	46.0		46.0	46.0	
Actuated g/C Ratio	0.61	0.61		0.61	0.61		0.31	0.31		0.31	0.31	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	33	957		259	1107		164	566		142	542	
v/s Ratio Prot		0.47			c0.99			0.22			0.21	
v/s Ratio Perm	0.07			0.32			c0.31			0.20		
v/c Ratio	0.12	0.77		0.53	1.63		1.01	0.71		0.67	0.69	
Uniform Delay, d1	12.5	21.8		17.0	29.5		52.0	46.0		45.4	45.7	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	1.6	3.9		1.9	289.1		71.9	7.3		22.3	7.0	
Delay (s)	14.2	25.7		18.9	318.6		123.9	53.3		67.6	52.8	
Level of Service	B	C		B	F		F	D		E	D	
Approach Delay (s)		25.6			297.7			73.8			55.8	
Approach LOS		C			F			E			E	
Intersection Summary												
HCM 2000 Control Delay		178.9					HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio		1.42										
Actuated Cycle Length (s)		150.0					Sum of lost time (s)		13.0			
Intersection Capacity Utilization		174.7%					ICU Level of Service		H			
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/out Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Traffic Volume (veh/h)	6	707	948	92	18	25
Future Volume (Veh/h)	6	707	948	92	18	25
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	768	1030	100	20	27
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	1130				1862	1080
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1130				1862	1080
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				75	90
cM capacity (veh/h)	618				79	265
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	775	1130	47			
Volume Left	7	0	20			
Volume Right	0	100	27			
cSH	618	1700	133			
Volume to Capacity	0.01	0.66	0.35			
Queue Length 95th (m)	0.3	0.0	11.6			
Control Delay (s)	0.3	0.0	46.2			
Lane LOS	A		E			
Approach Delay (s)	0.3	0.0	46.2			
Approach LOS			E			
Intersection Summary						
Average Delay			1.2			
Intersection Capacity Utilization		65.5%		ICU Level of Service		C
Analysis Period (min)		15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	118	94	117	6	104	141	20	24	1	207	141	172
Future Volume (vph)	118	94	117	6	104	141	20	24	1	207	141	172
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)	128	102	127	7	113	153	22	26	1	225	153	187
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total (vph)	357	273	22	27	565							
Volume Left (vph)	128	7	22	0	225							
Volume Right (vph)	127	153	0	1	187							
Hadj (s)	-0.11	-0.30	0.53	0.30	-0.03							
Departure Headway (s)	6.4	6.4	8.4	8.1	6.1							
Degree Utilization, x	0.64	0.49	0.05	0.06	0.96							
Capacity (veh/h)	542	543	382	400	582							
Control Delay (s)	19.9	15.4	10.6	10.5	52.6							
Approach Delay (s)	19.9	15.4	10.5		52.6							
Approach LOS	C	C	B		F							
Intersection Summary												
Delay			33.4									
Level of Service			D									
Intersection Capacity Utilization			79.1%		ICU Level of Service					D		
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 32.1

Intersection LOS D

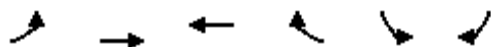
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	118	94	117	6	104	141	20	24	1	207	141	172
Future Vol, veh/h	118	94	117	6	104	141	20	24	1	207	141	172
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	20	2	2	15	2
Mvmt Flow	128	102	127	7	113	153	22	26	1	225	153	187
Number of Lanes	0	1	0	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	20	15.4	11.4	49.7
HCM LOS	C	C	B	E

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	100%	0%	36%	2%	40%
Vol Thru, %	0%	96%	29%	41%	27%
Vol Right, %	0%	4%	36%	56%	33%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	25	329	251	520
LT Vol	20	0	118	6	207
Through Vol	0	24	94	104	141
RT Vol	0	1	117	141	172
Lane Flow Rate	22	27	358	273	565
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.05	0.061	0.635	0.485	0.948
Departure Headway (Hd)	8.302	8.073	6.395	6.405	6.038
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	430	442	565	562	599
Service Time	6.085	5.856	4.452	4.468	4.085
HCM Lane V/C Ratio	0.051	0.061	0.634	0.486	0.943
HCM Control Delay	11.5	11.4	20	15.4	49.7
HCM Lane LOS	B	B	C	C	E
HCM 95th-tile Q	0.2	0.2	4.4	2.6	12.7

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/out Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	↕
Traffic Volume (veh/h)	33	693	1034	85	13	6
Future Volume (Veh/h)	33	693	1034	85	13	6
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	36	753	1124	92	14	7
Pedestrians						
Lane Width (m)						
Walking Speed (m/s)						
Percent Blockage						
Right turn flare (veh)						
Median type		None	None			
Median storage veh)						
Upstream signal (m)						
pX, platoon unblocked						
vC, conflicting volume	1216				1995	1170
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	1216				1995	1170
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	94				77	97
cM capacity (veh/h)	573				62	235
Direction, Lane #	EB 1	WB 1	SB 1	SB 2		
Volume Total	789	1216	14	7		
Volume Left	36	0	14	0		
Volume Right	0	92	0	7		
cSH	573	1700	62	235		
Volume to Capacity	0.06	0.72	0.23	0.03		
Queue Length 95th (m)	1.6	0.0	6.2	0.7		
Control Delay (s)	1.8	0.0	79.0	20.8		
Lane LOS	A		F	C		
Approach Delay (s)	1.8	0.0	59.6			
Approach LOS			F			
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization			73.3%		ICU Level of Service	D
Analysis Period (min)			15			

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Total (2031) PM Peak Hour w/out Post-2031 Imp.

								
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	203	1793	43	1287	242	56	122	83
Future Volume (vph)	203	1793	43	1287	242	56	122	83
Lane Group Flow (vph)	231	2143	49	1514	275	136	139	329
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	23.0	71.0	18.0	66.0	25.0	46.0	14.0	35.0
Total Split (%)	15.4%	47.7%	12.1%	44.3%	16.8%	30.9%	9.4%	23.5%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.87	0.84	0.35	0.73	0.90	0.29	0.38	0.92
Control Delay	66.9	36.2	23.0	38.7	70.5	32.8	36.6	76.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.9	36.2	23.0	38.7	70.5	32.8	36.6	76.4
Queue Length 50th (m)	52.0	214.3	6.5	146.1	65.8	24.1	29.2	79.5
Queue Length 95th (m)	#95.1	232.9	12.7	159.6	#114.7	42.2	45.1	#129.2
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	278	2549	215	2081	310	505	366	384
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.84	0.23	0.73	0.89	0.27	0.38	0.86

Intersection Summary

Cycle Length: 149

Actuated Cycle Length: 145.2

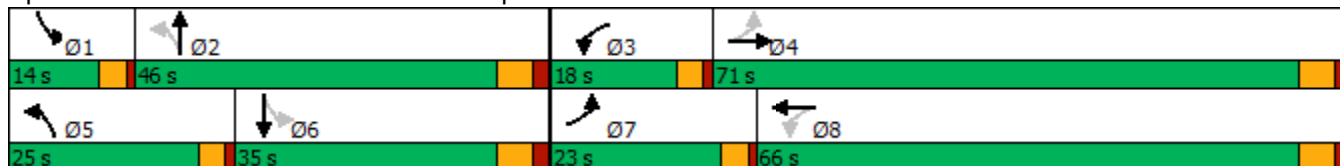
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



140 Lockhart Road
1: Welham Rd & Maplview Drive E

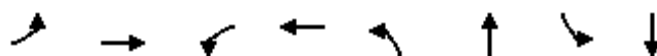
HCM Signalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  							
Traffic Volume (vph)	203	1793	92	43	1287	45	242	56	63	122	83	207
Future Volume (vph)	203	1793	92	43	1287	45	242	56	63	122	83	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5081		1703	5021		1770	1732		1770	1622	
Flt Permitted	0.07	1.00		0.07	1.00		0.13	1.00		0.67	1.00	
Satd. Flow (perm)	127	5081		118	5021		244	1732		1248	1622	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	231	2038	105	49	1462	51	275	64	72	139	94	235
RTOR Reduction (vph)	0	4	0	0	2	0	0	28	0	0	61	0
Lane Group Flow (vph)	231	2139	0	49	1512	0	275	108	0	139	268	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.9	72.7		67.2	61.0		51.2	37.4		36.3	26.5	
Effective Green, g (s)	82.9	72.7		67.2	61.0		51.2	37.4		36.3	26.5	
Actuated g/C Ratio	0.57	0.50		0.46	0.42		0.35	0.26		0.25	0.18	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	263	2528		121	2096		301	443		345	294	
v/s Ratio Prot	c0.11	0.42		0.02	0.30		c0.13	0.06		0.03	0.16	
v/s Ratio Perm	c0.39			0.17			c0.19			0.07		
v/c Ratio	0.88	0.85		0.40	0.72		0.91	0.24		0.40	0.91	
Uniform Delay, d1	41.9	31.9		28.1	35.5		41.8	43.1		44.8	58.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	26.4	3.7		2.2	2.2		30.4	0.3		0.8	30.3	
Delay (s)	68.3	35.6		30.3	37.6		72.2	43.4		45.5	89.0	
Level of Service	E	D		C	D		E	D		D	F	
Approach Delay (s)		38.8			37.4			62.7			76.1	
Approach LOS		D			D			E			E	
Intersection Summary												
HCM 2000 Control Delay		44.0			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.93										
Actuated Cycle Length (s)		146.1			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		108.4%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues

Total (2031) PM Peak Hour w/out Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations	↰	→	↰	→	↰	→	↰	→
Traffic Volume (vph)	16	977	52	598	60	453	257	461
Future Volume (vph)	16	977	52	598	60	453	257	461
Lane Group Flow (vph)	18	1363	59	843	68	704	292	537
Turn Type	Perm	NA	Perm	NA	Perm	NA	Perm	NA
Protected Phases		4		8		2		6
Permitted Phases	4		8		2		6	
Detector Phase	4	4	8	8	2	2	6	6
Switch Phase								
Minimum Initial (s)	12.0	12.0	12.0	12.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	47.0	47.0	47.0	47.0
Total Split (s)	66.0	66.0	66.0	66.0	84.0	84.0	84.0	84.0
Total Split (%)	44.0%	44.0%	44.0%	44.0%	56.0%	56.0%	56.0%	56.0%
Yellow Time (s)	4.0	4.0	4.0	4.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0
Lead/Lag								
Lead-Lag Optimize?								
Recall Mode	None	None	None	None	Max	Max	Max	Max
v/c Ratio	0.43	1.89	1.26	1.32	0.28	0.77	1.64	0.57
Control Delay	68.5	433.3	254.3	190.1	24.9	35.5	339.9	27.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	68.5	433.3	254.3	190.1	24.9	35.5	339.9	27.9
Queue Length 50th (m)	4.1	~654.4	~22.9	~339.2	11.9	169.4	~131.7	112.6
Queue Length 95th (m)	#16.1	#719.6	#53.4	#408.2	23.6	216.4	#133.0	144.6
Internal Link Dist (m)		1115.0		505.2		596.6		662.8
Turn Bay Length (m)								
Base Capacity (vph)	42	721	47	640	239	915	178	949
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.43	1.89	1.26	1.32	0.28	0.77	1.64	0.57

Intersection Summary

Cycle Length: 150

Actuated Cycle Length: 150

Natural Cycle: 150

Control Type: Semi Act-Uncoord

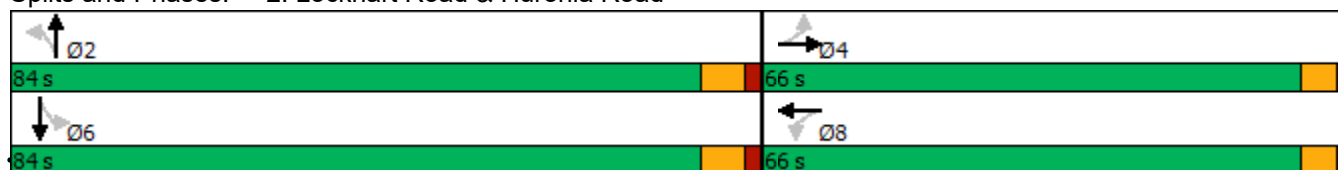
~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road



JD Engineering

Synchro 10 Report
02-04-2021

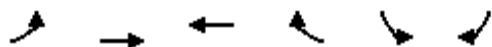
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/out Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	977	223	52	598	143	60	453	166	257	461	11
Future Volume (vph)	16	977	223	52	598	143	60	453	166	257	461	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Lane Util. Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.97		1.00	0.97		1.00	0.96		1.00	1.00	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1504	1790		1687	1586		1388	1766		1719	1849	
Flt Permitted	0.07	1.00		0.07	1.00		0.32	1.00		0.19	1.00	
Satd. Flow (perm)	106	1790		118	1586		466	1766		347	1849	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	18	1110	253	59	680	162	68	515	189	292	524	12
RTOR Reduction (vph)	0	5	0	0	6	0	0	9	0	0	0	0
Lane Group Flow (vph)	18	1358	0	59	837	0	68	695	0	292	537	0
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA		Perm	NA		Perm	NA		Perm	NA	
Protected Phases		4			8			2			6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	60.0	60.0		60.0	60.0		77.0	77.0		77.0	77.0	
Effective Green, g (s)	60.0	60.0		60.0	60.0		77.0	77.0		77.0	77.0	
Actuated g/C Ratio	0.40	0.40		0.40	0.40		0.51	0.51		0.51	0.51	
Clearance Time (s)	6.0	6.0		6.0	6.0		7.0	7.0		7.0	7.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	42	716		47	634		239	906		178	949	
v/s Ratio Prot		c0.76			0.53			0.39			0.29	
v/s Ratio Perm	0.17			0.50			0.15			c0.84		
v/c Ratio	0.43	1.90		1.26	1.32		0.28	0.77		1.64	0.57	
Uniform Delay, d1	32.6	45.0		45.0	45.0		20.8	29.3		36.5	25.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	6.9	408.5		215.4	155.0		3.0	6.2		312.1	2.4	
Delay (s)	39.5	453.5		260.4	200.0		23.8	35.5		348.6	27.5	
Level of Service	D	F		F	F		C	D		F	C	
Approach Delay (s)		448.1			203.9			34.5			140.6	
Approach LOS		F			F			C			F	
Intersection Summary												
HCM 2000 Control Delay		243.5					HCM 2000 Level of Service		F			
HCM 2000 Volume to Capacity ratio		1.75										
Actuated Cycle Length (s)		150.0					Sum of lost time (s)		13.0			
Intersection Capacity Utilization		148.9%					ICU Level of Service		H			
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/out Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↕	↕		↕	
Traffic Volume (veh/h)	25	1012	705	76	15	7
Future Volume (Veh/h)	25	1012	705	76	15	7
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	27	1100	766	83	16	8
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	849				1962	808
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	849				1962	808
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	97				76	98
cM capacity (veh/h)	789				67	381
Direction, Lane #	EB 1	WB 1	SB 1			
Volume Total	1127	849	24			
Volume Left	27	0	16			
Volume Right	0	83	8			
cSH	789	1700	93			
Volume to Capacity	0.03	0.50	0.26			
Queue Length 95th (m)	0.8	0.0	7.6			
Control Delay (s)	1.2	0.0	56.9			
Lane LOS	A		F			
Approach Delay (s)	1.2	0.0	56.9			
Approach LOS			F			
Intersection Summary						
Average Delay			1.3			
Intersection Capacity Utilization		83.4%		ICU Level of Service	E	
Analysis Period (min)			15			

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	119	31	23	1	31	119	106	127	6	96	27	96
Future Volume (vph)	119	31	23	1	31	119	106	127	6	96	27	96
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)	129	34	25	1	34	129	115	138	7	104	29	104
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1							
Volume Total (vph)	188	164	115	145	237							
Volume Left (vph)	129	1	115	0	104							
Volume Right (vph)	25	129	0	7	104							
Hadj (s)	0.09	-0.44	0.53	-0.02	-0.12							
Departure Headway (s)	5.6	5.1	6.3	5.8	5.3							
Degree Utilization, x	0.29	0.23	0.20	0.23	0.35							
Capacity (veh/h)	590	633	536	584	636							
Control Delay (s)	10.9	9.7	9.7	9.3	11.1							
Approach Delay (s)	10.9	9.7	9.5		11.1							
Approach LOS	B	A	A		B							
Intersection Summary												
Delay			10.3									
Level of Service			B									
Intersection Capacity Utilization			51.6%			ICU Level of Service			A			
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 10.6

Intersection LOS B

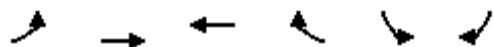
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	119	31	23	1	31	119	106	127	6	96	27	96
Future Vol, veh/h	119	31	23	1	31	119	106	127	6	96	27	96
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	1	2	2	11	2
Mvmt Flow	129	34	25	1	34	129	115	138	7	104	29	104
Number of Lanes	0	1	0	0	1	0	1	1	0	0	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	1	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	1	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	1	1	1
HCM Control Delay	10.9	9.7	10.4	11.1
HCM LOS	B	A	B	B

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1
Vol Left, %	100%	0%	69%	1%	44%
Vol Thru, %	0%	95%	18%	21%	12%
Vol Right, %	0%	5%	13%	79%	44%
Sign Control	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	106	133	173	151	219
LT Vol	106	0	119	1	96
Through Vol	0	127	31	31	27
RT Vol	0	6	23	119	96
Lane Flow Rate	115	145	188	164	238
Geometry Grp	7	7	2	2	5
Degree of Util (X)	0.202	0.231	0.292	0.234	0.347
Departure Headway (Hd)	6.32	5.764	5.59	5.127	5.247
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes
Cap	568	623	643	699	686
Service Time	4.055	3.5	3.629	3.167	3.282
HCM Lane V/C Ratio	0.202	0.233	0.292	0.235	0.347
HCM Control Delay	10.7	10.2	10.9	9.7	11.1
HCM Lane LOS	B	B	B	A	B
HCM 95th-tile Q	0.7	0.9	1.2	0.9	1.6

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/out Post-2031 Imp.

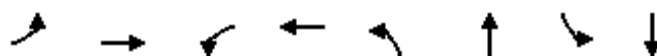


Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↰	↰		↰	↰
Traffic Volume (veh/h)	6	1021	750	17	77	31
Future Volume (Veh/h)	6	1021	750	17	77	31
Sign Control		Free	Free		Stop	
Grade		0%	0%		0%	
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92
Hourly flow rate (vph)	7	1110	815	18	84	34
Pedestrians						
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	833				1948	824
vC1, stage 1 conf vol						
vC2, stage 2 conf vol						
vCu, unblocked vol	833				1948	824
tC, single (s)	4.1				6.4	6.2
tC, 2 stage (s)						
tF (s)	2.2				3.5	3.3
p0 queue free %	99				0	91
cM capacity (veh/h)	800				70	373
Direction, Lane #	EB 1	WB 1	SB 1	SB 2		
Volume Total	1117	833	84	34		
Volume Left	7	0	84	0		
Volume Right	0	18	0	34		
cSH	800	1700	70	373		
Volume to Capacity	0.01	0.49	1.19	0.09		
Queue Length 95th (m)	0.2	0.0	52.3	2.4		
Control Delay (s)	0.3	0.0	271.4	15.6		
Lane LOS	A		F	C		
Approach Delay (s)	0.3	0.0	197.7			
Approach LOS			F			
Intersection Summary						
Average Delay			11.4			
Intersection Capacity Utilization			69.4%		ICU Level of Service	C
Analysis Period (min)			15			

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Total (2031) AM Peak Hour w/ Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	252	768	64	1492	139	98	43	60
Future Volume (vph)	252	768	64	1492	139	98	43	60
Lane Group Flow (vph)	260	1197	66	1622	143	147	44	157
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	29.0	66.0	29.0	66.0	14.0	35.0	14.0	35.0
Total Split (%)	20.1%	45.8%	20.1%	45.8%	9.7%	24.3%	9.7%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.79	0.42	0.24	0.68	0.67	0.56	0.15	0.72
Control Delay	48.1	14.0	11.6	28.9	57.4	55.3	38.2	56.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	48.1	14.0	11.6	28.9	57.4	55.3	38.2	56.0
Queue Length 50th (m)	46.3	55.1	5.2	120.8	31.8	33.8	9.1	28.3
Queue Length 95th (m)	#86.8	80.7	12.5	162.8	53.2	58.9	19.4	54.2
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	386	2838	476	2380	213	366	321	354
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.67	0.42	0.14	0.68	0.67	0.40	0.14	0.44

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 127.1

Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E

Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
Ø5	Ø6	Ø7	Ø8
14 s	35 s	29 s	66 s

140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	252	768	393	64	1492	81	139	98	45	43	60	92
Future Volume (vph)	252	768	393	64	1492	81	139	98	45	43	60	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Frt	1.00	0.95		1.00	0.99		1.00	0.95		1.00	0.91	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1641	4704		1543	5004		1467	1551		1804	1386	
Flt Permitted	0.07	1.00		0.22	1.00		0.39	1.00		0.66	1.00	
Satd. Flow (perm)	128	4704		363	5004		610	1551		1250	1386	
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	260	792	405	66	1538	84	143	101	46	44	62	95
RTOR Reduction (vph)	0	46	0	0	4	0	0	12	0	0	42	0
Lane Group Flow (vph)	260	1151	0	66	1618	0	143	135	0	44	115	0
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	85.7	75.5		67.5	61.3		30.6	20.5		23.6	17.0	
Effective Green, g (s)	85.7	75.5		67.5	61.3		30.6	20.5		23.6	17.0	
Actuated g/C Ratio	0.67	0.59		0.52	0.48		0.24	0.16		0.18	0.13	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	324	2757		247	2381		212	246		257	182	
v/s Ratio Prot	c0.13	0.24		0.01	0.32		c0.05	0.09		0.01	0.08	
v/s Ratio Perm	c0.41			0.13			c0.11			0.02		
v/c Ratio	0.80	0.42		0.27	0.68		0.67	0.55		0.17	0.63	
Uniform Delay, d1	34.8	14.6		15.2	26.1		42.1	49.9		44.0	53.0	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	13.3	0.5		0.6	1.6		8.2	2.5		0.3	7.0	
Delay (s)	48.2	15.1		15.8	27.7		50.3	52.4		44.4	60.0	
Level of Service	D	B		B	C		D	D		D	E	
Approach Delay (s)		21.0			27.3			51.4			56.6	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay			28.3	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.81									
Actuated Cycle Length (s)			128.8	Sum of lost time (s)			20.0					
Intersection Capacity Utilization			97.1%	ICU Level of Service			F					
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Total (2031) AM Peak Hour w/ Post-2031 Imp.

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	3	553	48	110	1259	209	134	303	23	77	280	24
Future Volume (vph)	3	553	48	110	1259	209	134	303	23	77	280	24
Lane Group Flow (vph)	4	683	59	136	1554	258	165	374	28	95	346	30
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	8	8	8	5	2	2	6	6	6
Switch Phase												
Minimum Initial (s)	12.0	12.0	12.0	12.0	12.0	12.0	7.0	40.0	40.0	40.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	25.0	25.0	25.0	11.0	47.0	47.0	47.0	47.0	47.0
Total Split (s)	82.0	82.0	82.0	82.0	82.0	82.0	11.0	58.0	58.0	47.0	47.0	47.0
Total Split (%)	58.6%	58.6%	58.6%	58.6%	58.6%	58.6%	7.9%	41.4%	41.4%	33.6%	33.6%	33.6%
Yellow Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	3.0	5.0	5.0	5.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	4.0	7.0	7.0	7.0	7.0	7.0
Lead/Lag							Lead			Lag	Lag	Lag
Lead-Lag Optimize?							Yes			Yes	Yes	Yes
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
v/c Ratio	0.10	0.45	0.09	0.46	0.87	0.33	0.53	0.50	0.05	0.34	0.61	0.06
Control Delay	23.0	21.4	3.7	26.1	34.6	15.0	34.1	33.6	12.4	41.0	44.8	2.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	23.0	21.4	3.7	26.1	34.6	15.0	34.1	33.6	12.4	41.0	44.8	2.8
Queue Length 50th (m)	0.6	59.6	0.0	22.7	186.7	29.5	28.3	75.4	0.8	19.8	79.5	0.0
Queue Length 95th (m)	2.8	65.0	5.1	35.6	180.5	40.8	44.9	103.8	6.6	35.6	109.4	1.5
Internal Link Dist (m)		1115.0			505.2			596.6			662.8	
Turn Bay Length (m)	100.0		50.0	100.0		20.0	100.0		30.0	100.0		20.0
Base Capacity (vph)	47	1822	765	355	2129	924	310	752	590	281	567	463
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.09	0.37	0.08	0.38	0.73	0.28	0.53	0.50	0.05	0.34	0.61	0.06

Intersection Summary

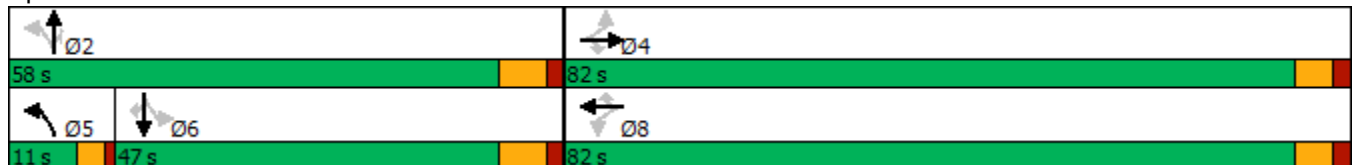
Cycle Length: 140

Actuated Cycle Length: 128.4

Natural Cycle: 105

Control Type: Actuated-Uncoordinated

Splits and Phases: 2: Lockhart Road & Huronia Road



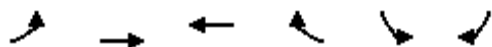
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		 			 						 	
Traffic Volume (vph)	3	553	48	110	1259	209	134	303	23	77	280	24
Future Volume (vph)	3	553	48	110	1259	209	134	303	23	77	280	24
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	6.0	6.0	6.0	4.0	7.0	7.0	7.0	7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1203	3059	1242	1719	3574	1509	1703	1881	1442	1671	1810	1357
Flt Permitted	0.06	1.00	1.00	0.33	1.00	1.00	0.33	1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)	79	3059	1242	598	3574	1509	590	1881	1442	897	1810	1357
Peak-hour factor, PHF	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81	0.81
Adj. Flow (vph)	4	683	59	136	1554	258	165	374	28	95	346	30
RTOR Reduction (vph)	0	0	30	0	0	31	0	0	14	0	0	21
Lane Group Flow (vph)	4	683	29	136	1554	227	165	374	14	95	346	9
Heavy Vehicles (%)	50%	18%	30%	5%	1%	7%	6%	1%	12%	8%	5%	19%
Turn Type	Perm	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm
Protected Phases		4			8		5	2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	64.0	64.0	64.0	64.0	64.0	64.0	51.3	51.3	51.3	40.3	40.3	40.3
Effective Green, g (s)	64.0	64.0	64.0	64.0	64.0	64.0	51.3	51.3	51.3	40.3	40.3	40.3
Actuated g/C Ratio	0.50	0.50	0.50	0.50	0.50	0.50	0.40	0.40	0.40	0.31	0.31	0.31
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	4.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	39	1525	619	298	1782	752	296	752	576	281	568	426
v/s Ratio Prot		0.22			c0.43		0.03	c0.20			c0.19	
v/s Ratio Perm	0.05		0.02	0.23		0.15	0.19		0.01	0.11		0.01
v/c Ratio	0.10	0.45	0.05	0.46	0.87	0.30	0.56	0.50	0.02	0.34	0.61	0.02
Uniform Delay, d1	17.0	20.7	16.5	20.9	28.5	19.0	29.1	28.8	23.3	33.8	37.3	30.4
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.2	0.2	0.0	1.1	5.0	0.2	2.3	0.5	0.0	0.7	1.9	0.0
Delay (s)	18.1	21.0	16.5	22.0	33.5	19.2	31.4	29.4	23.4	34.5	39.2	30.4
Level of Service	B	C	B	C	C	B	C	C	C	C	D	C
Approach Delay (s)		20.6			30.8			29.7			37.7	
Approach LOS		C			C			C			D	
Intersection Summary												
HCM 2000 Control Delay			29.5		HCM 2000 Level of Service				C			
HCM 2000 Volume to Capacity ratio			0.76									
Actuated Cycle Length (s)			128.3		Sum of lost time (s)				17.0			
Intersection Capacity Utilization			133.1%		ICU Level of Service				H			
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/ Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	6	707	948	92	18	25	
Future Volume (Veh/h)	6	707	948	92	18	25	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	7	768	1030	100	20	27	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		TWLT	LT	TWLT			
Median storage veh)		2		2			
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	1130				1478	565	
vC1, stage 1 conf vol					1080		
vC2, stage 2 conf vol					398		
vCu, unblocked vol	1130				1478	565	
tC, single (s)	4.1				6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)	2.2				3.5	3.3	
p0 queue free %	99				93	94	
cM capacity (veh/h)	614				268	468	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	7	384	384	687	443	20	27
Volume Left	7	0	0	0	0	20	0
Volume Right	0	0	0	0	100	0	27
cSH	614	1700	1700	1700	1700	268	468
Volume to Capacity	0.01	0.23	0.23	0.40	0.26	0.07	0.06
Queue Length 95th (m)	0.3	0.0	0.0	0.0	0.0	1.9	1.5
Control Delay (s)	10.9	0.0	0.0	0.0	0.0	19.5	13.2
Lane LOS	B					C	B
Approach Delay (s)	0.1			0.0		15.9	
Approach LOS						C	
Intersection Summary							
Average Delay			0.4				
Intersection Capacity Utilization			39.1%		ICU Level of Service		A
Analysis Period (min)			15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	118	94	117	6	104	141	20	24	1	207	141	172
Future Volume (vph)	118	94	117	6	104	141	20	24	1	207	141	172
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)	128	102	127	7	113	153	22	26	1	225	153	187
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	357	273	22	27	225	340						
Volume Left (vph)	128	7	22	0	225	0						
Volume Right (vph)	127	153	0	1	0	187						
Hadj (s)	-0.11	-0.30	0.53	0.30	0.53	-0.25						
Departure Headway (s)	5.9	5.9	8.0	7.8	7.0	6.2						
Degree Utilization, x	0.59	0.45	0.05	0.06	0.44	0.59						
Capacity (veh/h)	586	578	383	389	492	551						
Control Delay (s)	16.9	13.5	10.2	10.1	14.2	16.6						
Approach Delay (s)	16.9	13.5	10.1		15.6							
Approach LOS	C	B	B		C							
Intersection Summary												
Delay			15.3									
Level of Service			C									
Intersection Capacity Utilization			61.2%		ICU Level of Service		B					
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 16.1

Intersection LOS C

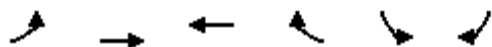
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	118	94	117	6	104	141	20	24	1	207	141	172
Future Vol, veh/h	118	94	117	6	104	141	20	24	1	207	141	172
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	20	2	2	15	2
Mvmt Flow	128	102	127	7	113	153	22	26	1	225	153	187
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	17.3	13.8	11.1	16.9
HCM LOS	C	B	B	C

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	36%	2%	100%	0%
Vol Thru, %	0%	96%	29%	41%	0%	45%
Vol Right, %	0%	4%	36%	56%	0%	55%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	20	25	329	251	207	313
LT Vol	20	0	118	6	207	0
Through Vol	0	24	94	104	0	141
RT Vol	0	1	117	141	0	172
Lane Flow Rate	22	27	358	273	225	340
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.049	0.059	0.589	0.448	0.437	0.597
Departure Headway (Hd)	8.066	7.837	5.931	5.916	6.989	6.312
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	447	460	604	603	513	568
Service Time	5.766	5.537	4.01	4.001	4.762	4.084
HCM Lane V/C Ratio	0.049	0.059	0.593	0.453	0.439	0.599
HCM Control Delay	11.2	11	17.3	13.8	15.1	18.1
HCM Lane LOS	B	B	C	B	C	C
HCM 95th-tile Q	0.2	0.2	3.8	2.3	2.2	3.9

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/ Post-2031 Imp.

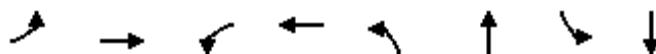


Movement	EBL	EBT	WBT	WBR	SBL	SBR		
Lane Configurations								
Traffic Volume (veh/h)	33	693	1034	85	14	6		
Future Volume (Veh/h)	33	693	1034	85	14	6		
Sign Control		Free	Free		Stop			
Grade		0%	0%		0%			
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92		
Hourly flow rate (vph)	36	753	1124	92	15	7		
Pedestrians								
Lane Width (m)								
Walking Speed (m/s)								
Percent Blockage								
Right turn flare (veh)								
Median type	TWLTL		TWLTL					
Median storage veh)	2		2					
Upstream signal (m)								
pX, platoon unblocked								
vC, conflicting volume	1216				1572	562		
vC1, stage 1 conf vol					1124			
vC2, stage 2 conf vol					448			
vCu, unblocked vol	1216				1572	562		
tC, single (s)	4.1				6.8	6.9		
tC, 2 stage (s)					5.8			
tF (s)	2.2				3.5	3.3		
p0 queue free %	94				94	99		
cM capacity (veh/h)	569				250	470		
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	WB 3	SB 1	SB 2
Volume Total	36	376	376	562	562	92	15	7
Volume Left	36	0	0	0	0	0	15	0
Volume Right	0	0	0	0	0	92	0	7
cSH	569	1700	1700	1700	1700	1700	250	470
Volume to Capacity	0.06	0.22	0.22	0.33	0.33	0.05	0.06	0.01
Queue Length 95th (m)	1.6	0.0	0.0	0.0	0.0	0.0	1.5	0.4
Control Delay (s)	11.8	0.0	0.0	0.0	0.0	0.0	20.3	12.8
Lane LOS	B						C	B
Approach Delay (s)	0.5			0.0			17.9	
Approach LOS							C	
Intersection Summary								
Average Delay			0.4					
Intersection Capacity Utilization			38.6%			ICU Level of Service		A
Analysis Period (min)			15					

140 Lockhart Road
1: Welham Rd & Maplview Drive E

Queues

Total (2031) PM Peak Hour w/ Post-2031 Imp.



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT
Lane Configurations								
Traffic Volume (vph)	203	1793	43	1287	242	56	122	83
Future Volume (vph)	203	1793	43	1287	242	56	122	83
Lane Group Flow (vph)	231	2143	49	1514	275	136	139	329
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA
Protected Phases	7	4	3	8	5	2	1	6
Permitted Phases	4		8		2		6	
Detector Phase	7	4	3	8	5	2	1	6
Switch Phase								
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0
Total Split (s)	23.0	71.0	18.0	66.0	25.0	46.0	14.0	35.0
Total Split (%)	15.4%	47.7%	12.1%	44.3%	16.8%	30.9%	9.4%	23.5%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None
v/c Ratio	0.87	0.84	0.35	0.73	0.90	0.29	0.38	0.92
Control Delay	66.9	36.2	23.0	38.7	70.5	32.8	36.6	76.4
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	66.9	36.2	23.0	38.7	70.5	32.8	36.6	76.4
Queue Length 50th (m)	52.0	214.3	6.5	146.1	65.8	24.1	29.2	79.5
Queue Length 95th (m)	#95.1	232.9	12.7	159.6	#114.7	42.2	45.1	#129.2
Internal Link Dist (m)		672.8		566.0		484.7		544.0
Turn Bay Length (m)	79.0		60.0		48.0		42.0	
Base Capacity (vph)	278	2549	215	2081	310	505	366	384
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.84	0.23	0.73	0.89	0.27	0.38	0.86

Intersection Summary

Cycle Length: 149

Actuated Cycle Length: 145.2

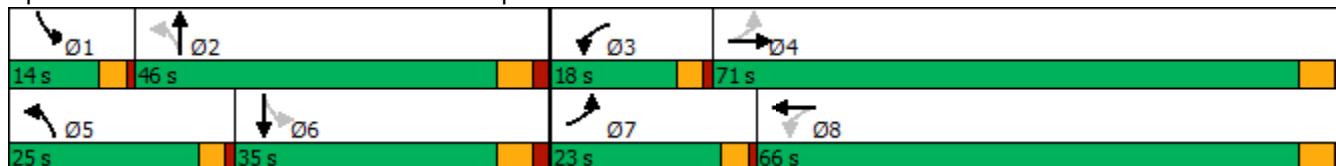
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E



140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	1793	92	43	1287	45	242	56	63	122	83	207
Future Volume (vph)	203	1793	92	43	1287	45	242	56	63	122	83	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	
Frt	1.00	0.99		1.00	0.99		1.00	0.92		1.00	0.89	
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1687	5081		1703	5021		1770	1732		1770	1622	
Flt Permitted	0.07	1.00		0.07	1.00		0.13	1.00		0.67	1.00	
Satd. Flow (perm)	127	5081		118	5021		244	1732		1248	1622	
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	231	2038	105	49	1462	51	275	64	72	139	94	235
RTOR Reduction (vph)	0	4	0	0	2	0	0	28	0	0	61	0
Lane Group Flow (vph)	231	2139	0	49	1512	0	275	108	0	139	268	0
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		
Actuated Green, G (s)	82.9	72.7		67.2	61.0		51.2	37.4		36.3	26.5	
Effective Green, g (s)	82.9	72.7		67.2	61.0		51.2	37.4		36.3	26.5	
Actuated g/C Ratio	0.57	0.50		0.46	0.42		0.35	0.26		0.25	0.18	
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	263	2528		121	2096		301	443		345	294	
v/s Ratio Prot	c0.11	0.42		0.02	0.30		c0.13	0.06		0.03	0.16	
v/s Ratio Perm	c0.39			0.17			c0.19			0.07		
v/c Ratio	0.88	0.85		0.40	0.72		0.91	0.24		0.40	0.91	
Uniform Delay, d1	41.9	31.9		28.1	35.5		41.8	43.1		44.8	58.6	
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	
Incremental Delay, d2	26.4	3.7		2.2	2.2		30.4	0.3		0.8	30.3	
Delay (s)	68.3	35.6		30.3	37.6		72.2	43.4		45.5	89.0	
Level of Service	E	D		C	D		E	D		D	F	
Approach Delay (s)		38.8			37.4			62.7			76.1	
Approach LOS		D			D			E			E	
Intersection Summary												
HCM 2000 Control Delay		44.0			HCM 2000 Level of Service			D				
HCM 2000 Volume to Capacity ratio		0.93										
Actuated Cycle Length (s)		146.1			Sum of lost time (s)			20.0				
Intersection Capacity Utilization		108.4%			ICU Level of Service			G				
Analysis Period (min)		15										
c Critical Lane Group												

140 Lockhart Road
2: Lockhart Road & Huronia Road

Queues
Total (2031) PM Peak Hour w/ Post-2031 Imp.

												
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	977	223	52	598	143	60	453	166	257	461	11
Future Volume (vph)	16	977	223	52	598	143	60	453	166	257	461	11
Lane Group Flow (vph)	18	1110	253	59	680	163	68	515	189	292	524	13
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Detector Phase	4	4	4	3	8	8	2	2	2	1	6	6
Switch Phase												
Minimum Initial (s)	12.0	12.0	12.0	7.0	12.0	12.0	40.0	40.0	40.0	7.0	40.0	40.0
Minimum Split (s)	25.0	25.0	25.0	11.0	25.0	25.0	47.0	47.0	47.0	11.0	47.0	47.0
Total Split (s)	57.0	57.0	57.0	11.0	68.0	68.0	57.0	57.0	57.0	23.0	80.0	80.0
Total Split (%)	38.5%	38.5%	38.5%	7.4%	45.9%	45.9%	38.5%	38.5%	38.5%	15.5%	54.1%	54.1%
Yellow Time (s)	4.0	4.0	4.0	3.0	4.0	4.0	5.0	5.0	5.0	3.0	5.0	5.0
All-Red Time (s)	2.0	2.0	2.0	1.0	2.0	2.0	2.0	2.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	7.0	7.0	7.0	4.0	7.0	7.0
Lead/Lag	Lag	Lag	Lag	Lead			Lag	Lag	Lag	Lead		
Lead-Lag Optimize?	Yes	Yes	Yes	Yes			Yes	Yes	Yes	Yes		
Recall Mode	None	None	None	None	None	None	None	None	None	None	None	None
v/c Ratio	0.09	0.92	0.41	0.42	0.55	0.25	0.30	0.84	0.33	0.87	0.57	0.02
Control Delay	34.2	55.8	20.7	33.5	32.9	16.3	40.6	56.9	21.9	51.8	28.2	0.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	34.2	55.8	20.7	33.5	32.9	16.3	40.6	56.9	21.9	51.8	28.2	0.1
Queue Length 50th (m)	3.6	165.8	29.6	10.1	78.2	17.4	15.4	146.1	23.9	54.0	111.9	0.0
Queue Length 95th (m)	10.1	#199.3	54.6	19.6	99.1	34.2	29.4	188.7	44.1	#103.7	144.2	0.0
Internal Link Dist (m)		1115.0			505.2			596.6			662.8	
Turn Bay Length (m)	100.0		50.0	100.0		20.0	100.0		30.0	100.0		20.0
Base Capacity (vph)	212	1330	661	139	1400	745	255	686	628	346	1011	767
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.08	0.83	0.38	0.42	0.49	0.22	0.27	0.75	0.30	0.84	0.52	0.02

Intersection Summary

Cycle Length: 148

Actuated Cycle Length: 136.4

Natural Cycle: 105

Control Type: Actuated-Uncoordinated

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 2: Lockhart Road & Huronia Road

			
23 s	57 s	11 s	57 s
			
80 s		68 s	

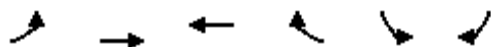
140 Lockhart Road
2: Lockhart Road & Huronia Road

HCM Signalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/ Post-2031 Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	16	977	223	52	598	143	60	453	166	257	461	11
Future Volume (vph)	16	977	223	52	598	143	60	453	166	257	461	11
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	6.0	6.0	6.0	4.0	6.0	6.0	7.0	7.0	7.0	4.0	7.0	7.0
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1504	3505	1553	1687	3034	1538	1388	1845	1553	1719	1863	1369
Flt Permitted	0.35	1.00	1.00	0.08	1.00	1.00	0.47	1.00	1.00	0.15	1.00	1.00
Satd. Flow (perm)	560	3505	1553	139	3034	1538	686	1845	1553	275	1863	1369
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	18	1110	253	59	680	162	68	515	189	292	524	12
RTOR Reduction (vph)	0	0	77	0	0	39	0	0	54	0	0	7
Lane Group Flow (vph)	18	1110	176	59	680	124	68	515	135	292	524	6
Heavy Vehicles (%)	20%	3%	4%	7%	19%	5%	30%	3%	4%	5%	2%	18%
Turn Type	Perm	NA	Perm	pm+pt	NA	Perm	Perm	NA	Perm	pm+pt	NA	Perm
Protected Phases		4		3	8			2		1	6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	47.1	47.1	47.1	56.4	56.4	56.4	45.6	45.6	45.6	67.7	67.7	67.7
Effective Green, g (s)	47.1	47.1	47.1	56.4	56.4	56.4	45.6	45.6	45.6	67.7	67.7	67.7
Actuated g/C Ratio	0.34	0.34	0.34	0.41	0.41	0.41	0.33	0.33	0.33	0.49	0.49	0.49
Clearance Time (s)	6.0	6.0	6.0	4.0	6.0	6.0	7.0	7.0	7.0	4.0	7.0	7.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Lane Grp Cap (vph)	192	1204	533	117	1248	632	228	613	516	326	919	676
v/s Ratio Prot		c0.32		0.02	c0.22			0.28		c0.12	0.28	
v/s Ratio Perm	0.03		0.11	0.19		0.08	0.10		0.09	c0.32		0.00
v/c Ratio	0.09	0.92	0.33	0.50	0.54	0.20	0.30	0.84	0.26	0.90	0.57	0.01
Uniform Delay, d1	30.5	43.2	33.3	31.4	30.6	25.8	33.9	42.4	33.4	29.2	24.4	17.6
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	0.2	11.6	0.4	3.4	0.5	0.2	0.7	10.1	0.3	25.4	0.9	0.0
Delay (s)	30.7	54.8	33.7	34.8	31.1	26.0	34.6	52.4	33.7	54.5	25.3	17.7
Level of Service	C	D	C	C	C	C	C	D	C	D	C	B
Approach Delay (s)		50.6			30.4			46.3			35.5	
Approach LOS		D			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			41.8									
HCM 2000 Volume to Capacity ratio			0.92									
Actuated Cycle Length (s)			137.1							21.0		
Intersection Capacity Utilization			119.5%									
Analysis Period (min)			15									
c Critical Lane Group												

140 Lockhart Road
3: Lockhart Road & Bayview Road

HCM Unsignalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/ Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations							
Traffic Volume (veh/h)	25	1013	705	76	15	7	
Future Volume (Veh/h)	25	1013	705	76	15	7	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	27	1101	766	83	16	8	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		TWLT	LT	TWLT			
Median storage veh)		2		2			
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	849				1412	424	
vC1, stage 1 conf vol					808		
vC2, stage 2 conf vol					604		
vCu, unblocked vol	849				1412	424	
tC, single (s)	4.1				6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)	2.2				3.5	3.3	
p0 queue free %	97				95	99	
cM capacity (veh/h)	785				324	578	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	27	550	550	511	338	16	8
Volume Left	27	0	0	0	0	16	0
Volume Right	0	0	0	0	83	0	8
cSH	785	1700	1700	1700	1700	324	578
Volume to Capacity	0.03	0.32	0.32	0.30	0.20	0.05	0.01
Queue Length 95th (m)	0.9	0.0	0.0	0.0	0.0	1.2	0.3
Control Delay (s)	9.8	0.0	0.0	0.0	0.0	16.7	11.3
Lane LOS	A					C	B
Approach Delay (s)	0.2			0.0		14.9	
Approach LOS						B	
Intersection Summary							
Average Delay			0.3				
Intersection Capacity Utilization			38.0%		ICU Level of Service		A
Analysis Period (min)			15				

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Sign Control		Stop			Stop			Stop			Stop	
Traffic Volume (vph)	119	31	23	1	31	119	106	127	6	96	27	96
Future Volume (vph)	119	31	23	1	31	119	106	127	6	96	27	96
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)	129	34	25	1	34	129	115	138	7	104	29	104
Direction, Lane #	EB 1	WB 1	NB 1	NB 2	SB 1	SB 2						
Volume Total (vph)	188	164	115	145	104	133						
Volume Left (vph)	129	1	115	0	104	0						
Volume Right (vph)	25	129	0	7	0	104						
Hadj (s)	0.09	-0.44	0.53	-0.02	0.53	-0.48						
Departure Headway (s)	5.5	5.1	6.4	5.8	6.4	5.4						
Degree Utilization, x	0.29	0.23	0.20	0.23	0.19	0.20						
Capacity (veh/h)	601	645	536	584	527	625						
Control Delay (s)	10.8	9.6	9.8	9.4	9.7	8.5						
Approach Delay (s)	10.8	9.6	9.5		9.0							
Approach LOS	B	A	A		A							
Intersection Summary												
Delay			9.7									
Level of Service			A									
Intersection Capacity Utilization			45.2%		ICU Level of Service		A					
Analysis Period (min)			15									

Intersection

Intersection Delay, s/veh 10.3

Intersection LOS B

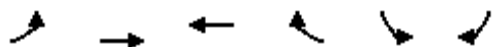
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Vol, veh/h	119	31	23	1	31	119	106	127	6	96	27	96
Future Vol, veh/h	119	31	23	1	31	119	106	127	6	96	27	96
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles, %	2	2	2	2	2	2	2	1	2	2	11	2
Mvmt Flow	129	34	25	1	34	129	115	138	7	104	29	104
Number of Lanes	0	1	0	0	1	0	1	1	0	1	1	0

Approach	EB	WB	NB	SB
Opposing Approach	WB	EB	SB	NB
Opposing Lanes	1	1	2	2
Conflicting Approach Left	SB	NB	EB	WB
Conflicting Lanes Left	2	2	1	1
Conflicting Approach Right	NB	SB	WB	EB
Conflicting Lanes Right	2	2	1	1
HCM Control Delay	10.9	9.7	10.5	10
HCM LOS	B	A	B	A

Lane	NBLn1	NBLn2	EBLn1	WBLn1	SBLn1	SBLn2
Vol Left, %	100%	0%	69%	1%	100%	0%
Vol Thru, %	0%	95%	18%	21%	0%	22%
Vol Right, %	0%	5%	13%	79%	0%	78%
Sign Control	Stop	Stop	Stop	Stop	Stop	Stop
Traffic Vol by Lane	106	133	173	151	96	123
LT Vol	106	0	119	1	96	0
Through Vol	0	127	31	31	0	27
RT Vol	0	6	23	119	0	96
Lane Flow Rate	115	145	188	164	104	134
Geometry Grp	7	7	2	2	7	7
Degree of Util (X)	0.204	0.233	0.292	0.234	0.186	0.204
Departure Headway (Hd)	6.36	5.804	5.593	5.132	6.401	5.495
Convergence, Y/N	Yes	Yes	Yes	Yes	Yes	Yes
Cap	565	619	641	699	561	652
Service Time	4.094	3.538	3.632	3.172	4.136	3.23
HCM Lane V/C Ratio	0.204	0.234	0.293	0.235	0.185	0.206
HCM Control Delay	10.7	10.3	10.9	9.7	10.6	9.6
HCM Lane LOS	B	B	B	A	B	A
HCM 95th-tile Q	0.8	0.9	1.2	0.9	0.7	0.8

140 Lockhart Road
5: Lockhart Road & Welham Extension

HCM Unsignalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/ Post-2031 Imp.



Movement	EBL	EBT	WBT	WBR	SBL	SBR	
Lane Configurations		 	 				
Traffic Volume (veh/h)	7	1021	750	17	77	31	
Future Volume (Veh/h)	7	1021	750	17	77	31	
Sign Control		Free	Free		Stop		
Grade		0%	0%		0%		
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	
Hourly flow rate (vph)	8	1110	815	18	84	34	
Pedestrians							
Lane Width (m)							
Walking Speed (m/s)							
Percent Blockage							
Right turn flare (veh)							
Median type		TWLT	LT	TWLT			
Median storage veh)		2	2				
Upstream signal (m)							
pX, platoon unblocked							
vC, conflicting volume	833				1395	416	
vC1, stage 1 conf vol					824		
vC2, stage 2 conf vol					571		
vCu, unblocked vol	833				1395	416	
tC, single (s)	4.1				6.8	6.9	
tC, 2 stage (s)					5.8		
tF (s)	2.2				3.5	3.3	
p0 queue free %	99				74	94	
cM capacity (veh/h)	796				329	585	
Direction, Lane #	EB 1	EB 2	EB 3	WB 1	WB 2	SB 1	SB 2
Volume Total	8	555	555	543	290	84	34
Volume Left	8	0	0	0	0	84	0
Volume Right	0	0	0	0	18	0	34
cSH	796	1700	1700	1700	1700	329	585
Volume to Capacity	0.01	0.33	0.33	0.32	0.17	0.26	0.06
Queue Length 95th (m)	0.2	0.0	0.0	0.0	0.0	8.0	1.5
Control Delay (s)	9.6	0.0	0.0	0.0	0.0	19.7	11.5
Lane LOS	A					C	B
Approach Delay (s)	0.1			0.0		17.3	
Approach LOS						C	
Intersection Summary							
Average Delay			1.0				
Intersection Capacity Utilization			39.2%		ICU Level of Service		A
Analysis Period (min)			15				

									
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	252	768	68	1492	141	98	43	63	92
Future Volume (vph)	252	768	68	1492	141	98	43	63	92
Lane Group Flow (vph)	260	1233	70	1622	145	147	44	65	95
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2	1	6	
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	6
Switch Phase									
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0	35.0
Total Split (s)	29.0	66.0	29.0	66.0	14.0	35.0	14.0	35.0	35.0
Total Split (%)	20.1%	45.8%	20.1%	45.8%	9.7%	24.3%	9.7%	24.3%	24.3%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None	None
v/c Ratio	0.78	0.43	0.26	0.67	0.57	0.59	0.15	0.33	0.41
Control Delay	46.6	13.7	11.5	28.1	50.4	56.9	38.5	55.8	15.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	46.6	13.7	11.5	28.1	50.4	56.9	38.5	55.8	15.2
Queue Length 50th (m)	44.8	55.1	5.3	117.2	32.2	33.7	9.0	16.0	0.0
Queue Length 95th (m)	84.9	82.6	12.8	161.3	53.8	58.9	19.6	31.1	16.4
Internal Link Dist (m)		672.8		566.0		484.7		544.0	
Turn Bay Length (m)	79.0		60.0		48.0		42.0		35.0
Base Capacity (vph)	391	2853	474	2403	255	370	313	382	358
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.66	0.43	0.15	0.67	0.57	0.40	0.14	0.17	0.27

Intersection Summary

Cycle Length: 144

Actuated Cycle Length: 125.8

Natural Cycle: 125

Control Type: Semi Act-Uncoord

Splits and Phases: 1: Welham Rd & Maplview Drive E

			
Ø1	Ø2	Ø3	Ø4
14 s	35 s	29 s	66 s
			
Ø5	Ø6	Ø7	Ø8
14 s	35 s	29 s	66 s

140 Lockhart Road
1: Welham Rd & Mapview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2031) AM Peak Hour w/ Post-2031 & Recommended Imp.

												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		  			  						 	
Traffic Volume (vph)	252	768	428	68	1492	81	141	98	45	43	63	92
Future Volume (vph)	252	768	428	68	1492	81	141	98	45	43	63	92
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Flpb, ped/bikes	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.95		1.00	0.99		1.00	0.95		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1641	4691		1543	5004		1467	1551		1804	1652	1233
Flt Permitted	0.08	1.00		0.22	1.00		0.59	1.00		0.66	1.00	1.00
Satd. Flow (perm)	130	4691		349	5004		905	1551		1251	1652	1233
Peak-hour factor, PHF	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97	0.97
Adj. Flow (vph)	260	792	441	70	1538	84	145	101	46	44	65	95
RTOR Reduction (vph)	0	49	0	0	4	0	0	12	0	0	0	83
Lane Group Flow (vph)	260	1184	0	70	1618	0	145	135	0	44	65	12
Confl. Peds. (#/hr)									1	1		
Heavy Vehicles (%)	10%	5%	4%	17%	3%	0%	23%	20%	8%	0%	15%	31%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	85.5	75.3		67.4	61.2		29.5	19.4		22.5	15.9	15.9
Effective Green, g (s)	85.5	75.3		67.4	61.2		29.5	19.4		22.5	15.9	15.9
Actuated g/C Ratio	0.67	0.59		0.53	0.48		0.23	0.15		0.18	0.12	0.12
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	327	2770		242	2401		253	235		249	206	153
v/s Ratio Prot	c0.13	0.25		0.01	0.32		c0.05	c0.09		0.01	0.04	
v/s Ratio Perm	c0.40			0.14			0.09			0.02		0.01
v/c Ratio	0.80	0.43		0.29	0.67		0.57	0.58		0.18	0.32	0.08
Uniform Delay, d1	34.0	14.3		14.8	25.5		42.0	50.2		44.3	50.8	49.3
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	12.5	0.5		0.7	1.5		3.1	3.4		0.3	0.9	0.2
Delay (s)	46.5	14.8		15.5	27.0		45.2	53.6		44.7	51.7	49.5
Level of Service	D	B		B	C		D	D		D	D	D
Approach Delay (s)		20.3			26.5			49.4			49.2	
Approach LOS		C			C			D			D	
Intersection Summary												
HCM 2000 Control Delay			27.1	HCM 2000 Level of Service			C					
HCM 2000 Volume to Capacity ratio			0.78									
Actuated Cycle Length (s)			127.5	Sum of lost time (s)			20.0					
Intersection Capacity Utilization			96.8%	ICU Level of Service			F					
Analysis Period (min)			15									
c Critical Lane Group												



Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBL	SBT	SBR
Lane Configurations									
Traffic Volume (vph)	203	1793	43	1287	272	59	122	83	207
Future Volume (vph)	203	1793	43	1287	272	59	122	83	207
Lane Group Flow (vph)	231	2140	49	1514	309	142	139	94	235
Turn Type	pm+pt	NA	pm+pt	NA	pm+pt	NA	pm+pt	NA	Perm
Protected Phases	7	4	3	8	5	2	1	6	
Permitted Phases	4		8		2		6		6
Detector Phase	7	4	3	8	5	2	1	6	6
Switch Phase									
Minimum Initial (s)	7.0	60.0	7.0	60.0	7.0	10.0	7.0	10.0	10.0
Minimum Split (s)	11.0	66.0	11.0	66.0	11.0	35.0	11.0	35.0	35.0
Total Split (s)	23.0	71.0	18.0	66.0	25.0	46.0	14.0	35.0	35.0
Total Split (%)	15.4%	47.7%	12.1%	44.3%	16.8%	30.9%	9.4%	23.5%	23.5%
Yellow Time (s)	3.0	4.0	3.0	4.0	3.0	4.0	3.0	4.0	4.0
All-Red Time (s)	1.0	2.0	1.0	2.0	1.0	2.0	1.0	2.0	2.0
Lost Time Adjust (s)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Lost Time (s)	4.0	6.0	4.0	6.0	4.0	6.0	4.0	6.0	6.0
Lead/Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lead	Lag	Lag
Lead-Lag Optimize?	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Recall Mode	None	Max	None	Max	None	None	None	None	None
v/c Ratio	0.76	0.76	0.32	0.66	0.75	0.42	0.51	0.56	0.65
Control Delay	43.9	25.8	17.8	29.6	51.6	38.8	43.6	69.5	16.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	43.9	25.8	17.8	29.6	51.6	38.8	43.6	69.5	16.8
Queue Length 50th (m)	37.9	163.8	4.7	117.2	72.4	25.7	29.2	25.2	2.1
Queue Length 95th (m)	#74.1	196.5	10.4	139.0	100.6	45.4	45.8	43.2	25.8
Internal Link Dist (m)		672.8		566.0		484.7		544.0	
Turn Bay Length (m)	79.0		60.0		48.0		42.0		35.0
Base Capacity (vph)	321	2819	238	2309	417	556	277	380	528
Starvation Cap Reductn	0	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.72	0.76	0.21	0.66	0.74	0.26	0.50	0.25	0.45

Intersection Summary

Cycle Length: 149

Actuated Cycle Length: 130.9

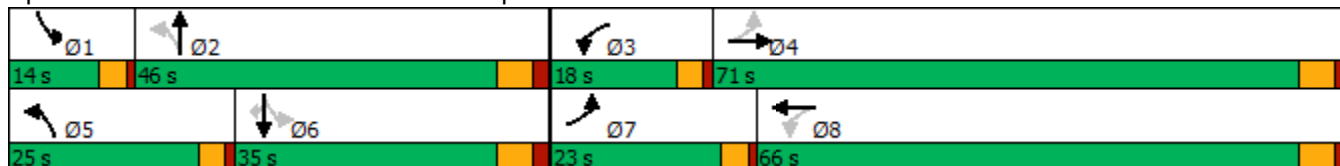
Natural Cycle: 125

Control Type: Semi Act-Uncoord

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

Splits and Phases: 1: Welham Rd & Maplview Drive E

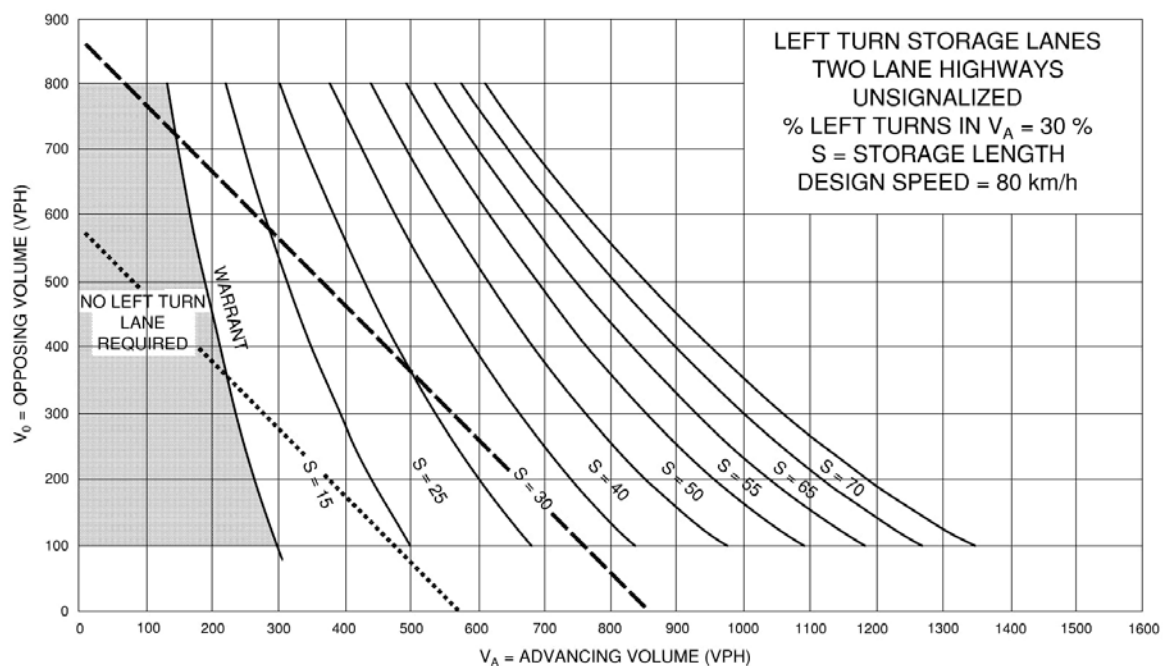
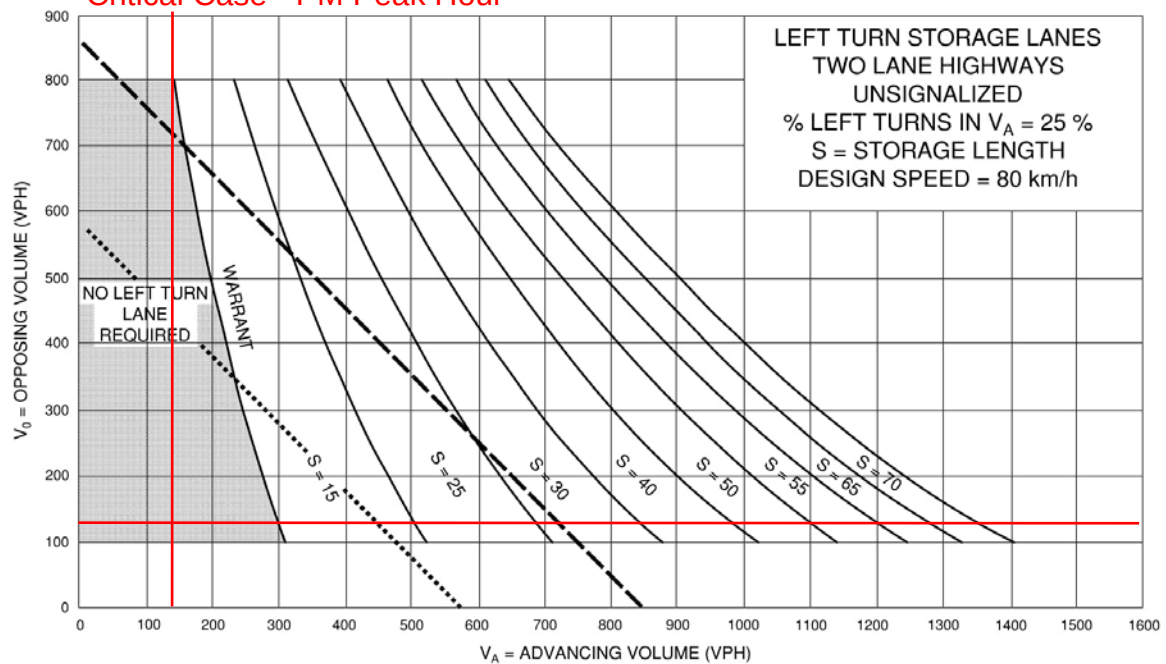


140 Lockhart Road
1: Welham Rd & Maplview Drive E

HCM Signalized Intersection Capacity Analysis
Total (2031) PM Peak Hour w/ Post-2031 & Recommended Imp.

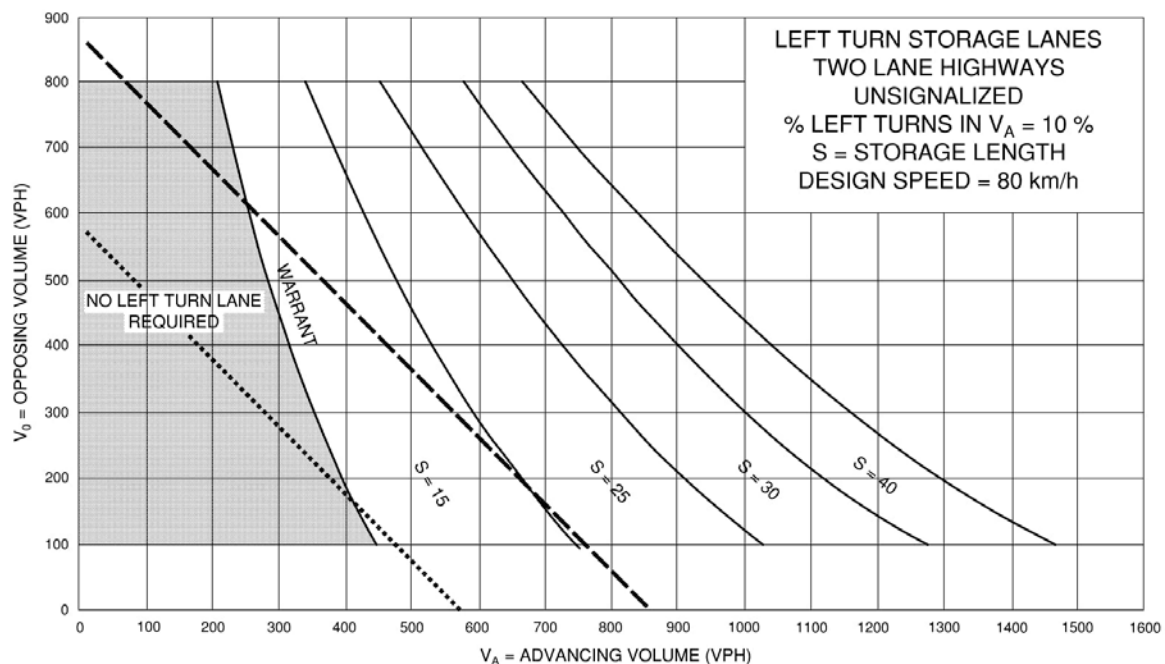
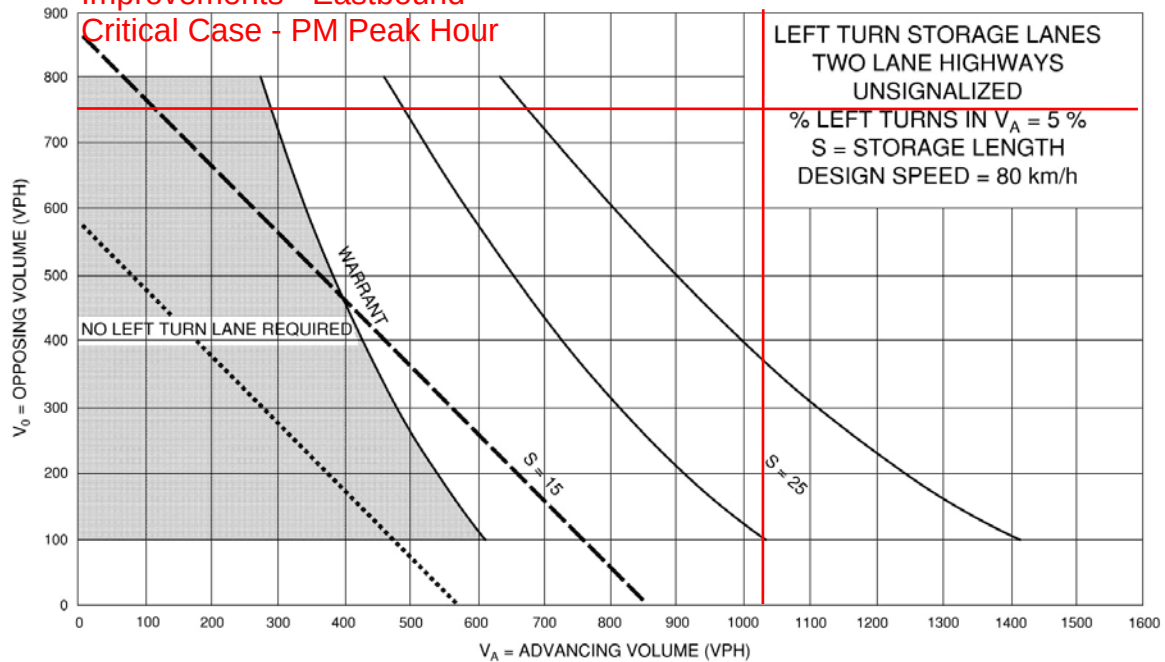
												
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	203	1793	90	43	1287	45	272	59	66	122	83	207
Future Volume (vph)	203	1793	90	43	1287	45	272	59	66	122	83	207
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	6.0
Lane Util. Factor	1.00	0.91		1.00	0.91		1.00	1.00		1.00	1.00	1.00
Frt	1.00	0.99		1.00	0.99		1.00	0.92		1.00	1.00	0.85
Flt Protected	0.95	1.00		0.95	1.00		0.95	1.00		0.95	1.00	1.00
Satd. Flow (prot)	1687	5082		1703	5021		1770	1732		1770	1712	1583
Flt Permitted	0.09	1.00		0.07	1.00		0.51	1.00		0.67	1.00	1.00
Satd. Flow (perm)	155	5082		118	5021		950	1732		1241	1712	1583
Peak-hour factor, PHF	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88
Adj. Flow (vph)	231	2038	102	49	1462	51	309	67	75	139	94	235
RTOR Reduction (vph)	0	3	0	0	2	0	0	30	0	0	0	205
Lane Group Flow (vph)	231	2137	0	49	1512	0	309	112	0	139	94	30
Heavy Vehicles (%)	7%	1%	8%	6%	2%	25%	2%	1%	1%	2%	11%	2%
Turn Type	pm+pt	NA		pm+pt	NA		pm+pt	NA		pm+pt	NA	Perm
Protected Phases	7	4		3	8		5	2		1	6	
Permitted Phases	4			8			2			6		6
Actuated Green, G (s)	82.4	72.5		66.9	61.0		37.3	23.5		22.8	13.0	13.0
Effective Green, g (s)	82.4	72.5		66.9	61.0		37.3	23.5		22.8	13.0	13.0
Actuated g/C Ratio	0.63	0.55		0.51	0.46		0.28	0.18		0.17	0.10	0.10
Clearance Time (s)	4.0	6.0		4.0	6.0		4.0	6.0		4.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0		3.0	3.0		3.0	3.0		3.0	3.0	3.0
Lane Grp Cap (vph)	299	2797		130	2325		395	309		254	168	156
v/s Ratio Prot	c0.10	0.42		0.02	0.30		c0.12	0.06		0.04	0.05	
v/s Ratio Perm	c0.38			0.17			c0.10			0.05		0.02
v/c Ratio	0.77	0.76		0.38	0.65		0.78	0.36		0.55	0.56	0.19
Uniform Delay, d1	30.4	23.0		20.3	27.2		41.1	47.5		48.9	56.6	54.5
Progression Factor	1.00	1.00		1.00	1.00		1.00	1.00		1.00	1.00	1.00
Incremental Delay, d2	11.7	2.0		1.8	1.4		9.7	0.7		2.4	4.0	0.6
Delay (s)	42.1	25.0		22.1	28.6		50.8	48.2		51.3	60.6	55.2
Level of Service	D	C		C	C		D	D		D	E	E
Approach Delay (s)		26.7			28.4			50.0			55.1	
Approach LOS		C			C			D			E	
Intersection Summary												
HCM 2000 Control Delay		32.1					HCM 2000 Level of Service		C			
HCM 2000 Volume to Capacity ratio		0.82										
Actuated Cycle Length (s)		131.7					Sum of lost time (s)		20.0			
Intersection Capacity Utilization		101.3%					ICU Level of Service		G			
Analysis Period (min)		15										
c Critical Lane Group												

Appendix H – MTO Left Turn Analysis

Bayview Drive / Lockhart Road**2020 Existing - Eastbound Exhibit 9A-16****Critical Case - PM Peak Hour**

Bayview Drive / Lockhart Road

2031 Background w/out Capital Improvements - Eastbound

Exhibit 9A-14**Critical Case - PM Peak Hour**

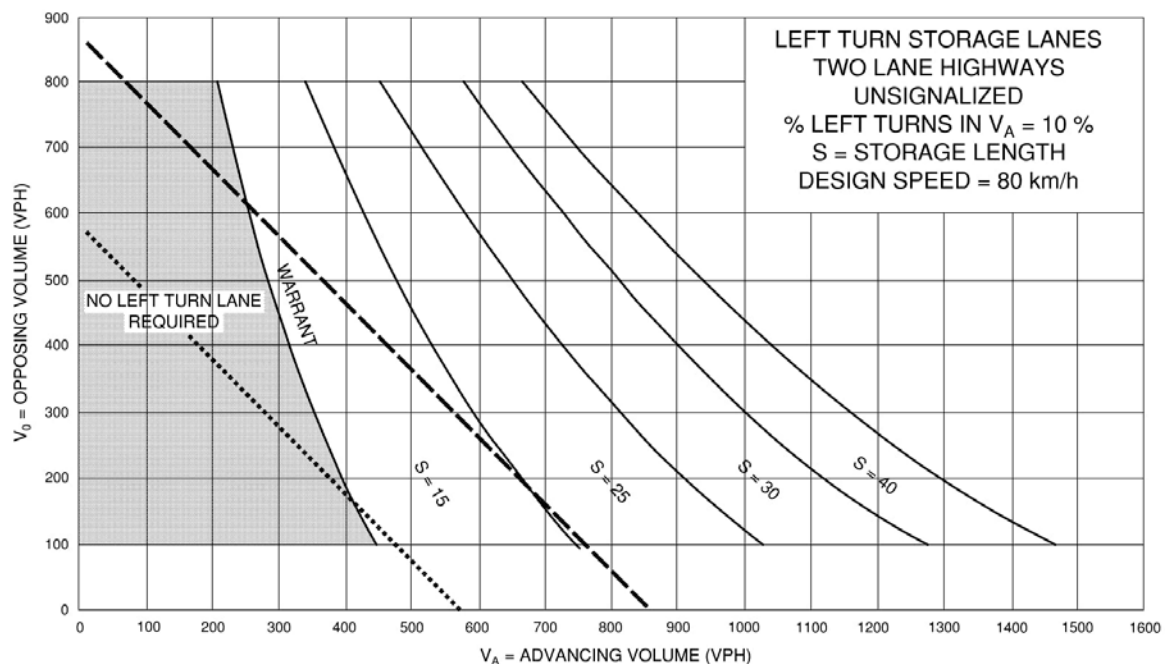
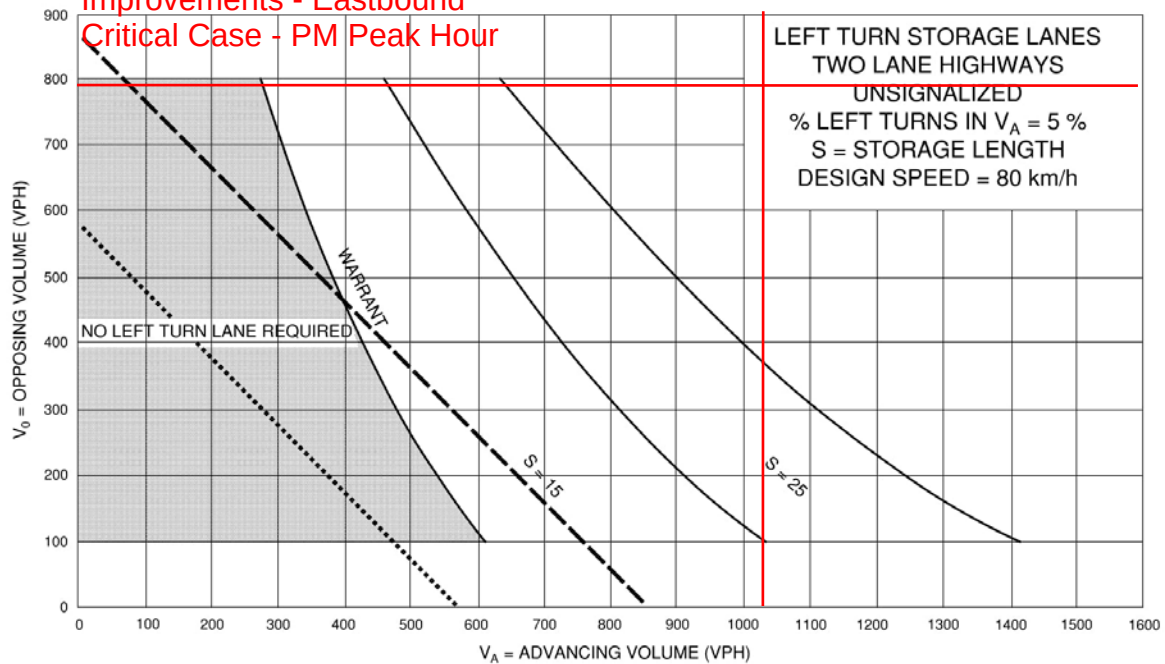
Bayview Drive / Lockhart Road

2031 Total w/out Capital

Exhibit 9A-14

Improvements - Eastbound

Critical Case - PM Peak Hour



Welham Extension / Lockhart Road

2031 Total w/out Capital

Exhibit 9A-14

Improvements - Eastbound

Critical Case - AM Peak Hour

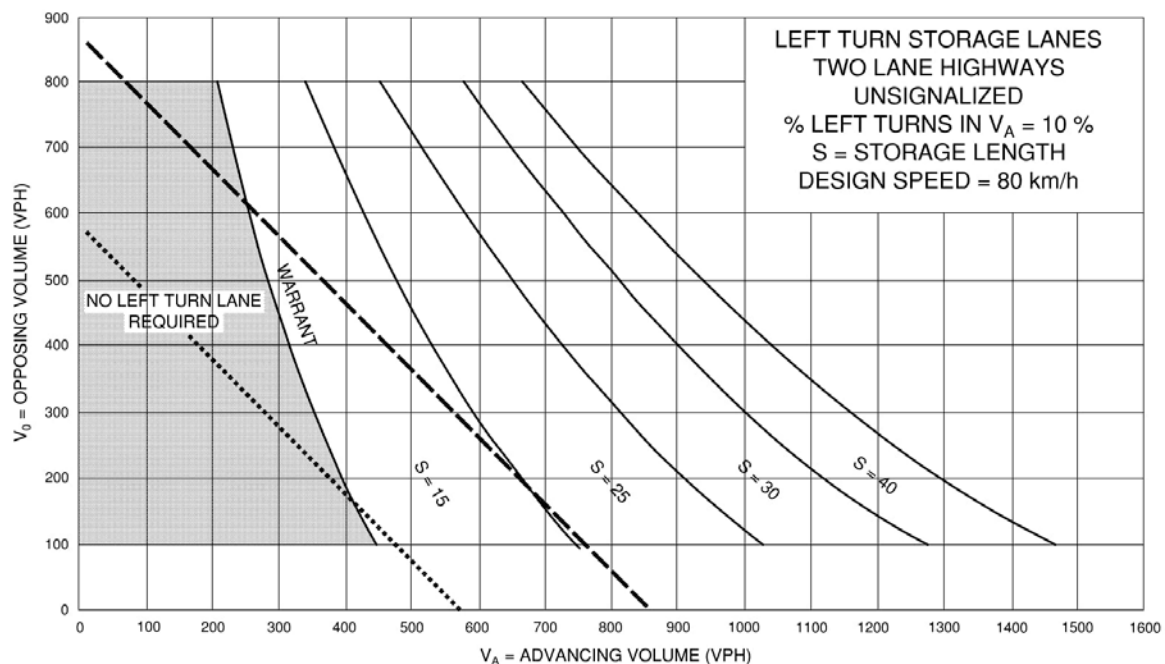
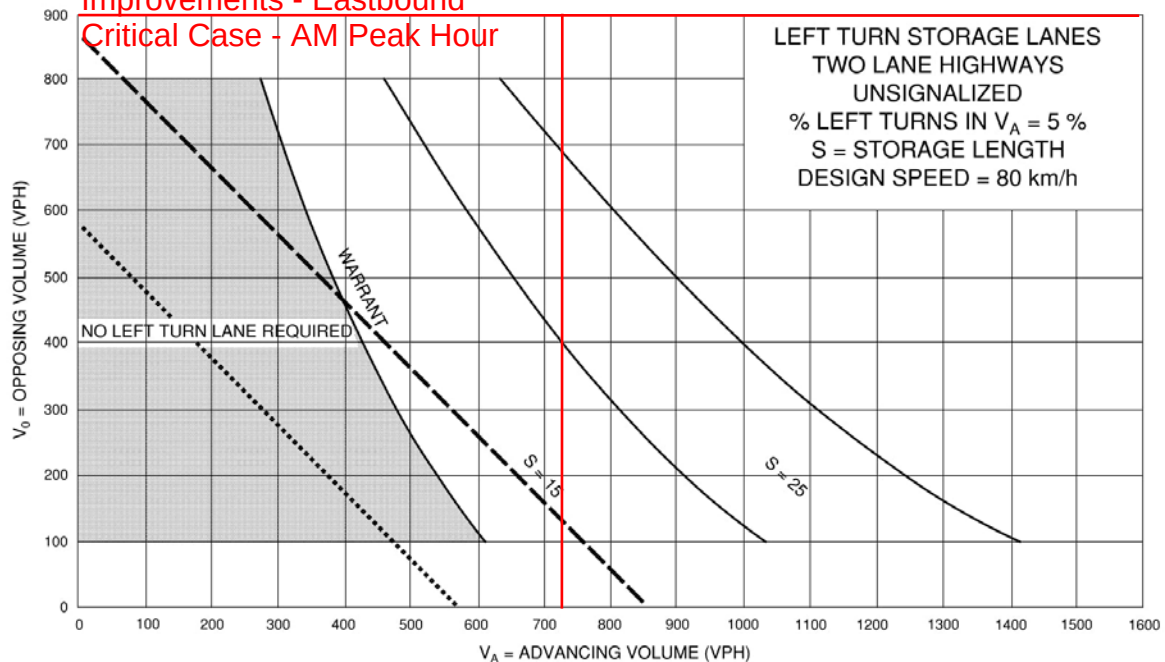
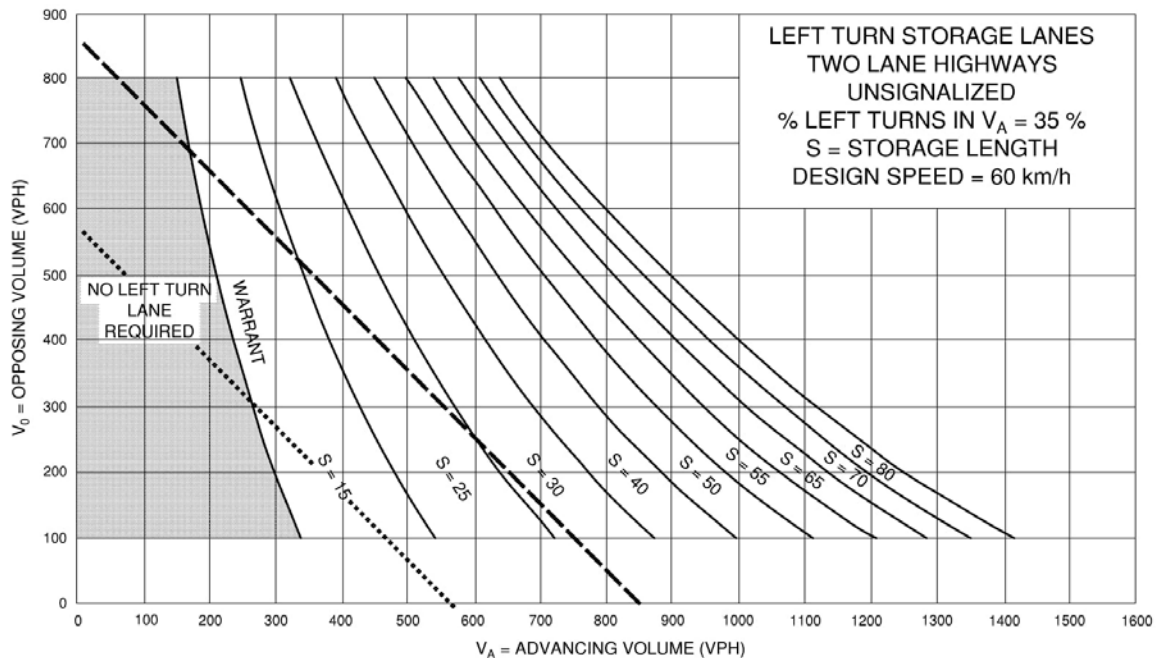


Exhibit 9A-9

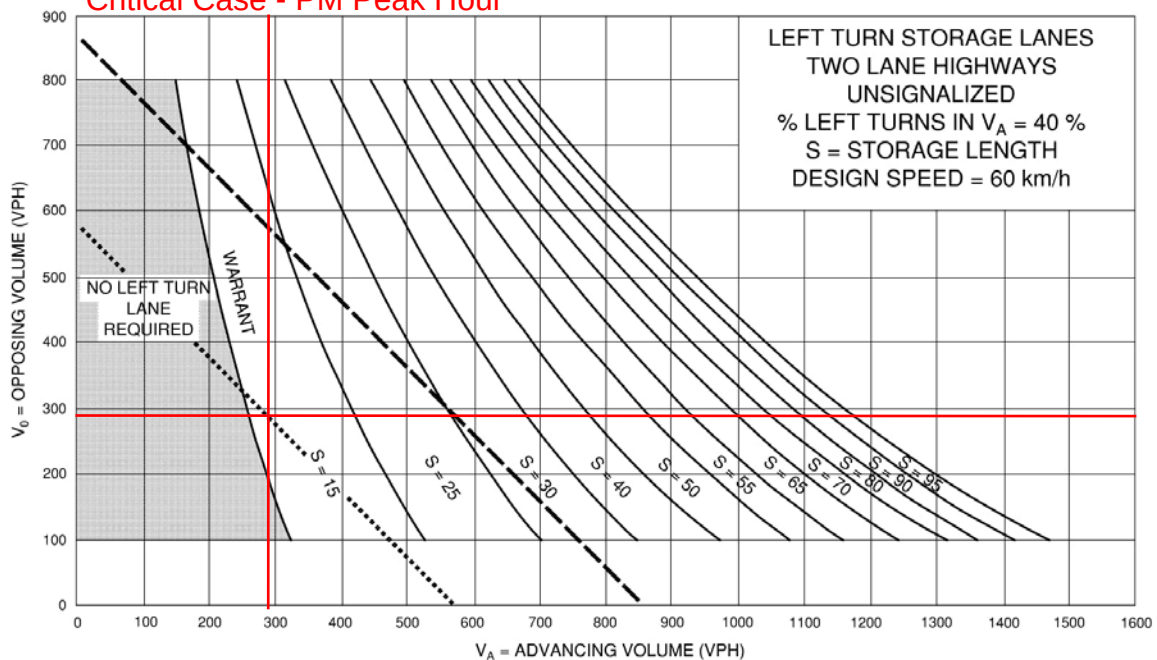
--- TRAFFIC SIGNALS MAY BE WARRANTED IN RURAL AREAS OR URBAN AREAS WITH RESTRICTED FLOW

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

Welham Road / Saunders Road

2020 Existing - Eastbound

Critical Case - PM Peak Hour



Appendix I – OTM Signal Justification Sheets

Justification No. 7 - 2031 Total Traffic (Critical Case) - without Post-2031 Infrastructure Improvements

Bayview Drive / Lockhart Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Rest. Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	720	909	126%	5%	YES	YES
	B. Vehicle volume, along minor streets (average hour)	255	16	6%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	851	118%	9%	NO	YES
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	8	11%		NO	NO

Justification No. 7 - 2031 Total Traffic (Critical Case) - with Post-2031 Infrastructure Improvements

Bayview Drive / Lockhart Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Rest. Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	900	909	101%	5%	NO	YES
	B. Vehicle volume, along minor streets (average hour)	255	16	6%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	900	851	95%	4%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	170	8	5%		NO	NO

Justification No. 7 - 2031 Total Traffic (Critical Case)

Welham Road / Saunders Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Rest. Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	720	482	67%	56%	NO	NO
	B. Vehicle volume, along minor streets (average hour)	170	256	150%		YES	YES
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	126	18%	15%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	149	199%		YES	YES

Justification No. 7 - 2031 Total Traffic (Critical Case) - without Post-2031 Infrastructure Improvements

Welham Extension / Lockhart Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Rest. Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	720	942	131%	10%	YES	YES
	B. Vehicle volume, along minor streets (average hour)	255	32	13%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	720	885	123%	25%	YES	YES
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	75	23	30%		NO	NO

Justification No. 7 - 2031 Total Traffic (Critical Case) - with Post-2031 Infrastructure Improvements

Welham Extension / Lockhart Road

Justification	Description		Compliance			Signal Warrant	Underground Provisions Warrant
			Sectional		Entire %		
			Rest. Flow	Numerical			
1. Minimum Vehicular Volume	A. Vehicle volume, all approaches (average hour)	900	942	105%	10%	NO	YES
	B. Vehicle volume, along minor streets (average hour)	255	32	13%		NO	NO
2. Delay to cross traffic	A. Vehicle volume, major street (average hour)	900	885	98%	11%	NO	NO
	B. Combined vehicle and pedestrian volume crossing artery from minor streets (average hour)	170	23	13%		NO	NO

Appendix J – Transportation Tomorrow Survey Excerpts

Thu Oct 01 2020 10:02:56 GMT-0400 (Eastern Daylight Time) - Run Time: 2774ms	Thu Oct 01 2020 10:22:41 GMT-0400 (Eastern Daylight Time) - Run Time: 2335ms
Cross Tabulation Query Form - Trip - 2016 v1.1	Cross Tabulation Query Form - Trip - 2016 v1.1
Row: Planning district of household - pd_hhld	Row: 2006 GTA zone of household - gta06_hhld
Column: 2006 GTA zone of destination - gta06_dest	Column: 2006 GTA zone of destination - gta06_dest
Filters:	Filters:
(2006 GTA zone of destination - gta06_dest In 8527); and	(2006 GTA zone of destination - gta06_dest In 8527); and
(Start time of trip - start_time In 700 - 900); and	(Start time of trip - start_time In 700 - 900);
(Trip purpose of destination - purp_dest In W, R).	(Trip purpose of destination - purp_dest In W,R); and
	(Planning district of household - pd_hhld In 81).
Trip 2016	
ROW : pd_hhld	ROW : gta06_hhld
COLUMN : gta06_dest	COLUMN : gta06_dest

Cross Tabulation Query Form - Trip - 2016 v1.1

Filter Variables

Planning district of hous... x

2006 GTA zone of desti... x

(Optional) Table Attribute

Group Attributes

Row Grouping

Column Grouping

Table Grouping

Grouping file:

Choose File

 No file chosen

Filter Selection +

☐ 2006 GTA zone of destination In

8527

And

☐ Start time of trip In

700 - 900

And

☐ Trip purpose of destination In

W, R

AddDelete

Output

☒ Comma-delimited table ☐ Column format

Expansion Factor On

Click to Select Load

Load

Execute Query

Select All

Save As

Thu Feb 04 2021 10:45:21 GMT-0500 (Eastern Standard Time) - Run Time: 2213ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: Planning district of household - pd_hhld

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 8527

and

Start time of trip - start_time In 700 - 900

and

Trip purpose of destination - purp_dest In W, R

Trip 2016

Table:

,8527

PD 1 of Toronto,15
PD 8 of Toronto,20
PD 9 of Toronto,100
PD 10 of Toronto,55
Pickering,20
East Gwillimbury,20
Newmarket,103
Aurora,8
Richmond Hill,17
Markham,52
King,8
Vaughan,90
Mississauga,51
Milton,40
Kitchener,31
Orangeville,16
Barrie,2791
Innisfil,369
Bradford-West Gwillimbury,34
New Tecumseth,45
Essa,181
Clearview,68
Springwater,275
Kawartha Lakes,11
Collingwood,19
Wasaga Beach,41
Midland,14
Tay,11
Oro-Medonte,313
Severn,23
Ramara,54
Orillia,206

Cross Tabulation Query Form - Trip - 2016 v1.1

Filter Variables

2006 GTA zone of hous... x ▾

2006 GTA zone of desti... x ▾

(Optional) Table Attribute ▾

Group Attributes

Row Grouping

Column Grouping

Table Grouping

Grouping file: Choose File No file chosen

Filter Selection +

☐ 2006 GTA zone of destination ▾ In ▾

8527

And ▾

☐ Start time of trip ▾ In ▾

700 - 900

And ▾

☐ Trip purpose of destination ▾ In ▾

W, R

And ▾

☐ Planning district of household ▾ In ▾

81,

Add Delete

Output

☒ Comma-delimited table ☐ Column format

Expansion Factor On

Click to Select Load

Load

Execute Query

Select All

Save As

Thu Feb 04 2021 10:47:43 GMT-0500 (Eastern Standard Time) - Run Time: 2286ms

Cross Tabulation Query Form - Trip - 2016 v1.1

Row: 2006 GTA zone of household - gta06_hh1d

Column: 2006 GTA zone of destination - gta06_dest

Filters:

2006 GTA zone of destination - gta06_dest In 8527

and

Start time of trip - start_time In 700 - 900

and

Trip purpose or destination - purp_dest In W, R
and
Planning district of household - pd_hhld In 81,

Trip 2016
Table:

,8527
8501,26
8503,25
8504,13
8505,37
8506,69
8507,125
8508,16
8509,132
8511,86
8512,183
8513,122
8515,86
8516,47
8518,68
8520,39
8522,270
8523,431
8524,22
8525,160
8526,111
8527,25
8528,172
8529,213
8530,168
8531,130
8532,15