APPENDIX A
ANCASTER TRANSPORTATION MASTER PLAN PHASE 1 REPORT

Table of Contents

Page

1.0 Transportation Analysis 2
1.1 Existing Infrastructure and Traffic Data 2
1.1.1 Existing Infrastructure Inventory 2
1.1.2 Existing Traffic Volumes 2
1.1.3 Traffic Signal Timing and Phasing 8
1.2 Transportation Network Analysis 9
1.2.1 Existing Transportation Assessment 9
1.3 Existing Infrastructure Condition 18
1.3.1 Pavement Condition 18
1.3.2 Summary of Transportation Problems/Opportunities/Constraints 21

LIST OF FIGURES

Page

Figure 1 – Infrastructure Inventory 4
Figure 2 – Average Annual Daily Traffic Volumes 7
Figure 3 – Intersection Constraints 17
Figure 4 - Pavement Conditions 19

LIST OF TABLES

Page

Table 1 – Weekday AM Peak Hour Signalized Intersection Performance 10
Table 2 – Weekday PM Peak Hour Signalized Intersection Performance 13

1.0 Transportation Analysis

1.1 Existing Infrastructure and Traffic Data

1.1.1 Existing Infrastructure Inventory

An inventory of the existing roadway infrastructure was undertaken to determine roadway lane geometry, intersection control, intersection lane configurations and posted speed limits. The inventory is illustrated on **Figure 1**.

1.1.2 Existing Traffic Volumes

Existing peak hour turning movement volumes were provided by the City of Hamilton for the following intersections:

1. Fiddler's Green Road and Amberly Boulevard/Calvin Street.
2. Fiddler's Green Road and Garner Road.
3. Fiddler's Green Road and Gilbert Avenue.
4. Fiddler's Green Road and Highway 403 eastbound on ramp.
5. Fiddler's Green Road and Jerseyville Road.
6. Fiddler's Green Road and Wilson Street.
7. Garner Road and Highway 403 on and off ramps.
8. Garner Road and Kitty Murray Lane.
9. Garner Road and Shaver Road.
10. Garner Road and Hamilton Drive.
11. Garner Road and Southcote Road.
12. Golf Links Road and Cloverleaf Drive/Neville Drive.
13. Golf Links Road and Kitty Murray Lane.
14. Golf Links Road and Legend Court/Meadowlands Boulevard.
15. Golf Links Road and Martindale Crescent.
16. Golf Links Road and McNiven Road/Southcote Road.
17. Golf Links Road and Stone Church Road.
18. Highway 6 and Book Road.
19. Jerseyville Road and Lover's Lane.

20. Jerseyville Road and Wilson Street.
21. Meadowlands Boulevard and Stonehenge Drive.
22. Mohawk Road and Filman Road.
23. Mohawk Road and Lincoln M. Alexander Parkway WB Ramps.
24. Mohawk Road and Scenic Drive/Upper Horning Drive.
25. Mohawk Road/Rousseaux Street and McNiven Road/Lime Kiln Road.
26. Rymal Road and Glancaster Road.
27. Shaver Road and Book Road.
28. Shaver Road and Jerseyville Road.
29. Southcote Road and Stonehenge Drive.
30. Stone Church Road and Harrogate Drive.
31. Stone Church Road and Stonehenge Drive.
32. Stonehenge Drive and Kitty Murray Lane.
33. Sulphur Springs Road and Lover's Lane.
34. Trinity Road and Book Road.
35. Upper Paradise Road and Garner Road/Rymal Road.
36. Wilson Street and Church Street/Sulphur Springs Road.
37. Wilson Street and Fortino's Plaza access.
38. Wilson Street and Garner Road on ramp (west of signal).
39. Wilson Street and Garner Road/Mason Drive.
40. Wilson Street and Halson Street.
41. Wilson Street and Highway 403 eastbound off ramp.
42. Wilson Street and Highway 403 westbound off ramp.
43. Wilson Street and Highway 52/Trinity Road.
44. Wilson Street and Montgomery Drive.
45. Wilson Street and Shaver Road.
46. Wilson Street and Tradewind Drive.
47. Wilson Street and Wal-Mart Plaza access.
48. Wilson Street East and Rousseaux Street/Old Dundas Road.

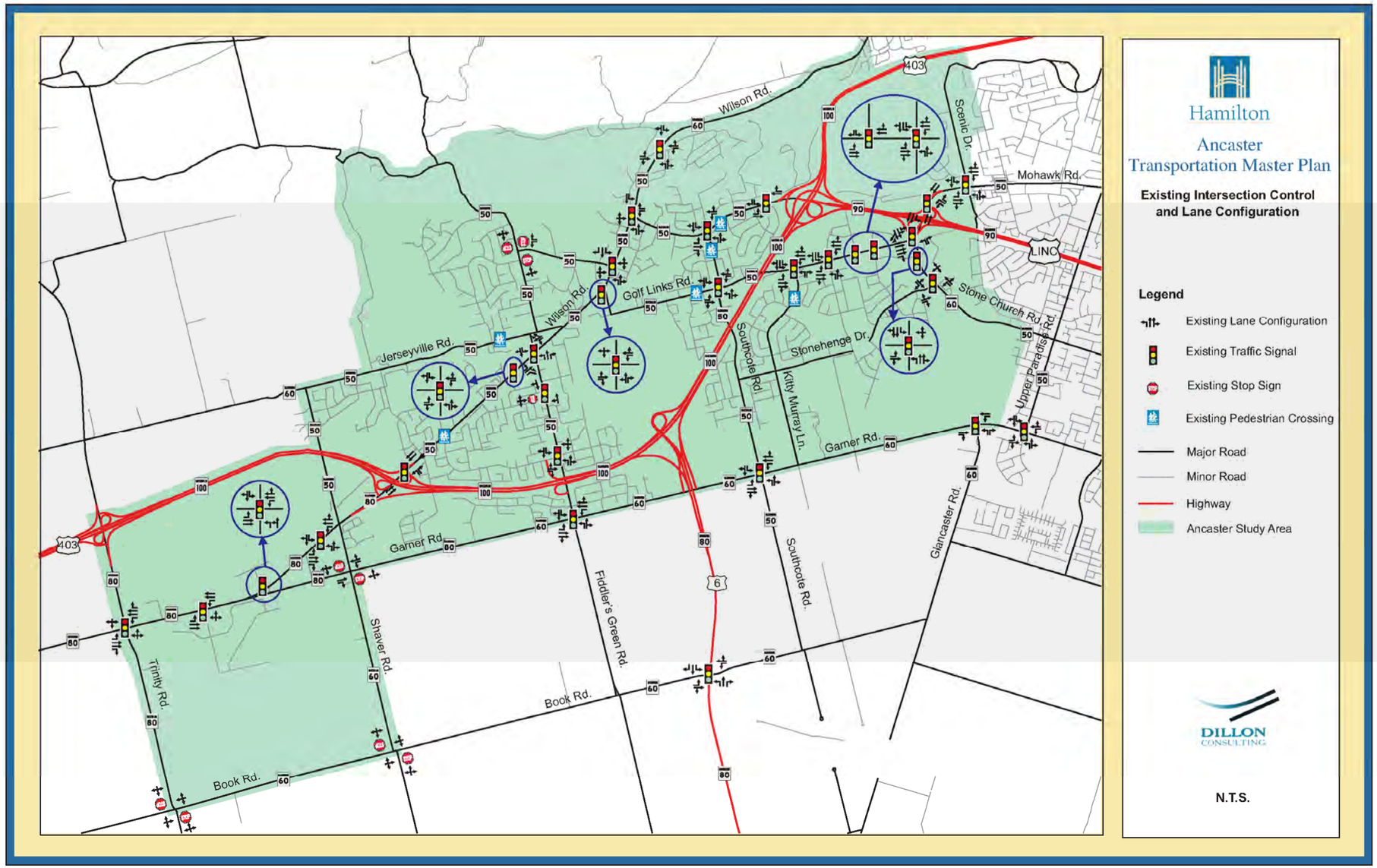


Figure 1 – Infrastructure Inventory

The counts were undertaken by the City in early to late June of 2008.

Average Annual Daily Traffic (AADT) volumes were also provided for the following roadway segments:

1. Fiddler's Green north of Oakley Crescent.
2. Garner Road east of Shaver Road.
3. Garner Road west of Glancaster Road.
4. Garner Road west of Highway 403 off ramp.
5. Garner Road west of Southcote Road.
6. Golf Links Road west of Chancery Drive.
7. Golf Links Road west of Highway 403.
8. Golf Links Road west of Stone Church Road.
9. Highway 403 between Highway 6 and Lincoln M. Alexander Parkway.
10. Highway 403 east of Highway 52.
11. Highway 403 north of Lincoln M. Alexander Parkway.
12. Highway 52 north of Garner Road.
13. Jerseyville Road east of Lover's Lane.
14. Jerseyville Road west of Shaver.
15. Kitty Murray Lane between Garner Road and access to Redeemer College.
16. Lincoln M. Alexander Parkway east of Golf Links Road.
17. Mohawk Road east of Filman Road.
18. Mohawk Road west of McNiven Road.
19. Mohawk Road west of Scenic Drive/Upper Horning Drive.
20. Old Dundas Road north of Montgomery Drive.
21. Rousseaux Street west of McNiven Road/Lime Kiln Road.
22. Scenic Drive north of Mohawk Road.
23. Shaver Road south of Highway 403.
24. Southcote Road north of Garner Road.
25. Stone Church west of Omni Boulevard.
26. Stonehenge Drive east of Southcote Road.
27. Sulphur Springs Road north of Woodview Crescent.
28. Sulphur Springs Road west of Mansfield Drive.
29. Wilson Street between Highway 403 W-N/S ramp and S-E ramp.

30. Wilson Street east of Trinity Road.
31. Wilson Street north of Montgomery Drive.
32. Wilson Street south of Academy Street.
33. Wilson Street west of Fiddler's Green.
34. Wilson Street west of Halson Street.

The AADT volumes are illustrated on **Figure 2**.

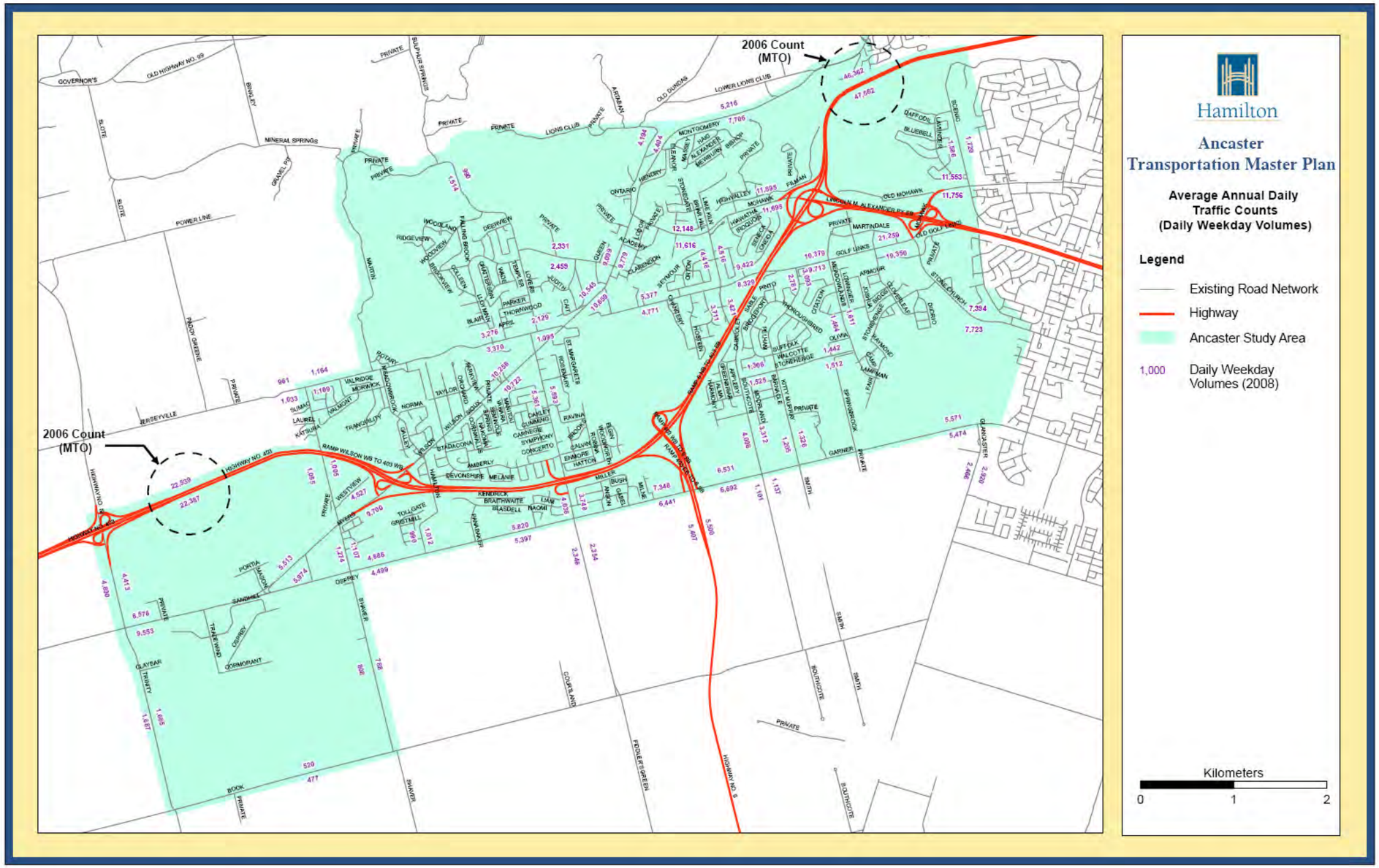


Figure 2 – Average Annual Daily Traffic Volumes

1.1.3 Traffic Signal Timing and Phasing

Signal timing and phasing were provided for the 31 signalized intersections in the study area:

1. Fiddler's Green Road and Amberly Boulevard/Calvin Street;
2. Fiddler's Green Road and Gilbert Avenue;
3. Fiddler's Green Road and Wilson Street;
4. Golf Links Road and Cloverleaf Drive/Neville Drive;
5. Fiddler's Green Road and Amberly Boulevard/Calvin Street;
6. Fiddler's Green Road and Gilbert Avenue;
7. Fiddler's Green Road and Wilson Street;
8. Golf Links Road and Cloverleaf Drive/Neville Drive;
9. Golf Links Road and Kitty Murray Lane;
10. Golf Links Road and Legend Court/Meadowlands Boulevard;
11. Golf Links Road and Martindale Crescent;
12. Golf Links Road and McNiven Road/Southcote Road;
13. Highway 6 and Book Road;
14. Mohawk Road and Filman Road;
15. Mohawk Road and Lincoln M. Alexander Parkway WB Ramps;
16. Mohawk Road and McNiven Road/Lime Kiln Road;
17. Mohawk Road and Scenic Drive/Upper Horning Drive;
18. Stone Church Road and Golf Links Road;
19. Stone Church Road and Harrogate Drive;
20. Stone Church Road and Stonehenge Drive;
21. Upper Paradise Road and Garner Road/Rymal Road;
22. Wilson Street and Church Street/Sulphur Springs Road;
23. Wilson Street and Fortino's Plaza access;
24. Wilson Street and Garner Road;
25. Wilson Street and Halson Street;
26. Wilson Street and Highway 403 westbound off ramp;
27. Wilson Street and Highway 52/Trinity Road;
28. Wilson Street and Montgomery Drive;
29. Wilson Street and Rousseaux Street;

30. Wilson Street and Tradewind Drive; and
31. Wilson Street and Wal-Mart Plaza access.

With the exception of the Book Road/Fiddler's Green Road, Garner Road/Southcote Road, Garner Road/Fiddler's Green Road, and Glancaster Road/Rymal Road intersections, all signal timings provided are relatively new.

1.2 Transportation Network Analysis

A transportation network operational analysis was undertaken to assess the existing conditions at signalized intersections for the Ancaster Transportation Master Plan study area.

1.2.1 Existing Transportation Assessment

The existing transportation assessment was undertaken for signalized intersections within the Ancaster study area for the weekday morning and afternoon peak periods to identify current capacity constraints. Additional assessment was conducted for signalized intersections along the Golf Links Road corridor for the Saturday peak period to reflect the increase in traffic demand generated by adjacent retail and commercial developments. The Synchro (version 6) software package was utilized to evaluate the operational performance of the signalized intersections. Synchro employs the Highway Capacity Manual (HCM) techniques for signalized intersections. This analysis method generates performance measures for signalized intersections, including average delay and Level of Service (LOS) for each intersection as a whole and on a per movement basis.

LOS is a measure used to quantify the amount of delay experienced by motorists at an intersection or particular movement. HCM measures Level of Service as a range from LOS A to LOS F, where LOS A reflects excellent conditions with little or no delay and LOS F reflects congested conditions and failure of the movement or intersection with significant delays experienced by motorist.

The operational performance of the signalized intersections within the study area were measured using the intersection HCM (overall) volume-to-capacity (v/c) ratio and the corresponding LOS for the Weekday AM, PM, and Saturday peak hours. In the case of individual turning movements, those movements / lane groups with either a v/c ratio in excess of 0.85 or a LOS below D or both were identified as "critical" movements. Turning movements meeting these "critical" criteria are approaching capacity and prone to poor operation during the peak periods.

AM Peak Hour

The analysis indicates that the majority of the signalized intersections is currently operating at a LOS C or better during the Weekday AM peak hour (**Table 1**). The exception is the Wilson Street and Rousseaux Street/Old Ancaster Road, which operates at a LOS E with a corresponding v/c ratio of 0.82.

Table 1 – Weekday AM Peak Hour Signalized Intersection Performance

Intersection Location	Overall Intersection		Critical Movements			
	LOS	v/c	Approach & Movement	LOS	v/c > 0.85	Delay (sec/veh)
Fiddler's Green Road and Amberly Boulevard/Calvin Street	B	0.53	N/A			
Fiddler's Green Road and Gilbert Avenue	A	0.37	N/A			
Fiddler's Green and Garner Road	B	0.66	N/A			
Fiddler's Green Road and Wilson Street	C	0.66	NBL	F	0.95	88.7
Garner Road and Southcote Road	A	0.47	N/A			
Garner Road and Glancaster Road	B	0.34	N/A			
Golf Links Road and Cloverleaf Drive/Neville Drive	B	0.45	N/A			
Golf Links Road and Kitty Murray Lane	B	0.37	N/A			

Intersection Location	Overall Intersection		Critical Movements			
	LOS	v/c	Approach & Movement	LOS	v/c > 0.85	Delay (sec/veh)
Golf Links Road and Legend Court/Meadowlands Boulevard	B	0.38	N/A			
Golf Links Road and Martindale Crescent	B	0.45	N/A			
Golf Links Road and McNiven Road/Southcote Road	B	0.60	N/A			
Highway 6 and Book Road	A	0.47	N/A			
Mohawk Road and Filman Road	A	0.82	EBT	B	0.86	10.9
Mohawk Road and Lincoln M. Alexander Parkway WB Off-ramp	B	0.39	N/A			
Mohawk Road/Rousseaux Street and McNiven Road/Lime Kiln Road	C	0.84	EBT	C	0.90	28.0
Mohawk Road and Scenic Drive/Upper Horning Drive	B	0.44	N/A			
Rymal Road and Upper Paradise Road	B	0.56	N/A			
Stone Church Road and Golf Links Road	C	0.58	N/A			
Stone Church Road and Harrogate Drive	A	0.21	N/A			
Stone Church Road and Stonehenge Drive	A	0.43	N/A			
Wilson Street and Church Street/Sulphur Springs Road	B	0.66	N/A			
Wilson Street and Fortino's Plaza	B	0.44	N/A			
Wilson Street and Garner Road	A	0.33	N/A			
Wilson Street and Halson Street	B	0.68	N/A			
Wilson Street and Highway 403 WB Off-ramp	B	0.78	N/A			

Intersection Location	Overall Intersection		Critical Movements			
	LOS	v/c	Approach & Movement	LOS	v/c > 0.85	Delay (sec/veh)
Wilson Street and Highway 52/Trinity Road	B	0.40	N/A			
Wilson Street and Montgomery Drive	A	0.71	N/A			
Wilson Street and Rousseaux Street/Old Ancaster Road	D	0.82	EBT NBT SBL	E D D	0.88 0.85 0.87	62.5 53.6 48.7
Wilson Street and Tradewind Drive	C	0.76	N/A			
Wilson Street and Wal-Mart Plaza	A	0.38	N/A			

Individual turning movements beyond the critical threshold (v / c ratio > 0.85) include the following:

Fiddler's Green Road and Wilson Street

The northbound left turn movement experiences a LOS F with a corresponding v/c ratio of 0.95. The movement experiences delays of 88.7 seconds per vehicle as motorists wait for a gap in opposing traffic to make the left turn movement.

Mohawk Road and Filman Road

The eastbound through movement experiences a LOS B with a corresponding v/c ratio of 0.86 and delays of 10.9 seconds per vehicle. Although the movement is beyond the critical threshold it is below capacity and the delay experienced is considered minor.

Mohawk Road/Rousseaux Street and McNiven Road/Lime Kiln Road

The eastbound through movement experiences a LOS C with a corresponding v/c ratio of 0.90 and delays of 28 seconds per vehicle. Although the movement is beyond the critical threshold it is below capacity and the delay experienced is considered acceptable.

Wilson Street and Rousseaux Street/Old Ancaster Road

The eastbound through movement experiences a LOS E with a corresponding v/c ratio of 0.88 and delays of 62.5 seconds per vehicle. The northbound through movement experiences a LOS D with a corresponding v/c ratio of 0.85 and delays of 53.6 seconds per vehicle. The southbound left turn movement experiences a LOS D with a corresponding v/c ratio of 0.87 and delays of 48.7 seconds per vehicle.

PM Peak Hour

The analysis indicates that the majority of the signalized intersections are currently operating at a LOS C or better during the Weekday PM peak hour (**Table 2**). The exceptions are the intersections at Fiddler's Green Road and Wilson Street, and at Wilson Street and Rousseaux Street/Old Ancaster Road, which operates at a LOS D (v/c ratio of 0.89) and LOS E (v/c ratio of 1.04) respectively.

Table 2 – Weekday PM Peak Hour Signalized Intersection Performance

Intersection Location	Overall Intersection		Critical Movements			
	LOS	v/c	Approach & Movement	LOS	v/c > 0.85	Delay (sec/veh)
Fiddler's Green Road and Amberly Boulevard/Calvin Street	B	0.61	N/A			
Fiddler's Green Road and Gilbert Avenue	A	0.40	N/A			
Fiddler's Green and Garner Road	B	0.42	N/A			
Fiddler's Green Road and Wilson Street	D	0.89	NBL EBT WBL WBT	E D D D	0.94 0.88 0.91 0.93	68.3 35.9 50.3 43.8
Garner Road and Southcote Road	A	0.49	N/A			
Garner Road and Glancaster Road	B	0.35	N/A			
Golf Links Road and Cloverleaf Drive/Neville Drive	C	0.83	NBL SBL	F E	0.97 0.93	87.5 56.7

Intersection Location	Overall Intersection		Critical Movements			
	LOS	v/c	Approach & Movement	LOS	v/c > 0.85	Delay (sec/veh)
Golf Links Road and Kitty Murray Lane	C	0.63	N/A			
Golf Links Road and Legend Court/Meadowlands Boulevard	B	0.53	N/A			
Golf Links Road and Martindale Crescent	C	0.93	EBL WBT SBL	E C D	0.91 0.99 0.86	62.8 34.3 48.2
Golf Links Road and McNiven Road/Southcote Road	C	0.90	WBL SBL	D D	0.91 0.89	51.3 47.0
Highway 6 and Book Road	B	0.55	N/A			
Mohawk Road and Filman Road	A	0.49	N/A			
Mohawk Road and Lincoln M. Alexander Parkway WB Off-ramp	C	0.57	N/A			
Mohawk Road/Rousseaux Street and McNiven Road/Lime Kiln Road	C	0.80	N/A			
Mohawk Road and Scenic Drive/Upper Horning Drive	B	0.59	N/A			
Rymal Road and Upper Paradise Road	B	0.59	N/A			
Stone Church Road and Golf Links Road	C	0.82	NBL	E	0.88	55.7
Stone Church Road and Harrogate Drive	A	0.40	N/A			
Stone Church Road and Stonehenge Drive	A	0.61	N/A			
Wilson Street and Church Street/Sulphur Springs Road	B	0.60	N/A			
Wilson Street and Fortino's Plaza	B	0.77	SBL	F	0.95	83.1
Wilson Street and Garner Road	B	0.41	N/A			

Intersection Location	Overall Intersection		Critical Movements			
	LOS	v/c	Approach & Movement	LOS	v/c > 0.85	Delay (sec/veh)
Wilson Street and Halson Street	C	0.78	NBTL	E	0.95	57.4
Wilson Street and Highway 403 WB Off-ramp	C	0.84	EBT	D	0.97	44.1
Wilson Street and Highway 52/Trinity Road	B	0.52	N/A			
Wilson Street and Montgomery Drive	A	0.72	N/A			
Wilson Street and Rousseaux Street/Old Ancaster Road	E	1.00	EBT WBL NBT SBL	E E E F	0.92 0.93 0.85 1.13	76.6 68.4 58.9 123.7
Wilson Street and Tradewind Drive	C	0.62	NBLR	D	0.88	37.2
Wilson Street and Wal-Mart Plaza	A	0.51	N/A			

Individual turning movements beyond the critical threshold (v / c ratio > 0.85) include the following:

Fiddler's Green Road and Wilson Street

The northbound left turn movement experiences a LOS E with a corresponding v/c ratio of 0.94 and delays of 68.3 seconds per vehicle. The eastbound through movement experiences a LOS D with a corresponding v/c ratio of 0.88 and delays of 35.9 seconds per vehicle. The westbound left turn movement experiences a LOS D with a corresponding v/c ratio of 0.91 and delays of 50.1 seconds per vehicle. The westbound left through movement experiences a LOS D with a corresponding v/c ratio of 0.93 and delays of 43.6 seconds per vehicle.

Golf Links Road and Cloverleaf Drive/Neville Drive

The northbound left turn movement experiences a LOS F with a corresponding v/c ratio of 0.97 and delays of 87.5 seconds per vehicle. The southbound left turn movement

experiences a LOS E with a corresponding v/c ratio of 0.93 and delays of 56.7 seconds per vehicle.

Golf Links Road and Martindale Crescent

The eastbound left turn movement experiences a LOS E with a corresponding v/c ratio of 0.91 and delays of 62.8 seconds per vehicle. The westbound through movement experiences a LOS C with a v/c ratio of 0.99 and delays of 34.3 seconds per vehicle. The southbound left turn movement experiences a LOS D with a v/c ratio of 0.86 and delays of 48.2 seconds per vehicle.

Golf Links Road and McNiven Road/Southcote Road

The westbound left turn movement experiences a LOS D with a corresponding v/c ratio of 0.91 and delays of 51.3 seconds per vehicle. The southbound left turn movement also experiences a LOS D with a v/c ratio of 0.89 and delays of 47.0 seconds per vehicle.

Stone Church Road and Golf Links Road

The northbound left turn movement experiences a LOS D with a corresponding v/c ratio of 0.88 and delays of 54.5 seconds per vehicle.

Wilson Street and Fortino's Plaza

The southbound left turn movement experiences a LOS F with a corresponding v/c ratio of 0.95 and delays of 83.1 seconds per vehicle.

Wilson Street and Highway 403 WB Off-ramp

The eastbound through movement experiences a LOS D with a v/c ratio of 0.97 and delays of 44.1 seconds per vehicle.

Wilson Street and Rousseaux Street/Old Ancaster Road

The eastbound through movement experiences a LOS E with a corresponding v/c ratio of 0.92 and delays of 76.6 seconds per vehicle. The westbound left turn movement experiences a LOS E with a v/c ratio of 0.93 and delays of 68.4 seconds per vehicle. The northbound through movement also experiences a LOS E with a v/c ratio of 0.85 and delays of 58.9 seconds per vehicle. The southbound left turn movement is over

capacity with a v/c ratio of 1.13 and corresponding LOS F, delays reach 123.7 seconds per vehicle.

Overall, the signalized intersections currently operate with sufficient capacity to accommodate the existing traffic volumes during the AM and PM peak hours with the exception of the Wilson Street and Rousseaux Street/Old Ancaster Road intersection, which is over capacity in the PM peak hour with a v/c ratio of 1.04. Congestion at the intersection can be attributed to the high volume of commuting traffic to/from the Lincoln M. Alexander Parkway and crossing the escarpment along Wilson Street. Old Ancaster Road is also utilized by commuters originating from the Town of Dundas to access the Lincoln M. Alexander Parkway and the Meadowlands commercial area, adding to the congestion experienced at the intersection.

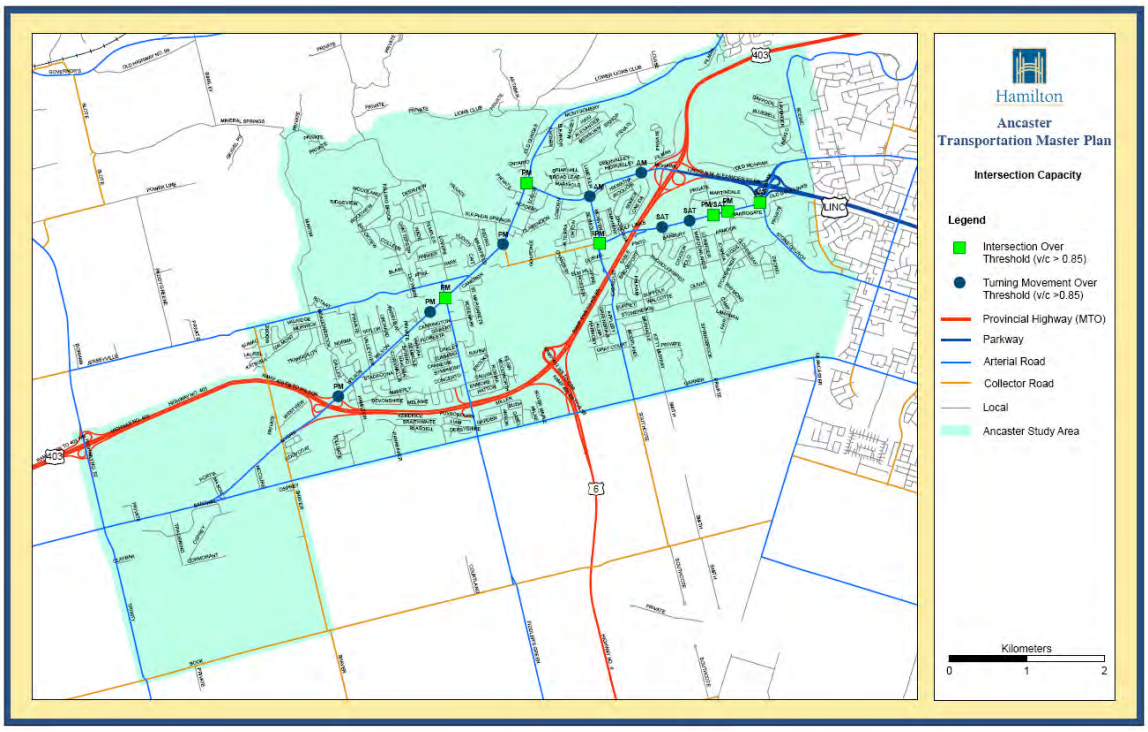
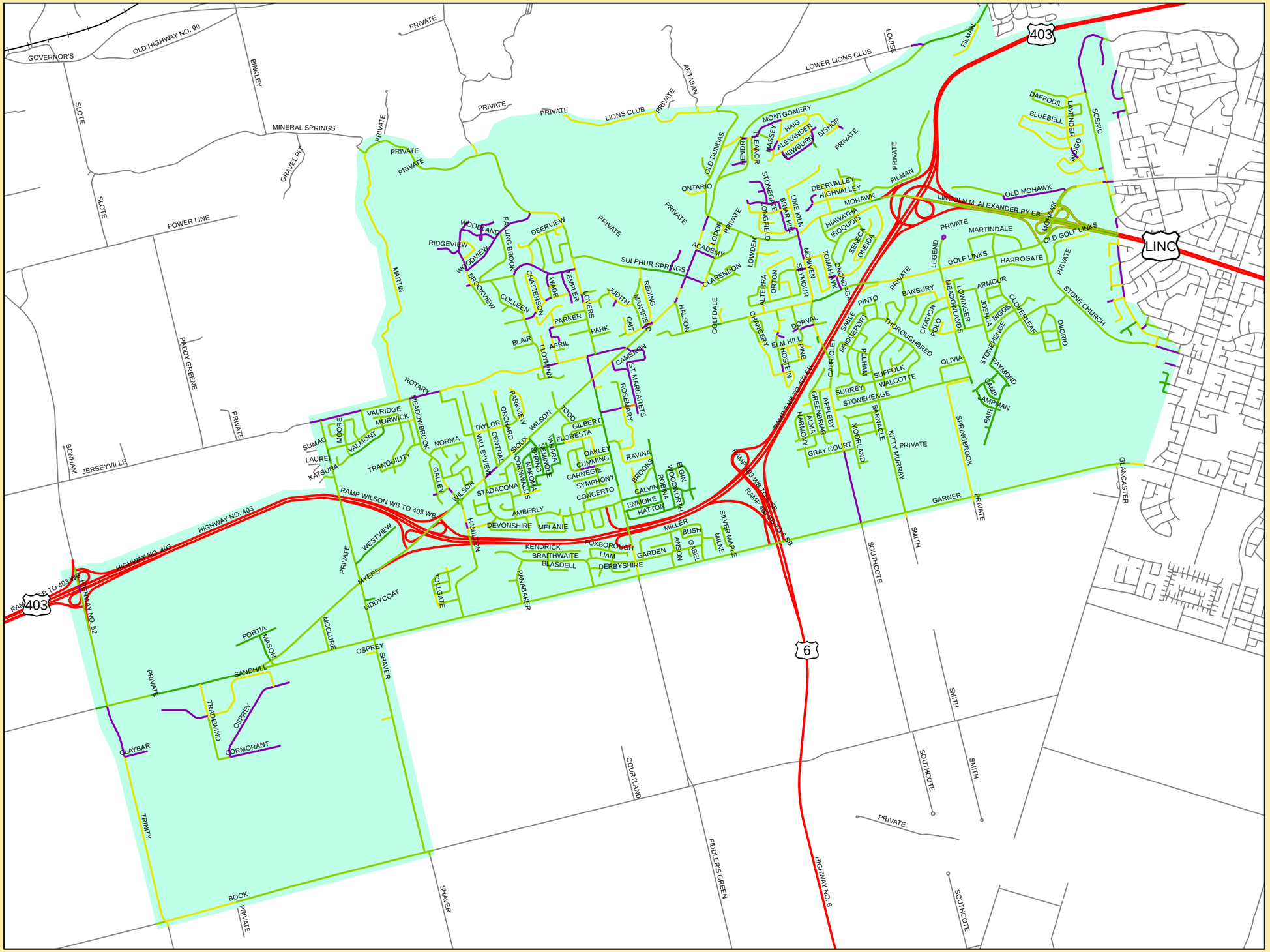


Figure 3 – Intersection Constraints

1.3 Existing Infrastructure Condition

1.3.1 Pavement Condition

The condition of the paved infrastructure within the Ancaster Study area has been assessed by City staff for each road segment and is illustrated on **Figure 4**. Pavement deterioration is site specific since it depends on many variables (environment, traffic, pavement type/structure and sub grade condition), which makes the deterioration rates vary significantly from one pavement section to another.



Hamilton

Ancaster Transportation Master Plan

Figure 4

Road Condition Index

Legend

- Existing Road Network
- Highway
- Ancaster Study Area

Road Condition

- Excellent
- Good
- Adequate
- Poor
- Deficient

Kilometers

0 1 2

The following major road segments within the Ancaster study area have been assessed as being deficient and may require preventative maintenance and/or rehabilitation:

- Southcote Road
  - South of Gray Court Drive
- Wilson Street
  - Between Valleyview Drive and Central Drive
  - Between Halson Street and Rousseaux Street
- Jerseyville Road
  - East of Fiddler's Green Road
  - Between Meadowbrook Drive and Valleyview Drive
  - West of Stevenson Street
- Stone Church Road
  - East of Omni Boulevard
- Scenic Drive
  - North of Daffodil Crescent
- Mohawk Road
  - East of Scenic Drive.

All other major roadways within the study area are currently within their functional life cycle.

1.3.2 Summary of Transportation Problems/Opportunities/Constraints

Based on an evaluation of the existing conditions and through input received from the public and technical agencies, there have been a number of transportation problems/opportunities identified. A summary of these problems/opportunities in a broad context are as follows:

- Impacts of commuter traffic infiltration and congestion on the ability to preserve Ancaster's historic urban street character;
- Safety and operational traffic problems and the potential need for increased capacity on roadways and intersections within the study area;
- Traffic impacts of development areas;
- Capacity constraints on external road linkages (i.e., escarpment crossings, Highway 403);
- Limited network connectivity to Highway 403 (lack of westbound ramps) to provide alternative access and deal with Highway 403 emergency/traffic congestion impacts;
- Lack of east-west network connectivity within the community;
- Impacts of external truck traffic;
- Travel Demand Management opportunities within the ATMP study area;
- Local transit service modifications/enhancements opportunities; and
- Cycling, trails and pedestrian facility enhancements opportunities.

APPENDIX C
TRANSPORTATION MODELLING REPORT

City of Hamilton
Ancaster Transportation Master Plan

Technical Paper on Travel Demand Forecasting

June 2011

City of Hamilton

Project No. 08-8952

Submitted by

Dillon Consulting Limited

TABLE OF CONTENTS

Page

1.0 Introduction 1

1.1 Hamilton Model Trip Purposes 1
1.2 Hamilton Model Travel Modes 1

2.0 Model Refinement Process 2

2.1 Model Input Data 2
2.2 Road Network Modifications 3
2.3 Modifications to Base Zone Structure 8
2.3.1 HTMP and GRIDS Population Comparison 11
2.3.2 Post-GRIDS Population Adjustments 12
2.3.3 Airport Employment Growth District 12
2.4 Trip Generation and Distribution 15
2.5 Trip Assignment 15
2.6 Base Year Validation 16
2.7 Screenline Volume Comparison 18

3.0 Screenline Capacity Analysis 22

4.0 Future Horizons and Scenarios 26

4.1 Overview 26
4.2 "Do Nothing" Scenario 26
4.3 HTMP Improvements Scenario 29
4.4 Future Horizon Years and Base Scenarios 29
4.5 2031 Scenario Testing 30
4.5.1 EMME/2 2031 Ancaster Result Plots 33
4.5.2 EMME/2 2031 Ancaster Corridor Impacts 33

LIST OF TABLES

Page

Table 1 – 2006 TTS Data - AM Peak Period (06:00 - 08:59) 2
Table 2 – 2006 Base EMME/2 Network Modifications 4
Table 3 – HTMP and GRIDS Population Comparison 11
Table 4 – Ancaster Persons per Unit (PPU) Factors 13
Table 5 – Post-GRIDS Ancaster Population Adjustments 13
Table 6 – Ancaster Population and Employment Modifications 14
Table 7 – Trip Generation by Zone 16
Table 8 – External Trip Comparison (No Adjustment) 18
Table 9 – Screenline Validation 20
Table 10 – 2006 Link and Screenline Volume to Capacity Ratios 24
Table 11 – 2006 and 2031 Link and Screenline Volume to Capacity Ratios 27
Table 12 – HTMP Planned Infrastructure Improvements (Ancaster Projects) 29
Table 13 – 2031 Scenario Descriptions 31
Table 14 – 2031 Corridor Impacts 34

LIST OF FIGURES

Page

Figure 1 – 2006 Base Road Network Modifications 6
Figure 2 – 2006 Base Network Speed and Capacity 7
Figure 3 – HTMP Original Transportation Zones 9
Figure 4 – ATMP Modified Transportation Zones 10
Figure 5 – Ancaster Peak Hour Count Volumes 17
Figure 6 – 2006 AM Peak Hour Volumes 19
Figure 7 – Ancaster Screenlines 23
Figure 8 – 2031 Scenario Map 32

LIST OF EXHIBITS

Exhibit 1 – 2016 "Do Nothing" Volumes
Exhibit 2 – 2016 "Do Nothing" V/C
Exhibit 3 – 2016 HTMP Improvements Volumes
Exhibit 4 – 2016 HTMP Improvements V/C
Exhibit 5 – 2021 "Do Nothing" Volumes
Exhibit 6 – 2021 "Do Nothing" V/C
Exhibit 7 – 2021 HTMP Improvements Volumes
Exhibit 8 – 2021 HTMP Improvements V/C
Exhibit 9 – 2031 "Do Nothing" Volumes
Exhibit 10 – 2031 "Do Nothing" V/C
Exhibit 11 – 2031 HTMP Improvements Volumes
Exhibit 12 – 2031 HTMP Improvements V/C
Exhibit 13 – 2031 Mohawk On-Ramp to Hwy 403 WB (S2) Volumes
Exhibit 14 – 2031 Mohawk On-Ramp to Hwy 403 WB (S2) Select Link
Exhibit 15 – 2031 Mohawk On-Ramp to Hwy 403 WB (S2) V/C
Exhibit 16 – 2031 Golf Links Ramps (S3) Volumes
Exhibit 17 – 2031 Golf Links Ramps (S3) Select Link
Exhibit 18 – 2031 Golf Links Ramps (S3) V/C
Exhibit 19 – 2031 Widen Rousseaux (S4) Volumes
Exhibit 20 – 2031 Widen Rousseaux (S4) Select Link
Exhibit 21 – 2031 Widen Rousseaux (S4) V/C
Exhibit 22 – 2031 Wilson Two-Way Left Turn Lane (S5) Volumes
Exhibit 23 – 2031 Wilson Two-Way Left Turn Lane (S5) V/C
Exhibit 24 – 2031 Widen Rousseaux and Maintain Mohawk Cross-Section (S6) Volumes
Exhibit 25 – 2031 Widen Rousseaux and Maintain Mohawk Cross-Section (S6) V/C
Exhibit 26 – 2031 Maintain McNiven Cross-Section (S7) Volumes
Exhibit 27 – 2031 Maintain McNiven Cross-Section (S7) V/C
Exhibit 28 – 2031 Combination of S3 and S7 (S8) Volumes
Exhibit 29 – 2031 Combination of S3 and S7 (S8) V/C
Exhibit 30 – 2031 Combination of S3 and S4 (S9) Volumes
Exhibit 31 – 2031 Combination of S3 and S4 (S9) V/C

LIST OF EXHIBITS (Continued)

Exhibit 32 – 2031 Lime Kiln Link (S10) Volumes
Exhibit 33 – 2031 Lime Kiln Link (S10) Select Link
Exhibit 34 – 2031 Lime Kiln Link (S10) V/C
Exhibit 35 – 2031 Combination of S5, S6, and S7 (S11) Volumes
Exhibit 36 – 2031 Combination of S5, S6, and S7 (S11) V/C
Exhibit 37 – 2031 Wilson, Rousseaux, Mohawk, and McNiven Two-Way Left Turn Lane (S12) Volumes
Exhibit 38 – 2031 Wilson, Rousseaux, Mohawk, and McNiven Two-Way Left Turn Lane (S12) V/C

Note: Exhibits are located at the end of this document.

LIST OF OPERATIONAL OUTPUTS

FHWA Roundabout Analysis
Synchro 2016 AM Peak Hour Recommended Mitigation
Synchro 2016 PM Peak Hour Recommended Mitigation
Synchro 2021 AM Peak Hour Recommended Mitigation
Synchro 2021 PM Peak Hour Recommended Mitigation
Synchro 2031 AM Peak Hour Recommended Mitigation
Synchro 2031 PM Peak Hour Recommended Mitigation

Note: Operational Outputs are located at the end of this document.

1.0 INTRODUCTION

An analysis of the existing transportation network in the Ancaster Transportation Master Plan (ATMP) study area was undertaken using the City of Hamilton's AM Peak Hour Travel Demand Model that is used to help determine future transportation infrastructure needs.

The Hamilton model is built using Inro's EMME/2 software package and is comprised of approximately 400 transportation zones covering the Greater Golden Horseshoe area from Toronto to Niagara. The model is an AM peak period model, reflecting travel in the morning peak 3-hour period, comprising trips starting between 6:00 a.m. and 8:59 a.m. This AM peak 3-hour period has been adopted as a Greater Golden Horseshoe (GGH) standard for travel demand forecasting.

This document describes the steps taken to refine the model to a suitable level of detail in the Ancaster area for use in the ATMP.

1.1 Hamilton Model Trip Purposes

Travel in the model is estimated based on the three major trip purposes of home-based work, home-based school and home-based discretionary. Using Transportation Tomorrow Survey (TTS) definitions, work trips are categorized into professional, manufacturing and office, with each work category modeled separately. School was categorized into secondary school (high school) and post-secondary school.

1.2 Hamilton Model Travel Modes

The existing Hamilton model contained data representing trips with the auto travel mode, but did not contain transit, active, or other mode trip data. As such, the model used for this project relied on TTS data and did not specifically analyze non-auto modes.

Table 1 provides an overview of the various trip purposes for the Ancaster study area zones.

Table 1 – 2006 TTS Data - AM Peak Period (06:00 - 08:59)

	Trip purpose	Auto Driver	Auto pas.	GO Rail	Local Transit	School bus	Walk/Cycle
Ancaster origins							
	Home-based Work	91.0%	5.9%	1.7%	0.7%	0.0%	0.7%
	Home-based School	7.4%	24.6%	0.0%	6.9%	43.1%	17.9%
	Home-based Discretionary	89.9%	9.1%	0.0%	0.6%	0.0%	0.5%
	Non Home-based	93.5%	2.5%	4.0%	0.0%	0.0%	0.0%
	Total	69.9%	11.0%	1.1%	2.2%	10.9%	4.9%
Ancaster destinations							
	Home-based Work	88.1%	8.1%	0.0%	3.1%	0.0%	0.7%
	Home-based School	6.2%	20.9%	0.0%	3.5%	51.9%	17.5%
	Home-based Discretionary	93.7%	5.2%	0.0%	0.6%	0.0%	0.6%
	Non Home-based	83.6%	7.5%	0.0%	2.0%	7.0%	0.0%
	Total	65.4%	11.1%	0.0%	2.5%	15.6%	5.4%

2.0 MODEL REFINEMENT PROCESS

The development of the Ancaster sub-area from the city-wide model required the combination of data sources to develop the 2006 base year Ancaster model used for analysis. Examining the existing Hamilton city-wide model, the Ancaster sub-area did not contain sufficient enough detail. There was a need to perform changes to the model road network and transportation zone structure. The existing Hamilton model, developed by IBI Group, contains only network and trip table data for 2004 and 2011. Available land use data includes population and employment numbers for 2006, but not 2004. In order to resolve these discrepancies, the 2011 network was adopted as the most appropriate base network to represent the 2006 road network within the study area.

2.1 Model Input Data

Dillon obtained the following relevant information from the city-wide model as inputs to the Ancaster study area model:

- Networks for 2004, 2011, 2021 and 2031;
- AM peak hour auto trip matrices for 2004, 2011, 2021 and 2031;
- AM peak hour total person trip matrices for 2004, 2011, 2021 and 2031;
- City of Hamilton population data for 2001, 2006, 2011, 2016, 2021 and 2031;

- City of Hamilton employment data for 2001, 2011, 2021 and 2031; and
- IBI Group's Model Development Draft Report (Dated April 2005).

In order to ensure accuracy in the EMME/2 network, City of Hamilton input and available documentation was utilized including, but not limited to, the following:

- Scope of Work for Wilson Street at Rousseaux Street Intersection Operation Analysis (2007);
- GRIDS (Growth Related Infrastructure Development Strategy);
- Post-GRIDS population adjustments based on additional development approvals;
- Existing Ancaster Official Plan;
- City of Hamilton Transportation Master Plan (2007);
- Ancaster Comprehensive Transportation Study (2001);
- Relevant information from Vision 2020;
- City Capital Program;
- *City Planning and Economic Development Department* – Existing land use, community features, and development applications; and
- *City Public Works Department* – Existing traffic data and road network characteristics.

2.2 Road Network Modifications

The base year road network used in the Hamilton EMME/2 model was reviewed for accuracy within the study area, including speed and capacity, and additional detail added for consistency with the zone system. Changes made include the addition of roadway links, the splitting of various zones to reflect current land use patterns and barriers, the addition of required centroid connectors, and revisions to existing connectors.

In order to more accurately represent existing conditions, road network modifications were made in the 2006 base EMME/2 network as shown in **Table 2** and illustrated in **Figure 1**. The resulting base network speed and capacity diagram is shown in **Figure 2**.

Care was taken to accurately depict the model road network based on existing conditions. At this level of analysis, model performance is evaluated on a "screenline" level of detail (i.e. a comparison of simulated vs. counted vehicle volumes along key sections). As such, road network attributes (i.e. speed, capacity, etc.) may have been modified in order to match model results to existing conditions.

The 2016, 2021, and 2031 road network modifications are discussed in **Section 4.0**.

Table 2 – 2006 Base EMME/2 Network Modifications

Location	Network Modification	Justification
Highway 6 between Highway 403 and Upper James	• Roadway link added	• Accurately represent existing road network
Garth Street between Rymal Road and Twenty Road	• Roadway link added	• Accurately represent existing road network
Hamilton Drive from Wilson Street to Garner Road	• Roadway link added representing residential collector with 50 km/h speed	• Roadway represents a significant access point to/from Ancaster and surrounding area
Kitty Murray Lane from Golf Links Road to Garner Road	• Roadway link added representing residential collector with 50 km/h speed	• Differentiate demand from parallel Southcote Rd corridor for north-south trips accessing Ancaster and Redeemer College • Better represent demand at Southcote & Golf Links intersection
Stonehenge Road from Kitty Murray Lane to Southcote Road	• Roadway link added representing residential collector with 50 km/h speed	• Differentiate demand from parallel Golf Links Rd corridor for east-west trips accessing Ancaster and Redeemer College • Better represent demand at Southcote & Golf Links intersection
Sulphur Springs Road from Lovers Lane to Wilson Street	• Roadway link added representing residential / commercial collector with 50 km/h speed	• Better represent demand along Wilson Street at Fiddler's Green and Jerseyville intersections
Old Dundas Road from Wilson Street to Old Ancaster Road	• Roadway link added representing residential / commercial collector with 50 km/h speed	• Better represent demand along Wilson Street in northeast area of Ancaster
Lovers Lane & Sulphur Springs Road from Jerseyville Road to Governors Road	• Modify link speed limit to 50 km/h	• Accurately represent existing network conditions
Hwy 403 / Mohawk Road interchange	• Mohawk Road eastbound to Hwy 403 southbound ramp removed	• Accurately depict existing network at interchange
Mohawk Road from McNiven Road to Highway 403	• Reduce roadway capacity to represent 2-lane residential arterial	• Accurately represent existing network conditions

Location	Network Modification	Justification
Wilson Street from Montgomery Drive to Highway 403	• Modify link speed limit to 60 km/h • Reduce capacity to represent two-lane urban arterial	• Accurately represent existing network conditions
Old Dundas Road from Montgomery Drive to Wilson Street	• Roadway link added representing one-way residential collector	• Accurately represent existing network conditions
Garner Road from Wilson Street to Southcote Road	• Reduce capacity to represent 2-lane major arterial	• Accurately represent existing network conditions
McNiven Road from Mohawk Road to Golf Links Road	• Reduce capacity to represent 2-lane minor arterial	• Accurately represent existing network conditions
Southcote Road from Golf Links Road to Garner Road	• Reduce speed limit to 50 km/h	• Accurately represent existing network conditions
Jerseyville Road from Meadowbrook Drive to Fiddler's Green Road	• Reduce speed limit to 70 km/h	• Accurately represent existing network conditions
Morwick Drive from Shaver Road to Meadowbrook Drive	• Roadway link added representing a residential collector	• Added to better load vehicle trips onto network from local traffic zone
Stevenson Street from Jerseyville Road to Morwick Drive	• Roadway link added representing a residential collector	• Added to better load vehicle trips onto network from local traffic zone
Lloyminn Avenue from Jerseyville Road to Lovers Lane	• Roadway link added representing a residential collector	• Added to better load vehicle trips onto network from local traffic zone
Mohawk Road, west of Highway 403 interchange	• Added turning movement ban for U-turns	• Illegal turning movements being performed in model • Forces trips onto proper ramp

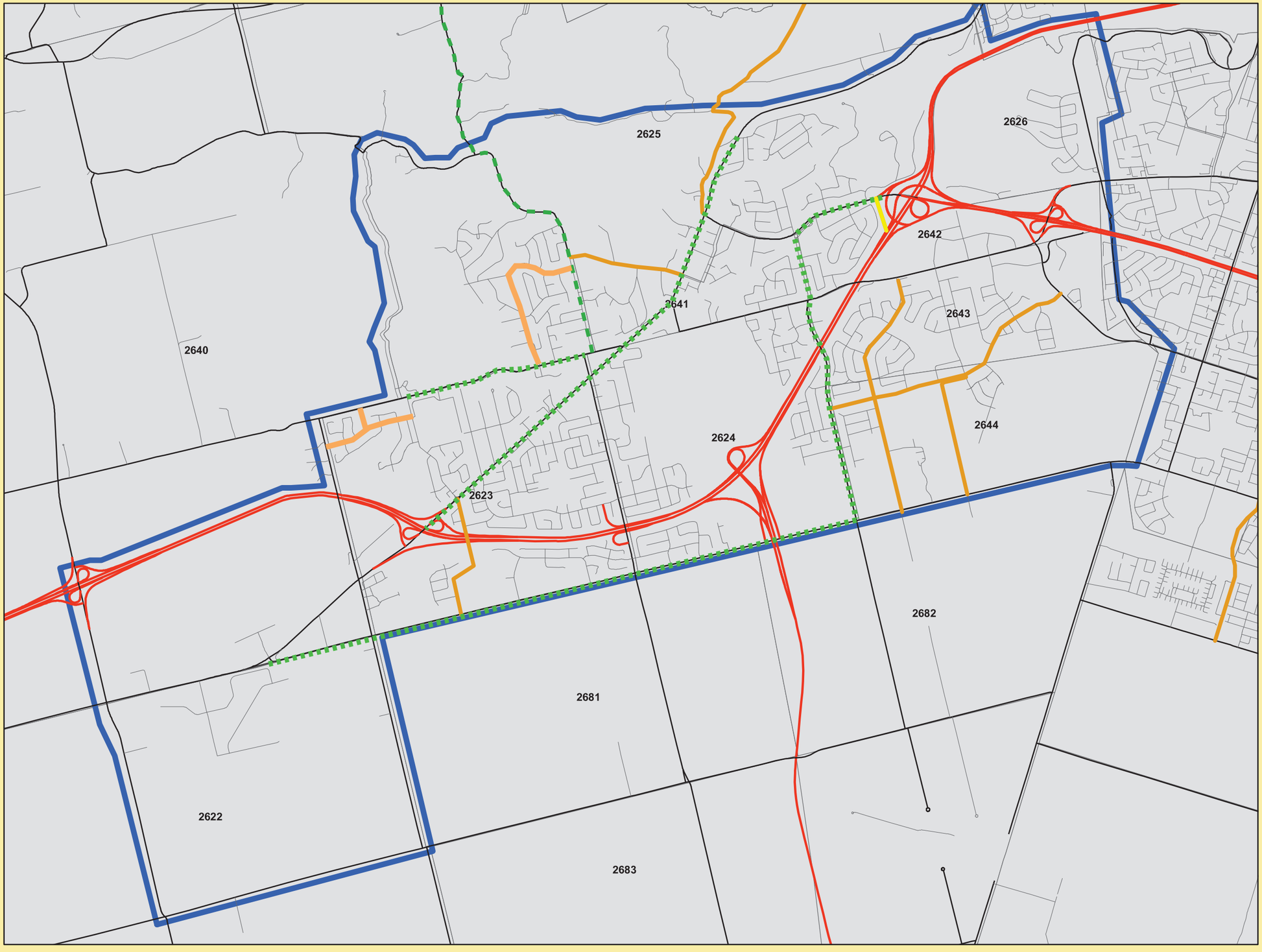
Notes:
[1] Future Horizon Years (2016, 2021, 2031) Only

Hamilton

Ancaster Transportation Master Plan

Figure 1

Network Modifications



Legend

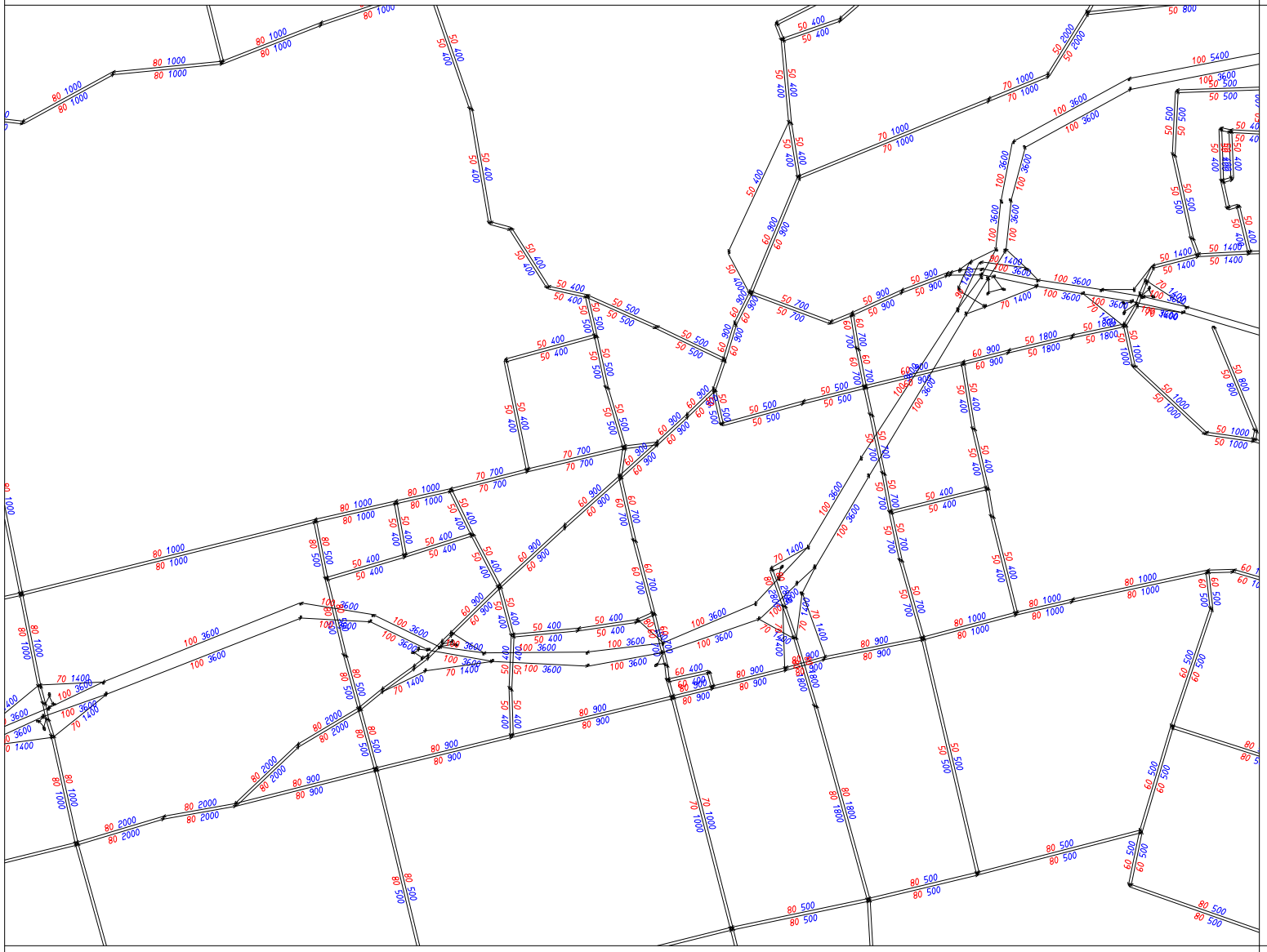
- Deleted Link
- Modified Link
- New Links
- Highway
- Major Road
- Minor Road
- Ancaster Study Area
- Model Zones

Kilometers

0 0.6 1.2

FREE FLOW SPEED & TOTAL ROAD CAPACITY (1 WAY)

emme/2



LINKS:
mod=c
&!ci=1
&!cj=1

LAYERS:
Capacity
Speed

Figure 2

WINDOW:
577261/ 781716
587402/ 789321

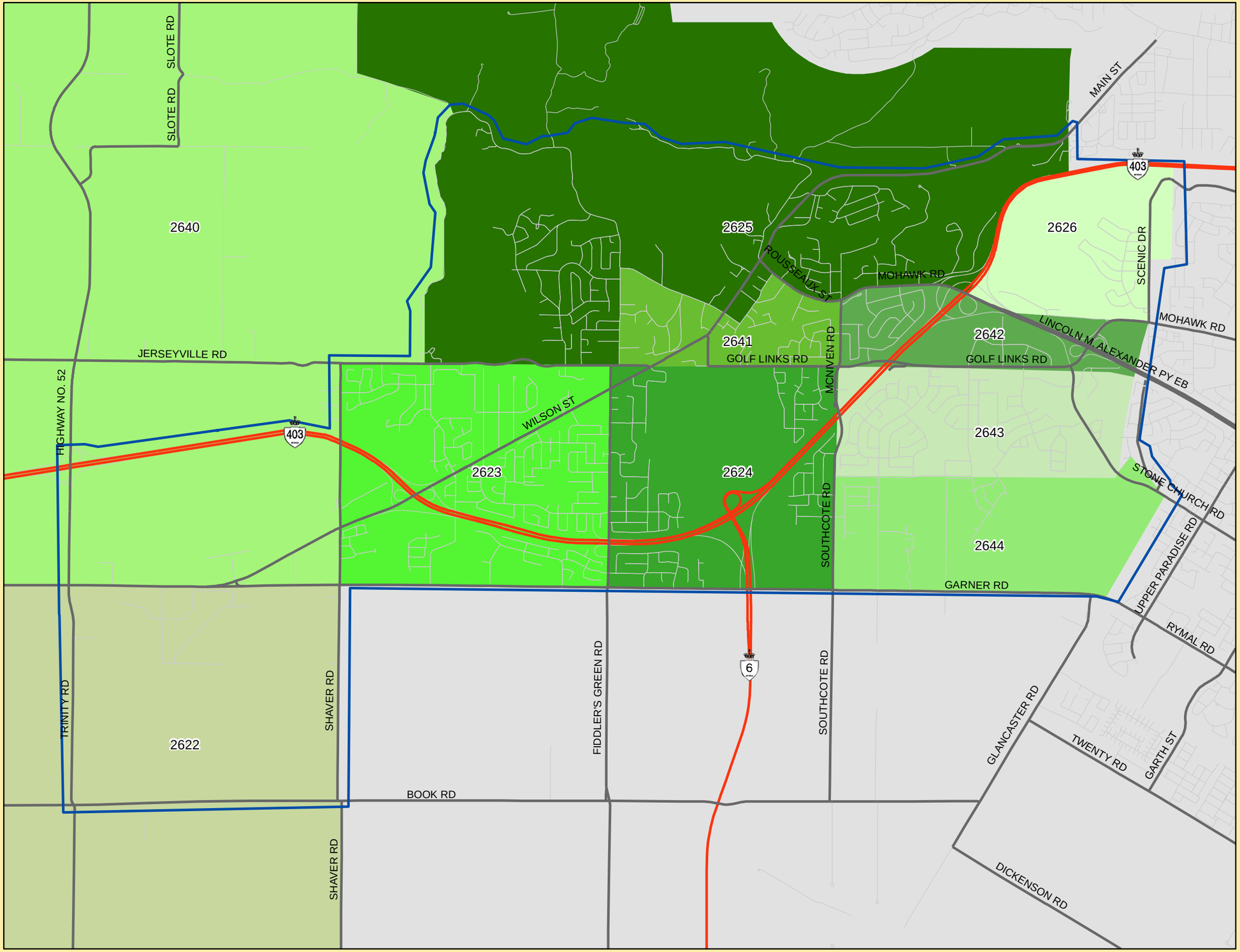
EMME/2 PROJECT: Hamilton Airport
SCENARIO 5000: 2006 Ancaster TMP (2010-08-13)

10-08-13 16:59
MODULE: 2.13
DMG.UTYU...jdk

2.3 Modifications to Base Zone Structure

The data used as input to the Hamilton model is based on the modified Greater Toronto Area (GTA) zone system developed by the Data Management Group (DMG). Overall, there are 195 zones in Hamilton, ten of which make up the majority of the Ancaster study area. The original zone system used as part of the Hamilton Transportation Master Plan (HTMP) is illustrated on **Figure 3**.

In order to provide a finer level of evaluation, reflect recent development patterns, and delineate a number of combined commercial/residential zones, the zone system in Ancaster sub-area was expanded to 26 zones. The zone system used in the Ancaster Transportation Master Plan (ATMP) is shown in **Figure 4**.



Hamilton

Ancaster Transportation Master Plan

Figure 3

Transportation Zones

Legend

- Minor Road
- Major Road
- Highway
- External Zones
- Study Area Zones
- Ancaster Study Area

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Date Modified: 022511
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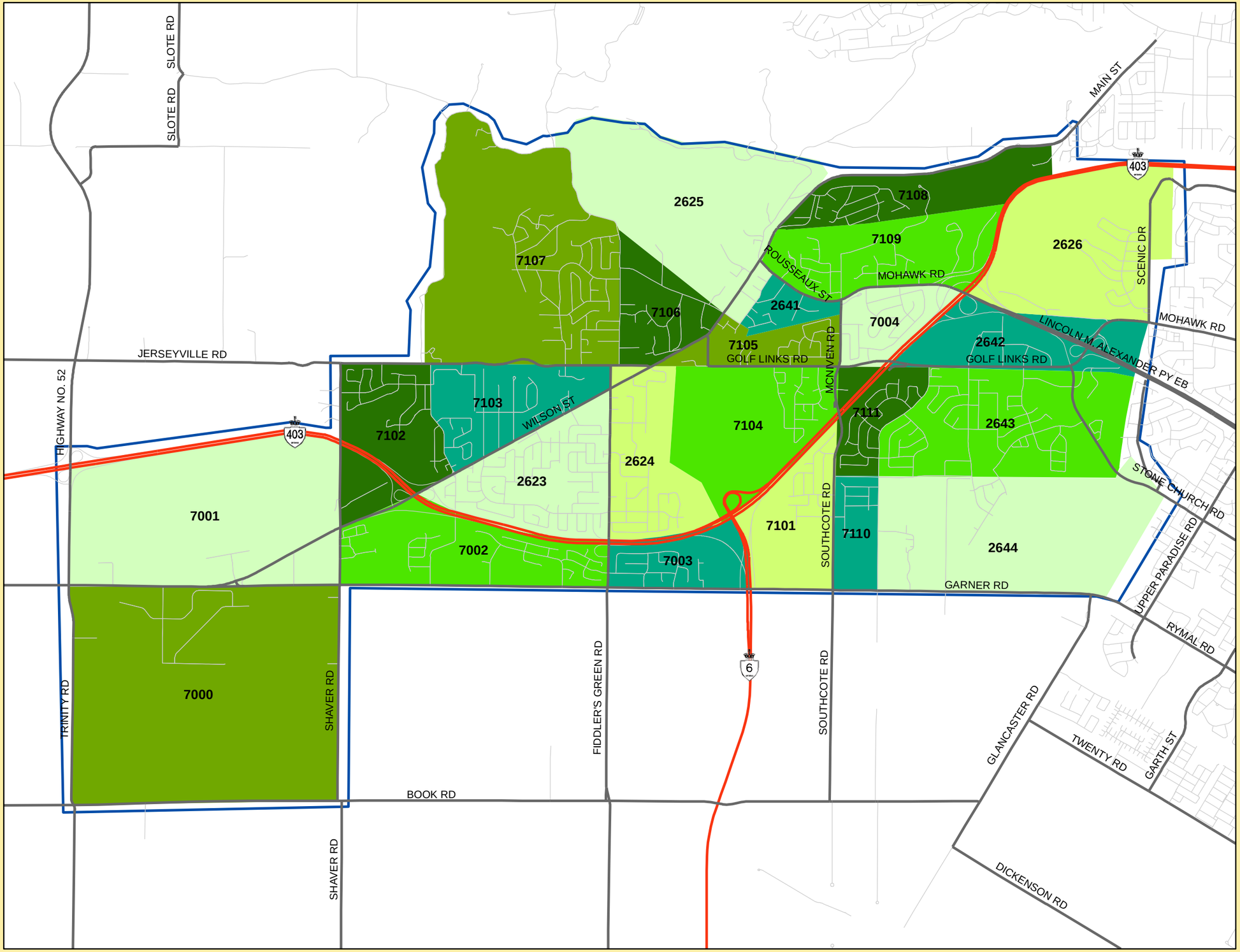

Hamilton

Ancaster Transportation Master Plan

Figure 4

Modified Transportation Zones

Legend

- Minor Road
- Major Road
- Highway
- Transportation Zones
- Ancaster Study Area

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Date Modified: 022311
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2.3.1 HTMP and GRIDS Population Comparison

The existing population and employment data, based on the Hamilton Transportation Master Plan (HTMP), was split to reflect estimated redistribution of population and employment in the revised zone system, based on the examination of aerial imagery. Population adjustments as a result of the Growth Related Integrated Development Strategy (GRIDS) were considered for existing and future horizon year models. Due to both the uncertainty of the Ancaster population redistribution in GRIDS and the insignificant differences between GRIDS and HTMP figures (within ±5%), HTMP figures were used in the model. **Table 3** show the comparison between HTMP and GRIDS population figures and **Table 4** provides a summary of the population and employment revisions.

Table 3 – HTMP and GRIDS Population Comparison

Horizon	HTMP	GRIDS	Difference	% Change
2006	33,170	32,226	944	2.8%
2011	36,314	35,308	1,006	2.8%
2016	38,532	39,509	-977	2.5%
2021	39,571	41,019	-1,448	3.7%
2026	39,143	40,893	-1,750	4.5%
2031	39,221	41,110	-1,889	4.8%

In order to ensure that the HTMP figures were sufficient for model analysis without significant revisions to the EMME/2 trip tables, a model sensitivity test was performed. In the sensitivity model run, an additional population of 2,000 was added to the high-growth area encompassed by Golf Links Road to the north, Garner Road to the south, Stone Church Road and the hydro easement to the east, and Kitty Murray Lane to the west. This area coincides with the EMME/2 Zones 2643 and 2644.

As a result of the model run, an additional 299 trips originating from and an additional 23 trips destined to the area of interest was observed. As expected, the vehicle trip growth was mostly localized around zones 2643 and 2644. The roadway experiencing the greatest impact was Garner Road westbound, between Springbrook Avenue and Highway 6, with an additional 124 trips (representing 8.4% growth) on the peak link. Critical network links (v/c greater than 0.85) in the Ancaster area experienced insignificant auto volume growth not exceeding 2%.

Based on these findings, we conclude that the GRIDS sensitivity test did not affect the EMME/2 network in the Ancaster area significantly. The existing HTMP trip tables will be used in the EMME/2 model for future year analysis in 2016, 2021, and 2031.

2.3.2 Post-GRIDS Population Adjustments

Following GRIDS, there have been additional developments approved within the Ancaster area (referred to as Post-GRIDS). Unlike GRIDS, which aggregated population changes to Ancaster as a whole, Post-GRIDS developments were based on individual parcels of land. This made it possible to identify developments in specific EMME/2 zones within Ancaster and adjust population figures accordingly.

The City of Hamilton provided persons per unit (PPU) values for Ancaster which allowed for the calculation of population changes. **Table 4** denotes the conversion factors used to translate the number of units into population and **Table 5** displays the Post-GRIDS population changes applied to Ancaster. **Table 6** represents the overall Ancaster area population and employment modifications, including Post-GRIDS adjustments.

2.3.3 Airport Employment Growth District

Another area of interest to the Ancaster model is Hamilton's Airport Employment Growth District (AEGD). It is known that the AEGD will experience significant employment growth by the year 2031, which will impact travel demand in the Ancaster area. The EMME/2 zones in the 2031 horizon contain employment figures of **approximately 29,000 jobs in the AEGD area**. In order to be consistent with the AEGD TMP, the existing 6 zones in the AEGD have been split into 13 for the 2016, 2021, and 2031 horizon years. The employment and population of these 13 zones has been modified to reflect growth in the AEGD over that time in order to examine the impacts on the Ancaster area.

Table 4 – Ancaster Persons per Unit (PPU) Factors

Year	Single Family	Semi-Detached	Row	Apartment
2001	3.170	2.733	2.113	1.590
2006	3.083	2.658	2.076	1.553
2011	2.996	2.593	2.031	1.517
2016	2.919	2.537	1.994	1.480
2021	2.887	2.509	1.972	1.461
2026	2.876	2.499	1.972	1.461
2031	2.865	2.490	1.972	1.461

Table 5 – Post-GRIDS Ancaster Population Adjustments

Emme Zones	2016 Population Change	2021 Population Change	2031 Population Change
2624	26	26	26
2625	-118	-117	-116
2643	178	176	176
2644	473	468	466
7002	186	183	183
7003	61	61	60
7101	434	428	429
7102	-38	-38	-37
7109	29	29	29
7110	1,417	1,402	1,392
Total	2,649	2,618	2,609

Table 6 – Ancaster Population and Employment Modifications

Emme Zones		Population					Employment					% Adjustment	
Old	New	2001	2006	2016	2021	2031	2001	2006	2016	2021	2031	Pop	Emp
2622	2622	1,149	1,170	1,112	1,096	1,075	74	79	90	94	105	100%	10%
	7000	0	0	0	0	0	669	715	807	850	948	0%	90%
2623	2623	2,504	2,713	2,924	2,930	2,895	366	400	441	462	495	30%	30%
	7002	2,504	2,713	3,109	3,113	3,079	183	200	220	231	248	30%	15%
	7102	1,669	1,809	1,911	1,916	1,893	61	67	73	77	83	20%	5%
	7103	1,669	1,809	1,949	1,953	1,930	611	667	735	770	825	20%	50%
2624	2624	1,814	1,806	2,416	2,573	2,532	396	423	498	564	602	45%	65%
	7003	605	602	858	910	896	0	0	0	0	0	15%	0%
	7101	605	602	1,230	1,277	1,265	30	33	38	43	46	15%	5%
	7104	1,008	1,004	1,328	1,415	1,393	183	195	230	260	278	25%	30%
2625	2625	791	818	693	779	805	195	200	224	235	265	15%	25%
	7107	2,372	2,453	2,434	2,688	2,764	507	519	582	610	688	45%	65%
	7108	791	818	811	896	921	0	0	0	0	0	15%	0%
	7109	1,318	1,363	1,381	1,522	1,564	78	80	90	94	106	25%	10%
2626	2626	1,309	1,289	1,293	1,274	1,250	196	193	197	195	208	100%	100%
2640	2640	1,018	1,038	986	972	954	27	28	30	31	34	100%	10%
	7001	0	0	0	0	0	242	250	271	277	305	0%	90%
2641	2641	521	509	510	533	526	161	164	173	175	186	25%	45%
	7105	626	611	611	639	631	0	0	0	0	0	30%	0%
	7106	938	916	917	959	946	196	201	211	214	228	45%	55%
2642	2642	0	0	0	0	0	196	211	223	226	238	0%	100%
	7004	1,155	1,314	1,251	1,233	1,211	0	0	0	0	0	100%	0%
2643	2643	2,857	4,795	4,828	4,923	4,842	772	887	989	1,042	1,111	70%	100%
	7111	1,224	2,055	1,993	2,034	2,000	0	0	0	0	0	30%	0%
2644	2644	316	580	3,559	3,511	3,456	311	574	830	1,052	1,099	65%	100%
	7110	210	386	1,661	1,639	1,610	0	0	0	0	0	35%	0%
Totals		28,971	33,170	39,763	40,788	40,437	5,454	6,085	6,952	7,500	8,096		

2.4 Trip Generation and Distribution

The 2006 base matrix was created using a three-step process with the 2011 TMP peak period auto driver matrix as original input.

The trip end totals were adjusted to reflect the difference in population and employment numbers between 2006 and 2011. The origin adjustment factor was weighted using 95% of population and 5% of employment; the destination factor was weighted using 90% employment and 10% population. Origins and destinations external to the City of Hamilton were reduced by 2.4% and 4.5% respectively based on the total difference in population and employment for the City as a whole.

Using the standard Fratar distribution procedure, the 2011 matrix was re-balanced to the 2006 trip end totals, including the new Ancaster sub-zones added in **Table 6**.

For the future horizon year of 2016, a mean value matrix of the 2011 and 2021 trip matrices was calculated and factored to include the new sub-zones using the Fratar distribution procedure. The future horizon years of 2021 and 2031 were also factored to include the new sub-zones.

A peak hour factor of 0.5 was applied to the trip matrix prior to trip assignment in order to convert from the AM peak period (three hours) to the AM peak hour. The 0.5 factor is unusually high, but was selected to give a good average fit between the assigned traffic volumes and observed traffic counts within the study area.

Table 7 provides a summary of the number of trips attracted and produced by the Ancaster model during the AM Peak in the study area.

2.5 Trip Assignment

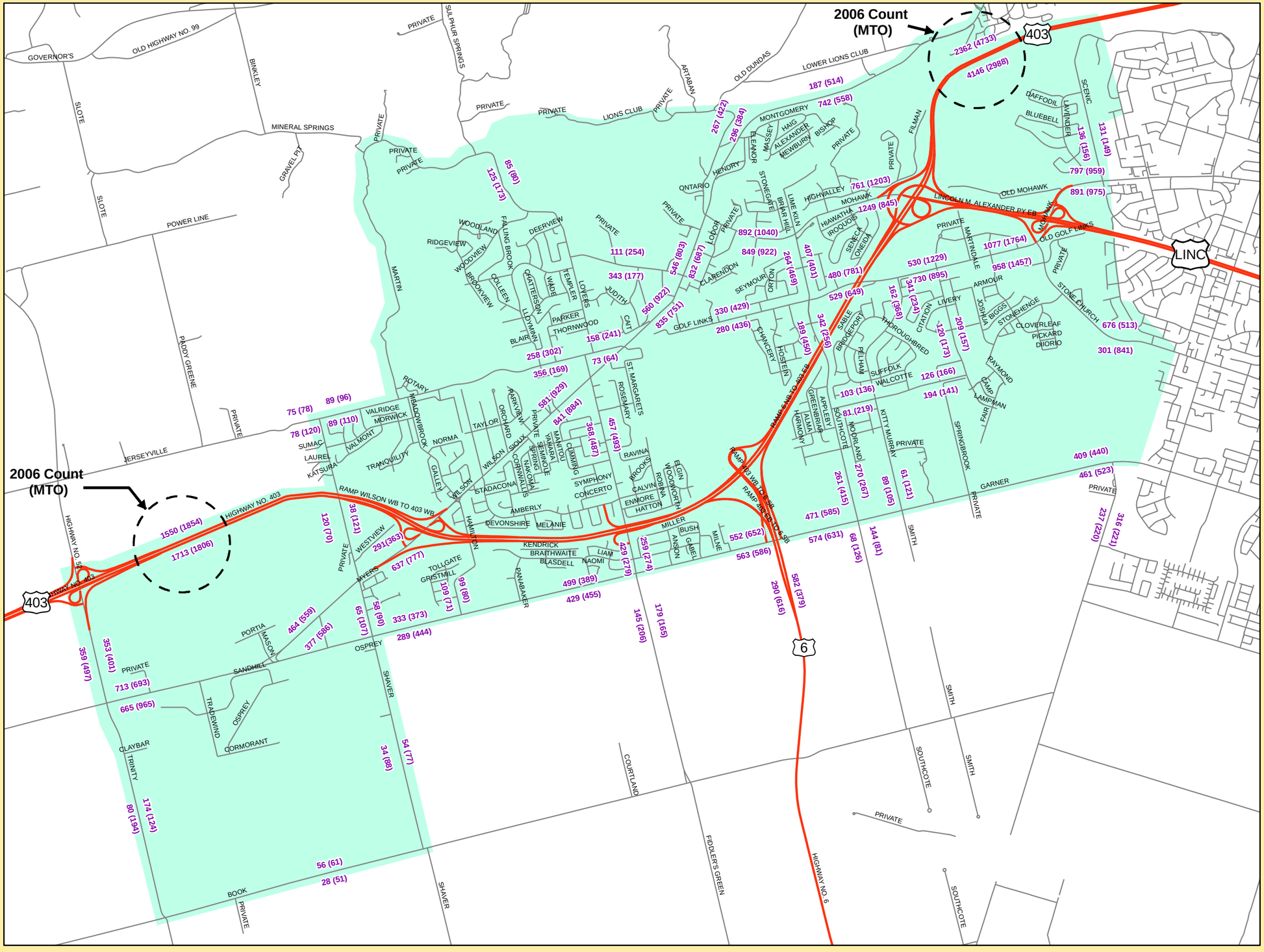
For the Ancaster model, the auto trip assignment was performed using EMME/2's standard equilibrium assignment and Tangent volume delay functions. Several iterations of the trip assignment algorithm were completed and analyzed for consistency with the Ancaster roadway network goals and assumptions.

2.6 Base Year Validation

Model validation requires comparing traffic simulated by the model to counted traffic in the field along contrived barriers called screenlines representing both imaginary and actual physical barriers. In order to facilitate this comparison, a comprehensive set of data (ATR) was collected as part of the data collection program for the study. The existing peak hour count volumes are illustrated on **Figure 5.**

Table 7 – Trip Generation by Zone

Zone	Origins				Destinations			
	2006	2016	2021	2031	2006	2016	2021	2031
422-424	728	751	755	762	1,599	1,664	1,681	1,745
503-504	1,717	1,767	1,793	1,835	1,303	1,240	1,242	1,342
2622	185	160	161	169	55	49	51	55
2623	566	432	456	480	255	157	184	198
2624	297	317	353	370	205	204	229	243
2625	134	108	116	126	137	113	119	129
2626	182	179	179	182	92	87	88	92
2640	173	135	135	142	25	18	19	20
2641	89	82	82	84	74	65	65	67
2642	11	10	9	10	135	124	123	127
2643	608	598	610	689	339	329	336	378
2644	115	540	614	615	198	333	370	389
7000	9	7	7	8	242	212	219	236
7001	7	6	6	6	122	86	86	92
7002	562	453	479	502	141	102	103	110
7003	188	107	118	124	25	5	6	6
7004	207	185	183	186	15	13	13	14
7101	0	0	0	0	0	0	0	0
7102	375	278	293	308	57	41	41	43
7103	396	304	322	340	409	294	298	314
7104	165	174	194	203	97	97	108	115
7105	98	90	90	93	5	5	5	5
7106	157	143	144	148	92	81	83	84
7107	382	359	378	409	344	287	303	328
7108	125	117	123	132	9	7	8	8
7109	211	201	211	228	65	54	57	62
7110	71	239	273	272	9	12	13	14
7111	284	264	267	296	12	12	12	13
Total	**8,042**	**8,006**	**8,351**	**8,719**	**6,061**	**5,691**	**5,862**	**6,229**



Hamilton

Ancaster Transportation Master Plan

Figure 5

Average Annual Daily Traffic Counts (Weekday Peak)

Legend

- Existing Road Network
- Highway
- Ancaster Study Area
- 100 (100) AM (PM) Weekday Peak Hour Volumes (2007)

Exhibit 7

Kilometers

0 1 2

An initial test assignment showed an over representation of traffic trips to and from the west on Highway 403 at the boundary with Brant County. **Table 8** provides a comparison of the external trips generated by the Hamilton model with data from the 2006 TTS. Previous TTSs have not included data for the City of Brantford, Brant County, and the Region of Waterloo.

Table 8 – External Trip Comparison (No Adjustment)

Zone #	Zone Description	Inbound to Hamilton		Outbound from Hamilton	
		Hamilton Model	2006 TTS (07:30-08:29)	Hamilton model	2006 TTS (07:30-08:29)
504	City of Brantford	1237	1025	356	1158
503	County of Brant	481	421	939	216
Sub-Total		1718	1446	1295	1374
422-424	Region of Waterloo	407	673	847	689
Total		2125	2119	2142	2063

The total number of simulated external trips is remarkably close to the observed TTS value although the distribution is somewhat different. To correct for those differences a factor of three has been applied to all outbound trip movements from the City of Hamilton to Zone 504. Trips to Zone 503 have been reduced by 75%.

The TMP network included a centroid connector that joined the zone centroid representing Brant County (503) directly to Highway 403. That connector has been removed. These changes resulted in a significant improvement in simulated traffic volumes on Highway 403 relative to the traffic counts.

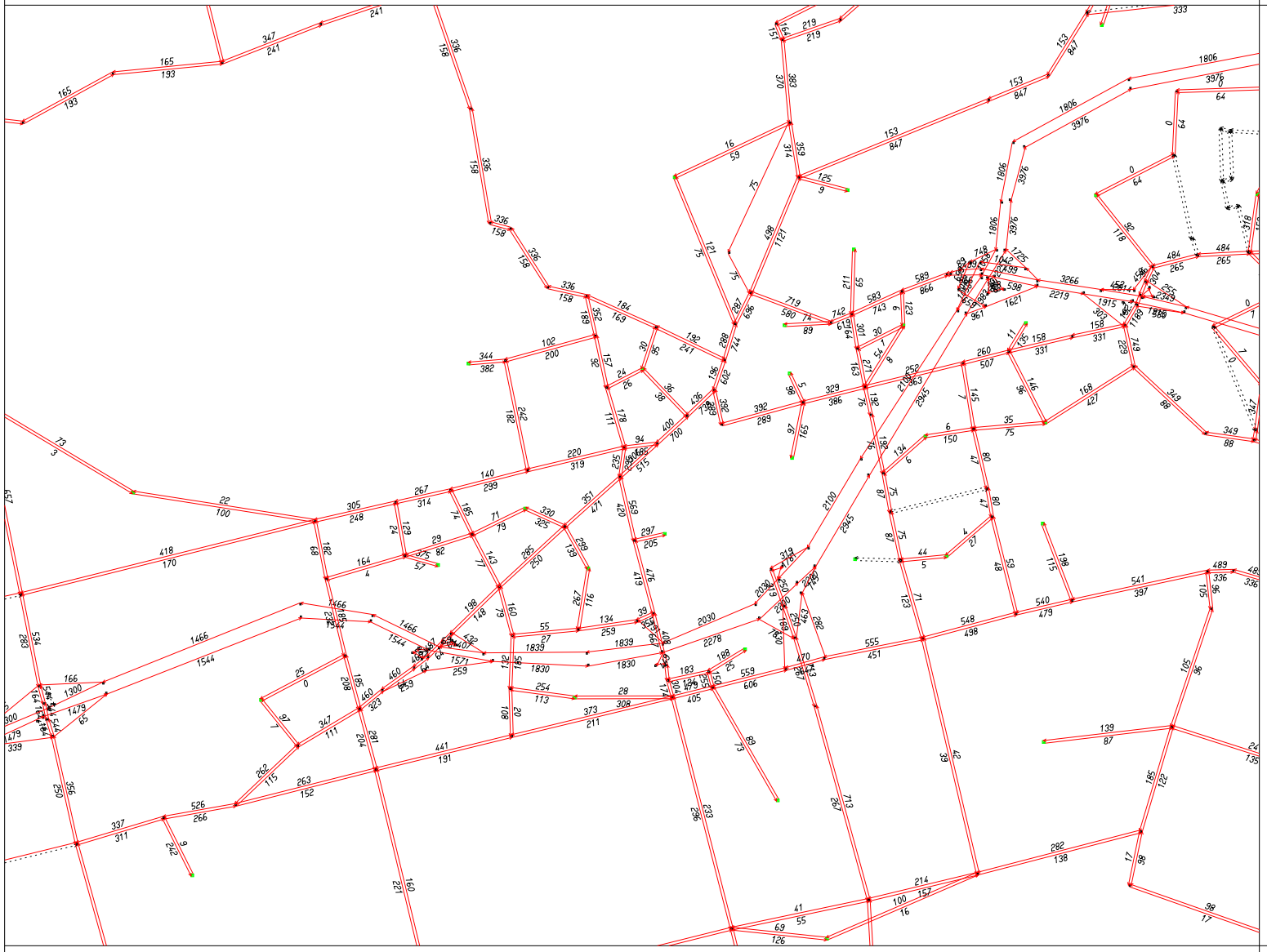
The 2006 simulated volumes are illustrated in **Figures 6.**

2.7 Screenline Volume Comparison

A comparison of counted and simulated volumes and capacity across a number of screenlines was completed for the 2006 existing scenario. **Table 9** provides an overview of the screenline validation of AM Peak Hour simulated trips and 2006 count data.

AUTO VOLUMES

emme/2



LINKS:
all

Figure 6

WINDOW:
577261/ 781716
587402/ 789321

EMME/2 PROJECT: Hamilton Airport
SCENARIO 5000: 2006 Ancaster TMP (2010-08-13)

10-08-13 17:13
MODULE: 6.12
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Table 9 – Screenline Validation

Number	Screenline	Road Name	Direction	AM Peak 2006 Vol Counted	AM Peak 2006 Vol Simulated	Screenline Ratio
1	South of Garner Road	Trinity Road	NB	174	343	
			SB	80	49	
		Shaver Road	NB	54	160	
			SB	34	221	
		Fiddler's Green Road	NB	170	233	
			SB	145	296	
		Highway 6	NB	582	713	
			SB	290	267	
		Southcote Road	NB	144	42	
			SB	68	39	
		Glancaster Road	NB	316	96	
			SB	237	105	
		Totals	NB	1,440	1,587	1.10
			SB	854	977	1.14
2	North of Garner Road	Trinity Road	NB	353	356	
			SB	359	250	
		Wilson Street	NB	377	115	
			SB	464	262	
		Shaver Road	NB	58	281	
			SB	65	204	
		Hamilton Drive	NB	99	20	
			SB	199	108	
		Fiddler's Green Road	NB	259	304	
			SB	429	174	
		Highway 6	NB	582	713	
			SB	290	267	
		Highway 403 Ramp	NB	133	282	
			SB	69	130	
		Southcote Road	NB	270	71	
			SB	261	123	
		Kitty Murray Lane	NB	61	59	
			SB	89	48	
		Totals	NB	2,192	2,201	1.00
			SB	2,225	1,566	0.70
3	South of Jerseyville Road	Shaver Road	NB	38	182	
			SB	120	68	
		Meadowbrook Drive	NB	-	185	
			SB	-	74	
		Fiddler's Green Road	NB	457	295	
			SB	368	235	
		Wilson Street	NB	841	515	
			SB	581	306	
		Southcote Road	NB	342	192	
			SB	189	76	
		Kitty Murray Lane	NB	341	145	
			SB	162	7	
		Stone Church Road	NB	676	749	
			SB	301	229	
		Totals	NB	2,695	2,263	0.84
			SB	1,721	995	0.58
4	South of Lions Club Road	Sulphur Springs Road	NB	85	336	
			SB	125	158	
		Old Dundas Road	NB	296	383	
			SB	267	370	
		Wilson Street	NB	742	847	
			SB	187	153	
		Highway 403	NB	4,146	3,976	
			SB	2,362	1,806	
		Totals	NB	5,269	5,542	1.05
			SB	2,941	2,487	0.85
5	East of Shaver Road	Garner Road	EB	289	191	
			WB	333	441	
		Wilson Street	EB	637	323	
			WB	291	460	
		Highway 403	EB	1,713	1,544	
			WB	1,550	1,466	
		Jerseyville Road	EB	89	248	
			WB	89	305	
		Totals	EB	2,728	2,306	0.85
			WB	2,263	2,672	1.18
6	West of Fiddler's Green	Garner Road	EB	429	211	
			WB	499	373	

Number	Screenline	Road Name	Direction	AM Peak 2006 Vol Counted	AM Peak 2006 Vol Simulated	Screenline Ratio
	Road	Highway 403	EB	2,143	1,830	
			WB	1,939	1,839	
		Amberly Blvd	EB	514	355	
			WB	121	39	
		Wilson Street	EB	841	471	
			WB	581	351	
		Jerseyville Road	EB	356	319	
			WB	258	220	
		Totals	EB	4,283	3,186	0.74
			WB	3,398	2,822	0.83
7	West of Highway 6	Garner Road	EB	563	606	
			WB	552	559	
		Highway 403	EB	2,247	2,278	
			WB	2,033	2,030	
		Wilson Street	EB	835	738	
			WB	560	436	
		Sulphur Springs Road	EB	343	241	
			WB	111	192	
		Totals	EB	3,988	3,863	0.97
			WB	3,256	3,217	0.99
8	West of Southcote Road	Garner Road	EB	574	451	
			WB	471	555	
		Highway 403	EB	2,629	2,945	
			WB	2,379	2,100	
		Golf Links Road	EB	280	386	
			WB	330	329	
		Mohawk Road	EB	849	619	
			WB	892	742	
		Totals	EB	4,332	4,401	1.02
			WB	4,072	3,726	0.92
9	West of Stone Church Road	Garner Road	EB	461	397	
			WB	409	541	
		Mohawk Road	EB	958	331	
			WB	1,077	158	
		Totals	EB	1,419	728	0.51
			WB	1,486	699	0.47
NB/EB (Peak Direction) Totals				28,346	26,077	0.92
SB/WB Totals				22,216	19,161	0.86
GRAND TOTAL				50,562	45,238	0.89

Based on a review of the 2006 AM Peak Hour counted and simulated volumes from the modified EMME/2 model for the Ancaster study area, the model is operating within acceptable parameters having overall simulated/counted ratios within approximately ±15% in the peak direction (northbound and eastbound in the AM Peak Hour). The ratio of ±15% was chosen based on the level of detail available in the EMME/2 model. This value provides a good fit for a high-level analysis of Ancaster and the surrounding area.

Overall the model is operating acceptably, however there are several screenlines, particularly in the peak direction, which appear to under-simulate volumes compared to counted values. This occurs at the screenlines west of Fiddler's Green Road and west of Stone Church Road. During the model analysis, the screenline variances were recognized in the evaluation of each scenario.

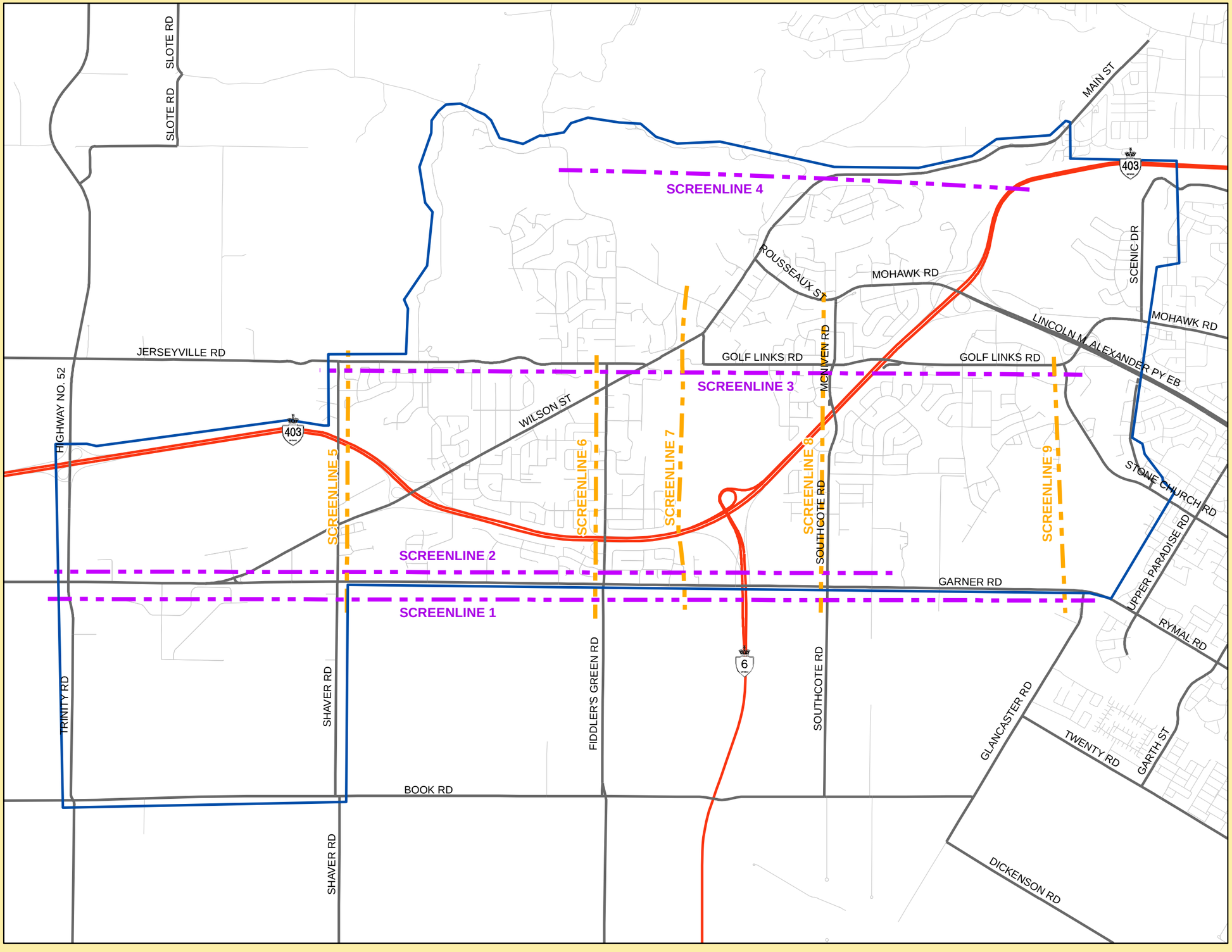
It should be noted that the City of Hamilton is currently undertaking an update of the Hamilton EMME/2 model to reflect the 2006 Transportation Tomorrow Survey and future modifications may arise as a result of that process.

3.0 SCREENLINE CAPACITY ANALYSIS

A comparison of counted and simulated volumes versus roadway capacity across a number of screenlines was completed for the 2006 existing scenario to help understand existing network deficiencies across screenlines. **Figure 7** illustrates the screenlines that were used in this analysis.

Volume to capacity (v/c) ratios in excess of 0.85 were used as an indicator of potential problems for both screenlines and individual links. **Table 10** provides an overview of the link and screenline volume to capacity ratios using AM and PM counted volumes and 2006 simulated trips.

Under 2006 existing conditions, there are a number of screenlines and individual links that are congested. Screenline 4 (South of Lions Clubs Road), along the Niagara Escarpment, exhibits an overall screenline capacity constraint as well as individual link constraints on Highway 403 and Old Dundas Road. Capacity constraints are also observed along Screenline 8 (West of Southcote Road) and specifically along Golf Links Road and Mohawk Road.



Hamilton

Ancaster Transportation Master Plan

Figure 7

Travel Demand Screenlines

Legend

- Minor Road
- Major Road
- Highway
- Ancaster Study Area
- Screenlines

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Table 10 – 2006 Link and Screenline Volume to Capacity Ratios

Number	Screenline	Road Name	Direction	Capacity (1-way)	AM Peak 2006 Vol Counted	AM Peak 2006 Vol Simulated	PM Peak 2006 Vol Counted	AM Peak 2006 V/C Counted	AM Peak 2006 V/C Simulated	PM Peak 2006 V/C Counted
1	South of Garner Road	Trinity Road	NB	1,000	174	343	124	0.17	0.34	0.12
			SB	1,000	80	49	194	0.08	0.05	0.19
		Shaver Road	NB	500	54	160	77	0.11	0.32	0.15
			SB	500	34	221	88	0.07	0.44	0.18
		Fiddler's Green Road	NB	1,000	170	233	165	0.17	0.23	0.17
			SB	1,000	145	296	206	0.15	0.30	0.21
		Highway 6	NB	1,800	582	713	379	0.32	0.40	0.21
			SB	1,800	290	267	616	0.16	0.15	0.34
		Southcote Road	NB	500	144	42	81	0.29	0.08	0.16
			SB	500	68	39	126	0.14	0.08	0.25
		Glancaster Road	NB	500	316	96	221	0.63	0.19	0.44
			SB	500	237	105	220	0.47	0.21	0.44
		Totals	NB	5,300	1,440	1,587	1,047	0.27	0.30	0.20
			SB	5,300	854	977	1,450	0.16	0.18	0.27
2	North of Garner Road	Trinity Road	NB	1,000	353	356	401	0.35	0.36	0.40
			SB	1,000	359	250	497	0.36	0.25	0.50
		Wilson Street	NB	2,000	377	115	586	0.19	0.06	0.29
			SB	2,000	464	262	559	0.23	0.13	0.28
		Shaver Road	NB	500	58	281	90	0.12	0.56	0.18
			SB	500	65	204	107	0.13	0.41	0.21
		Hamilton Drive	NB	400	99	20	80	0.25	0.05	0.20
			SB	400	199	108	107	0.50	0.27	0.27
		Fiddler's Green Road	NB	700	259	304	274	0.37	0.43	0.39
			SB	700	429	174	279	0.61	0.25	0.40
		Highway 6	NB	1,800	582	713	379	0.32	0.40	0.21
			SB	1,800	290	267	616	0.16	0.15	0.34
		Highway 403 Ramp	NB	1,400	133	282	77	0.10	0.20	0.06
			SB	1,400	69	130	145	0.05	0.09	0.10
		Southcote Road	NB	700	270	71	267	0.39	0.10	0.38
			SB	700	261	123	415	0.37	0.18	0.59
		Kitty Murray Lane	NB	400	61	59	121	0.15	0.15	0.30
			SB	400	89	48	105	0.22	0.12	0.26
		Totals	NB	8,900	2,192	2,201	2,275	0.25	0.25	0.26
			SB	8,900	2,225	1,566	2,830	0.25	0.18	0.32
3	South of Jerseyville Road	Shaver Road	NB	500	38	182	121	0.08	0.36	0.24
			SB	500	120	68	70	0.24	0.14	0.14
		Meadowbrook Drive	NB	400	-	185	-	-	0.46	-
			SB	400	-	74	-	-	0.19	-
		Fiddler's Green Road	NB	700	457	295	493	0.65	0.42	0.70
			SB	700	368	235	487	0.53	0.34	0.70
		Wilson Street	NB	900	841	515	884	0.93	0.57	0.98
			SB	900	581	306	929	0.65	0.34	1.03
		Southcote Road	NB	700	342	192	256	0.49	0.27	0.37
			SB	700	189	76	450	0.27	0.11	0.64
		Kitty Murray Lane	NB	400	341	145	234	0.85	0.36	0.59
			SB	400	162	7	368	0.41	0.02	0.92
		Stone Church Road	NB	1,000	676	749	513	0.68	0.75	0.51
			SB	1,000	301	229	841	0.30	0.23	0.84
		Totals	NB	4,600	2,695	2,263	2,501	0.59	0.49	0.54
			SB	4,600	1,721	995	3,145	0.37	0.22	0.68
4	South of Lions Club Road	Sulphur Springs Road	NB	400	85	336	80	0.21	0.84	0.20
			SB	400	125	158	173	0.31	0.40	0.43
		Old Dundas Road	NB	400	296	383	384	0.74	0.96	0.96
			SB	400	267	370	422	0.67	0.93	1.06
		Wilson Street	NB	1,000	742	847	558	0.74	0.85	0.56
			SB	1,000	187	153	514	0.19	0.15	0.51
		Highway 403	NB	3,600	4,146	3,976	2,988	1.15	1.10	0.83
			SB	3,600	2,362	1,806	4,733	0.66	0.50	1.31
		Totals	NB	5,400	5,269	5,542	4,010	0.98	1.03	0.74
			SB	5,400	2,941	2,487	5,842	0.54	0.46	1.08
5	East of Shaver Road	Garner Road	EB	900	289	191	444	0.32	0.21	0.49
			WB	900	333	441	373	0.37	0.49	0.41
		Wilson Street	EB	2,000	637	323	777	0.32	0.16	0.39
			WB	2,000	291	460	363	0.15	0.23	0.18
		Highway 403	EB	3,600	1,713	1,544	1,806	0.48	0.43	0.50
			WB	3,600	1,550	1,466	1,854	0.43	0.41	0.52
		Jerseyville Road	EB	1,000	89	248	110	0.09	0.25	0.11
			WB	1,000	89	305	96	0.09	0.31	0.10
		Totals	EB	7,500	2,728	2,306	3,137	0.36	0.31	0.42
			WB	7,500	2,263	2,672	2,686	0.30	0.36	0.36
6	West of Fiddler's	Garner Road	EB	900	429	211	455	0.48	0.23	0.51

			WB	900	499	373	389	0.55	0.41	0.43
		Highway 403	EB	3,600	2,143	1,830	2,259	0.60	0.51	0.63
			WB	3,600	1,939	1,839	2,320	0.54	0.51	0.64
		Amberly Blvd	EB	400	514	355	512	1.29	0.89	1.28
			WB	400	121	39	136	0.30	0.10	0.34
		Wilson Street	EB	900	841	471	884	0.93	0.52	0.98
			WB	900	581	351	929	0.65	0.39	1.03
		Jerseyville Road	EB	700	356	319	169	0.51	0.46	0.24
			WB	700	258	220	302	0.37	0.31	0.43
		Totals	EB	6,500	4,283	3,186	4,279	0.66	0.49	0.66
			WB	6,500	3,398	2,822	4,076	0.52	0.43	0.63
7	West of Highway 6	Garner Road	EB	900	563	606	586	0.63	0.67	0.65
			WB	900	552	559	652	0.61	0.62	0.72
		Highway 403	EB	3,600	2,247	2,278	2,369	0.62	0.63	0.66
			WB	3,600	2,033	2,030	2,432	0.56	0.56	0.68
		Wilson Street	EB	900	835	738	751	0.93	0.82	0.83
			WB	900	560	436	922	0.62	0.48	1.02
		Sulphur Springs Road	EB	500	343	241	177	0.69	0.48	0.35
			WB	500	111	192	254	0.22	0.38	0.51
		Totals	EB	5,900	3,988	3,863	3,883	0.68	0.65	0.66
			WB	5,900	3,256	3,217	4,260	0.55	0.55	0.72
8	West of Southcote Road	Garner Road	EB	900	574	451	631	0.64	0.50	0.70
			WB	900	471	555	585	0.52	0.62	0.65
		Highway 403	EB	3,600	2,629	2,945	2,772	0.73	0.82	0.77
			WB	3,600	2,379	2,100	2,845	0.66	0.58	0.79
		Golf Links Road	EB	500	280	386	436	0.56	0.77	0.87
			WB	500	330	329	429	0.66	0.66	0.86
		Mohawk Road	EB	700	849	619	922	1.21	0.88	1.32
			WB	700	892	742	1,040	1.27	1.06	1.49
		Totals	EB	5,700	4,332	4,401	4,761	0.76	0.77	0.84
			WB	5,700	4,072	3,726	4,899	0.71	0.65	0.86
9	West of Stone Church Road	Garner Road	EB	1,000	461	397	523	0.46	0.40	0.52
			WB	1,000	409	541	440	0.41	0.54	0.44
		Mohawk Road	EB	1,800	958	331	1,457	0.53	0.18	0.81
			WB	1,800	1,077	158	1,764	0.60	0.09	0.98
		Totals	EB	2,800	1,419	728	1,980	0.51	0.26	0.71
			WB	2,800	1,486	699	2,204	0.53	0.25	0.79

Individual Link Congestion (>0.85)
Screenline Congestion (>0.85)

4.0 FUTURE HORIZONS AND SCENARIOS

4.1 Overview

Once validation for the Ancaster model was complete for 2006 base year conditions, the "do nothing" scenario (existing base conditions) was run with the projected population and employment data for the future horizon years of 2016, 2021, and 2031.

4.2 "Do Nothing" Scenario

The "do nothing" scenarios in the 2016, 2021, and 2031 horizons took into consideration any projects that were approved or planned from the capital budget, development charge studies, secondary plans, and EA studies undertaken by the City of Hamilton within the 2031 horizon year. These projects included, but are not limited to:

- AEGD TMP study area;
- Trinity Church connection;
- Red Hill Valley Parkway;
- GRIDS (Growth Related Infrastructure Development Strategy); and
- Additional approved Ancaster developments (Post-GRIDS).

The "do nothing" scenarios identified Ancaster network capacity deficiencies with the increase in population and employment by 2031. Under this scenario, more roadway links and screenlines will become congested. **Table 11** provides an overview of the link and screenline volume to capacity ratios for the AM Peak Hour in the 2006 and 2031 existing network.

Additional capacity constraints are anticipated along Screenlines 1 and 2 (North/South of Garner Road) and along Garner Road, corresponding to the development of the Airport Employment Growth District (AEGD). Transportation analysis associated with this development is addressed in the AEGD TMP report.

In order to address these additional network deficiencies, two main areas were examined:

- Opportunities for enhanced connectivity to Highway 403; and
- Consideration of options that would divert/alleviate traffic from the Wilson Street core area.

Table 11 – 2006 and 2031 Link and Screenline Volume to Capacity Ratios

Number	Screenline	Road Name	Direction	Capacity (1-way)	AM Peak 2006 Vol Counted	AM Peak 2006 Vol Simulated	AM Peak 2031 Vol Simulated	AM Peak 2006 V/C Simulated	AM Peak 2031 V/C Simulated
1	South of Garner Road	Trinity Road	NB	1,000	174	343	458	0.34	0.46
			SB	1,000	80	49	177	0.05	0.18
		Shaver Road	NB	500	54	160	224	0.32	0.45
			SB	500	34	221	201	0.44	0.40
		Fiddler's Green Road	NB	1,000	170	233	429	0.23	0.43
			SB	1,000	145	296	424	0.30	0.42
		Highway 6	NB	1,800	582	713	1,837	0.40	1.02
			SB	1,800	290	267	1,547	0.15	0.86
		Southcote Road	NB	500	144	42	289	0.08	0.58
			SB	500	68	39	393	0.08	0.79
		Glancaster Road	NB	500	316	96	182	0.19	0.36
			SB	500	237	105	859	0.21	1.72
		Totals	NB	5,300	1,440	1,587	3,419	0.30	0.65
			SB	5,300	854	977	3,601	0.18	0.68
2	North of Garner Road	Trinity Road	NB	1,000	353	356	473	0.36	0.47
			SB	1,000	359	250	501	0.25	0.50
		Wilson Street	NB	2,000	377	115	104	0.06	0.05
			SB	2,000	464	262	454	0.13	0.23
		Shaver Road	NB	500	58	281	409	0.56	0.82
			SB	500	65	204	335	0.41	0.67
		Hamilton Drive	NB	400	99	20	61	0.05	0.15
			SB	400	199	108	151	0.27	0.38
		Fiddler's Green Road	NB	700	259	304	503	0.43	0.72
			SB	700	429	174	217	0.25	0.31
		Highway 6	NB	1,800	582	713	1,837	0.40	1.02
			SB	1,800	290	267	1,547	0.15	0.86
		Highway 403 Ramp	NB	1,400	133	282	115	0.20	0.08
			SB	1,400	69	130	582	0.09	0.42
		Southcote Road	NB	700	270	71	242	0.10	0.35
			SB	700	261	123	548	0.18	0.78
		Kitty Murray Lane	NB	400	61	59	60	0.15	0.15
			SB	400	89	48	341	0.12	0.85
		Totals	NB	8,900	2,192	2,201	3,804	0.25	0.43
			SB	8,900	2,225	1,566	4,676	0.18	0.53
3	South of Jerseyville Road	Shaver Road	NB	500	38	182	272	0.36	0.54
			SB	500	120	68	186	0.14	0.37
		Meadowbrook Drive	NB	400	-	185	194	0.46	0.49
			SB	400	-	74	58	0.19	0.15
		Fiddler's Green Road	NB	700	457	295	309	0.42	0.44
			SB	700	368	235	319	0.34	0.46
		Wilson Street	NB	900	841	515	636	0.57	0.71
			SB	900	581	306	518	0.34	0.58
		Southcote Road	NB	700	342	192	394	0.27	0.56
			SB	700	189	76	374	0.11	0.53
		Kitty Murray Lane	NB	400	341	145	172	0.36	0.43
			SB	400	162	7	122	0.02	0.31
		Stone Church Road	NB	1,000	676	749	839	0.75	0.84
			SB	1,000	301	229	376	0.23	0.38
		Totals	NB	4,600	2,695	2,263	2,816	0.49	0.61
			SB	4,600	1,721	995	1,953	0.22	0.42
4	South of Lions Club Road	Sulphur Springs Road	NB	400	85	336	472	0.84	1.18
			SB	400	125	158	256	0.40	0.64
		Old Dundas Road	NB	400	296	383	478	0.96	1.20
			SB	400	267	370	421	0.93	1.05
		Wilson Street	NB	1,000	742	847	1,130	0.85	1.13
			SB	1,000	187	153	389	0.15	0.39
		Highway 403	NB	3,600	4,146	3,976	4,790	1.10	1.33
			SB	3,600	2,362	1,806	3,000	0.50	0.83
		Totals	NB	5,400	5,269	5,542	6,870	1.03	1.27
			SB	5,400	2,941	2,487	4,066	0.46	0.75
5	East of Shaver Road	Garner Road	EB	900	289	191	382	0.21	0.42
			WB	900	333	441	708	0.49	0.79
		Wilson Street	EB	2,000	637	323	284	0.16	0.14
			WB	2,000	291	460	640	0.23	0.32
		Highway 403	EB	3,600	1,713	1,544	1,770	0.43	0.49
			WB	3,600	1,550	1,466	1,366	0.41	0.38
		Jerseyville Road	EB	1,000	89	248	122	0.25	0.12
			WB	1,000	89	305	285	0.31	0.29
		Totals	EB	7,500	2,728	2,306	2,558	0.31	0.34
			WB	7,500	2,263	2,672	2,999	0.36	0.40
6	West of Fiddler's	Garner Road	EB	900	429	211	491	0.23	0.55

	Green Road		WB	900	499	373	728	0.41	0.81
		Highway 403	EB	3,600	2,143	1,830	2,110	0.51	0.59
			WB	3,600	1,939	1,839	1,957	0.51	0.54
		Amberly Blvd	EB	400	514	355	356	0.89	0.89
			WB	400	121	39	47	0.10	0.12
		Wilson Street	EB	900	841	471	322	0.52	0.36
			WB	900	581	351	293	0.39	0.33
		Jerseyville Road	EB	700	356	319	258	0.46	0.37
			WB	700	258	220	242	0.31	0.35
		Totals	EB	6,500	4,283	3,186	3,537	0.49	0.54
			WB	6,500	3,398	2,822	3,267	0.43	0.50
7	West of Highway 6	Garner Road	EB	900	563	606	989	0.67	1.10
			WB	900	552	559	1,039	0.62	1.15
		Highway 403	EB	3,600	2,247	2,278	2,489	0.63	0.69
			WB	3,600	2,033	2,030	2,156	0.56	0.60
		Wilson Street	EB	900	835	738	820	0.82	0.91
			WB	900	560	436	499	0.48	0.55
		Sulphur Springs Road	EB	500	343	241	198	0.48	0.40
			WB	500	111	192	214	0.38	0.43
		Totals	EB	5,900	3,988	3,863	4,496	0.65	0.76
			WB	5,900	3,256	3,217	3,908	0.55	0.66
8	West of Southcote Road	Garner Road	EB	900	574	451	1,514	0.50	1.68
			WB	900	471	555	1,087	0.62	1.21
		Highway 403	EB	3,600	2,629	2,945	3,402	0.82	0.95
			WB	3,600	2,379	2,100	3,257	0.58	0.90
		Golf Links Road	EB	500	280	386	512	0.77	1.02
			WB	500	330	329	489	0.66	0.98
		Mohawk Road	EB	700	849	619	799	0.88	1.14
			WB	700	892	742	1,000	1.06	1.43
		Totals	EB	5,700	4,332	4,401	6,227	0.77	1.09
			WB	5,700	4,072	3,726	5,833	0.65	1.02
9	West of Stone Church Road	Garner Road	EB	1,000	461	397	525	0.40	0.53
			WB	1,000	409	541	1,243	0.54	1.24
		Mohawk Road	EB	1,800	958	331	228	0.18	0.13
			WB	1,800	1,077	158	225	0.09	0.13
		Totals	EB	2,800	1,419	728	422	0.26	0.15
			WB	2,800	1,486	699	405	0.25	0.14

Individual Link Congestion
Screenline Congestion

4.3 HTMP Improvements Scenario

Using the "do nothing" scenario as a starting point, proposed HTMP roadway projects were added to the Ancaster model networks, as appropriate, for the 2016, 2021, and 2031 horizon years. These modifications reflect the *Proposed Road Infrastructure Improvements* table outlined in the HTMP.

Table 12 summarizes the HTMP improvements recommended for implementation in Ancaster, as input into the model. The horizon denotes the earliest year a specific improvement was included in the model.

Table 12 – HTMP Planned Infrastructure Improvements (Ancaster Projects)

Road Name	From	To	Description	Horizon[1]
Garner Road	Shaver Road	Fiddler's Green Road	Road Widening and TWLTL	2021
Golf Links Road	McNiven Road	Kitty Murray Lane	TWLTL	2021
Jerseyville Road	Shaver Road	Wilson Street	TWLTL	2021
McNiven Road	Rousseaux Street	Golf Links Road	Road Widening	2016
Mohawk Road	McNiven Road	Highway 403	Road Widening	2016
Scenic Drive	Lavender Drive (South Leg)	Old City Limits	TWLTL	2016
Shaver Road	Wilson Street	Garner Road	TWLTL	2021[2]
Southcote Road	Golf Links Road	Garner Road	Road Widening	2021
Trinity Road	1km S of Wilson St	Highway 403	Road Widening	2031
Wilson Street	Hamilton Drive	Halson Street	Road Widening	2021

Notes:
[1] Denotes the earliest year a specific improvement was included in the model.
[2] Project implemented earlier than HTMP anticipated timing.
TWLTL = Two-Way Left Turn Lane

4.4 Future Horizon Years and Base Scenarios

In the Ancaster transportation demand model, three future horizon years were examined: 2016, 2021, and 2031.

The 2016 and 2021 horizons are interim years in the Ancaster TMP. The primary use of the 2016 and 2021 horizons were to review the impacts of increased population and employment on the existing road network under a "do nothing" scenario and to evaluate the impacts of the HTMP proposed improvements. The 2016 and 2021 horizons were also used in the phasing (i.e. timing) of recommended roadway projects determined in the 2031 horizon.

The 2031 horizon year was primarily used for the testing of various roadway scenarios in the Ancaster area. This was used to compare suggested roadway modification scenarios to the proposed HTMP improvements (used as the base case). The transportation scenario results from the EMME/2 Ancaster model were used with the overall transportation master plan (TMP) evaluation criteria to determine the recommended scenario, as evaluated in the Ancaster TMP report.

The following exhibits represent the auto volumes and volume-to-capacity (v/c) ratios for the 2016, 2021, and 2031 horizons:

- **Exhibits 1 to 2** – 2016 "Do Nothing" Scenario
- **Exhibits 3 to 4** – 2016 HTMP Improvements Scenario
- **Exhibits 5 to 6** – 2021 "Do Nothing" Scenario
- **Exhibits 7 to 8** – 2021 HTMP Improvements Scenario
- **Exhibits 9 to 10** – 2031 "Do Nothing" Scenario
- **Exhibits 11 to 12** – 2031 HTMP Improvements Scenario

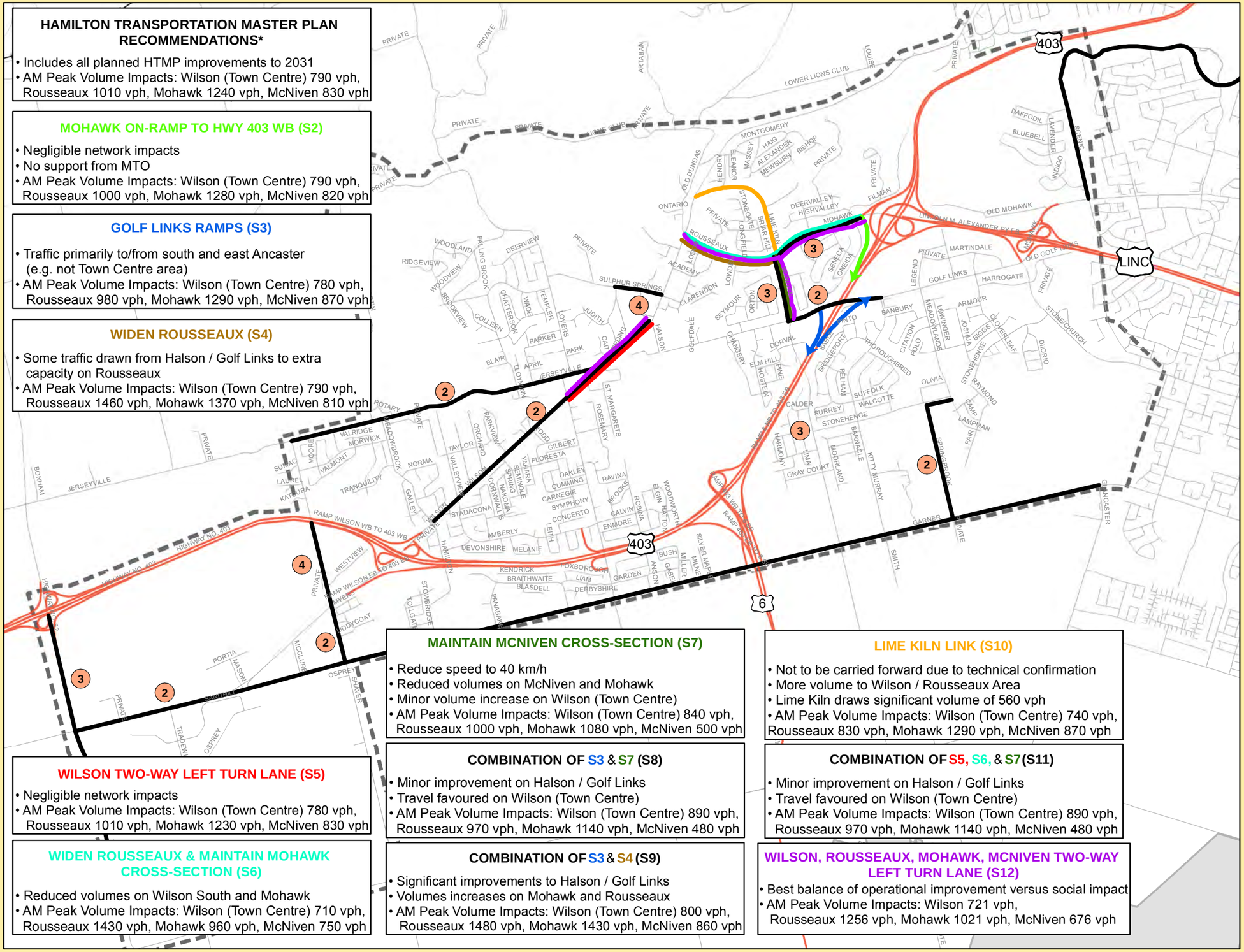
Note: Exhibits are located at the end of this document.

4.5 2031 Scenario Testing

Various scenarios were tested in the 2031 horizon Ancaster model to examine proposed network capacity and access improvements. The results of each scenario can then be analyzed compared to the base 2031 conditions (i.e. HTMP Improvements Scenario) to determine the impact of each proposed roadway improvement. Modifications to the roadway network for each scenario are listed in **Table 13** below and shown in **Figure 8**.

Table 13 – 2031 Scenario Descriptions

Scenario Name	Description
"Do Nothing" (S0)	• No improvements. Same roadway network as 2006 Base Year.
HTMP Improvements (S1)	• Added the proposed HTMP improvements as outlined in Table 12.
Mohawk On-Ramp to Hwy 403 WB (S2)	• Re-establish an on-ramp from EB Mohawk Road to WB Highway 403.
Golf Links Ramps (S3)	• Add off-ramp from Highway 403 EB to Golf Links Road. • Add on-ramp from Golf Links Road to Highway 403 WB.
Widen Rousseaux (S4)	• Widening to four-lane cross section between Wilson Street and McNiven Road.
Wilson Two-Way Left Turn Lane (S5)	• Three-lane cross section, including two-way left turn lane, between Fiddler's Green Road and Halson Street.
Widen Rousseaux and Maintain Mohawk Cross-Section (S6)	• Widen Rousseaux (same as S4) and maintain current two-lane cross section on Mohawk (no HTMP improvement) between McNiven Road and Highway 403.
Maintain McNiven Cross-Section (S7)	• Maintain existing two-lane cross section (no HTMP improvement) between Mohawk Road and Golf Links Road.
Combination of S3 & S7 (S8)	• Combination of roadway improvements listed in S3 and S7.
Combination of S3 & S4 (S9)	• Combination of roadway improvements listed in S3 and S7.
Lime Kiln Link (S10)	• Two-lane extension of Lime Kiln Road north of Mohawk Road to Wilson Street.
Combination of S5, S6, & S7 (S11)	• Combination of roadway improvements listed in S5, S6, and S7.
Wilson, Rousseaux, Mohawk, and McNiven Two-Way Left Turn Lane (S12)	• Three-lane cross-sections with two-way left turn lanes on selected links: o Wilson Street between Fiddler's Green Road and Halson Street. o Rousseaux Street / Mohawk Road between Wilson Street and Highway 403. o McNiven Road between Mohawk Road and Golf Links Road.



HAMILTON TRANSPORTATION MASTER PLAN RECOMMENDATIONS*

- Includes all planned HTMP improvements to 2031
- AM Peak Volume Impacts: Wilson (Town Centre) 790 vph, Rousseaux 1010 vph, Mohawk 1240 vph, McNiven 830 vph

MOHAWK ON-RAMP TO HWY 403 WB (S2)

- Negligible network impacts
- No support from MTO
- AM Peak Volume Impacts: Wilson (Town Centre) 790 vph, Rousseaux 1000 vph, Mohawk 1280 vph, McNiven 820 vph

GOLF LINKS RAMPS (S3)

- Traffic primarily to/from south and east Ancaster (e.g. not Town Centre area)
- AM Peak Volume Impacts: Wilson (Town Centre) 780 vph, Rousseaux 980 vph, Mohawk 1290 vph, McNiven 870 vph

WIDEN ROUSSEAUX (S4)

- Some traffic drawn from Halson / Golf Links to extra capacity on Rousseaux
- AM Peak Volume Impacts: Wilson (Town Centre) 790 vph, Rousseaux 1460 vph, Mohawk 1370 vph, McNiven 810 vph

MAINTAIN MCNIVEN CROSS-SECTION (S7)

- Reduce speed to 40 km/h
- Reduced volumes on McNiven and Mohawk
- Minor volume increase on Wilson (Town Centre)
- AM Peak Volume Impacts: Wilson (Town Centre) 840 vph, Rousseaux 1000 vph, Mohawk 1080 vph, McNiven 500 vph

LIME KILN LINK (S10)

- Not to be carried forward due to technical confirmation
- More volume to Wilson / Rousseaux Area
- Lime Kiln draws significant volume of 560 vph
- AM Peak Volume Impacts: Wilson (Town Centre) 740 vph, Rousseaux 830 vph, Mohawk 1290 vph, McNiven 870 vph

WILSON TWO-WAY LEFT TURN LANE (S5)

- Negligible network impacts
- AM Peak Volume Impacts: Wilson (Town Centre) 780 vph, Rousseaux 1010 vph, Mohawk 1230 vph, McNiven 830 vph

COMBINATION OF S3 & S7 (S8)

- Minor improvement on Halson / Golf Links
- Travel favoured on Wilson (Town Centre)
- AM Peak Volume Impacts: Wilson (Town Centre) 890 vph, Rousseaux 970 vph, Mohawk 1140 vph, McNiven 480 vph

COMBINATION OF S5, S6, & S7 (S11)

- Minor improvement on Halson / Golf Links
- Travel favoured on Wilson (Town Centre)
- AM Peak Volume Impacts: Wilson (Town Centre) 890 vph, Rousseaux 970 vph, Mohawk 1140 vph, McNiven 480 vph

WIDEN ROUSSEAUX & MAINTAIN MOHAWK CROSS-SECTION (S6)

- Reduced volumes on Wilson South and Mohawk
- AM Peak Volume Impacts: Wilson (Town Centre) 710 vph, Rousseaux 1430 vph, Mohawk 960 vph, McNiven 750 vph

COMBINATION OF S3 & S4 (S9)

- Significant improvements to Halson / Golf Links
- Volumes increases on Mohawk and Rousseaux
- AM Peak Volume Impacts: Wilson (Town Centre) 800 vph, Rousseaux 1480 vph, Mohawk 1430 vph, McNiven 860 vph

WILSON, ROUSSEAUX, MOHAWK, MCNIVEN TWO-WAY LEFT TURN LANE (S12)

- Best balance of operational improvement versus social impact
- AM Peak Volume Impacts: Wilson 721 vph, Rousseaux 1256 vph, Mohawk 1021 vph, McNiven 676 vph

Hamilton

Ancaster Transportation Master Plan

Figure 8

2031 Scenario Map

Legend

- Highway
- Existing Road Network
- Ancaster Study Area

Hamilton Transportation Master Plan Improvements (May 2007)

- 2 Two-Way Left Turn Lane
- 3 Road Widening
- 4 Conversion to Urban Cross-Section

*HTMP recommendations are shown as they relate to a number of scenarios.

Note:
Scenario 1-Do Nothing was not included as it represents the existing roadway network conditions

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DILLON CONSULTING

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4.5.1 EMME/2 2031 Ancaster Result Plots

For each scenario defined in **Table 13**, the EMME/2 network was modified to reflect the change and an assignment run completed to determine the impacts on the network.

The following result plots have been produced for each scenario run in EMME/2:

- **Exhibits 13 to 15** – Mohawk On-Ramp to Hwy 403 WB (S2) volume, select link, and v/c plots.
- **Exhibits 16 to 18** – Golf Links Ramps (S3) volume, select link, and v/c plots.
- **Exhibits 19 to 21** – Widen Rousseaux (S4) volume, select link, and v/c plots.
- **Exhibits 22 to 23** – Wilson Two-Way Left Turn Lane (S5) volume and v/c plots.
- **Exhibits 24 to 25** – Widen Rousseaux and Maintain Mohawk Cross-Section (S6) volume and v/c plots.
- **Exhibits 26 to 27** – Maintain McNiven Cross-Section (S7) volume and v/c plots.
- **Exhibits 28 to 29** – Combination of S3 and S7 (S8) volume and v/c plots.
- **Exhibits 30 to 31** – Combination of S3 and S4 (S9) volume and v/c plots.
- **Exhibits 32 to 34** – Lime Kiln Link (S10) volume, select link, and v/c plots.
- **Exhibits 35 to 36** – Combination of S5, S6, and S7 (S11) volume and v/c plots.
- **Exhibits 37 to 38** – Wilson, Rousseaux, Mohawk, and McNiven Two-Way Left Turn Lane (S12) volume and v/c plots.

Note: Exhibits are located at the end of this document.

4.5.2 EMME/2 2031 Ancaster Corridor Impacts

In order to compare and contrast the Ancaster model results between the various scenarios tested in EMME/2, a summary sheet was created in **Table 14**. This table identifies key corridors and examines the peak direction roadway link volumes, change in volume compared to the base HTMP Improvements (S0) scenario, and the volume-to-capacity (v/c) ratio experienced.

Table 14 – 2031 Corridor Impacts

Corridor Name	Wilson Street												Rousseaux Street / Mohawk Road						McNiven Road			Golf Links Road			Fiddler's Green Road		
Cross-Street Extents	Highway 403 to Fiddler's Green Road			Fiddler's Green Road to Halson Street			Halson Street to Rousseaux Street			Rousseaux Street to Montgomery Drive			Wilson Street to McNiven Road			McNiven Road to Highway 403			Mohawk Road to Golf Links Road			Halson Street to McNiven Road			Wilson Street to Highway 403		
Scenario Descriptions	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C	Volume[1]	Volume Change[2]	V/C
"Do Nothing" Conditions (S0)	370	-	0.41	820	-	0.91	760	-	0.84	1,510	-	1.67	1,000	-	1.40	910	-	1.01	580	-	0.82	530	-	1.06	750	-	1.07
Hamilton Transportation Master Plan (HTMP) Improvements (S1)	380	-	0.23	890	-	0.49	790	-	0.87	1,530	-	1.70	1,010	-	1.41	1,240	-	0.69	840	-	0.60	530	-	1.06	730	-	1.04
Mohawk On-Ramp to Highway 403 WB (S2)	370	-10	0.31	880	-10	0.49	790	0	0.88	1,520	-10	1.68	1,000	-10	1.38	1,280	40	0.71	830	-10	0.59	530	0	1.06	730	0	1.04
Golf Links Ramps (S3)	380	0	0.28	840	-50	0.47	780	-10	0.87	1,530	0	1.69	990	-20	1.35	1,300	60	0.72	870	30	0.62	510	-20	1.02	730	0	1.04
Widen Rousseaux Street (S4)	400	20	0.32	770	-120	0.42	790	0	0.87	1,610	80	1.78	1,460	450	1.04	1,370	130	0.76	810	-30	0.56	450	-80	0.89	680	-50	0.97
Wilson Two-Way Left Turn Lane (S5)	370	-10	0.32	870	-20	0.64	790	0	0.87	1,530	0	1.69	1,010	0	1.41	1,240	0	0.69	840	0	0.59	530	0	1.05	740	10	1.04
Widen Rousseaux Street and Maintain Mohawk Cross-Section (S6)	380	0	0.34	750	-140	0.41	710	-80	0.78	1,600	70	1.78	1,440	430	1.01	970	-270	1.07	750	-90	0.53	480	-50	0.95	690	-40	0.98
Maintain McNiven Cross-Section (S7)	380	0	0.33	870	-20	0.48	850	60	0.93	1,520	-10	1.68	1,000	-10	1.39	1,080	-160	0.60	500	-340	0.71	520	-10	1.04	750	20	1.06
Combine S3 & S7 (S8)	370	-10	0.30	740	-150	0.41	900	110	0.99	1,530	0	1.69	980	-30	1.34	1,150	-90	0.63	490	-350	0.69	510	-20	1.01	750	20	1.07
Combine S3 & S4 (S9)	410	30	0.25	760	-130	0.42	810	20	0.89	1,620	90	1.79	1,480	470	1.03	1,440	200	0.80	870	30	0.62	420	-110	0.84	690	-40	0.98
Lime Kiln Link (S10)	370	-10	0.35	780	-110	0.43	740	-50	0.82	1,660	130	1.84	840	-170	1.16	1,300	60	0.72	870	30	0.60	490	-40	0.97	690	-40	0.98
Combine S5, S6, & S7 (S11)	370	-10	0.35	750	-140	0.55	740	-50	0.82	1,590	60	1.76	1,360	350	0.97	950	-290	1.05	570	-270	0.76	480	-50	0.95	690	-40	0.98
Wilson, Rousseaux, Mohawk, and McNiven Two-Way Left Turn Lane (S12)	370	-10	0.33	780	-110	0.57	730	-60	0.78	1,570	40	1.74	1,260	250	1.17	1,030	-210	0.97	680	-160	0.64	490	-40	0.97	690	-40	0.98

Notes:

[1] Represents highest peak direction link volume on corridor; Rounded up to nearest 10 vph

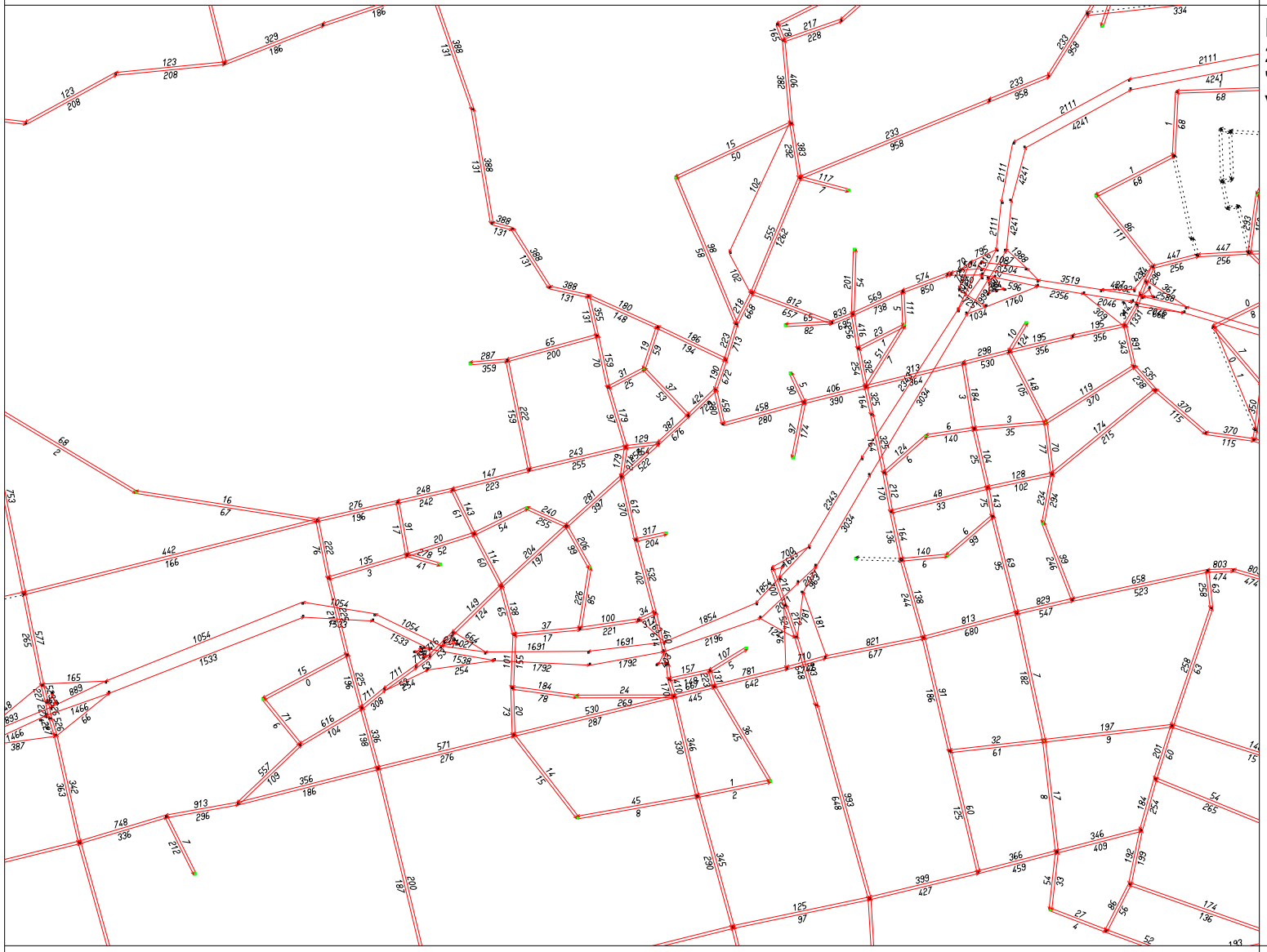
[2] Volume change compared to HTMP Improvements (S1)

EXHIBITS

AUTO VOLUMES

emme/2

Exhibit 1:
2016
"Do Nothing"
Volumes



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BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

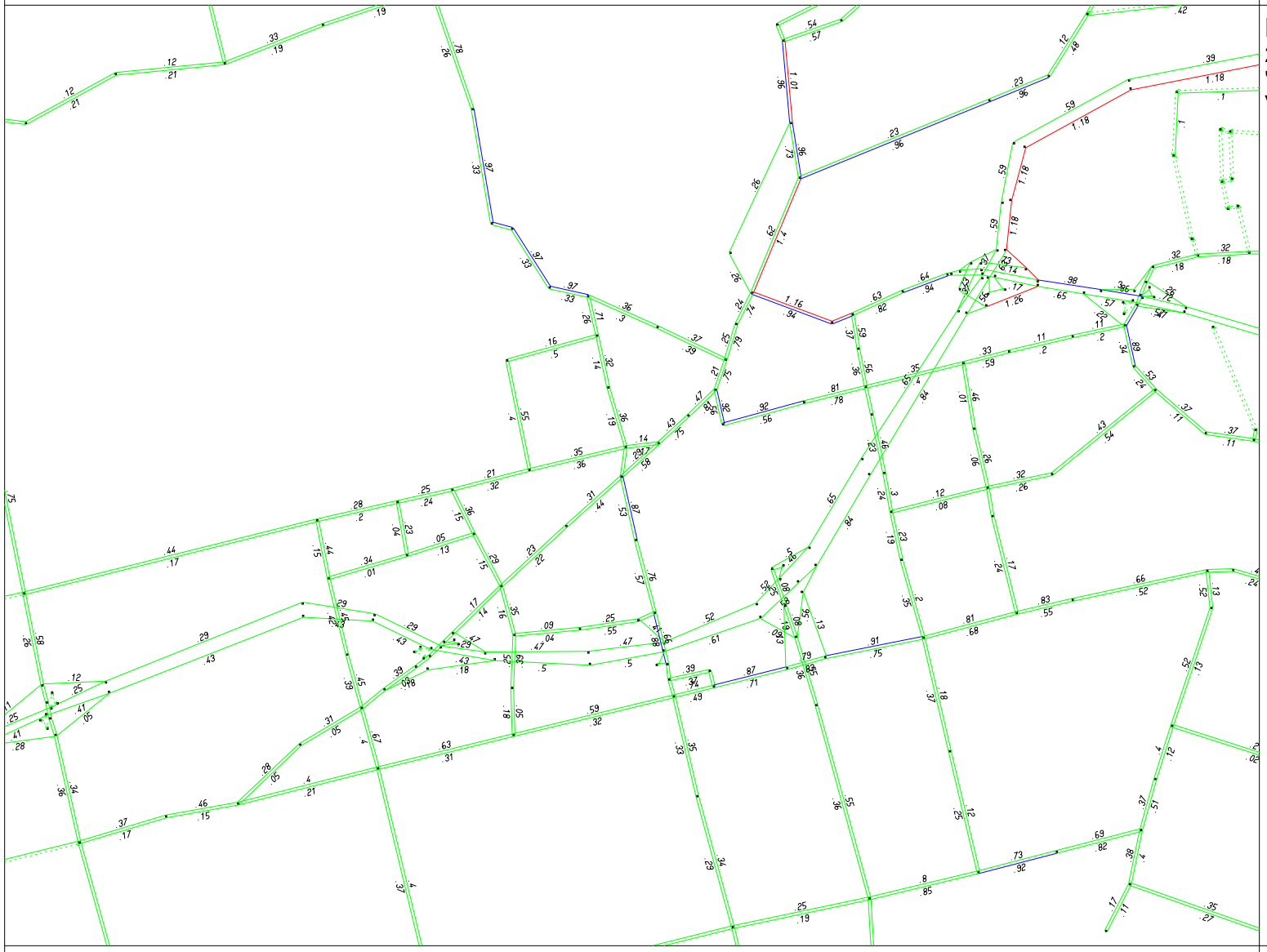

Exhibit 2:
2016
"Do Nothing"
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AUTO VOLUMES

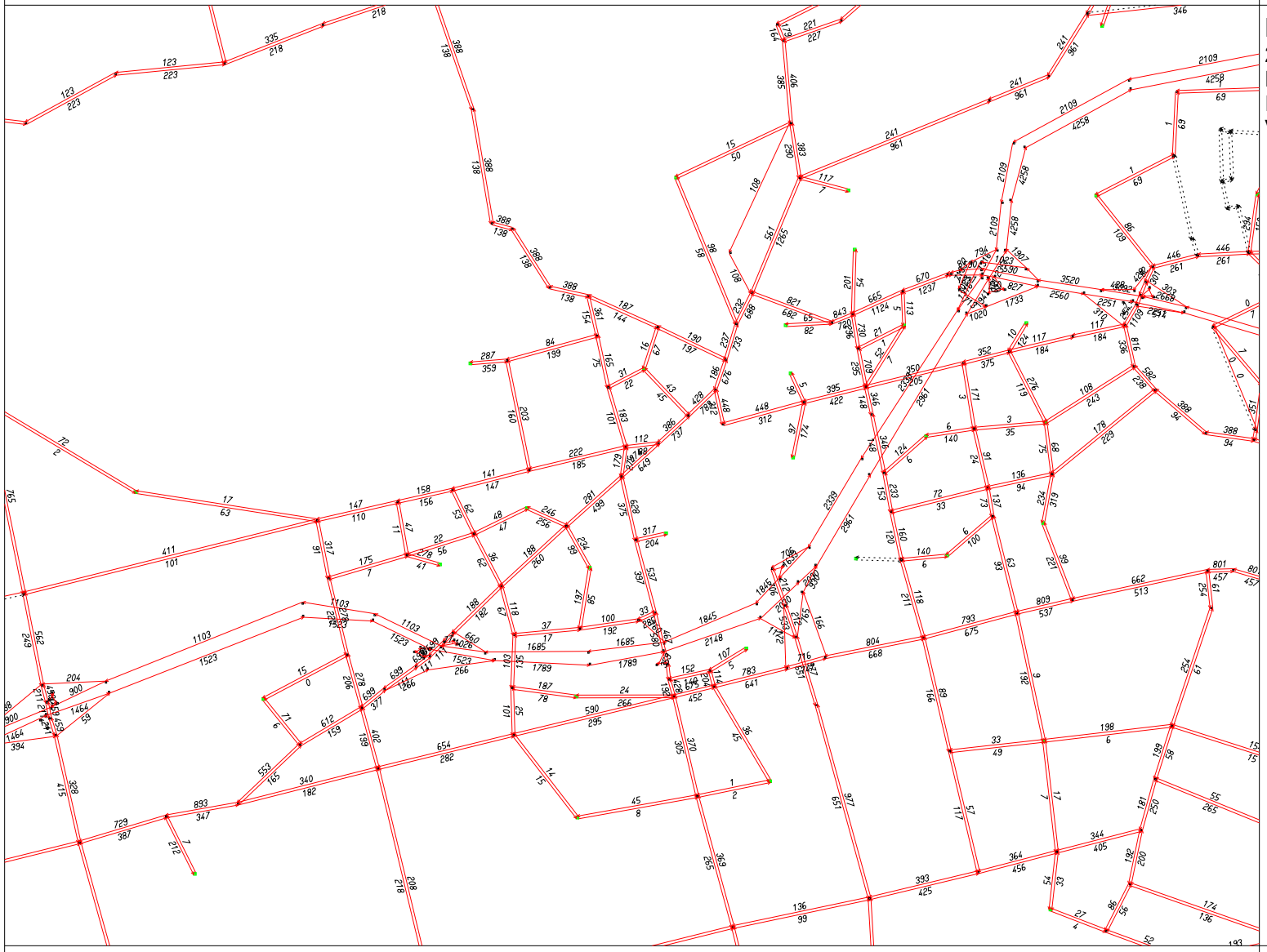

Exhibit 3:
2016
HTMP
Improvements
Volumes

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BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

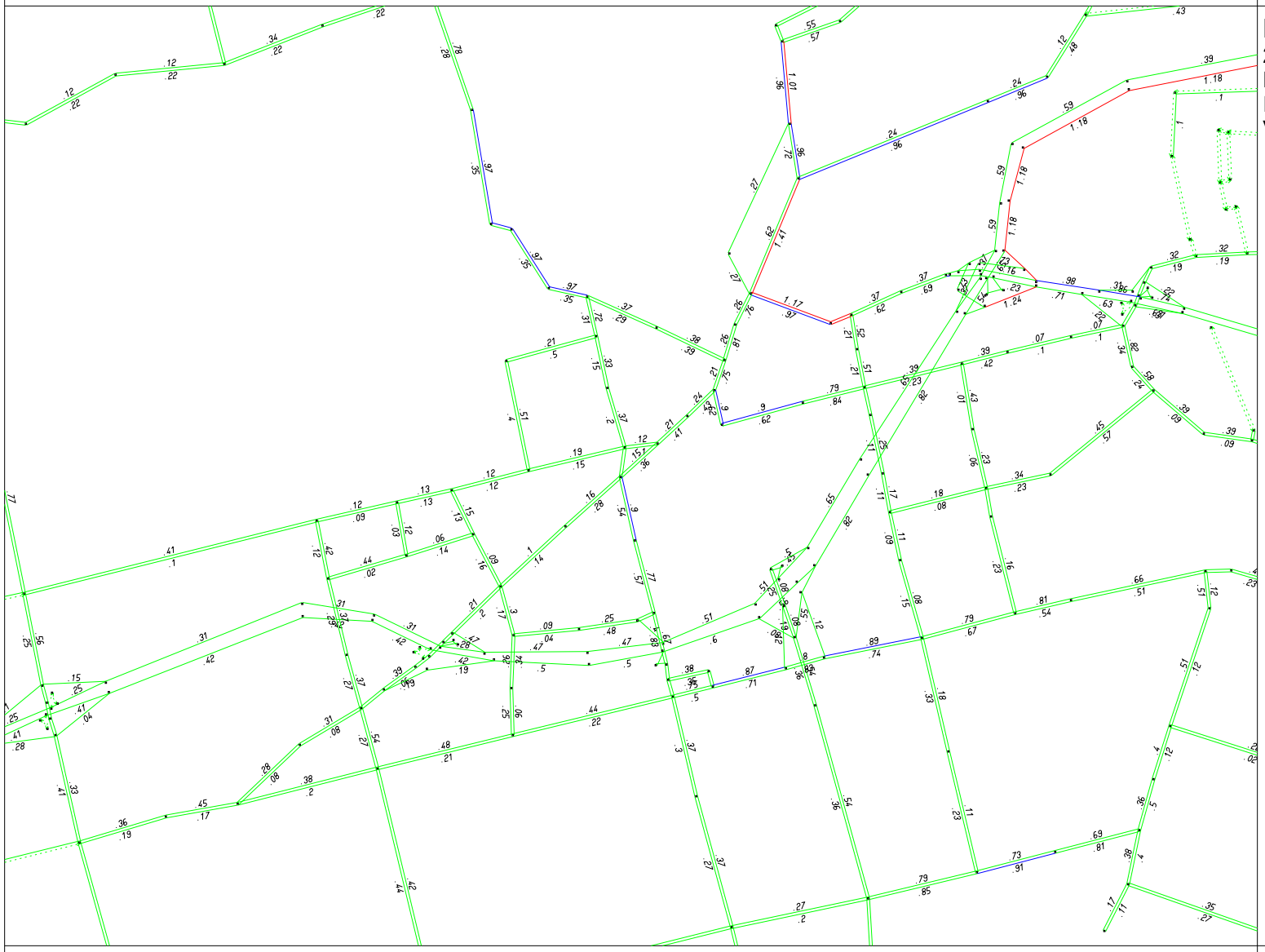

Exhibit 4:
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HTMP
Improvements
V/C

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AUTO VOLUMES

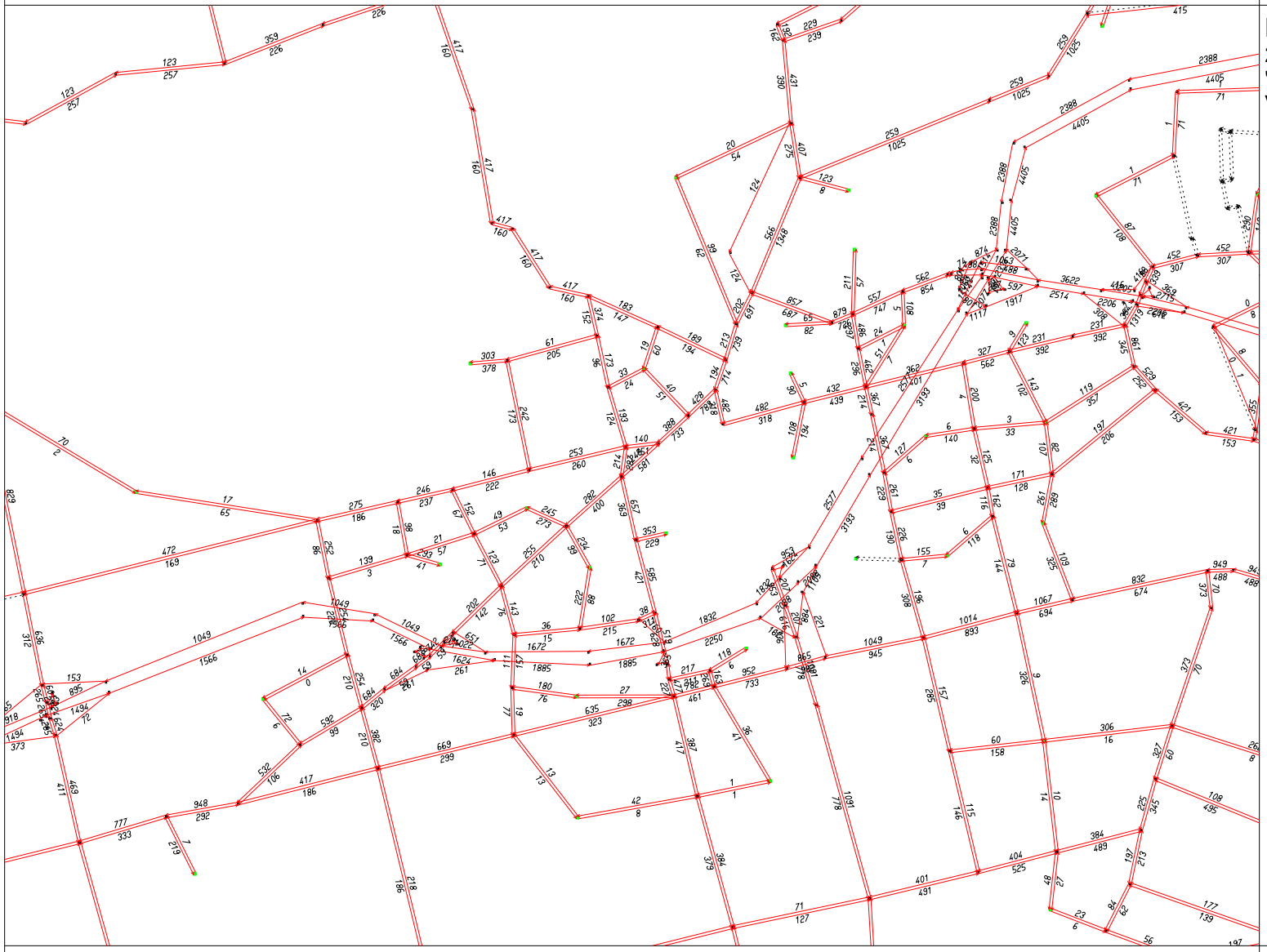

Exhibit 5:
2021
"Do Nothing"
Volumes

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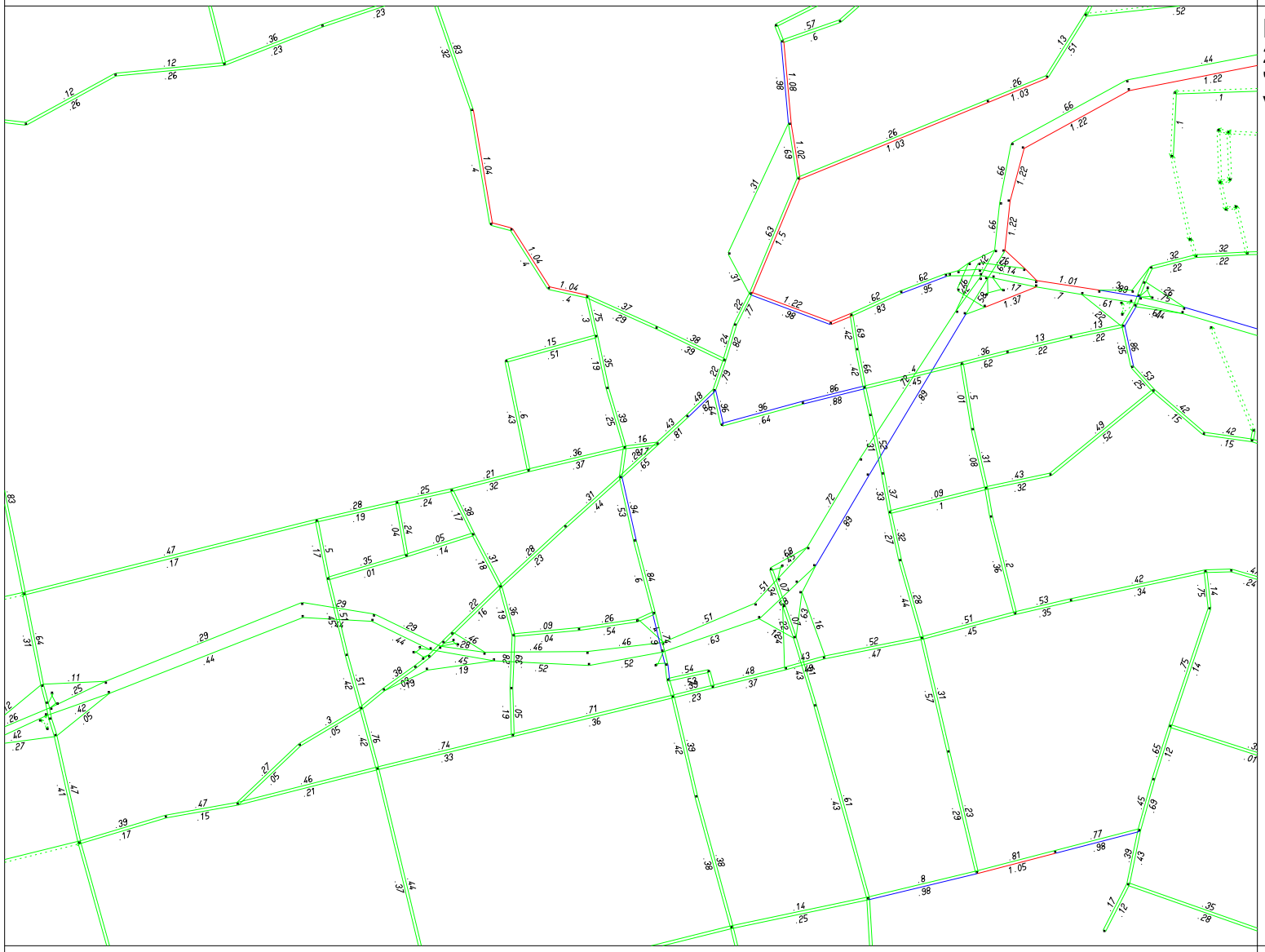
BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 6:
2021
"Do Nothing"
V/C



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AUTO VOLUMES

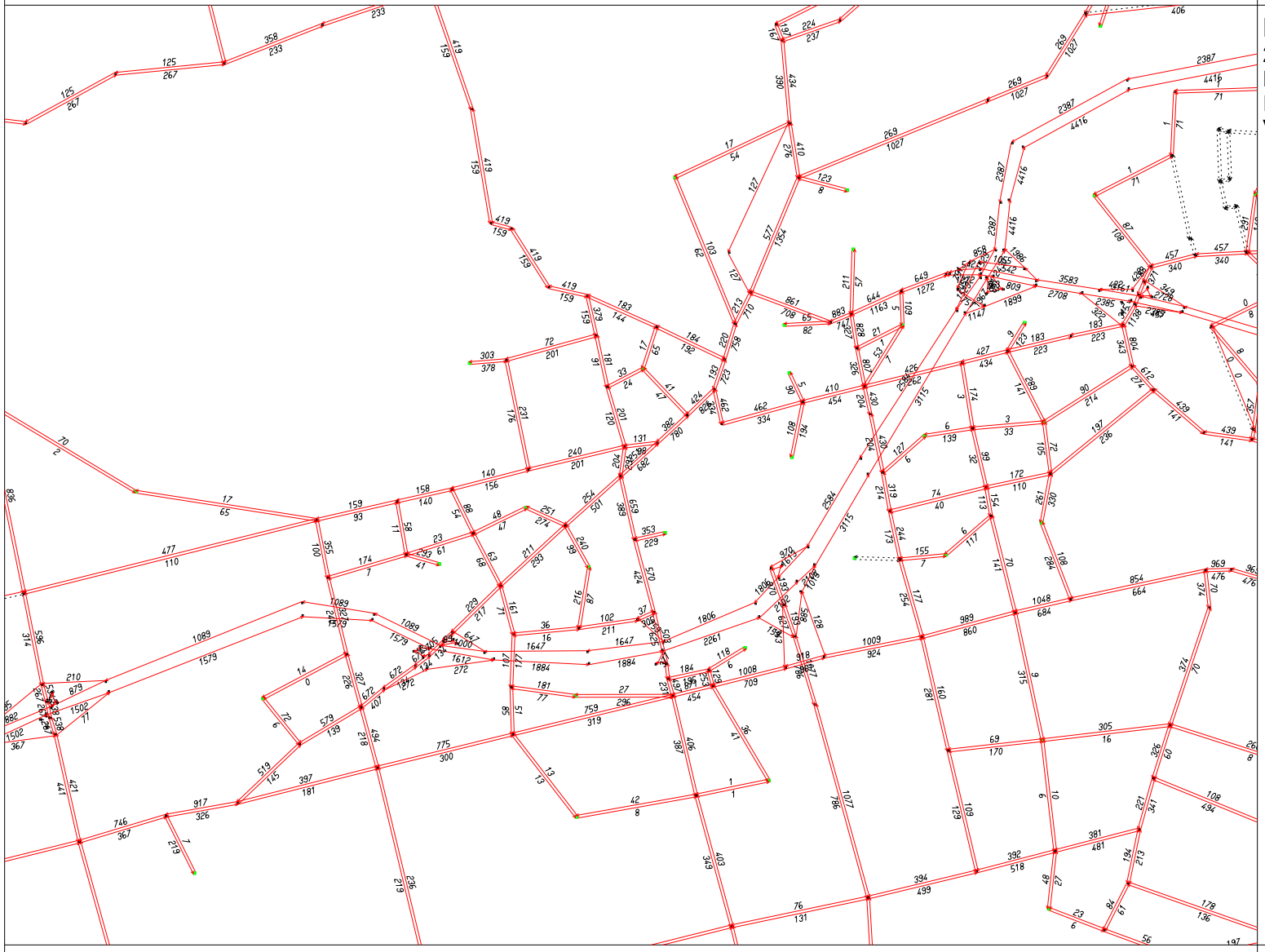

Exhibit 7:
2021
HTMP
Improvements
Volumes

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BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

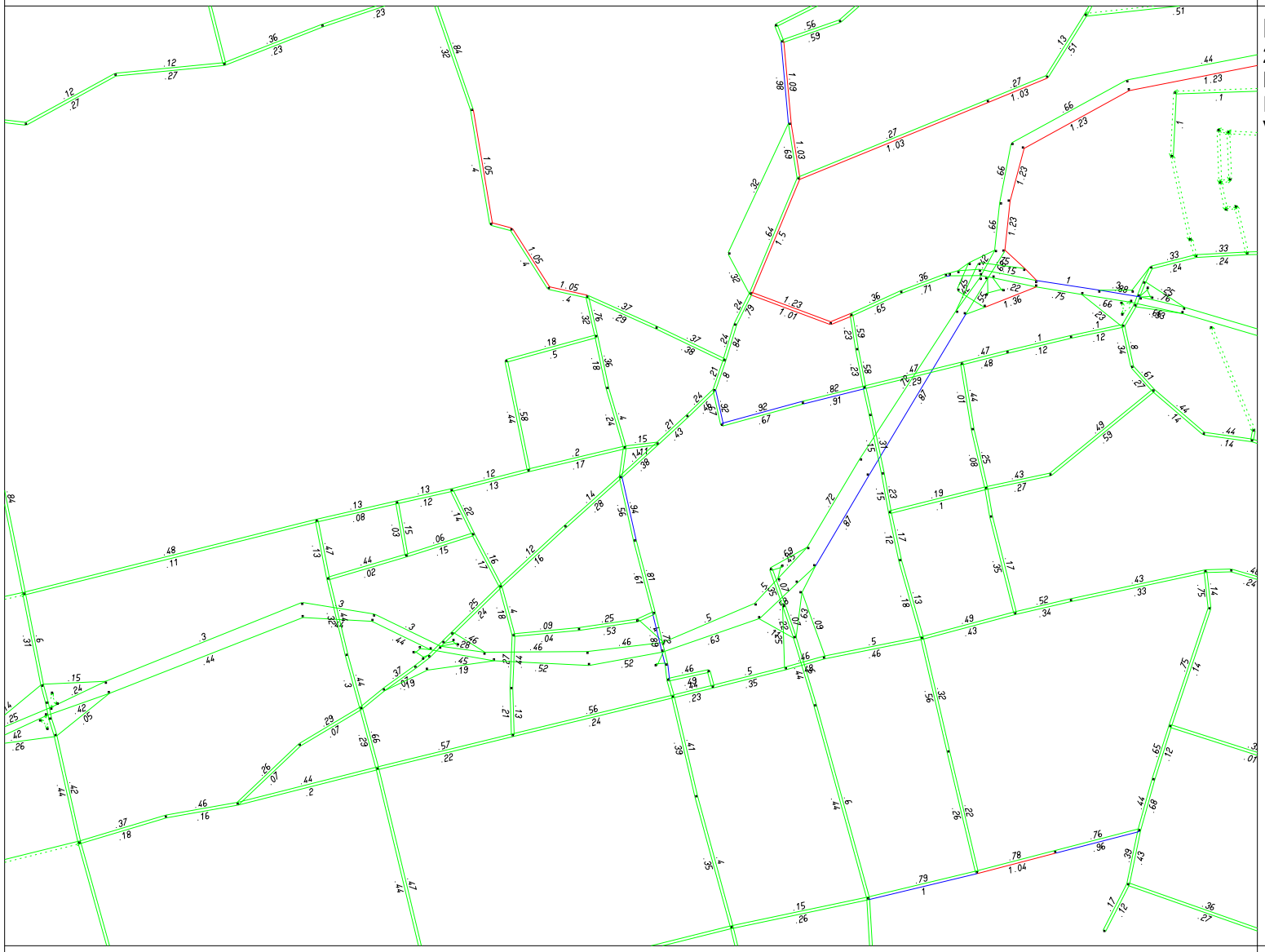

Exhibit 8:
2021
HTMP
Improvements
V/C

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AUTO VOLUMES

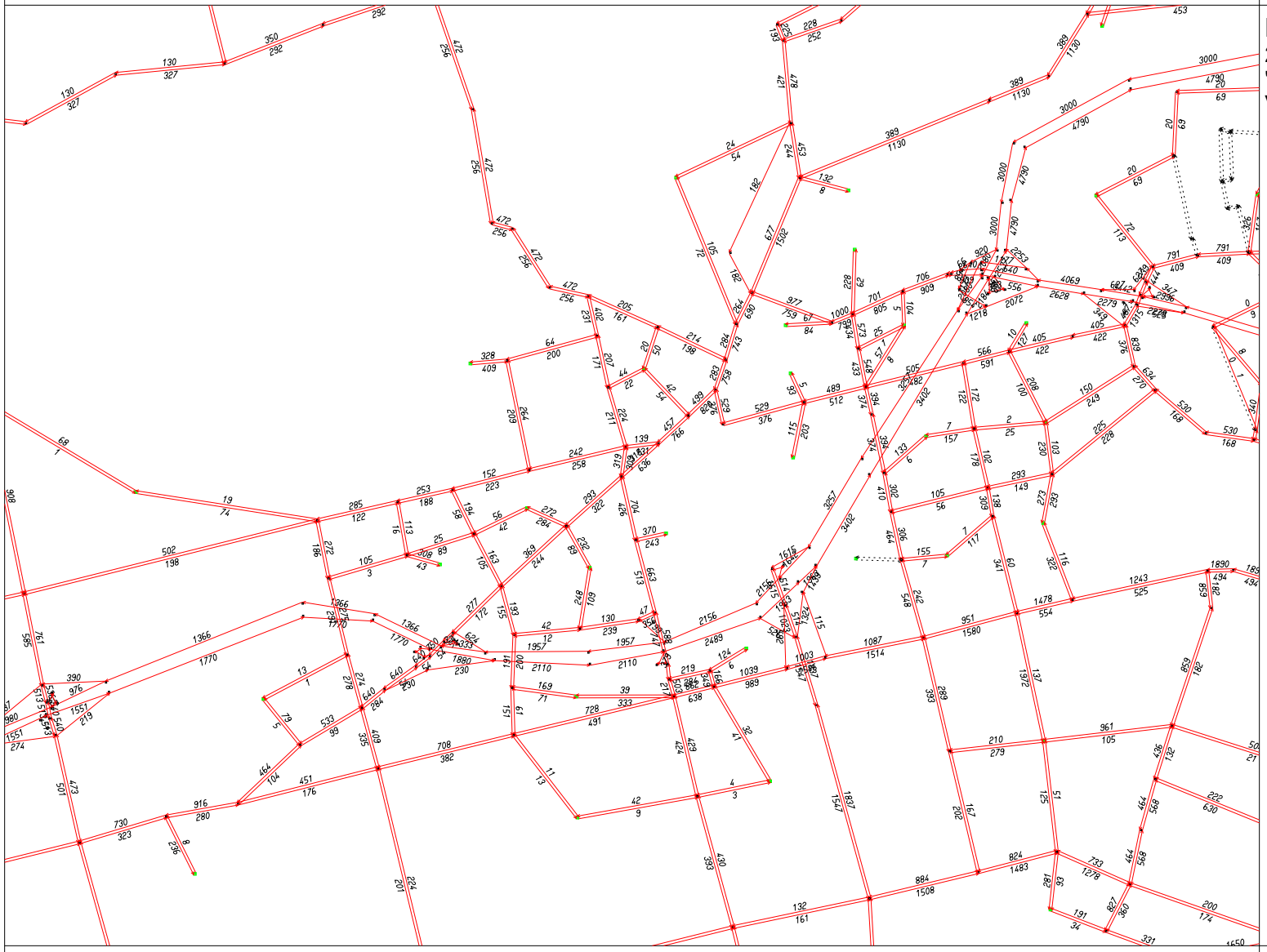

Exhibit 9:
2031
"Do Nothing"
Volumes

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BASE NETWORK

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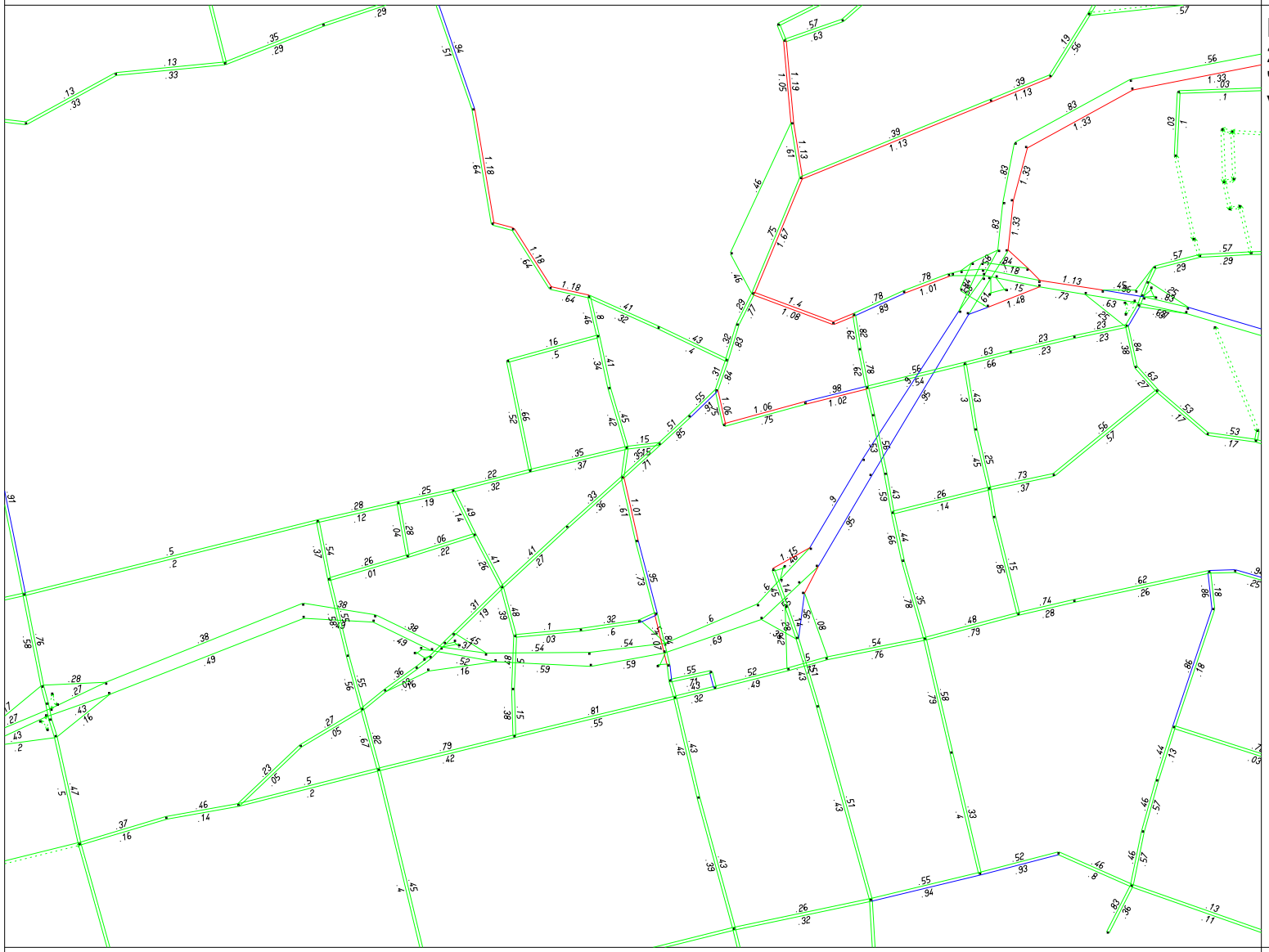

Exhibit 10:
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"Do Nothing"
V/C

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AUTO VOLUMES

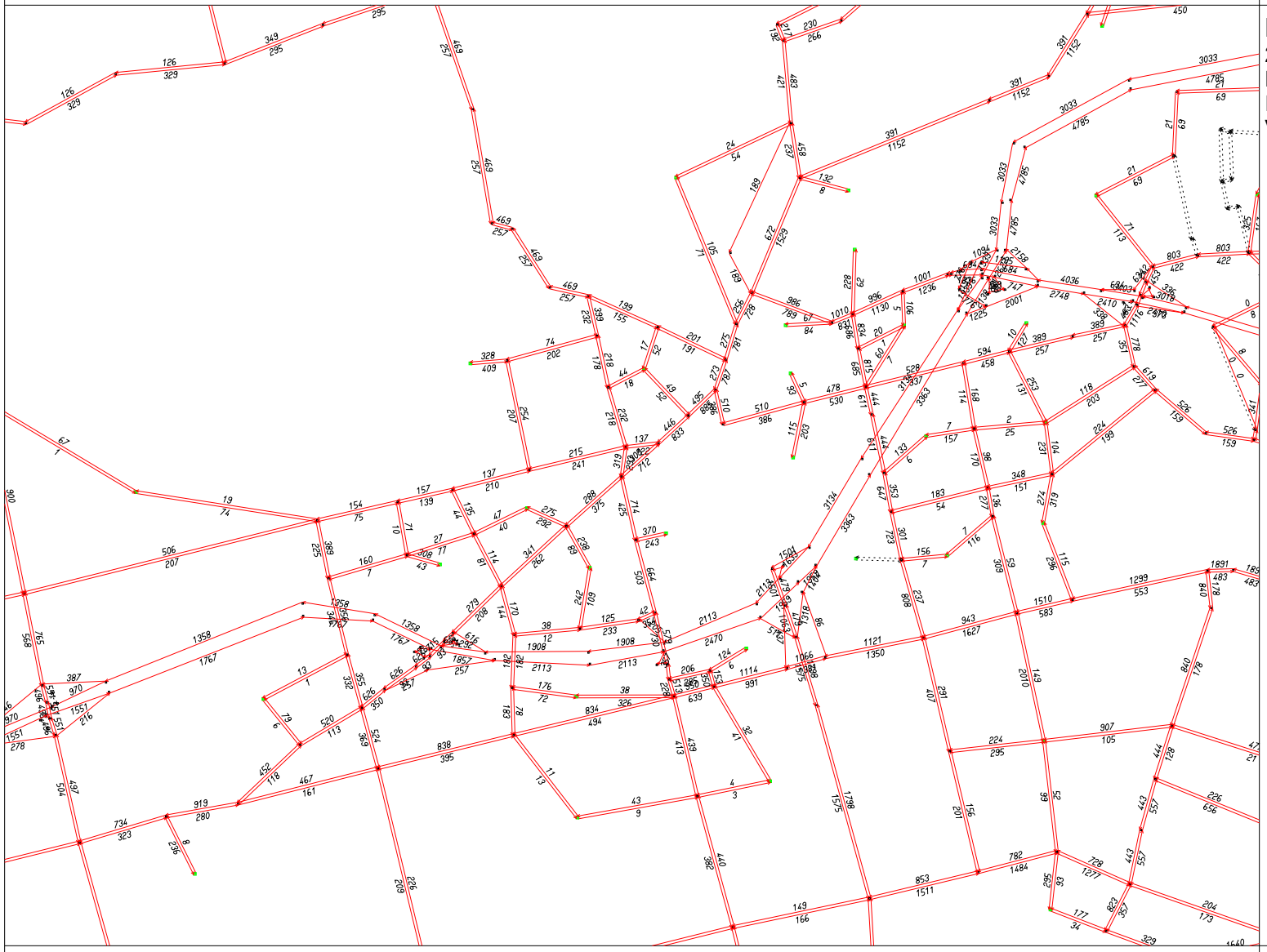

Exhibit 11:
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HTMP
Improvements
Volumes

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BASE NETWORK

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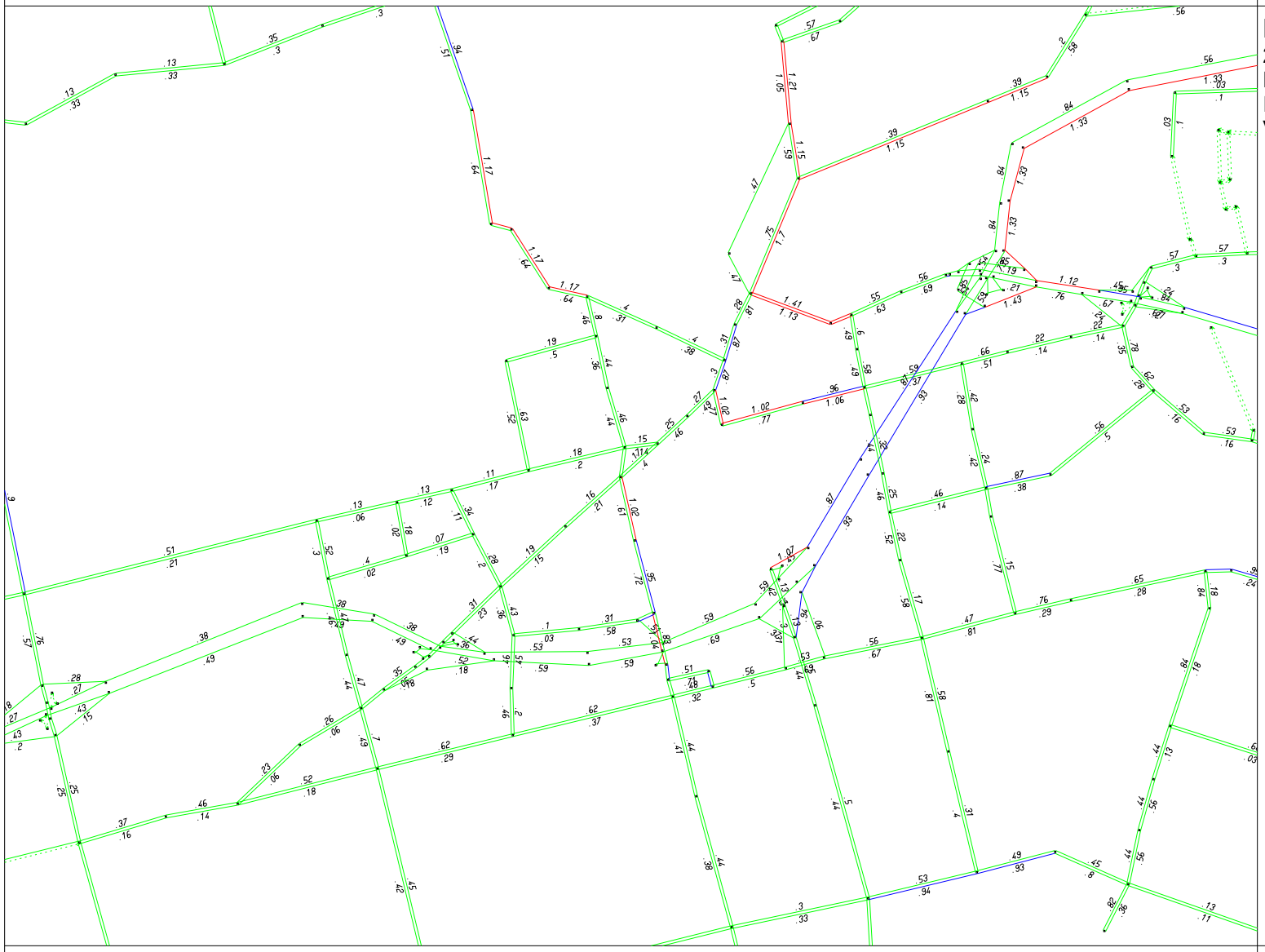


Exhibit 12:
2031
HTMP
Improvements
V/C

10-08-16 08:47
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

emme/2

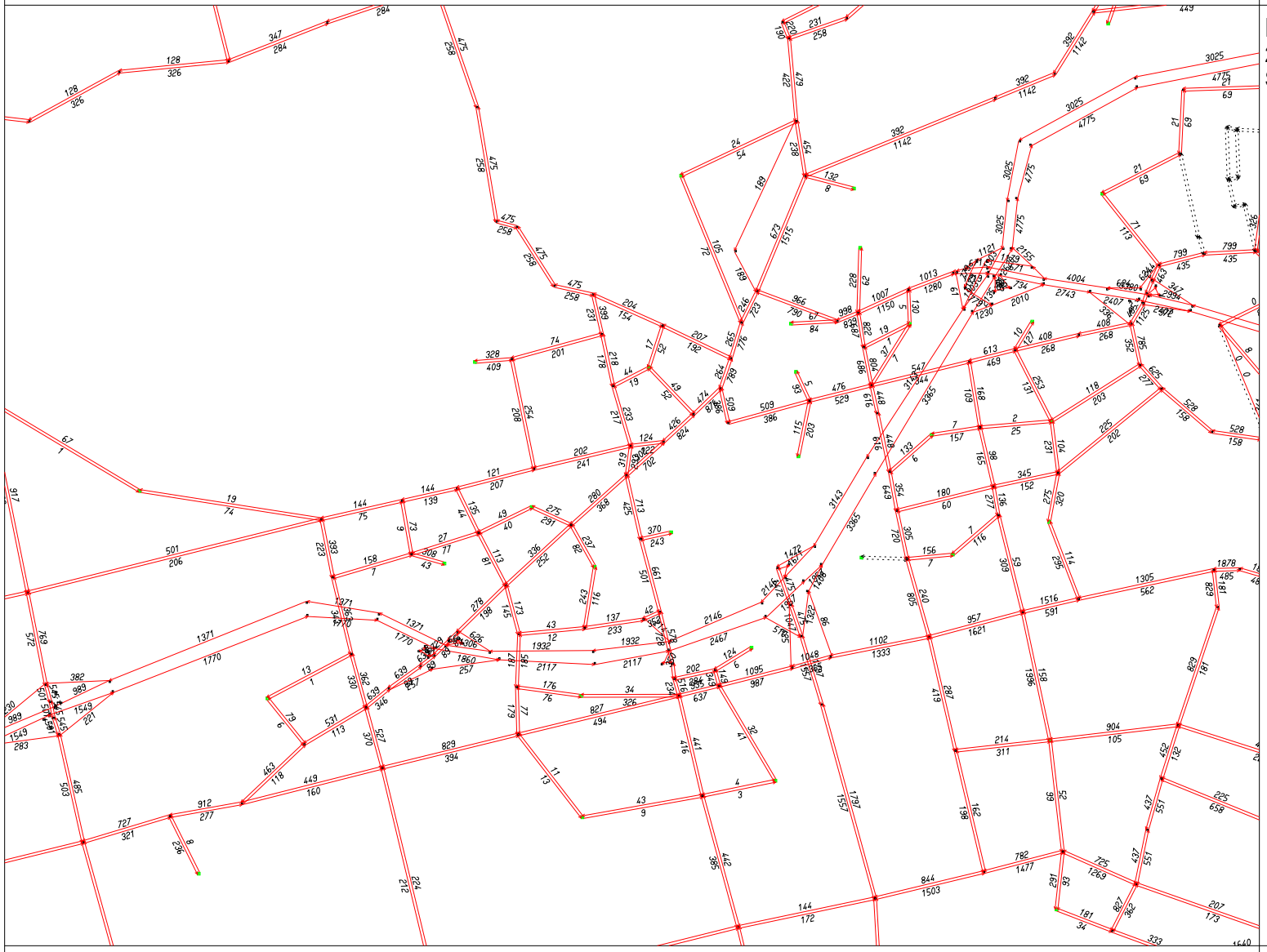


Exhibit 13:
2031
S2 Volumes

10-08-16 09:18
MODULE: 6.12
DMG.UTYU...jdk

ADDITIONAL VOLUMES ON AUTO NETWORK

emme/2

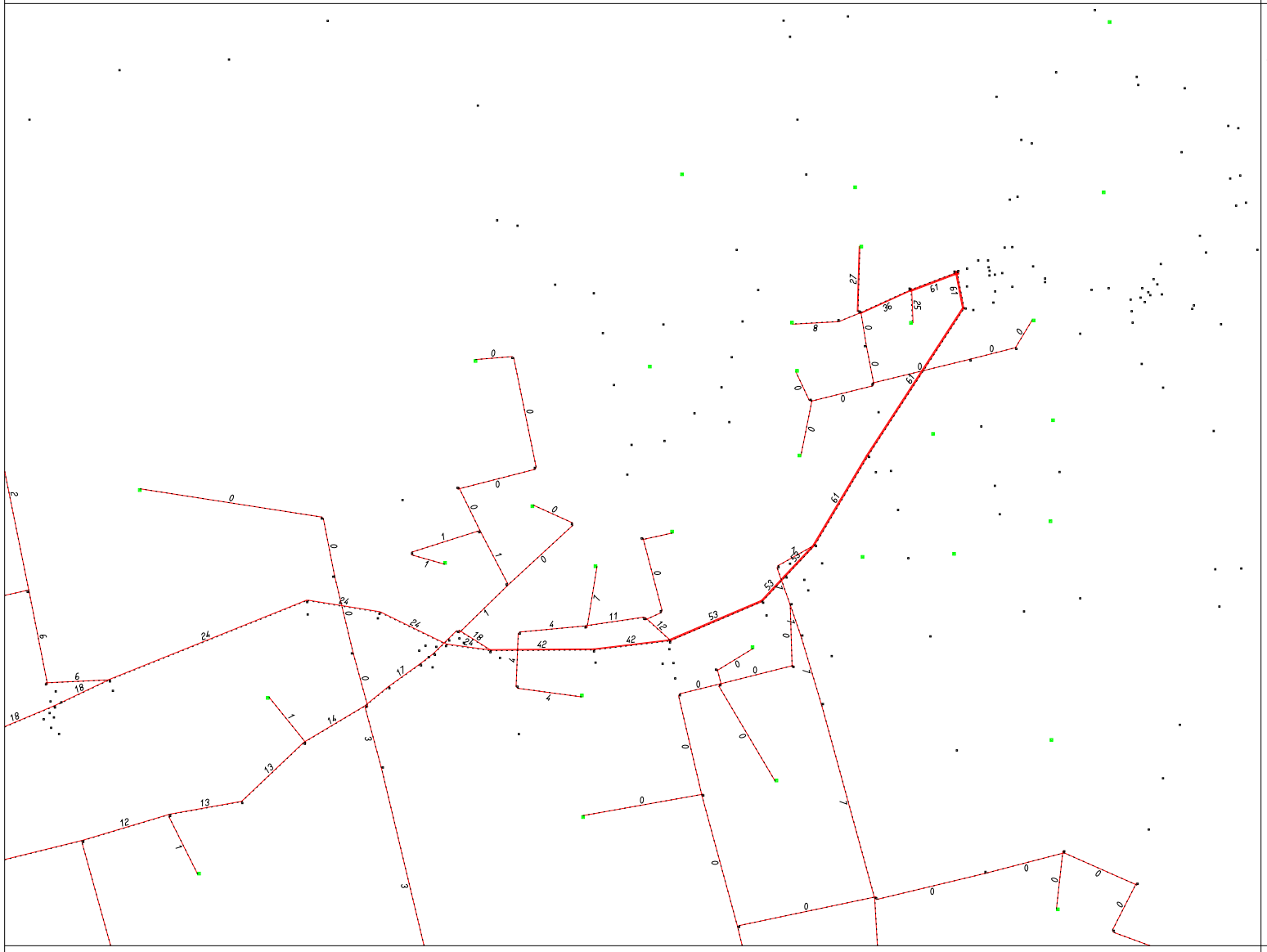


Exhibit 14:
2031
S2 Select Link

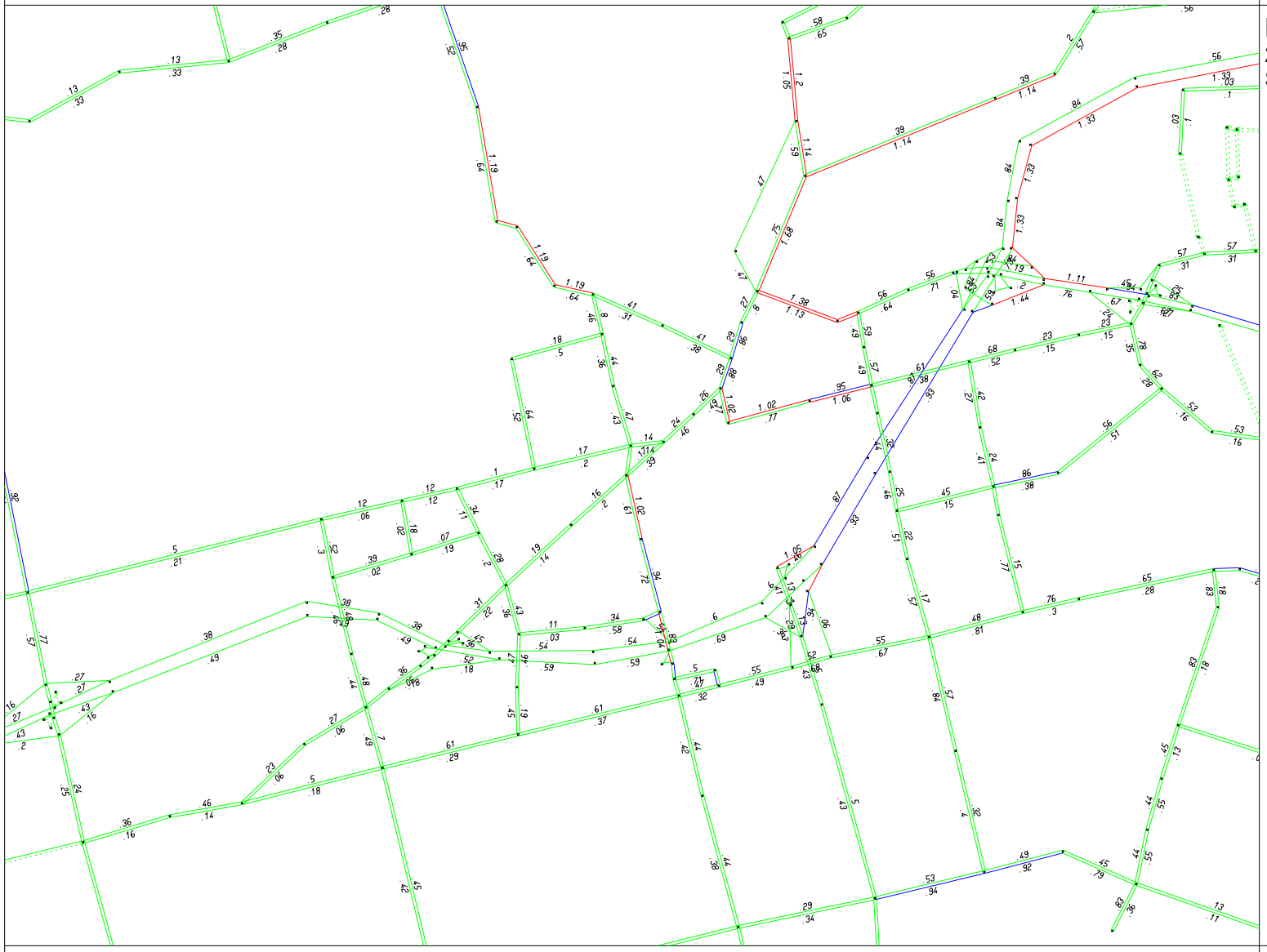
10-08-16 09:20
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 15:
2031
S2 V/C



10-08-16 09:21
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

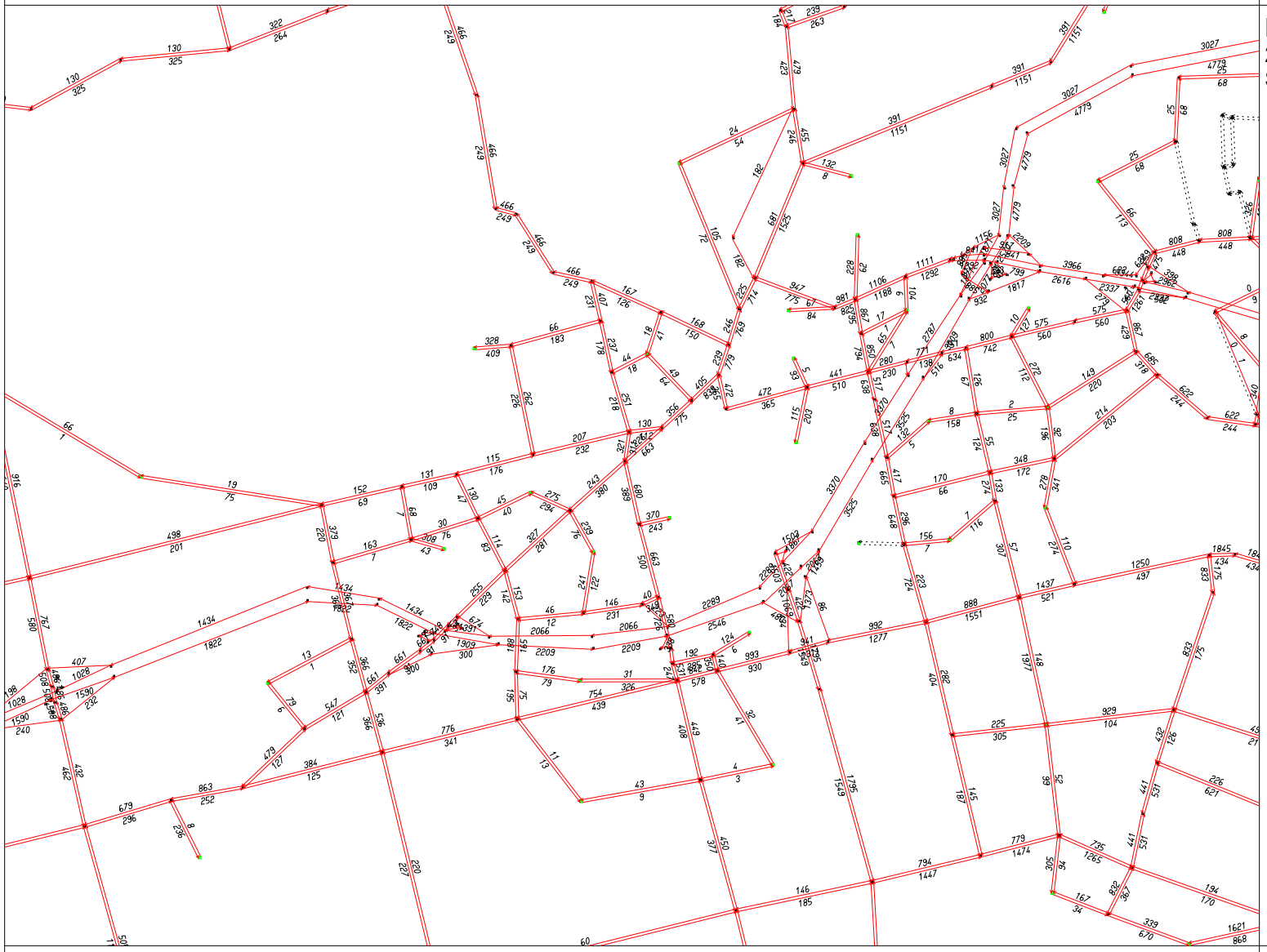


Exhibit 16:
2031
S3 Volumes

10-08-16 09:45
MODULE: 6.12
DMG.UTYU...jdk

ADDITIONAL VOLUMES ON AUTO NETWORK

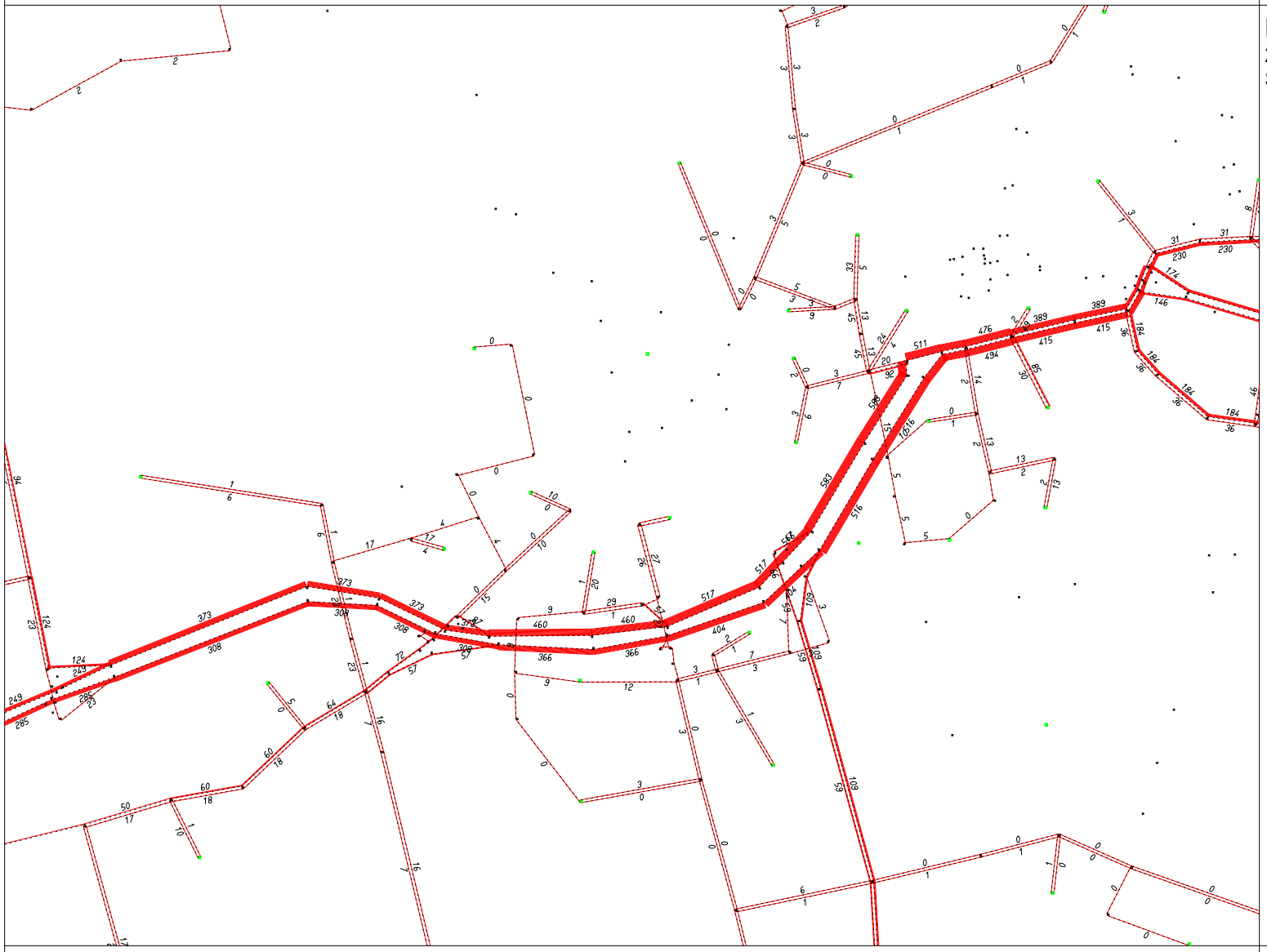


Exhibit 17:
2031
S3 Select Link

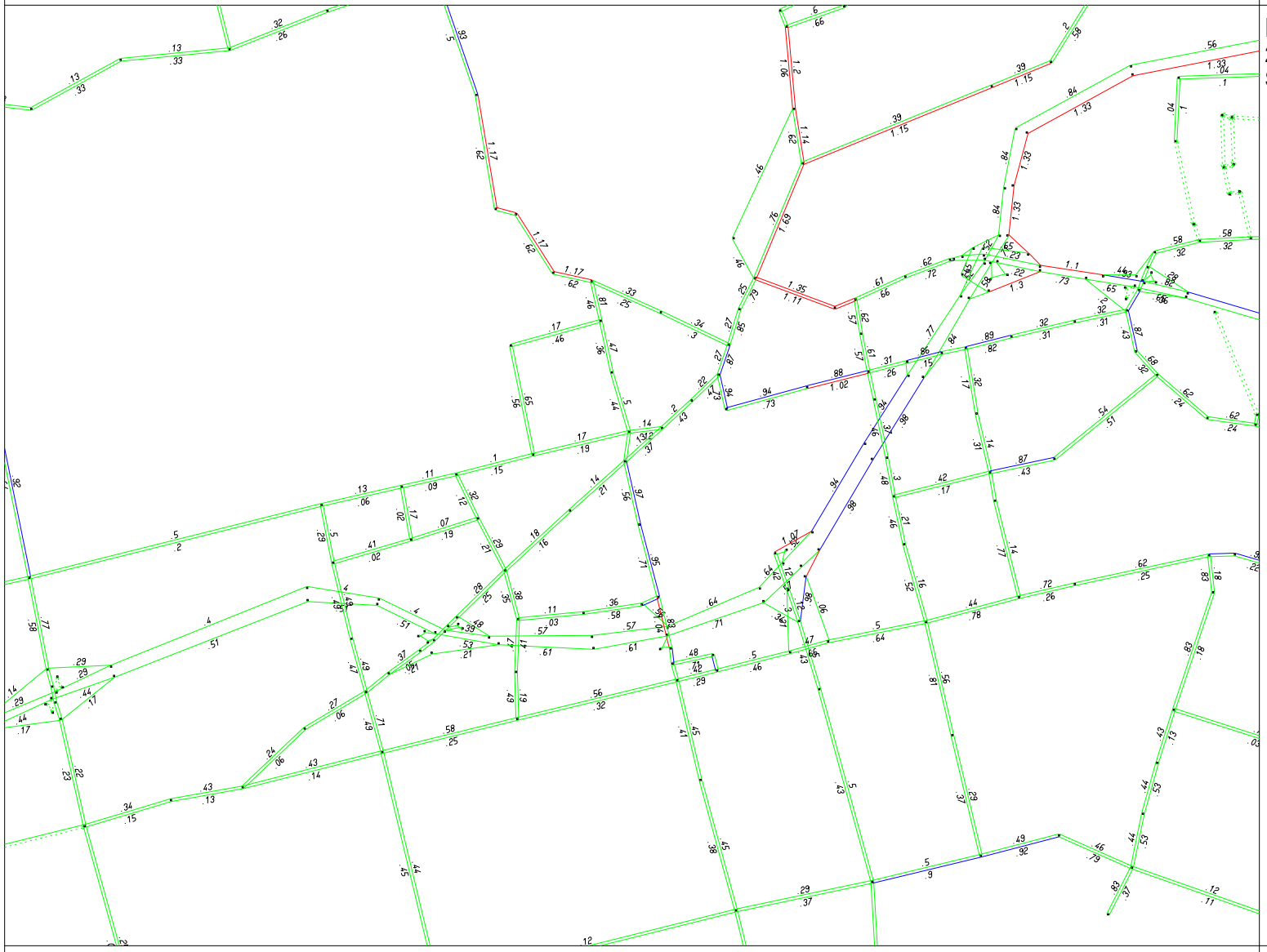
10-08-16 09:47
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 18:
2031
S3 V/C

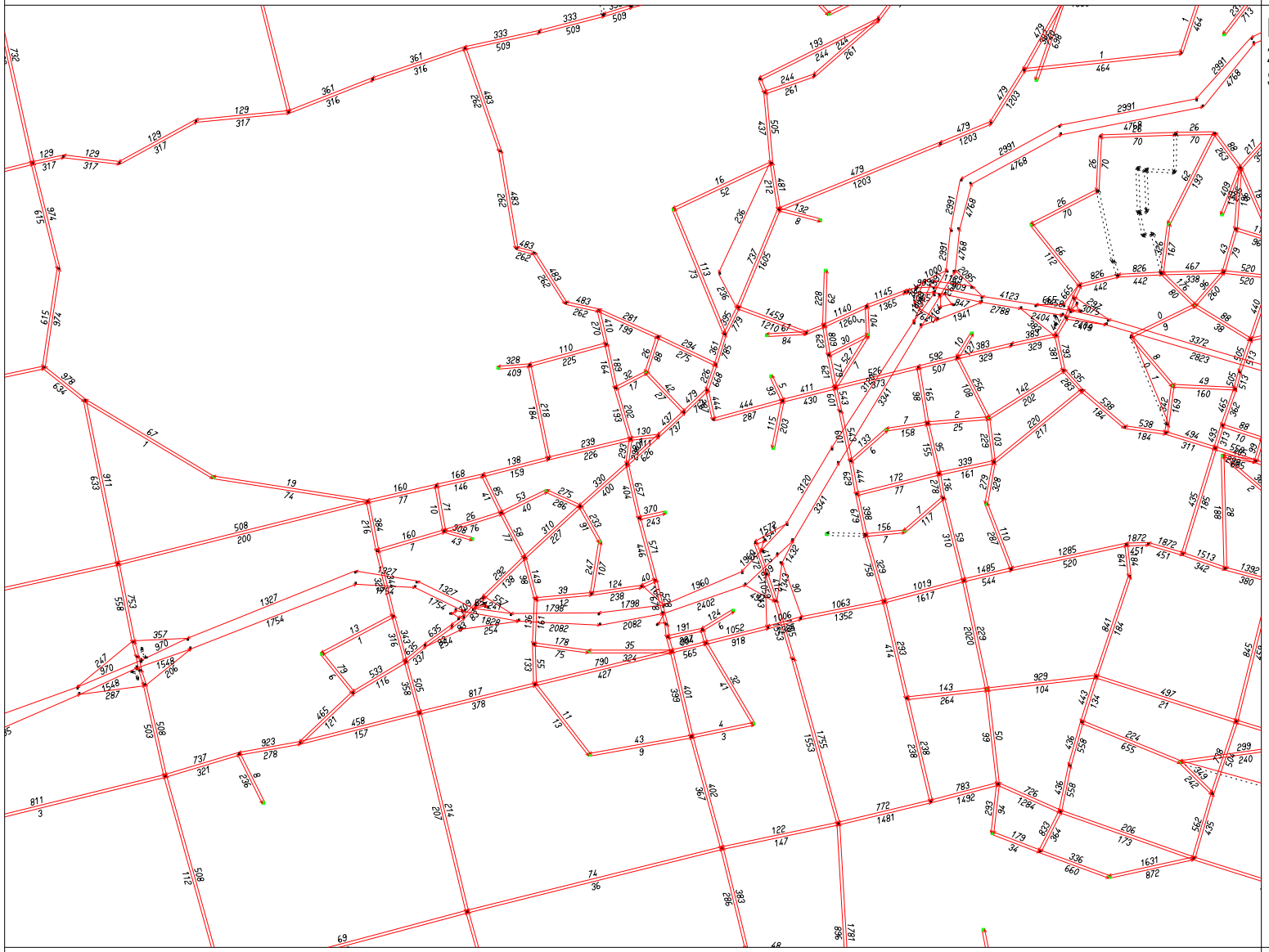


10-08-16 09:47
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

emme/2

Exhibit 19:
2031
S4 Volumes



10-08-16 10:09
MODULE: 6.12
DMG.UTYU...jdk

ADDITIONAL VOLUMES ON AUTO NETWORK

Exhibit 20:
2031
S4 Select Link

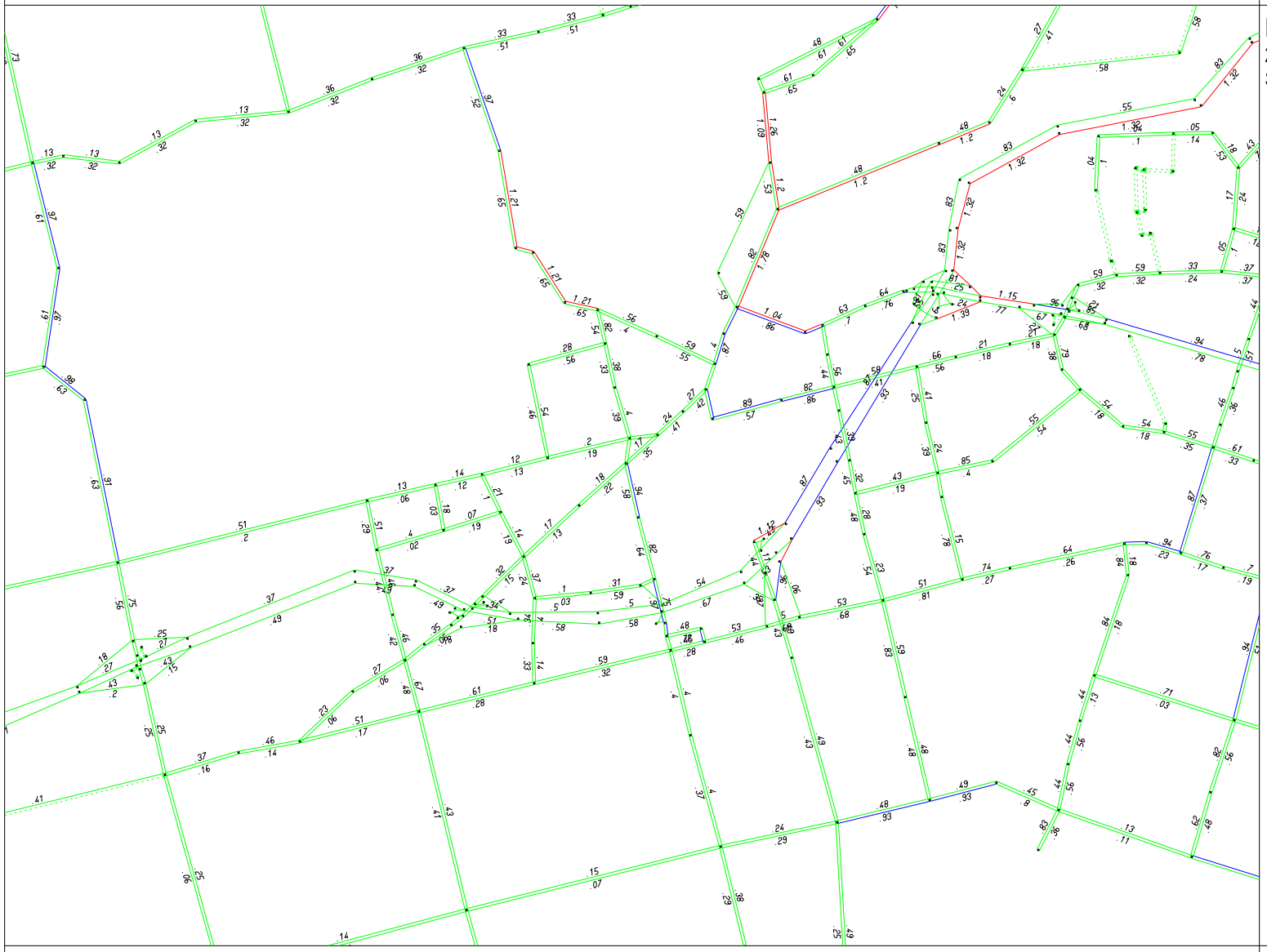
10-08-16 10:10
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 21:
2031
S4 V/C



10-08-16 10:10
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

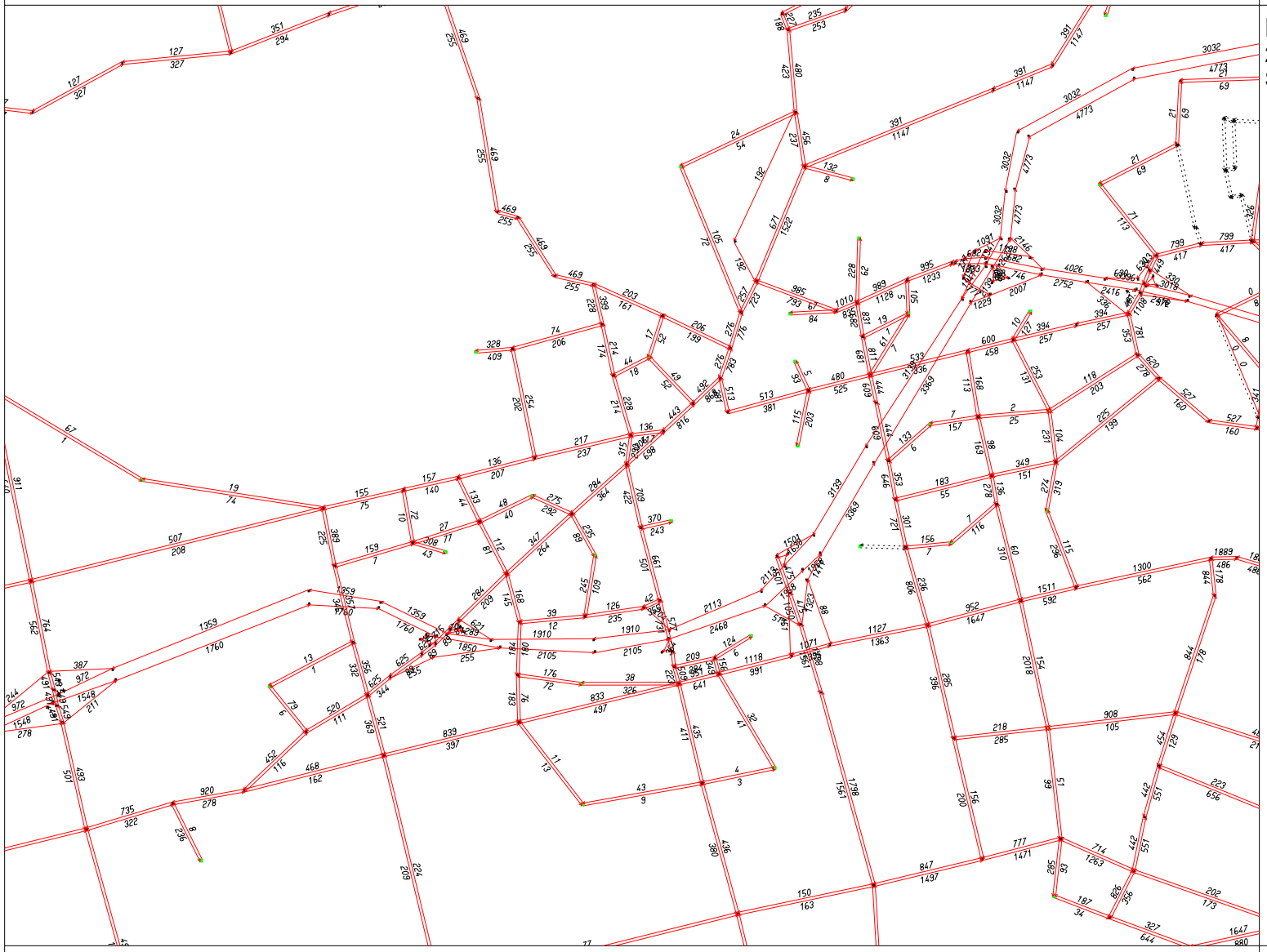


Exhibit 22:
2031
S5 Volumes

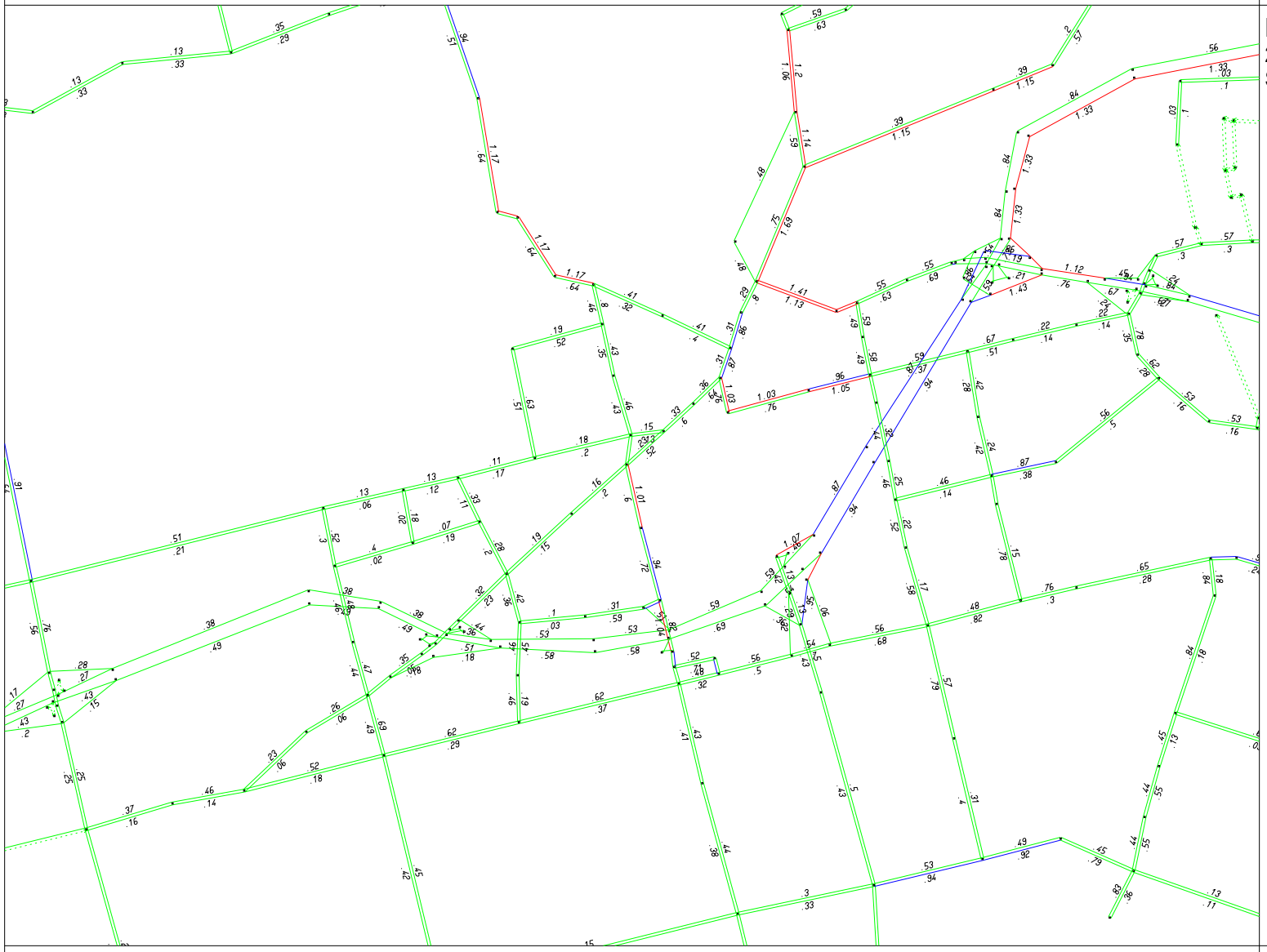
10-08-16 10:32
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 23:
2031
S5 V/C



10-08-16 10:33
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

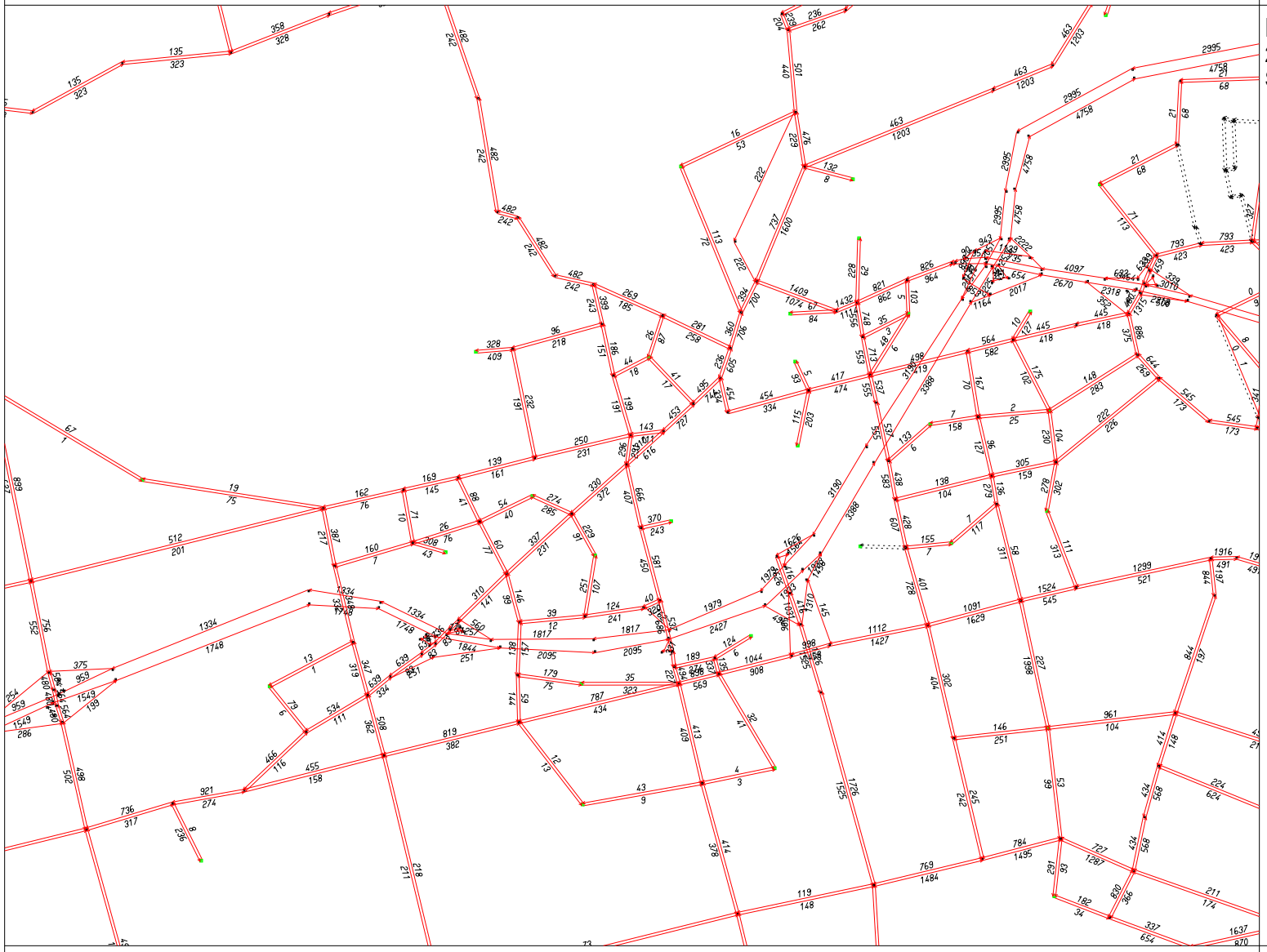


Exhibit 24:
2031
S6 Volumes

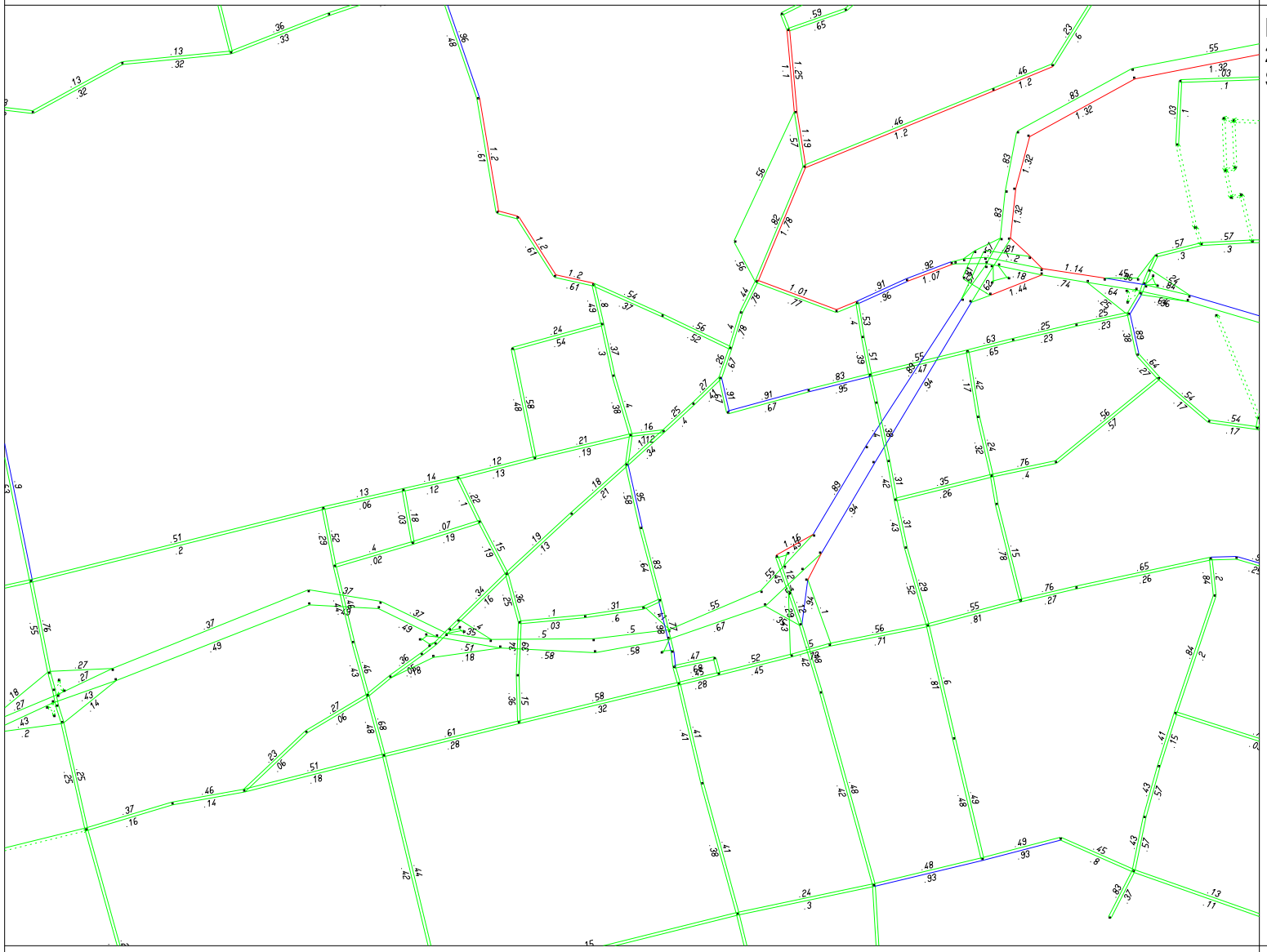
10-08-16 10:48
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 25:
2031
S6 V/C

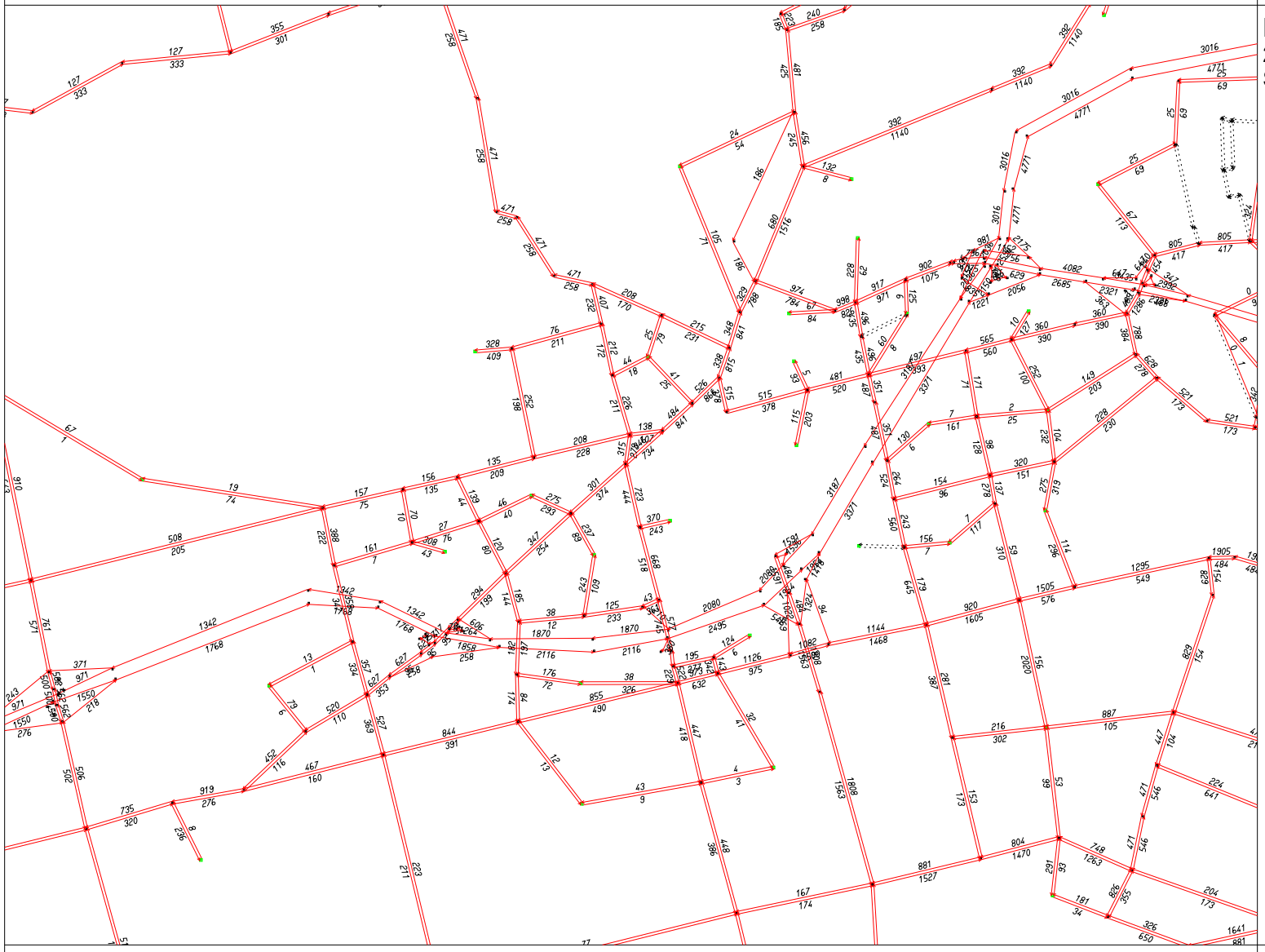


10-08-16 10:49
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

emme/2

Exhibit 26:
2031
S7 Volumes



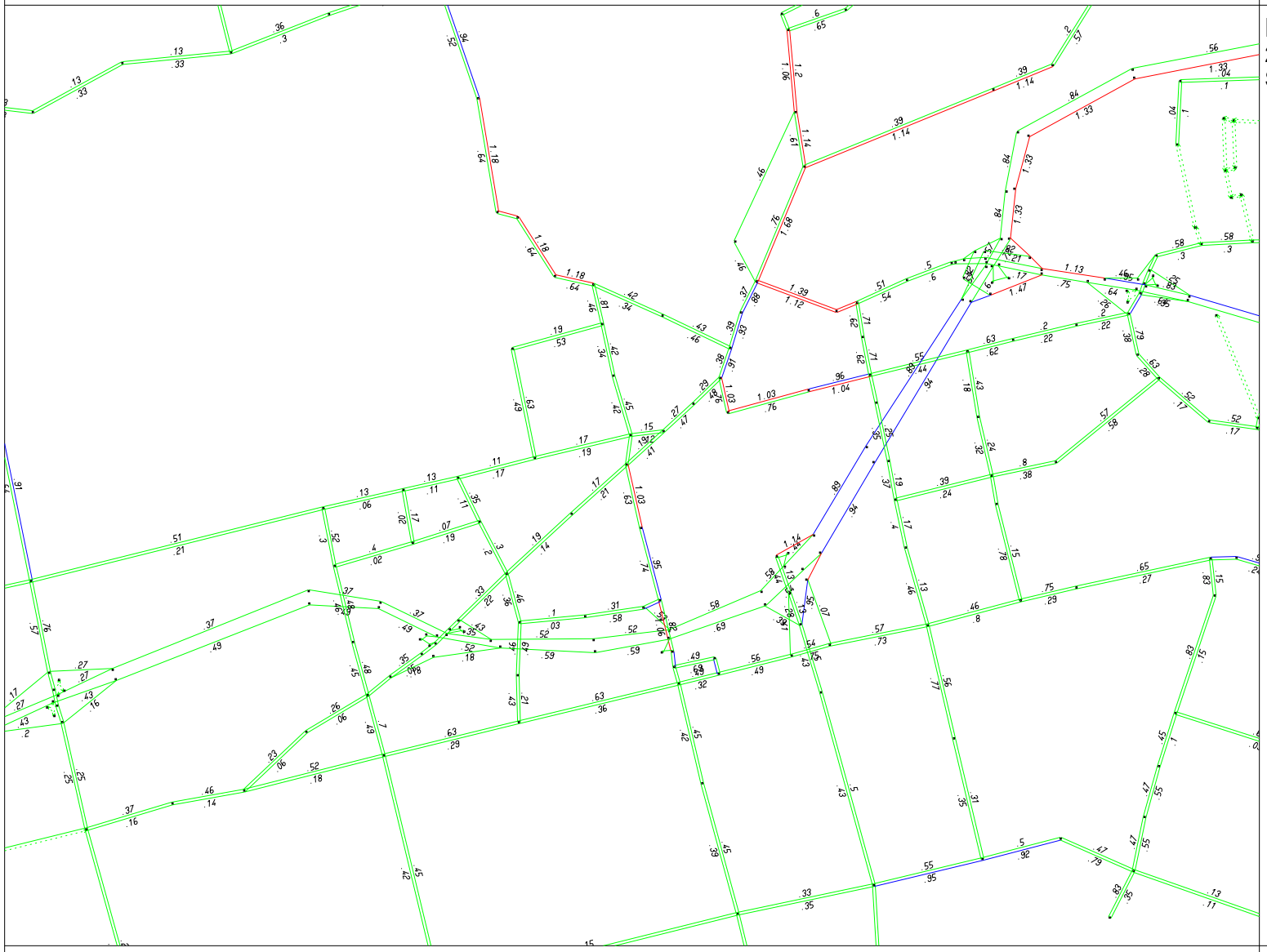
10-08-16 11:37
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 27:
2031
S7 V/C



10-08-16 11:38
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

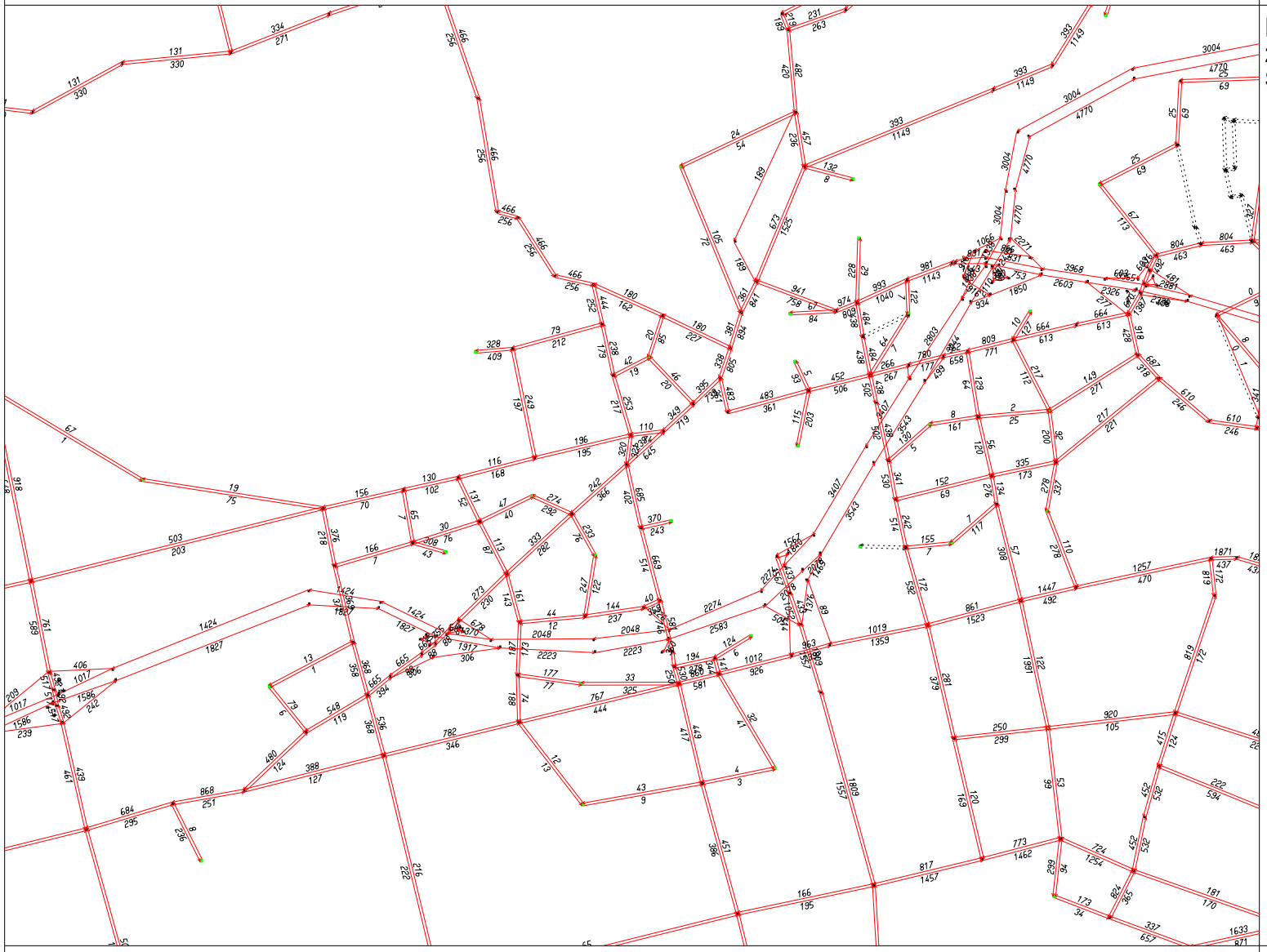


Exhibit 28:
2031
S8 Volumes

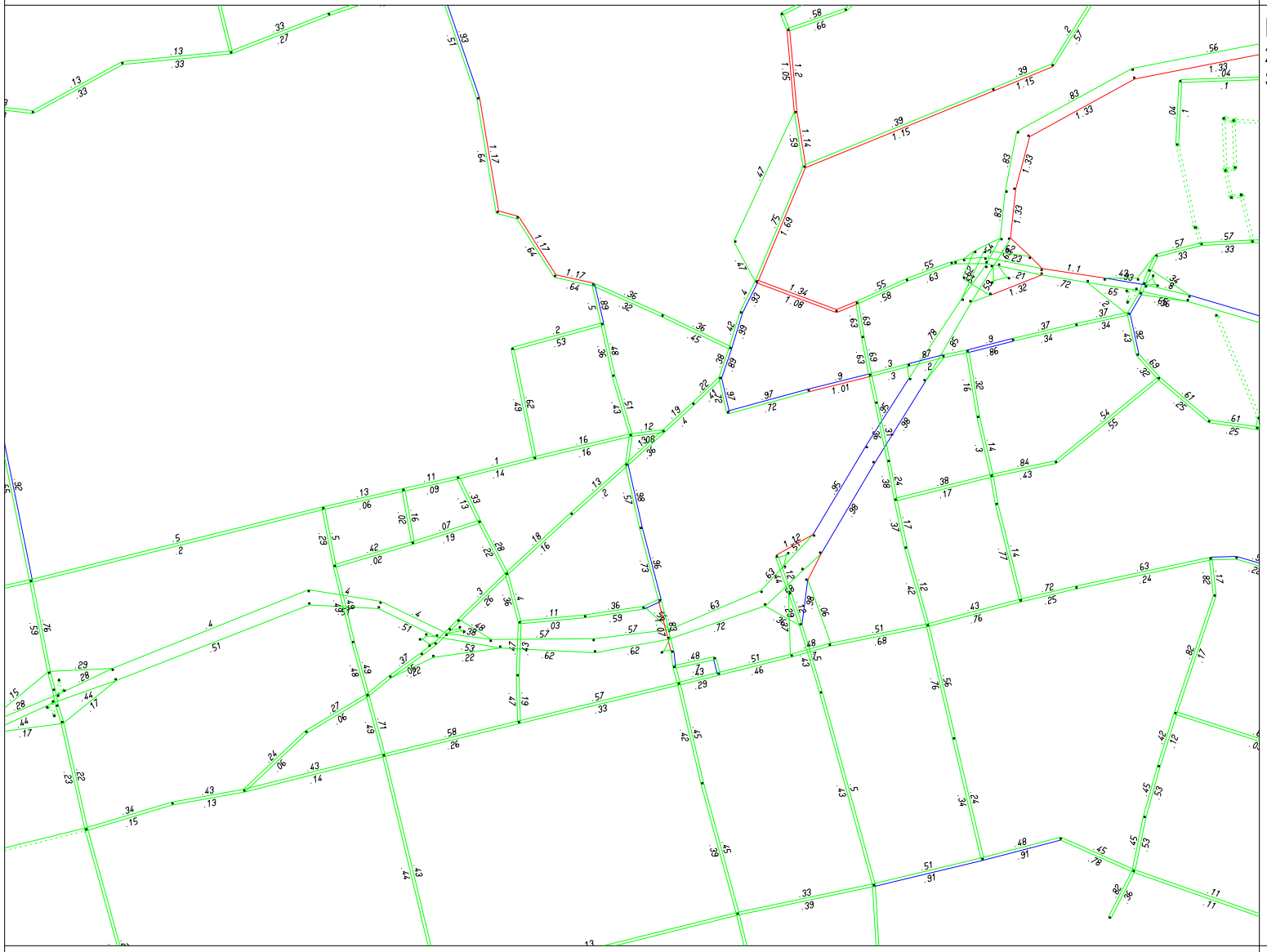
10-08-16 11:49
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 29:
2031
S8 V/C



10-08-16 11:50
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

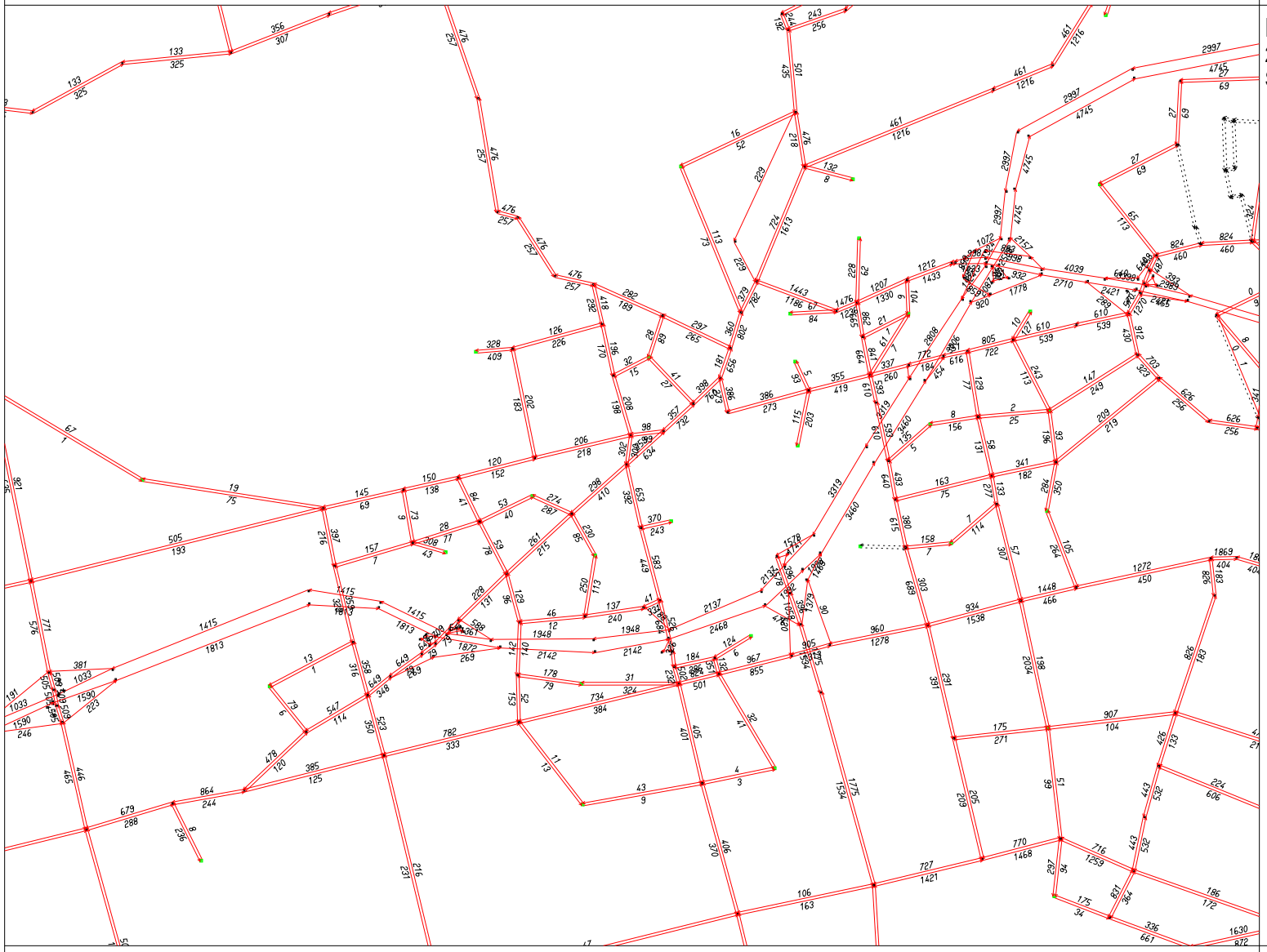


Exhibit 30:
2031
S9 Volumes

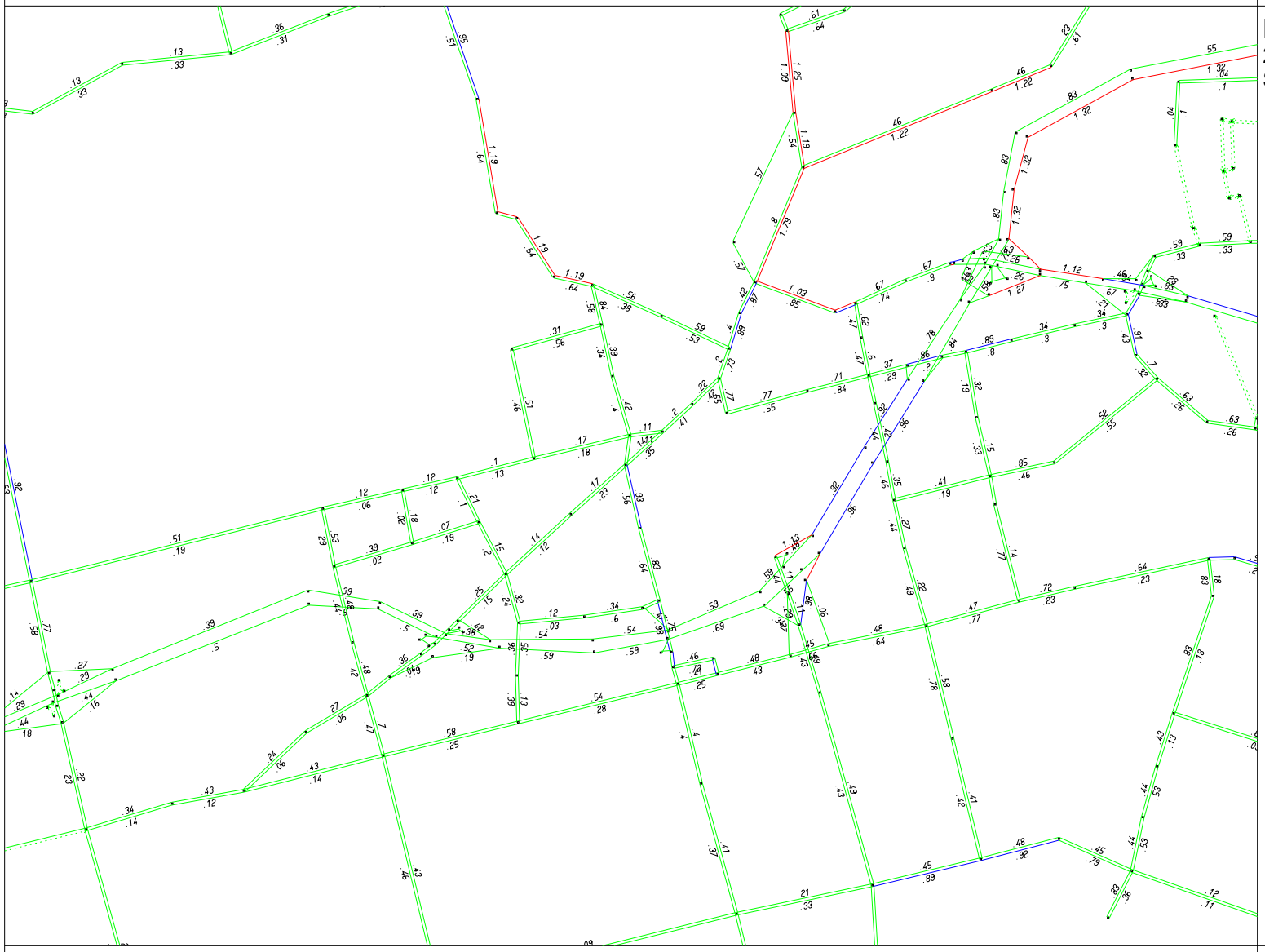
10-08-16 13:03
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 31:
2031
S9 V/C

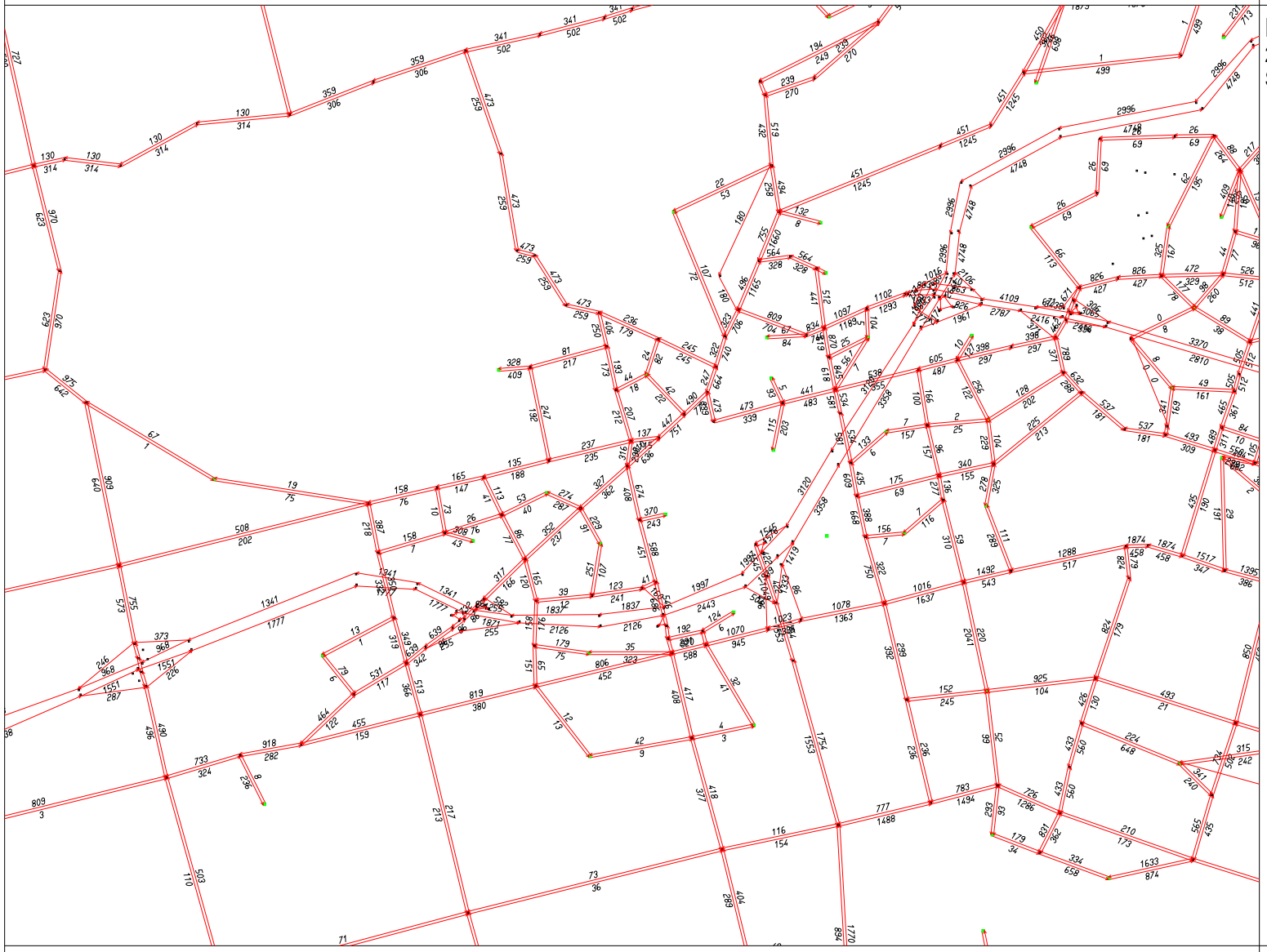


10-08-16 13:03
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

emme/2

Exhibit 32:
2031
S10 Volumes



10-08-16 13:18
MODULE: 6.12
DMG.UTYU...jdk

ADDITIONAL VOLUMES ON AUTO NETWORK

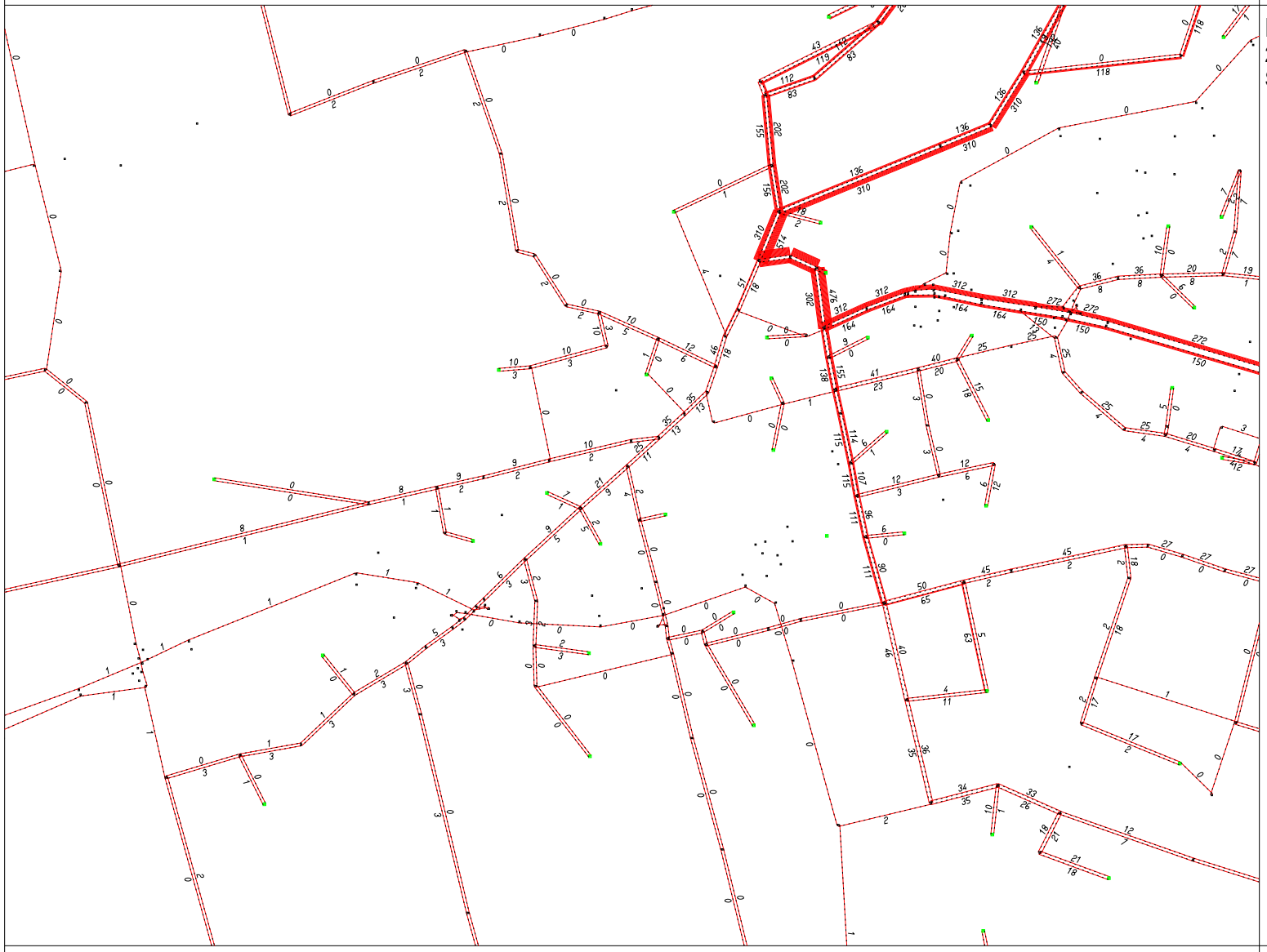


Exhibit 33:
2031
S10 Select Link

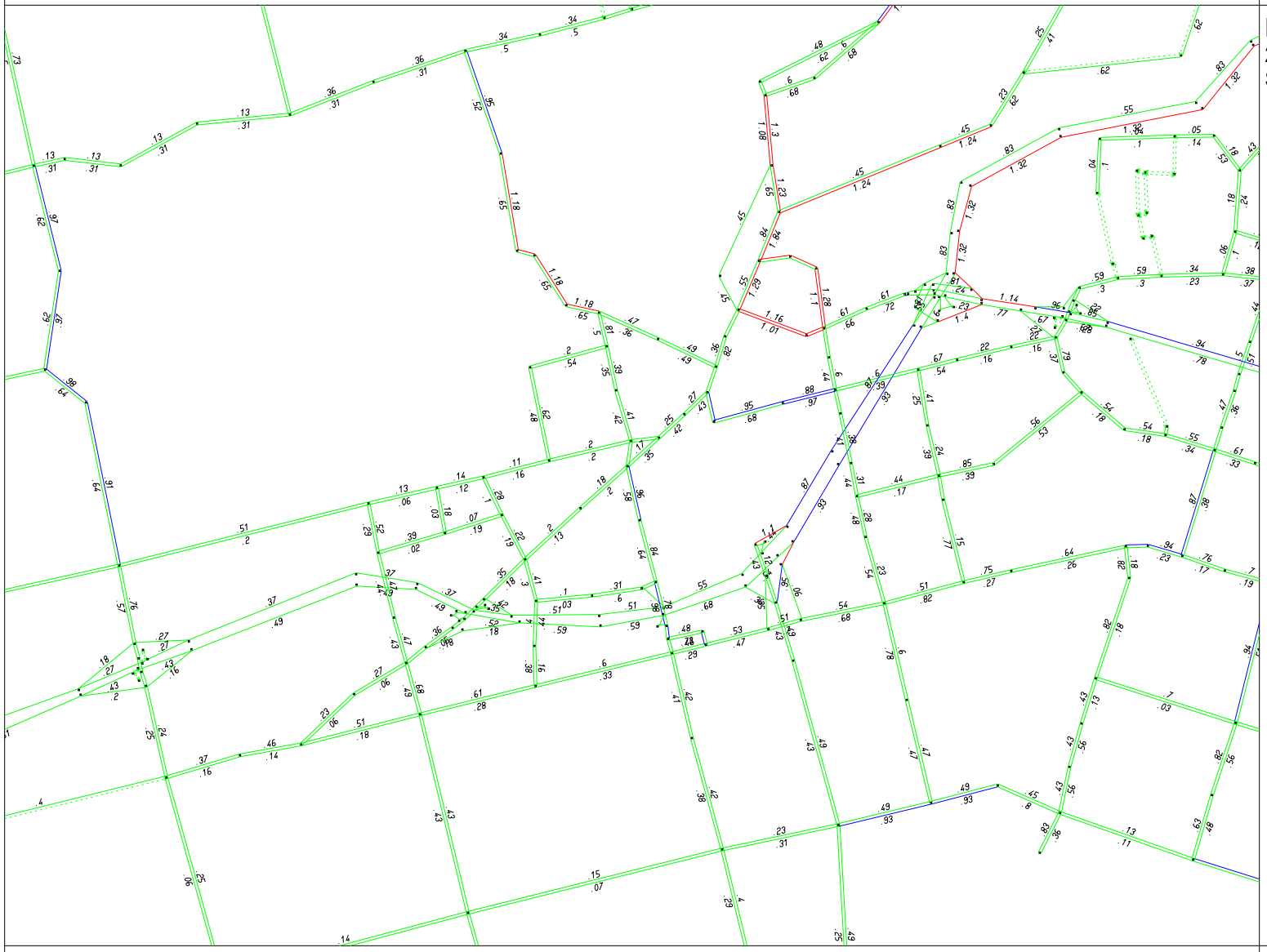
10-08-16 13:19
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 34:
2031
S10 V/C



10-08-16 13:19
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

emme/2

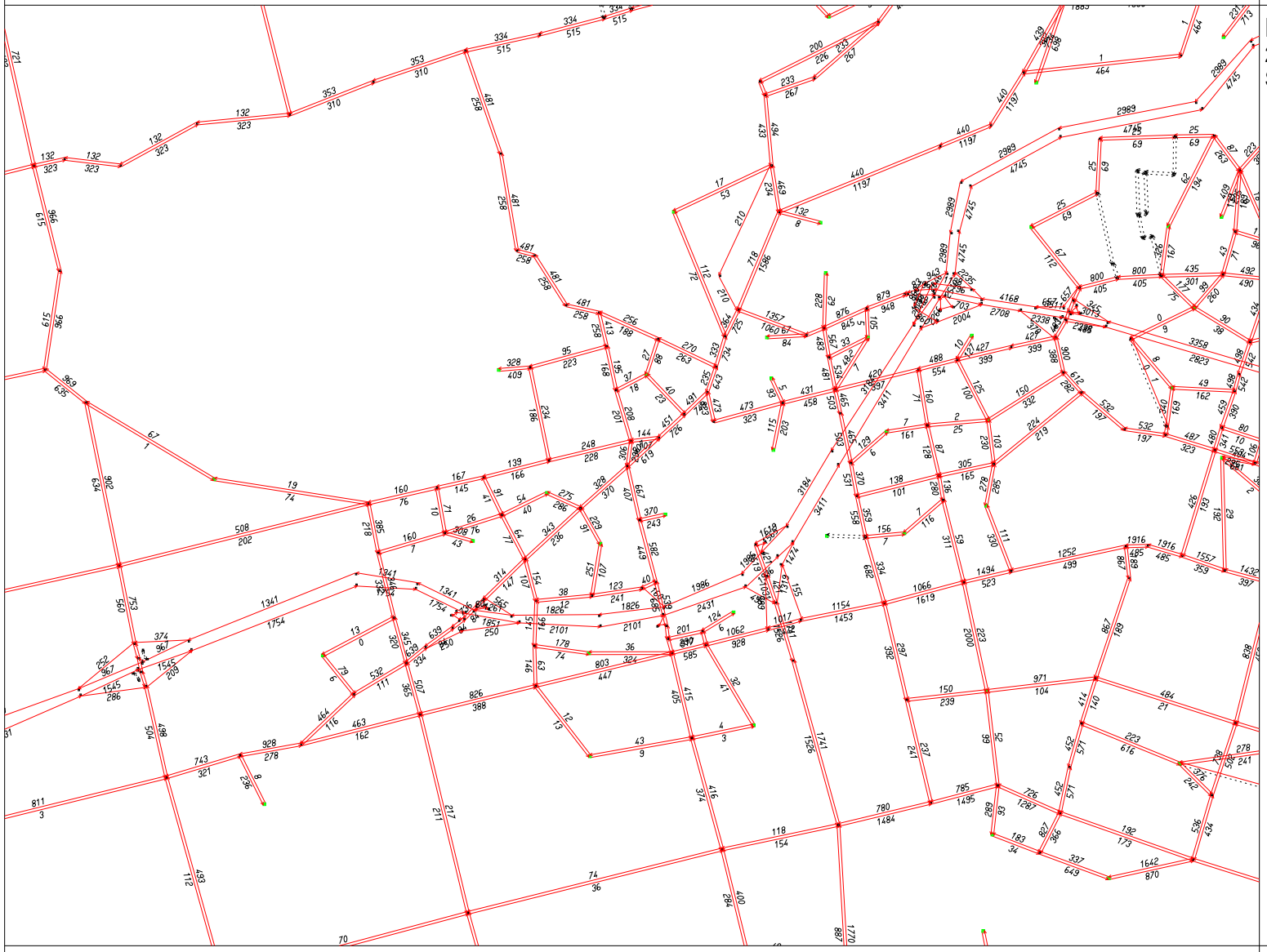


Exhibit 35:
2031
S11 Volumes

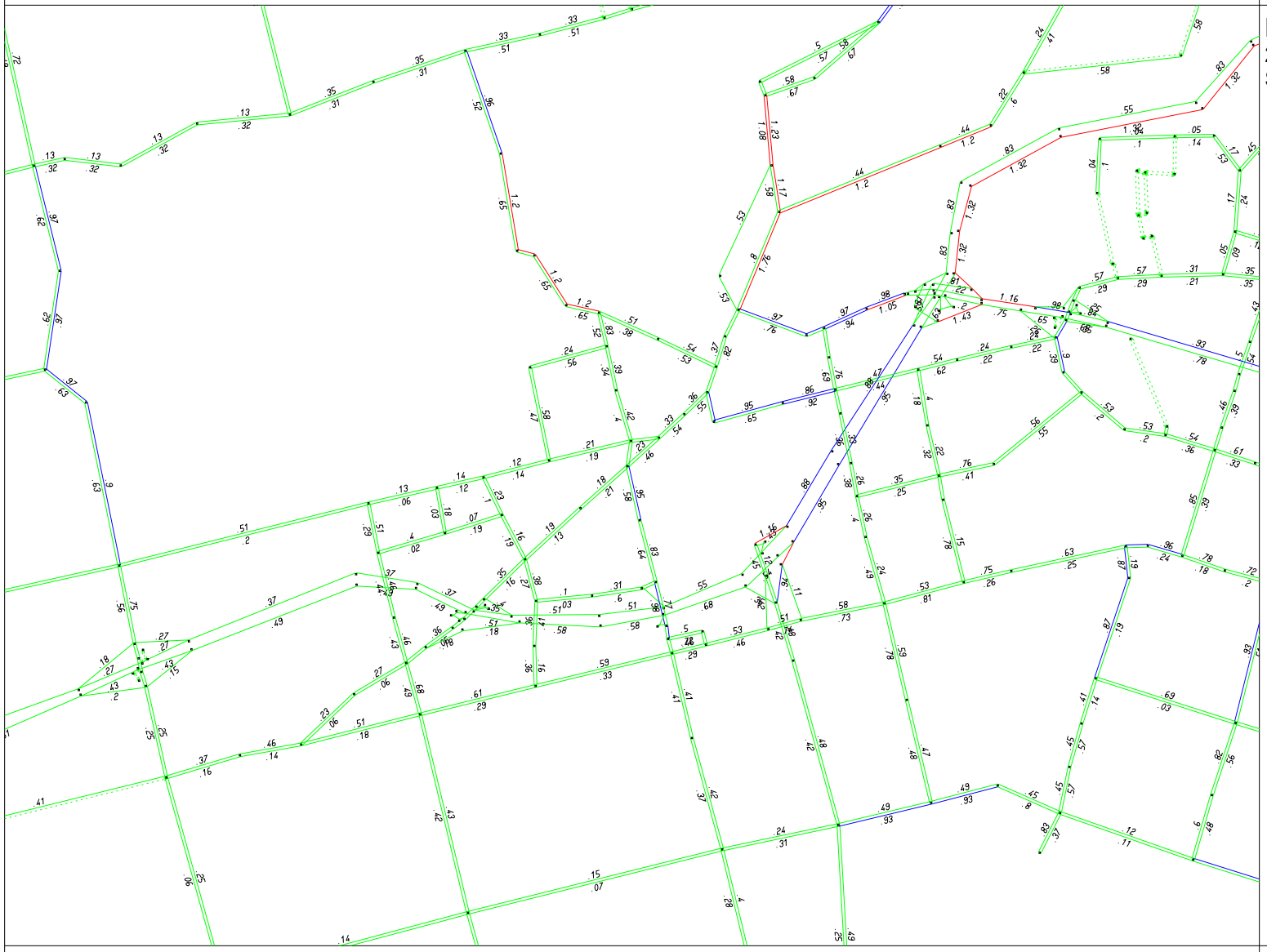
10-08-16 13:31
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 36:
2031
S11 V/C



10-08-16 13:33
MODULE: 2.13
DMG.UTYU...jdk

AUTO VOLUMES

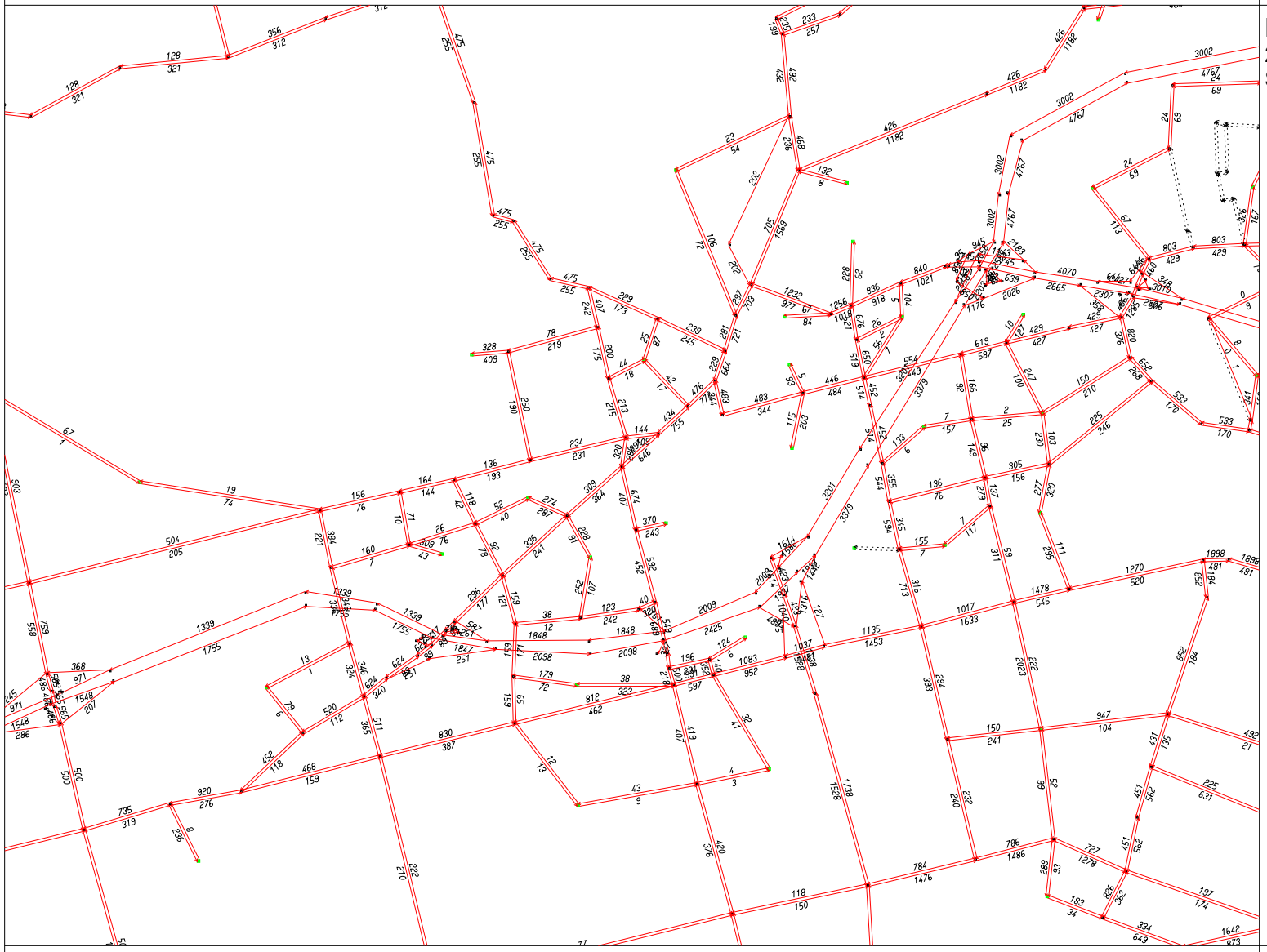


Exhibit 37:
2031
S12 Volumes

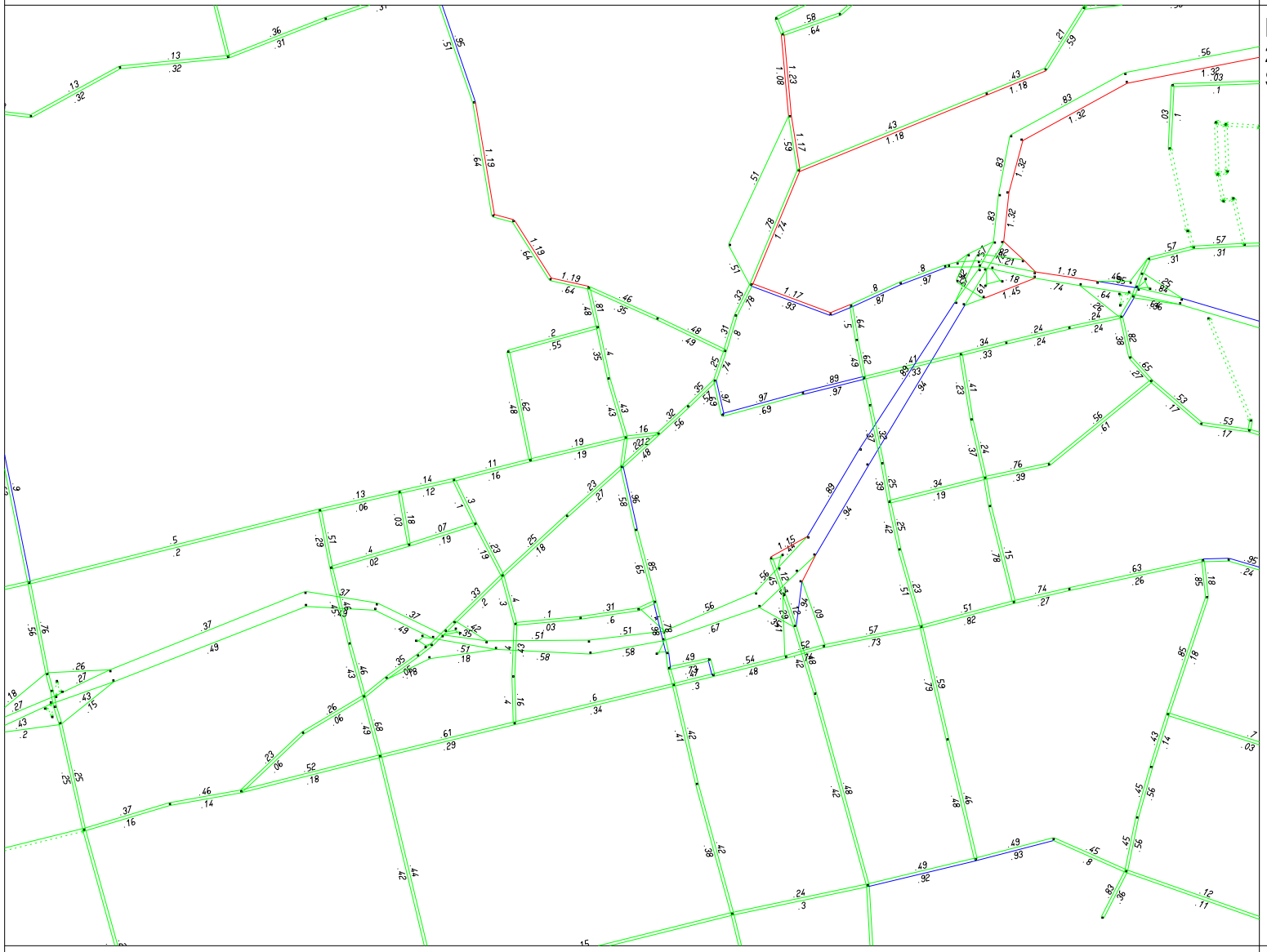
10-08-27 10:02
MODULE: 6.12
DMG.UTYU...jdk

BASE NETWORK

ATTRIBUTE @VC: VOLUME TO CAPACITY RATIO

emme/2

Exhibit 38:
2031
S12 V/C



10-08-27 10:03
MODULE: 2.13
DMG.UTYU...jdk

Double Lane Roundabout Operation Analysis

FHWA Methodology

Wilson & Rousseaux Operations
Two-Lane Roundabout
2021 AM Peak

08-8952 Ancaster TMP
City of Hamilton
2010 Oct 20

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	369	813	729	212	0	0	0	0	132	0	813
Peak hour factor	0.95	0	388	856	767	223	0	0	0	0	139	0	856
Heavy vehicle %	2%	0	396	873	782	227	0	0	0	0	142	0	873

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	1269	782	369	1009	142	1269	0	1151	0	1015	396	1655

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1848	2300	1588	2120
Total Delay	13,965	7,850	2,813	0	3,303
v/c	**-**	**0.69**	**0.44**	**0.00**	**0.48**
Avg. Delay	**4.2**	**6.2**	**2.8**	**2.3**	**3.3**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	2.2	0.8	0.0	0.9
Avg Queue Length (m)	16.4	5.9	0.0	6.9
95% Queue (veh)	6.4	2.3	0.0	2.7
95% Queue (m)	**48.2**	**17.5**	**0.0**	**20.6**

Note: Assumes closure (i.e. cul-de-sac) of Old Dundas Road.

Double Lane Roundabout Operation Analysis

FHWA Methodology

Wilson & Rousseaux Operations
Two-Lane Roundabout
2021 PM Peak

08-8952 Ancaster TMP
City of Hamilton
2010 Oct 20

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	307	190	598	362	0	0	0	0	367	0	721
Peak hour factor	0.95	0	323	200	629	381	0	0	0	0	386	0	759
Heavy vehicle %	2%	0	329	204	642	389	0	0	0	0	394	0	774

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	533	642	783	1031	394	1103	0	1425	0	1168	329	846

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1947	2122	1394	2168
Total Delay	8,957	1,357	3,400	0	4,201
v/c	**-**	**0.27**	**0.49**	**0.00**	**0.54**
Avg. Delay	**3.3**	**2.5**	**3.3**	**2.6**	**3.6**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.4	0.9	0.0	1.2
Avg Queue Length (m)	2.8	7.1	0.0	8.8
95% Queue (veh)	1.1	2.8	0.0	3.5
95% Queue (m)	**8.5**	**21.2**	**0.0**	**26.1**

Note: Assumes closure (i.e. cul-de-sac) of Old Dundas Road.

Double Lane Roundabout Operation Analysis

FHWA Methodology

Wilson & Rousseaux Operations
Two-Lane Roundabout
2031 AM Peak

08-8952 Ancaster TMP
City of Hamilton
2010 Oct 20

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	393	310	957	349	0	0	0	0	111	0	957
Peak hour factor	0.95	0	414	326	1007	367	0	0	0	0	117	0	1007
Heavy vehicle %	2%	0	422	333	1027	374	0	0	0	0	119	0	1027

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	755	1027	493	1401	119	1449	0	1520	0	1146	422	1360

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1675	2316	1327	2102
Total Delay	12,762	2,952	5,501	0	4,309
v/c	-	**0.45**	**0.60**	**0.00**	**0.55**
Avg. Delay	**3.9**	**3.9**	**3.9**	**2.7**	**3.8**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.8	1.5	0.0	1.2
Avg Queue Length (m)	6.1	11.5	0.0	9.0
95% Queue (veh)	2.4	4.5	0.0	3.6
95% Queue (m)	**18.4**	**34.1**	**0.0**	**26.8**

Note: Assumes closure (i.e. cul-de-sac) of Old Dundas Road.

Double Lane Roundabout Operation Analysis

FHWA Methodology

Wilson & Rousseaux Operations
Two-Lane Roundabout
2031 PM Peak

08-8952 Ancaster TMP
City of Hamilton
2010 Oct 20

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	427	160	667	379	0	0	0	0	315	0	795
Peak hour factor	0.95	0	449	168	702	399	0	0	0	0	332	0	837
Heavy vehicle %	2%	0	458	171	716	407	0	0	0	0	339	0	854

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	629	716	746	1123	339	1312	0	1462	0	1193	458	887

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1895	2161	1368	2077
Total Delay	10,532	1,789	3,892	0	4,852
v/c	-	**0.33**	**0.52**	**0.00**	**0.57**
Avg. Delay	**3.6**	**2.8**	**3.5**	**2.6**	**4.1**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.5	1.1	0.0	1.3
Avg Queue Length (m)	3.7	8.1	0.0	10.1
95% Queue (veh)	1.5	3.2	0.0	4.0
95% Queue (m)	**11.2**	**24.2**	**0.0**	**30.1**

Note: Assumes closure (i.e. cul-de-sac) of Old Dundas Road.

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Wilson Street & Jerseyville Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	1001	11	9	484	173	54	1	3	2	0	17
Peak hour factor	0.95	0	1054	12	9	509	182	57	1	3	2	0	18
Heavy vehicle %	2%	0	1075	12	9	519	186	58	1	3	2	0	18

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	1087	68	524	714	2	1151	62	530	186	20	1133	22

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1163	1199	915	590
Total Delay	46,167	40,497	5,282	262	126
v/c	-	**0.93**	**0.60**	**0.07**	**0.03**
Avg. Delay	**24.5**	**37.3**	**7.4**	**4.2**	**6.3**
Level of Service	**C**	**E**	**A**	**A**	**A**

Avg Queue Length (veh)	11.2	1.5	0.1	0.0
Avg Queue Length (m)	84.4	11.0	0.5	0.3
95% Queue (veh)	25.6	4.3	0.2	0.1
95% Queue (m)	**191.8**	**32.5**	**1.6**	**0.8**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Wilson Street & Jerseyville Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	782	7	8	943	164	54	0	7	5	0	1
Peak hour factor	0.95	0	823	7	8	993	173	57	0	7	5	0	1
Heavy vehicle %	2%	0	839	7	8	1013	176	58	0	7	5	0	1

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	846	66	1025	1197	5	898	65	1026	176	6	897	15

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1164	1197	648	717
Total Delay	101,255	9,451	91,371	402	30
v/c	**-**	**0.73**	**1.00**	**0.10**	**0.01**
Avg. Delay	**47.9**	**11.2**	**76.3**	**6.2**	**5.1**
Level of Service	**E**	**B**	**F**	**A**	**A**

Avg Queue Length (veh)	2.6	25.4	0.1	0.0
Avg Queue Length (m)	19.7	190.4	0.8	0.1
95% Queue (veh)	7.6	42.3	0.3	0.0
95% Queue (m)	**57.0**	**317.2**	**2.5**	**0.2**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Wilson Street & Shaver Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	86	44	93	15	31	172	84	743	33	32	936	15
Peak hour factor	0.95	91	46	98	16	33	181	88	782	35	34	985	16
Heavy vehicle %	2%	93	47	100	16	34	185	90	798	36	35	1005	16

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	240	904	105	235	1133	153	924	85	1283	1056	230	914

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1762	1600	2340	2238
Total Delay	6,751	568	620	2,348	3,215
v/c	-	**0.14**	**0.15**	**0.39**	**0.47**
Avg. Delay	**2.7**	**2.4**	**2.6**	**2.5**	**3.0**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.2	0.2	0.7	0.9
Avg Queue Length (m)	1.2	1.3	4.9	6.7
95% Queue (veh)	0.5	0.5	2.0	2.7
95% Queue (m)	**3.5**	**3.9**	**14.6**	**20.0**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Wilson Street & Shaver Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	42	26	51	7	9	195	238	1255	82	60	1144	24
Peak hour factor	0.95	44	27	54	7	9	205	251	1321	86	63	1204	25
Heavy vehicle %	2%	45	28	55	7	9	209	256	1347	88	64	1228	26

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	128	1610	161	225	1337	310	1691	80	1482	1318	329	1409

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1264	1456	2344	2168
Total Delay	15,912	406	658	9,277	5,571
v/c	**-**	**0.10**	**0.15**	**0.72**	**0.61**
Avg. Delay	**4.7**	**3.2**	**2.9**	**5.5**	**4.2**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.1	0.2	2.6	1.5
Avg Queue Length (m)	0.8	1.4	19.3	11.6
95% Queue (veh)	0.3	0.5	7.6	4.6
95% Queue (m)	**2.5**	**4.1**	**57.0**	**34.5**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Wilson Street & Halson Street (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	233	1	195	2	2	1	1	662	252	113	545	2
Peak hour factor	0.95	245	1	205	2	2	1	1	697	265	119	574	2
Heavy vehicle %	2%	250	1	209	2	2	1	1	711	270	121	585	2

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	460	714	393	5	956	4	982	125	836	708	252	922

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	816	685	1133	1064
Total Delay	33,719	4,639	26	21,952	7,101
v/c	**-**	**0.56**	**0.01**	**0.87**	**0.67**
Avg. Delay	**15.6**	**10.1**	**5.3**	**22.4**	**10.0**
Level of Service	**C**	**B**	**A**	**C**	**B**

Avg Queue Length (veh)	1.3	0.0	6.1	2.0
Avg Queue Length (m)	9.7	0.1	45.7	14.8
95% Queue (veh)	3.8	0.0	16.1	5.8
95% Queue (m)	**28.5**	**0.2**	**120.8**	**43.3**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Wilson Street & Halson Street (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	517	0	169	4	7	0	0	604	346	202	667	0
Peak hour factor	0.95	544	0	178	4	7	0	0	636	364	213	702	0
Heavy vehicle %	2%	555	0	182	4	7	0	0	649	371	217	716	0

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	737	653	595	11	1488	0	1020	228	1271	933	555	835

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	848	312	1077	901
Total Delay	186,913	21,815	132	45,767	119,200
v/c	**-**	**0.87**	**0.04**	**0.95**	**1.04**
Avg. Delay	**69.2**	**29.6**	**12.0**	**44.9**	**127.8**
Level of Service	**F**	**D**	**B**	**E**	**F**

Avg Queue Length (veh)	6.1	0.0	12.7	33.1
Avg Queue Length (m)	45.4	0.3	95.3	248.3
95% Queue (veh)	15.5	0.1	27.3	46.2
95% Queue (m)	**116.4**	**0.8**	**205.1**	**346.6**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Wilson Street & Halson Street (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	233	1	195	2	2	1	1	662	252	113	545	2
Peak hour factor	0.95	245	1	205	2	2	1	1	697	265	119	574	2
Heavy vehicle %	2%	250	1	209	2	2	1	1	711	270	121	585	2

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	460	714	393	5	956	4	982	125	836	708	252	922

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1896	1725	2312	2222
Total Delay	5,504	1,153	10	2,657	1,683
v/c	**-**	**0.24**	**0.00**	**0.42**	**0.32**
Avg. Delay	**2.6**	**2.5**	**2.1**	**2.7**	**2.4**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.3	0.0	0.7	0.5
Avg Queue Length (m)	2.4	0.0	5.5	3.5
95% Queue (veh)	1.0	0.0	2.2	1.4
95% Queue (m)	**7.2**	**0.1**	**16.6**	**10.5**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Wilson Street & Halson Street (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	517	0	169	4	7	0	0	604	346	202	667	0
Peak hour factor	0.95	544	0	178	4	7	0	0	636	364	213	702	0
Heavy vehicle %	2%	555	0	182	4	7	0	0	649	371	217	716	0

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	737	653	595	11	1488	0	1020	228	1271	933	555	835

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1939	1350	2239	2008
Total Delay	8,368	2,206	30	3,010	3,121
v/c	**-**	**0.38**	**0.01**	**0.46**	**0.46**
Avg. Delay	**3.1**	**3.0**	**2.7**	**3.0**	**3.3**
Level of Service	**A**	**A**	**A**	**A**	**A**

	Northbound	Southbound	Eastbound	Westbound
Avg Queue Length (veh)	0.6	0.0	0.8	0.9
Avg Queue Length (m)	4.6	0.1	6.3	6.5
95% Queue (veh)	1.8	0.0	2.5	2.6
95% Queue (m)	**13.8**	**0.2**	**18.7**	**19.4**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Mohawk Road & McNiven Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	376	18	1268	39	40	18	4	755	782	698	722	7
Peak hour factor	0.95	396	19	1335	41	42	19	4	795	823	735	760	7
Heavy vehicle %	2%	404	19	1362	42	43	19	4	811	839	750	775	7

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	1785	857	1632	104	1929	30	1654	835	1198	1532	427	2215

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1795	1038	1811	2099
Total Delay	146,263	101,902	401	34,293	9,667
v/c	**-**	**0.99**	**0.10**	**0.91**	**0.73**
Avg. Delay	**28.8**	**57.1**	**3.9**	**20.7**	**6.3**
Level of Service	**D**	**F**	**A**	**C**	**A**

Avg Queue Length (veh)	28.3	0.1	9.5	2.7
Avg Queue Length (m)	212.3	0.8	71.4	20.1
95% Queue (veh)	49.3	0.3	24.2	7.9
95% Queue (m)	**369.7**	**2.5**	**181.5**	**59.2**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Mohawk Road & McNiven Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	1392	57	774	18	27	7	15	740	427	1167	660	42
Peak hour factor	0.95	1465	60	815	19	28	7	16	779	449	1228	695	44
Heavy vehicle %	2%	1494	61	831	19	29	7	16	795	458	1253	709	45

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	2386	830	1740	55	3456	122	1269	1301	2210	2007	1571	1645

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1814	0	1482	1291
Total Delay	#DIV/0!	1,378,102	#DIV/0!	20,553	2,024,488
v/c	-	**1.32**	**#DIV/0!**	**0.86**	**1.55**
Avg. Delay	**#DIV/0!**	**577.6**	**#DIV/0!**	**16.2**	**1008.7**
Level of Service	**#DIV/0!**	**F**	**#DIV/0!**	**C**	**F**

Avg Queue Length (veh)	382.8	#DIV/0!	5.7	562.4
Avg Queue Length (m)	2871.0	#DIV/0!	42.8	4217.7
95% Queue (veh)	298.0	#DIV/0!	15.6	366.2
95% Queue (m)	**2234.6**	**#DIV/0!**	**117.1**	**2746.4**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Wilson Street & Fiddler's Green Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	141	125	222	162	179	149	61	419	83	76	326	26
Peak hour factor	0.95	148	132	234	171	188	157	64	441	87	80	343	27
Heavy vehicle %	2%	151	135	239	174	192	160	65	450	89	82	350	28

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	525	689	363	526	583	228	604	448	661	460	351	863

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	829	886	959	1011
Total Delay	20,501	6,173	5,234	6,093	3,001
v/c	**-**	**0.63**	**0.59**	**0.63**	**0.45**
Avg. Delay	**9.7**	**11.8**	**10.0**	**10.1**	**6.5**
Level of Service	**A**	**B**	**A**	**B**	**A**

Avg Queue Length (veh)	1.7	1.5	1.7	0.8
Avg Queue Length (m)	12.9	10.9	12.7	6.3
95% Queue (veh)	5.0	4.3	5.0	2.5
95% Queue (m)	**37.6**	**32.1**	**37.3**	**18.6**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Wilson Street & Fiddler's Green Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	188	94	126	51	108	115	151	511	244	228	648	11
Peak hour factor	0.95	198	99	133	54	114	121	159	538	257	240	682	12
Heavy vehicle %	2%	202	101	136	55	116	123	162	549	262	245	696	12

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	439	766	623	294	1143	275	973	416	1021	953	465	740

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	788	585	976	950
Total Delay	173,843	4,516	3,630	80,103	85,593
v/c	**-**	**0.56**	**0.50**	**1.00**	**1.00**
Avg. Delay	**65.4**	**10.3**	**12.3**	**82.3**	**89.8**
Level of Service	**F**	**B**	**B**	**F**	**F**

Avg Queue Length (veh)	1.3	1.0	22.3	23.8
Avg Queue Length (m)	9.4	7.6	166.9	178.3
95% Queue (veh)	3.7	3.0	37.5	38.7
95% Queue (m)	**27.8**	**22.3**	**281.0**	**290.0**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Wilson Street & Fiddler's Green Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	141	125	222	162	179	149	61	419	83	76	326	26
Peak hour factor	0.95	148	132	234	171	188	157	64	441	87	80	343	27
Heavy vehicle %	2%	151	135	239	174	192	160	65	450	89	82	350	28

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	525	689	363	526	583	228	604	448	661	460	351	863

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1914	1988	2084	2152
Total Delay	5,103	1,361	1,295	1,469	979
v/c	**-**	**0.27**	**0.26**	**0.29**	**0.21**
Avg. Delay	**2.4**	**2.6**	**2.5**	**2.4**	**2.1**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.4	0.4	0.4	0.3
Avg Queue Length (m)	2.8	2.7	3.1	2.0
95% Queue (veh)	1.1	1.1	1.2	0.8
95% Queue (m)	**8.5**	**8.1**	**9.2**	**6.1**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Wilson Street & Fiddler's Green Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	188	94	126	51	108	115	151	511	244	228	648	11
Peak hour factor	0.95	198	99	133	54	114	121	159	538	257	240	682	12
Heavy vehicle %	2%	202	101	136	55	116	123	162	549	262	245	696	12

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	439	766	623	294	1143	275	973	416	1021	953	465	740

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1859	1593	2106	2072
Total Delay	8,080	1,113	815	3,088	3,064
v/c	-	**0.24**	**0.18**	**0.46**	**0.46**
Avg. Delay	**3.0**	**2.5**	**2.8**	**3.2**	**3.2**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.3	0.2	0.9	0.9
Avg Queue Length (m)	2.3	1.7	6.4	6.4
95% Queue (veh)	0.9	0.7	2.6	2.5
95% Queue (m)	**6.9**	**5.1**	**19.2**	**19.1**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Golf Links Road & Southcote Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	66	418	139	365	685	38	281	187	207	82	376	534
Peak hour factor	0.95	69	440	146	384	721	40	296	197	218	86	396	562
Heavy vehicle %	2%	70	449	149	392	735	41	302	201	222	88	404	573

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	668	895	1045	1168	562	1324	725	1215	515	1065	821	742

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	718	897	546	758
Total Delay	1,944,706	35,610	658,302	451,887	798,907
v/c	**-**	**0.93**	**1.30**	**1.33**	**1.41**
Avg. Delay	**536.3**	**53.3**	**563.6**	**623.3**	**750.1**
Level of Service	**F**	**F**	**F**	**F**	**F**

Avg Queue Length (veh)	9.9	182.9	125.5	221.9
Avg Queue Length (m)	74.2	1371.5	941.4	1664.4
95% Queue (veh)	21.5	147.2	100.4	163.3
95% Queue (m)	**161.4**	**1104.1**	**753.3**	**1224.9**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Golf Links Road & Southcote Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	297	756	128	739	443	220	41	538	107	213	284	663
Peak hour factor	0.95	313	796	135	778	466	232	43	566	113	224	299	698
Heavy vehicle %	2%	319	812	138	794	475	237	44	577	115	228	305	712

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	1269	1415	818	1506	852	1568	736	1497	861	1245	1175	1509

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	385	741	303	567
Total Delay	########	5,273,605	2,818,528	1,916,689	2,699,382
v/c	-	**3.30**	**2.03**	**2.43**	**2.19**
Avg. Delay	**2672.0**	**4155.7**	**1871.5**	**2604.2**	**2168.2**
Level of Service	**F**	**F**	**F**	**F**	**F**

Avg Queue Length (veh)	1464.9	782.9	532.4	749.8
Avg Queue Length (m)	10986.7	5871.9	3993.1	5623.7
95% Queue (veh)	446.3	388.2	221.5	344.3
95% Queue (m)	**3347.0**	**2911.5**	**1661.1**	**2582.0**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Golf Links Road & Southcote Road (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	66	418	139	365	685	38	281	187	207	82	376	534
Peak hour factor	0.95	69	440	146	384	721	40	296	197	218	86	396	562
Heavy vehicle %	2%	70	449	149	392	735	41	302	201	222	88	404	573

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	668	895	1045	1168	562	1324	725	1215	515	1065	821	742

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1768	2003	1542	1820
Total Delay	15,463	2,185	5,024	3,190	5,064
v/c	**-**	**0.38**	**0.58**	**0.47**	**0.59**
Avg. Delay	**4.3**	**3.3**	**4.3**	**4.4**	**4.8**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.6	1.4	0.9	1.4
Avg Queue Length (m)	4.6	10.5	6.6	10.5
95% Queue (veh)	1.8	4.2	2.6	4.2
95% Queue (m)	**13.6**	**31.2**	**19.8**	**31.4**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Golf Links Road & Southcote Road (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	297	756	128	739	443	220	41	538	107	213	284	663
Peak hour factor	0.95	313	796	135	778	466	232	43	566	113	224	299	698
Heavy vehicle %	2%	319	812	138	794	475	237	44	577	115	228	305	712

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	1269	1415	818	1506	852	1568	736	1497	861	1245	1175	1509

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1401	1799	1343	1571
Total Delay	66,887	30,993	18,019	4,353	13,521
v/c	-	**0.91**	**0.84**	**0.55**	**0.79**
Avg. Delay	**14.1**	**24.4**	**12.0**	**5.9**	**10.9**
Level of Service	**B**	**C**	**B**	**A**	**B**

Avg Queue Length (veh)	8.6	5.0	1.2	3.8
Avg Queue Length (m)	64.6	37.5	9.1	28.2
95% Queue (veh)	21.7	14.1	3.6	10.8
95% Queue (m)	**162.6**	**105.6**	**26.9**	**80.7**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Garner Road & Hamilton Drive (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	0	0	177	0	50	48	633	0	0	740	301
Peak hour factor	0.95	0	0	0	186	0	53	51	666	0	0	779	317
Heavy vehicle %	2%	0	0	0	190	0	54	52	679	0	0	795	323

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	0	921	0	244	795	375	731	190	849	1118	52	869

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	704	772	1098	1172
Total Delay	59,359	0	1,663	7,126	50,571
v/c	**-**	**0.00**	**0.32**	**0.67**	**0.95**
Avg. Delay	**28.4**	**5.1**	**6.8**	**9.7**	**45.2**
Level of Service	**D**	**A**	**A**	**A**	**E**

Avg Queue Length (veh)	0.0	0.5	2.0	14.0
Avg Queue Length (m)	0.0	3.5	14.8	105.4
95% Queue (veh)	0.0	1.4	5.8	29.6
95% Queue (m)	**0.0**	**10.3**	**43.5**	**222.1**

Single Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
One-Lane Roundabout
Garner Road & Hamilton Drive (PM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	0	0	138	0	78	50	817	0	0	694	101
Peak hour factor	0.95	0	0	0	145	0	82	53	860	0	0	731	106
Heavy vehicle %	2%	0	0	0	148	0	84	54	877	0	0	746	108

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	0	1079	0	232	746	162	931	148	830	854	54	1025

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	619	798	1120	1171
Total Delay	28,069	0	1,474	17,010	9,584
v/c	**-**	**0.00**	**0.29**	**0.83**	**0.73**
Avg. Delay	**13.9**	**5.8**	**6.4**	**18.3**	**11.2**
Level of Service	**B**	**A**	**A**	**C**	**B**

Avg Queue Length (veh)	0.0	0.4	4.7	2.7
Avg Queue Length (m)	0.0	3.1	35.4	20.0
95% Queue (veh)	0.0	1.2	13.0	7.7
95% Queue (m)	**0.0**	**9.2**	**97.3**	**57.8**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Garner Road & Hamilton Drive (AM)

08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	0	0	177	0	50	48	633	0	0	740	301
Peak hour factor	0.95	0	0	0	186	0	53	51	666	0	0	779	317
Heavy vehicle %	2%	0	0	0	190	0	54	52	679	0	0	795	323

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	0	921	0	244	795	375	731	190	849	1118	52	869

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1750	1839	2266	2363
Total Delay	5,495	0	551	1,714	3,230
v/c	**-**	**0.00**	**0.13**	**0.32**	**0.47**
Avg. Delay	**2.6**	**2.1**	**2.3**	**2.3**	**2.9**
Level of Service	**A**	**A**	**A**	**A**	**A**

Avg Queue Length (veh)	0.0	0.2	0.5	0.9
Avg Queue Length (m)	0.0	1.1	3.6	6.7
95% Queue (veh)	0.0	0.5	1.4	2.7
95% Queue (m)	**0.0**	**3.4**	**10.7**	**20.1**

Double Lane Roundabout Operation Analysis

FHWA Methodology

2031 Horizon
Two-Lane Roundabout
Garner Road & Hamilton Drive (PM)

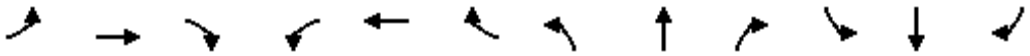
08-8952 Ancaster TMP
City of Hamilton
2010 Nov 09

	Adj	Northbound			Southbound			Eastbound			Westbound		
		L	T	R	L	T	R	L	T	R	L	T	R
Base volume	-	0	0	0	138	0	78	50	817	0	0	694	101
Peak hour factor	0.95	0	0	0	145	0	82	53	860	0	0	731	106
Heavy vehicle %	2%	0	0	0	148	0	84	54	877	0	0	746	108

	Entering	Circ	Exit SB	Entering	Circ	Exit NB	Entering	Circ	Exit WB	Entering	Circ	Exit EB
Flow Rate	0	1079	0	232	746	162	931	148	830	854	54	1025

	Overall	Northbound	Southbound	Eastbound	Westbound
Capacity	-	1638	1873	2296	2362
Total Delay	5,002	0	509	2,455	2,038
v/c	-	**0.00**	**0.12**	**0.41**	**0.36**
Avg. Delay	**2.5**	**2.2**	**2.2**	**2.6**	**2.4**
Level of Service	**A**	**A**	**A**	**A**	**A**

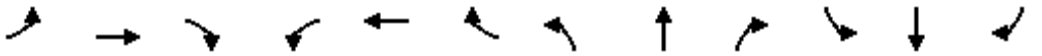
Avg Queue Length (veh)	0.0	0.1	0.7	0.6
Avg Queue Length (m)	0.0	1.1	5.1	4.2
95% Queue (veh)	0.0	0.4	2.0	1.7
95% Queue (m)	**0.0**	**3.2**	**15.3**	**12.7**



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	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	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1750	1842	1566	1750	1842	1566	1711	1842	1531	1711	1736	
Flt Permitted	0.30	1.00	1.00	0.08	1.00	1.00	0.63	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	554	1842	1566	153	1842	1566	1131	1842	1531	1345	1736	
Volume (vph)	4	825	368	212	592	6	319	15	1133	38	29	18
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	897	400	230	643	7	347	16	1232	41	32	20
RTOR Reduction (vph)	0	0	84	0	0	4	0	0	255	0	16	0
Lane Group Flow (vph)	4	897	316	230	643	3	347	16	977	41	36	0
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	42.2	42.2	42.2	61.9	61.9	61.9	55.6	55.6	55.6	24.7	24.7	
Effective Green, g (s)	44.1	44.1	44.1	63.8	63.8	63.8	57.3	57.3	57.3	26.4	26.4	
Actuated g/C Ratio	0.34	0.34	0.34	0.49	0.49	0.49	0.44	0.44	0.44	0.20	0.20	
Clearance Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	4.0	5.7	5.7	5.7	5.7	
Vehicle Extension (s)	3.5	3.5	3.5	2.0	3.5	3.5	3.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	189	629	535	270	910	774	623	818	680	275	355	
v/s Ratio Prot		c0.49		c0.10	0.35		0.12	0.01			0.02	
v/s Ratio Perm	0.01		0.20	0.32		0.00	0.13		c0.64	0.03		
v/c Ratio	0.02	1.43	0.59	0.85	0.71	0.00	0.56	0.02	1.44	0.15	0.10	
Uniform Delay, d1	28.2	42.5	35.1	37.5	25.4	16.6	25.1	20.1	35.9	42.1	41.7	
Progression Factor	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	0.1	200.9	1.9	21.2	2.6	0.0	1.1	0.0	205.1	0.1	0.0	
Delay (s)	28.2	243.4	36.9	58.7	28.0	16.6	26.2	20.1	241.0	42.2	41.8	
Level of Service	C	F	D	E	C	B	C	C	F	D	D	
Approach Delay (s)		179.2			35.9			192.0			42.0	
Approach LOS		F			D			F			D	

Intersection Summary			
HCM Average Control Delay	148.6	HCM Level of Service	F
HCM Volume to Capacity ratio	1.36		
Actuated Cycle Length (s)	129.1	Sum of lost time (s)	12.0
Intersection Capacity Utilization	131.9%	ICU Level of Service	H
Analysis Period (min)	15		

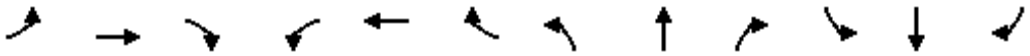
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	1.00	0.95		1.00		1.00	0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	0.98	1.00
Satd. Flow (prot)		4916	1531	1711	3421		1711		1531	1628	3348	1601
Flt Permitted		1.00	1.00	0.95	1.00		0.39		1.00	0.95	0.98	1.00
Satd. Flow (perm)		4916	1531	1711	3421		700		1531	1628	3348	1601
Volume (vph)	0	845	112	243	1202	0	301	0	327	313	173	236
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	918	122	264	1307	0	327	0	355	340	188	257
RTOR Reduction (vph)	0	0	85	0	0	0	0	0	5	0	0	37
Lane Group Flow (vph)	0	918	37	264	1307	0	327	0	350	170	358	220
Turn Type			Perm	Prot			custom		custom	Perm		Perm
Protected Phases		6		5	2		3		5 8		4	
Permitted Phases			6				8		3	4	4	4
Actuated Green, G (s)		25.3	25.3	13.0	43.3		34.7		53.7	23.7	23.7	23.7
Effective Green, g (s)		27.3	27.3	14.0	45.3		36.7		54.7	25.7	25.7	25.7
Actuated g/C Ratio		0.30	0.30	0.16	0.50		0.41		0.61	0.29	0.29	0.29
Clearance Time (s)		6.0	6.0	5.0	6.0		3.0			6.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0	1.0	2.0		1.0			1.0	1.0	1.0
Lane Grp Cap (vph)		1491	464	266	1722		364		931	465	956	457
v/s Ratio Prot		0.19		c0.15	c0.38		c0.07		0.23			
v/s Ratio Perm			0.02				c0.30			0.10	0.11	0.14
v/c Ratio		0.62	0.08	0.99	0.76		0.90		0.38	0.37	0.37	0.48
Uniform Delay, d1		26.9	22.4	37.9	18.0		24.1		9.0	25.6	25.7	26.6
Progression Factor		1.15	1.61	1.04	1.28		1.09		1.13	1.00	1.00	1.00
Incremental Delay, d2		1.7	0.3	41.5	2.0		23.2		0.1	0.2	0.1	0.3
Delay (s)		32.6	36.4	81.2	25.0		49.6		10.2	25.8	25.8	26.9
Level of Service		C	D	F	C		D		B	C	C	C
Approach Delay (s)		33.1			34.4			29.1			26.2	
Approach LOS		C			C			C			C	

Intersection Summary			
HCM Average Control Delay	31.6	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

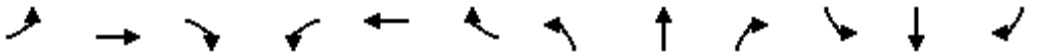
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.88		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1629		3319	1715	
Flt Permitted	0.07	1.00	1.00	0.31	1.00	1.00	0.63	1.00		0.40	1.00	
Satd. Flow (perm)	134	3500	1531	565	3500	1531	1136	1629		1410	1715	
Volume (vph)	53	690	22	125	1525	148	115	50	167	279	63	53
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	750	24	136	1658	161	125	54	182	303	68	58
RTOR Reduction (vph)	0	0	10	0	0	55	0	143	0	0	42	0
Lane Group Flow (vph)	58	750	14	136	1658	106	125	93	0	303	84	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			Perm		
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6		6	2		2	8			4		
Actuated Green, G (s)	55.7	51.6	51.6	59.3	53.4	53.4	17.5	17.5		17.5	17.5	
Effective Green, g (s)	56.7	53.6	53.6	60.3	55.4	55.4	19.5	19.5		19.5	19.5	
Actuated g/C Ratio	0.63	0.60	0.60	0.67	0.62	0.62	0.22	0.22		0.22	0.22	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	139	2084	912	441	2154	942	246	353		306	372	
v/s Ratio Prot	0.01	0.21		c0.02	c0.47			0.06			0.05	
v/s Ratio Perm	0.25		0.01	0.19		0.07	0.11			c0.21		
v/c Ratio	0.42	0.36	0.02	0.31	0.77	0.11	0.51	0.26		0.99	0.23	
Uniform Delay, d1	11.5	9.4	7.4	5.8	12.6	7.1	31.0	29.3		35.2	29.0	
Progression Factor	0.99	0.66	0.33	0.67	0.95	0.65	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.5	0.0	0.1	1.8	0.2	0.6	0.1		48.6	0.1	
Delay (s)	12.0	6.6	2.5	4.0	13.9	4.8	31.6	29.4		83.7	29.2	
Level of Service	B	A	A	A	B	A	C	C		F	C	
Approach Delay (s)		6.9			12.4			30.2			67.7	
Approach LOS		A			B			C			E	

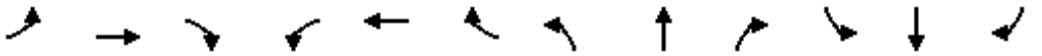
Intersection Summary			
HCM Average Control Delay	19.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



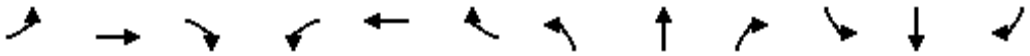
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	1801	1531	1711	1801	1531	1711	3249		1711	1726	
Flt Permitted	0.40	1.00	1.00	0.68	1.00	1.00	0.62	1.00		0.27	1.00	
Satd. Flow (perm)	724	1801	1531	1232	1801	1531	1111	3249		489	1726	
Volume (vph)	325	104	82	82	177	491	88	276	139	258	151	58
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	353	113	89	89	192	534	96	300	151	280	164	63
RTOR Reduction (vph)	0	0	49	0	0	395	0	55	0	0	13	0
Lane Group Flow (vph)	353	113	40	89	192	139	96	396	0	280	214	0
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt			pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	37.6	37.6	37.6	16.6	16.6	16.6	20.2	17.2		38.7	31.7	
Effective Green, g (s)	39.7	39.7	39.7	18.7	18.7	18.7	22.5	19.5		41.0	34.0	
Actuated g/C Ratio	0.45	0.45	0.45	0.21	0.21	0.21	0.25	0.22		0.46	0.38	
Clearance Time (s)	4.0	6.1	6.1	6.1	6.1	6.1	4.0	6.3		4.0	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	513	806	685	260	380	323	302	714		467	662	
v/s Ratio Prot	c0.13	0.06			0.11		0.01	0.12		c0.12	0.12	
v/s Ratio Perm	c0.18		0.03	0.07		0.09	0.07			c0.16		
v/c Ratio	0.69	0.14	0.06	0.34	0.51	0.43	0.32	0.55		0.60	0.32	
Uniform Delay, d1	17.6	14.4	13.9	29.8	30.9	30.4	26.2	30.7		16.2	19.3	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.8	0.1	0.0	0.8	1.1	0.9	0.6	0.9		2.1	0.3	
Delay (s)	21.5	14.5	13.9	30.6	32.0	31.3	26.8	31.7		18.3	19.5	
Level of Service	C	B	B	C	C	C	C	C		B	B	
Approach Delay (s)		18.8			31.4			30.8			18.9	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	25.8	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	88.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	70.5%	ICU Level of Service	C
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3421	1531	1711	3421	1531	1711	1801	1531	1711	1801	1531
Flt Permitted	0.24	1.00	1.00	0.46	1.00	1.00	0.66	1.00	1.00	0.64	1.00	1.00
Satd. Flow (perm)	424	3421	1531	832	3421	1531	1188	1801	1531	1150	1801	1531
Volume (vph)	73	474	23	37	529	46	12	174	78	57	141	105
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	79	515	25	40	575	50	13	189	85	62	153	114
RTOR Reduction (vph)	0	0	16	0	0	37	0	0	44	0	0	59
Lane Group Flow (vph)	79	515	9	40	575	13	13	189	41	62	153	55
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	20.1	20.1	20.1	13.9	13.9	13.9	26.5	26.5	26.5	26.5	26.5	26.5
Effective Green, g (s)	20.1	20.1	20.1	13.9	13.9	13.9	26.5	26.5	26.5	26.5	26.5	26.5
Actuated g/C Ratio	0.37	0.37	0.37	0.25	0.25	0.25	0.49	0.49	0.49	0.49	0.49	0.49
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	208	1259	564	212	871	390	577	874	743	558	874	743
v/s Ratio Prot	0.02	c0.15			c0.17			c0.10			0.08	
v/s Ratio Perm	0.12		0.01	0.05		0.01	0.01		0.03	0.05		0.04
v/c Ratio	0.38	0.41	0.02	0.19	0.66	0.03	0.02	0.22	0.06	0.11	0.18	0.07
Uniform Delay, d1	12.1	12.8	11.0	15.9	18.2	15.3	7.3	8.1	7.4	7.6	7.9	7.5
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	1.2	0.2	0.0	0.4	1.9	0.0	0.1	0.6	0.1	0.4	0.4	0.2
Delay (s)	13.3	13.0	11.0	16.4	20.1	15.3	7.4	8.6	7.6	8.0	8.3	7.7
Level of Service	B	B	B	B	C	B	A	A	A	A	A	A
Approach Delay (s)		13.0			19.5			8.3			8.1	
Approach LOS		B			B			A			A	

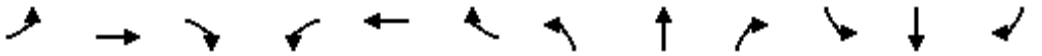
Intersection Summary			
HCM Average Control Delay	13.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.39		
Actuated Cycle Length (s)	54.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	44.5%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	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	0.96	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1750	1842	1566	1750	1842	1566	1711	1842	1531	1711	1775	
Flt Permitted	0.37	1.00	1.00	0.09	1.00	1.00	0.74	1.00	1.00	0.73	1.00	
Satd. Flow (perm)	679	1842	1566	167	1842	1566	1325	1842	1531	1310	1775	
Volume (vph)	15	607	362	1043	721	41	654	41	235	15	23	7
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	660	393	1134	784	45	711	45	255	16	25	8
RTOR Reduction (vph)	0	0	109	0	0	15	0	0	167	0	5	0
Lane Group Flow (vph)	16	660	284	1134	784	30	711	45	88	16	28	0
Turn Type	Perm		Perm	pm+pt		Perm	Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	38.1	38.1	38.1	88.1	88.1	88.1	50.3	50.3	50.3	50.3	50.3	
Effective Green, g (s)	40.0	40.0	40.0	90.0	90.0	90.0	52.0	52.0	52.0	52.0	52.0	
Actuated g/C Ratio	0.27	0.27	0.27	0.60	0.60	0.60	0.35	0.35	0.35	0.35	0.35	
Clearance Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	5.7	5.7	5.7	5.7	5.7	
Vehicle Extension (s)	3.5	3.5	3.5	2.0	3.5	3.5	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	181	491	418	586	1105	940	459	639	531	454	615	
v/s Ratio Prot		0.36		c0.59	0.43			0.02			0.02	
v/s Ratio Perm	0.02		0.18	c0.57		0.02	c0.54		0.06	0.01		
v/c Ratio	0.09	1.34	0.68	1.94	0.71	0.03	1.55	0.07	0.17	0.04	0.05	
Uniform Delay, d1	41.3	55.0	49.3	54.2	20.9	12.2	49.0	32.8	34.0	32.4	32.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.3	168.1	4.7	427.1	2.2	0.0	257.7	0.0	0.1	0.0	0.0	
Delay (s)	41.6	223.1	54.0	481.3	23.1	12.2	306.7	32.8	34.0	32.4	32.5	
Level of Service	D	F	D	F	C	B	F	C	C	C	C	
Approach Delay (s)		158.2			287.5			225.7			32.5	
Approach LOS		F			F			F			C	

Intersection Summary			
HCM Average Control Delay	235.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.78		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	142.6%	ICU Level of Service	H
Analysis Period (min)	15		

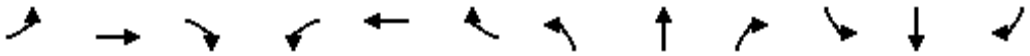
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	1.00	0.95		1.00		1.00	0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	0.99	1.00
Satd. Flow (prot)		4916	1531	1711	3421		1711		1531	1628	3403	1601
Flt Permitted		1.00	1.00	0.95	1.00		0.25		1.00	0.95	0.99	1.00
Satd. Flow (perm)		4916	1531	1711	3421		459		1531	1628	3403	1601
Volume (vph)	0	2377	284	106	741	0	282	0	433	294	402	351
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2584	309	115	805	0	307	0	471	320	437	382
RTOR Reduction (vph)	0	0	173	0	0	0	0	0	0	0	0	100
Lane Group Flow (vph)	0	2584	136	115	805	0	307	0	471	244	513	282
Turn Type			Perm	Prot			custom		custom	Perm		Perm
Protected Phases		6		5	2		3		5 8		4	
Permitted Phases			6				8		3	4	4	4
Actuated Green, G (s)		42.0	42.0	4.0	51.0		37.0		47.0	25.0	25.0	25.0
Effective Green, g (s)		44.0	44.0	5.0	53.0		39.0		48.0	27.0	27.0	27.0
Actuated g/C Ratio		0.44	0.44	0.05	0.53		0.39		0.48	0.27	0.27	0.27
Clearance Time (s)		6.0	6.0	5.0	6.0		3.0			6.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0	1.0	2.0		1.0			1.0	1.0	1.0
Lane Grp Cap (vph)		2163	674	86	1813		279		735	440	919	432
v/s Ratio Prot		c0.53		c0.07	0.24		c0.09		0.31			
v/s Ratio Perm			0.09				c0.34			0.15	0.15	0.18
v/c Ratio		1.19	0.20	1.34	0.44		1.10		0.64	0.55	0.56	0.65
Uniform Delay, d1		28.0	17.2	47.5	14.4		28.4		19.5	31.3	31.4	32.3
Progression Factor		0.99	1.62	1.05	0.96		1.60		1.59	1.00	1.00	1.00
Incremental Delay, d2		88.0	0.1	190.3	0.5		71.8		0.9	0.9	0.4	2.7
Delay (s)		115.9	28.0	240.3	14.4		117.1		32.0	32.2	31.8	35.0
Level of Service		F	C	F	B		F		C	C	C	D
Approach Delay (s)		106.5			42.6			65.6			33.0	
Approach LOS		F			D			E			C	

Intersection Summary			
HCM Average Control Delay	76.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.4%	ICU Level of Service	G
Analysis Period (min)	15		

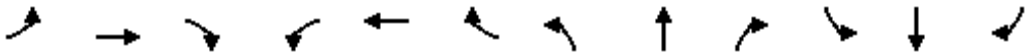
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1655		3319	1740	
Flt Permitted	0.23	1.00	1.00	0.08	1.00	1.00	0.34	1.00		0.25	1.00	
Satd. Flow (perm)	409	3500	1531	148	3500	1531	619	1655		882	1740	
Volume (vph)	238	2342	165	227	808	188	140	118	246	1124	190	112
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	259	2546	179	247	878	204	152	128	267	1222	207	122
RTOR Reduction (vph)	0	0	53	0	0	104	0	75	0	0	21	0
Lane Group Flow (vph)	259	2546	126	247	878	100	152	320	0	1222	308	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			Perm		
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6		6	2		2	8			4		
Actuated Green, G (s)	58.2	48.0	48.0	55.8	46.8	46.8	28.0	28.0		28.0	28.0	
Effective Green, g (s)	59.2	50.0	50.0	56.8	48.8	48.8	30.0	30.0		30.0	30.0	
Actuated g/C Ratio	0.59	0.50	0.50	0.57	0.49	0.49	0.30	0.30		0.30	0.30	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	362	1750	766	209	1708	747	186	497		265	522	
v/s Ratio Prot	0.07	c0.73		c0.09	0.25			0.19			0.18	
v/s Ratio Perm	0.36		0.08	0.58		0.07	0.25			c1.39		
v/c Ratio	0.72	1.45	0.16	1.18	0.51	0.13	0.82	0.64		4.61	0.59	
Uniform Delay, d1	11.8	25.0	13.6	48.2	17.5	14.0	32.5	30.4		35.0	29.8	
Progression Factor	1.05	0.96	0.82	1.15	1.00	1.56	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	205.0	0.0	112.6	0.8	0.3	22.4	2.1		1633.7	1.2	
Delay (s)	12.9	229.0	11.3	168.0	18.4	22.1	54.8	32.5		1668.7	31.0	
Level of Service	B	F	B	F	B	C	D	C		F	C	
Approach Delay (s)		197.2			46.8			38.7			1321.3	
Approach LOS		F			D			D			F	

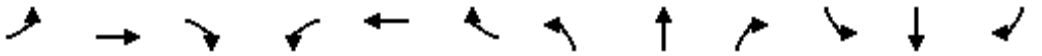
Intersection Summary			
HCM Average Control Delay	424.4	HCM Level of Service	F
HCM Volume to Capacity ratio	2.40		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	144.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



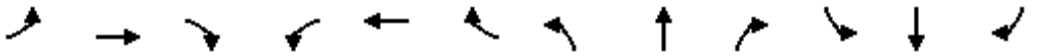
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	1801	1531	1711	1801	1531	1711	3199		1711	1675	
Flt Permitted	0.65	1.00	1.00	0.28	1.00	1.00	0.44	1.00		0.37	1.00	
Satd. Flow (perm)	1168	1801	1531	498	1801	1531	793	3199		668	1675	
Volume (vph)	64	253	142	213	158	469	117	167	128	681	292	255
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	70	275	154	232	172	510	127	182	139	740	317	277
RTOR Reduction (vph)	0	0	120	0	0	333	0	110	0	0	23	0
Lane Group Flow (vph)	70	275	34	232	172	177	127	211	0	740	571	0
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	19.6	19.6	19.6	31.7	31.7	31.7	25.5	17.7		53.3	41.5	
Effective Green, g (s)	21.7	21.7	21.7	33.8	33.8	33.8	27.8	20.0		55.6	43.8	
Actuated g/C Ratio	0.22	0.22	0.22	0.35	0.35	0.35	0.29	0.21		0.57	0.45	
Clearance Time (s)	6.1	6.1	6.1	4.0	6.1	6.1	4.0	6.3		4.0	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	260	401	341	274	625	531	300	657		720	753	
v/s Ratio Prot		0.15		c0.07	0.10		0.03	0.07		c0.33	0.34	
v/s Ratio Perm	0.06		0.02	c0.22		0.12	0.09			c0.25		
v/c Ratio	0.27	0.69	0.10	0.85	0.28	0.33	0.42	0.32		1.03	0.76	
Uniform Delay, d1	31.3	34.7	30.1	27.5	23.0	23.5	26.9	32.9		17.9	22.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.6	4.8	0.1	20.8	0.2	0.4	1.0	0.3		40.8	4.4	
Delay (s)	31.9	39.5	30.2	48.2	23.2	23.9	27.8	33.2		58.7	26.8	
Level of Service	C	D	C	D	C	C	C	C		E	C	
Approach Delay (s)		35.6			29.9			31.7			44.5	
Approach LOS		D			C			C			D	

Intersection Summary					
HCM Average Control Delay	37.1	HCM Level of Service	D		
HCM Volume to Capacity ratio	0.94				
Actuated Cycle Length (s)	97.4	Sum of lost time (s)	8.0		
Intersection Capacity Utilization	84.9%	ICU Level of Service	E		
Analysis Period (min)	15				
c Critical Lane Group					



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3421	1531	1711	3421	1531	1711	1801	1531	1711	1801	1531
Flt Permitted	0.26	1.00	1.00	0.37	1.00	1.00	0.64	1.00	1.00	0.65	1.00	1.00
Satd. Flow (perm)	471	3421	1531	658	3421	1531	1159	1801	1531	1165	1801	1531
Volume (vph)	96	695	27	40	508	81	32	161	46	40	166	57
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	104	755	29	43	552	88	35	175	50	43	180	62
RTOR Reduction (vph)	0	0	16	0	0	64	0	0	29	0	0	33
Lane Group Flow (vph)	104	755	13	43	552	24	35	175	21	43	180	29
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	25.1	25.1	25.1	15.3	15.3	15.3	23.6	23.6	23.6	23.6	23.6	23.6
Effective Green, g (s)	25.1	25.1	25.1	15.3	15.3	15.3	23.6	23.6	23.6	23.6	23.6	23.6
Actuated g/C Ratio	0.44	0.44	0.44	0.27	0.27	0.27	0.42	0.42	0.42	0.42	0.42	0.42
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	335	1514	678	178	923	413	482	750	637	485	750	637
v/s Ratio Prot	0.03	c0.22			c0.16			0.10			c0.10	
v/s Ratio Perm	0.11		0.01	0.07		0.02	0.03		0.01	0.04		0.02
v/c Ratio	0.31	0.50	0.02	0.24	0.60	0.06	0.07	0.23	0.03	0.09	0.24	0.05
Uniform Delay, d1	10.0	11.3	8.9	16.2	18.0	15.4	10.0	10.7	9.8	10.0	10.7	9.8
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	0.5	0.3	0.0	0.7	1.1	0.1	0.3	0.7	0.1	0.4	0.8	0.1
Delay (s)	10.6	11.6	8.9	16.9	19.1	15.4	10.3	11.4	9.9	10.4	11.5	10.0
Level of Service	B	B	A	B	B	B	B	B	A	B	B	A
Approach Delay (s)		11.4			18.5			11.0			11.0	
Approach LOS		B			B			B			B	

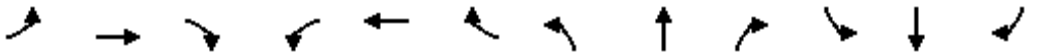
Intersection Summary			
HCM Average Control Delay	13.6	HCM Level of Service	B
HCM Volume to Capacity ratio	0.41		
Actuated Cycle Length (s)	56.7	Sum of lost time (s)	12.0
Intersection Capacity Utilization	47.9%	ICU Level of Service	A
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	4.0	3.3	3.3	4.0	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3500	1531	1711	3500	1531	1711	1946	1531	1711	1946	1531
Flt Permitted	0.15	1.00	1.00	0.62	1.00	1.00	0.60	1.00	1.00	0.69	1.00	1.00
Satd. Flow (perm)	265	3500	1531	1118	3500	1531	1085	1946	1531	1237	1946	1531
Volume (vph)	25	192	105	170	1070	30	456	100	60	17	204	136
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	209	114	185	1163	33	496	109	65	18	222	148
RTOR Reduction (vph)	0	0	70	0	0	20	0	0	33	0	0	8
Lane Group Flow (vph)	27	209	44	185	1163	13	496	109	32	18	222	140
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	25.2	25.2	25.2	25.2	25.2	25.2	31.8	31.8	31.8	31.8	31.8	31.8
Effective Green, g (s)	27.2	27.2	27.2	27.2	27.2	27.2	34.8	34.8	34.8	34.8	34.8	34.8
Actuated g/C Ratio	0.39	0.39	0.39	0.39	0.39	0.39	0.50	0.50	0.50	0.50	0.50	0.50
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	103	1360	595	434	1360	595	539	967	761	615	967	761
v/s Ratio Prot		0.06			c0.33			0.06			0.11	
v/s Ratio Perm	0.10		0.03	0.17		0.01	c0.46		0.02	0.01		0.09
v/c Ratio	0.26	0.15	0.07	0.43	0.86	0.02	0.92	0.11	0.04	0.03	0.23	0.18
Uniform Delay, d1	14.6	13.9	13.5	15.7	19.6	13.2	16.3	9.4	9.0	9.0	10.0	9.7
Progression Factor	1.00	1.00	1.00	0.81	0.88	0.59	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	0.2	0.2	3.0	7.0	0.1	21.4	0.1	0.0	0.0	0.2	0.2
Delay (s)	20.7	14.2	13.7	15.7	24.2	7.8	37.7	9.4	9.1	9.0	10.2	9.9
Level of Service	C	B	B	B	C	A	D	A	A	A	B	A
Approach Delay (s)		14.5			22.7			30.4			10.0	
Approach LOS		B			C			C			B	

Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

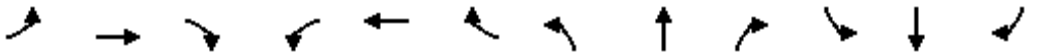
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	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	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1750	1842	1566	1750	1842	1566	1711	1842	1531	1711	1742	
Flt Permitted	0.22	1.00	1.00	0.08	1.00	1.00	0.64	1.00	1.00	0.75	1.00	
Satd. Flow (perm)	401	1842	1566	139	1842	1566	1147	1842	1531	1343	1742	
Volume (vph)	4	831	425	215	568	7	399	17	1213	40	32	18
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	903	462	234	617	8	434	18	1318	43	35	20
RTOR Reduction (vph)	0	0	100	0	0	4	0	0	109	0	16	0
Lane Group Flow (vph)	4	903	362	234	617	4	434	18	1209	43	39	0
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	47.1	47.1	47.1	60.1	60.1	60.1	69.4	69.4	69.4	28.5	28.5	
Effective Green, g (s)	49.0	49.0	49.0	62.0	62.0	62.0	71.1	71.1	71.1	30.2	30.2	
Actuated g/C Ratio	0.35	0.35	0.35	0.44	0.44	0.44	0.50	0.50	0.50	0.21	0.21	
Clearance Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	4.0	5.7	5.7	5.7	5.7	
Vehicle Extension (s)	3.5	3.5	3.5	2.0	3.5	3.5	3.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	139	640	544	164	809	688	725	928	771	287	373	
v/s Ratio Prot		0.49		c0.09	0.33		0.16	0.01			0.02	
v/s Ratio Perm	0.01		0.23	c0.54		0.00	0.15		c0.79	0.03		
v/c Ratio	0.03	1.41	0.67	1.43	0.76	0.01	0.60	0.02	1.57	0.15	0.11	
Uniform Delay, d1	30.4	46.0	39.1	68.2	33.3	22.2	23.4	17.5	35.0	45.0	44.6	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	
Incremental Delay, d2	0.1	194.1	3.2	223.6	4.4	0.0	1.3	0.0	262.1	0.1	0.0	
Delay (s)	30.5	240.2	42.3	291.8	37.8	22.2	24.7	17.5	297.1	45.1	44.6	
Level of Service	C	F	D	F	D	C	C	B	F	D	D	
Approach Delay (s)		172.8			106.8			227.5			44.8	
Approach LOS		F			F			F			D	

Intersection Summary			
HCM Average Control Delay	179.5	HCM Level of Service	F
HCM Volume to Capacity ratio	1.49		
Actuated Cycle Length (s)	141.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	137.2%	ICU Level of Service	H
Analysis Period (min)	15		

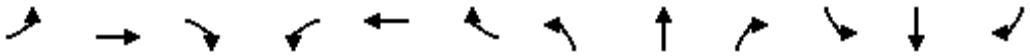
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	1.00	0.95		1.00		1.00	0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	0.98	1.00
Satd. Flow (prot)		4916	1531	1711	3421		1711		1531	1628	3348	1601
Flt Permitted		1.00	1.00	0.95	1.00		0.39		1.00	0.95	0.98	1.00
Satd. Flow (perm)		4916	1531	1711	3421		700		1531	1628	3348	1601
Volume (vph)	0	845	112	243	1202	0	301	0	327	313	173	236
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	918	122	264	1307	0	327	0	355	340	188	257
RTOR Reduction (vph)	0	0	85	0	0	0	0	0	5	0	0	37
Lane Group Flow (vph)	0	918	37	264	1307	0	327	0	350	170	358	220
Turn Type			Perm	Prot			custom		custom	Perm		Perm
Protected Phases		6		5	2		3		5 8		4	
Permitted Phases			6				8		3	4	4	4
Actuated Green, G (s)		25.3	25.3	13.0	43.3		34.7		53.7	23.7	23.7	23.7
Effective Green, g (s)		27.3	27.3	14.0	45.3		36.7		54.7	25.7	25.7	25.7
Actuated g/C Ratio		0.30	0.30	0.16	0.50		0.41		0.61	0.29	0.29	0.29
Clearance Time (s)		6.0	6.0	5.0	6.0		3.0			6.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0	1.0	2.0		1.0			1.0	1.0	1.0
Lane Grp Cap (vph)		1491	464	266	1722		364		931	465	956	457
v/s Ratio Prot		0.19		c0.15	c0.38		c0.07		0.23			
v/s Ratio Perm			0.02				c0.30			0.10	0.11	0.14
v/c Ratio		0.62	0.08	0.99	0.76		0.90		0.38	0.37	0.37	0.48
Uniform Delay, d1		26.9	22.4	37.9	18.0		24.1		9.0	25.6	25.7	26.6
Progression Factor		1.23	1.87	1.04	1.28		1.09		1.13	1.00	1.00	1.00
Incremental Delay, d2		1.7	0.3	41.5	2.0		23.2		0.1	0.2	0.1	0.3
Delay (s)		34.7	42.2	81.2	25.0		49.6		10.2	25.8	25.8	26.9
Level of Service		C	D	F	C		D		B	C	C	C
Approach Delay (s)		35.6			34.4			29.1			26.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	32.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

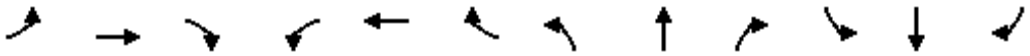
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.88		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1629		3319	1715	
Flt Permitted	0.07	1.00	1.00	0.31	1.00	1.00	0.63	1.00		0.40	1.00	
Satd. Flow (perm)	134	3500	1531	565	3500	1531	1136	1629		1410	1715	
Volume (vph)	53	690	22	125	1525	148	115	50	167	279	63	53
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	750	24	136	1658	161	125	54	182	303	68	58
RTOR Reduction (vph)	0	0	10	0	0	55	0	143	0	0	42	0
Lane Group Flow (vph)	58	750	14	136	1658	106	125	93	0	303	84	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			Perm		
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6		6	2		2	8			4		
Actuated Green, G (s)	55.7	51.6	51.6	59.3	53.4	53.4	17.5	17.5		17.5	17.5	
Effective Green, g (s)	56.7	53.6	53.6	60.3	55.4	55.4	19.5	19.5		19.5	19.5	
Actuated g/C Ratio	0.63	0.60	0.60	0.67	0.62	0.62	0.22	0.22		0.22	0.22	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	139	2084	912	441	2154	942	246	353		306	372	
v/s Ratio Prot	0.01	0.21		c0.02	c0.47			0.06			0.05	
v/s Ratio Perm	0.25		0.01	0.19		0.07	0.11			c0.21		
v/c Ratio	0.42	0.36	0.02	0.31	0.77	0.11	0.51	0.26		0.99	0.23	
Uniform Delay, d1	11.5	9.4	7.4	5.8	12.6	7.1	31.0	29.3		35.2	29.0	
Progression Factor	1.15	0.99	0.92	0.67	0.95	0.65	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.5	0.0	0.1	1.8	0.2	0.6	0.1		48.6	0.1	
Delay (s)	13.8	9.7	6.9	4.0	13.9	4.8	31.6	29.4		83.7	29.2	
Level of Service	B	A	A	A	B	A	C	C		F	C	
Approach Delay (s)		9.9			12.4			30.2			67.7	
Approach LOS		A			B			C			E	

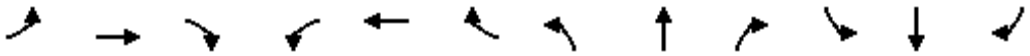
Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	1801	1531	1711	1801	1531	1711	3285		1711	1747	
Flt Permitted	0.29	1.00	1.00	0.66	1.00	1.00	0.60	1.00		0.20	1.00	
Satd. Flow (perm)	514	1801	1531	1197	1801	1531	1082	3285		368	1747	
Volume (vph)	302	133	125	82	244	543	80	385	139	331	189	47
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	328	145	136	89	265	590	87	418	151	360	205	51
RTOR Reduction (vph)	0	0	78	0	0	349	0	31	0	0	7	0
Lane Group Flow (vph)	328	145	58	89	265	241	87	538	0	360	249	0
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt			pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	41.5	41.5	41.5	20.4	20.4	20.4	25.7	22.7		48.6	41.6	
Effective Green, g (s)	43.6	43.6	43.6	22.5	22.5	22.5	28.0	25.0		50.9	43.9	
Actuated g/C Ratio	0.43	0.43	0.43	0.22	0.22	0.22	0.27	0.24		0.50	0.43	
Clearance Time (s)	4.0	6.1	6.1	6.1	6.1	6.1	4.0	6.3		4.0	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	418	766	651	263	395	336	314	801		470	748	
v/s Ratio Prot	c0.13	0.08			0.15		0.01	0.16		c0.16	0.14	
v/s Ratio Perm	c0.20		0.04	0.07		0.16	0.07			c0.22		
v/c Ratio	0.78	0.19	0.09	0.34	0.67	0.72	0.28	0.67		0.77	0.33	
Uniform Delay, d1	22.3	18.4	17.6	33.7	36.6	37.1	28.6	35.0		18.6	19.5	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	9.3	0.1	0.1	0.8	4.4	7.1	0.5	2.2		7.3	0.3	
Delay (s)	31.6	18.5	17.6	34.5	41.0	44.2	29.1	37.3		25.9	19.8	
Level of Service	C	B	B	C	D	D	C	D		C	B	
Approach Delay (s)		25.4			42.4			36.2			23.4	
Approach LOS		C			D			D			C	

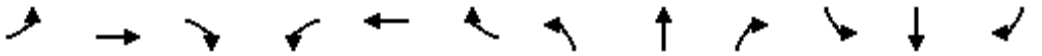
Intersection Summary			
HCM Average Control Delay	33.1	HCM Level of Service	C
HCM Volume to Capacity ratio	0.76		
Actuated Cycle Length (s)	102.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	76.3%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.3	3.0	3.5	3.3	3.3	3.3	3.3	3.0	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	3500	1531	1652	3500	1531	1711	3266		1652	3228	
Flt Permitted	0.20	1.00	1.00	0.26	1.00	1.00	0.47	1.00		0.26	1.00	
Satd. Flow (perm)	346	3500	1531	455	3500	1531	850	3266		460	3228	
Volume (vph)	297	991	37	59	650	138	20	290	125	72	218	235
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	323	1077	40	64	707	150	22	315	136	78	237	255
RTOR Reduction (vph)	0	0	20	0	0	102	0	48	0	0	171	0
Lane Group Flow (vph)	323	1077	20	64	707	48	22	403	0	78	321	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			pm+pt		
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	44.7	38.6	38.6	26.2	24.1	24.1	15.2	15.2		24.9	24.9	
Effective Green, g (s)	46.7	40.6	40.6	28.2	26.1	26.1	17.2	17.2		26.9	26.9	
Actuated g/C Ratio	0.57	0.50	0.50	0.35	0.32	0.32	0.21	0.21		0.33	0.33	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	464	1741	762	188	1119	490	179	688		235	1064	
v/s Ratio Prot	c0.14	0.31		0.01	0.20			c0.12		0.02	c0.10	
v/s Ratio Perm	c0.26		0.01	0.11		0.03	0.03			0.09		
v/c Ratio	0.70	0.62	0.03	0.34	0.63	0.10	0.12	0.59		0.33	0.30	
Uniform Delay, d1	11.8	14.9	10.4	18.2	23.7	19.5	26.1	29.0		19.9	20.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	4.5	0.9	0.0	1.1	1.5	0.2	0.3	1.3		0.8	0.2	
Delay (s)	16.3	15.7	10.5	19.3	25.1	19.6	26.4	30.3		20.7	20.5	
Level of Service	B	B	B	B	C	B	C	C		C	C	
Approach Delay (s)		15.7			23.8			30.1			20.5	
Approach LOS		B			C			C			C	

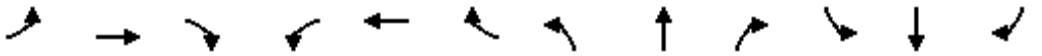
Intersection Summary			
HCM Average Control Delay	20.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	81.6	Sum of lost time (s)	12.0
Intersection Capacity Utilization	69.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3421	1531	1711	3421	1531	1711	1801	1531	1711	1801	1531
Flt Permitted	0.20	1.00	1.00	0.40	1.00	1.00	0.59	1.00	1.00	0.51	1.00	1.00
Satd. Flow (perm)	353	3421	1531	724	3421	1531	1062	1801	1531	912	1801	1531
Volume (vph)	400	604	37	59	672	56	20	290	125	81	218	147
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	435	657	40	64	730	61	22	315	136	88	237	160
RTOR Reduction (vph)	0	0	23	0	0	42	0	0	75	0	0	82
Lane Group Flow (vph)	435	657	17	64	730	19	22	315	61	88	237	78
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	24.4	24.4	24.4	16.4	16.4	16.4	26.0	26.0	26.0	26.0	26.0	26.0
Effective Green, g (s)	24.4	24.4	24.4	16.4	16.4	16.4	26.0	26.0	26.0	26.0	26.0	26.0
Actuated g/C Ratio	0.42	0.42	0.42	0.28	0.28	0.28	0.45	0.45	0.45	0.45	0.45	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	241	1429	640	203	961	430	473	802	682	406	802	682
v/s Ratio Prot	c0.12	0.19			0.21			c0.17			0.13	
v/s Ratio Perm	c0.63		0.01	0.09		0.01	0.02		0.04	0.10		0.05
v/c Ratio	1.80	0.46	0.03	0.32	0.76	0.04	0.05	0.39	0.09	0.22	0.30	0.12
Uniform Delay, d1	16.0	12.3	10.0	16.6	19.2	15.3	9.2	10.9	9.4	9.9	10.3	9.5
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	378.3	0.2	0.0	0.9	3.5	0.0	0.2	1.4	0.3	1.2	0.9	0.3
Delay (s)	394.3	12.5	10.0	17.5	22.7	15.3	9.4	12.3	9.6	11.2	11.3	9.8
Level of Service	F	B	B	B	C	B	A	B	A	B	B	A
Approach Delay (s)		159.1			21.8			11.4			10.8	
Approach LOS		F			C			B			B	

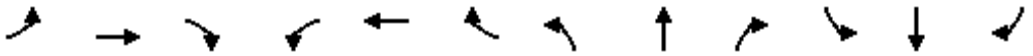
Intersection Summary			
HCM Average Control Delay	71.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.04		
Actuated Cycle Length (s)	58.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	73.8%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	4.0	3.3	3.3	4.0	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3500	1531	1711	3500	1531	1711	1946	1531	1711	1946	1531
Flt Permitted	0.56	1.00	1.00	0.16	1.00	1.00	0.64	1.00	1.00	0.34	1.00	1.00
Satd. Flow (perm)	1017	3500	1531	293	3500	1531	1148	1946	1531	614	1946	1531
Volume (vph)	174	1081	498	92	282	34	199	351	216	21	149	39
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	1175	541	100	307	37	216	382	235	23	162	42
RTOR Reduction (vph)	0	0	243	0	0	17	0	0	23	0	0	28
Lane Group Flow (vph)	189	1175	298	100	307	20	216	382	212	23	162	14
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	36.5	36.5	36.5	36.5	36.5	36.5	20.5	20.5	20.5	20.5	20.5	20.5
Effective Green, g (s)	38.5	38.5	38.5	38.5	38.5	38.5	23.5	23.5	23.5	23.5	23.5	23.5
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.55	0.55	0.34	0.34	0.34	0.34	0.34	0.34
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	559	1925	842	161	1925	842	385	653	514	206	653	514
v/s Ratio Prot		0.34			0.09			c0.20			0.08	
v/s Ratio Perm	0.19		0.19	c0.34		0.01	0.19		0.14	0.04		0.01
v/c Ratio	0.34	0.61	0.35	0.62	0.16	0.02	0.56	0.58	0.41	0.11	0.25	0.03
Uniform Delay, d1	8.7	10.7	8.8	10.8	7.8	7.2	19.0	19.2	17.9	16.0	16.8	15.6
Progression Factor	1.00	1.00	1.00	0.63	0.38	0.11	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	1.6	1.5	1.2	14.8	0.2	0.0	2.3	1.6	0.7	0.3	0.3	0.0
Delay (s)	10.3	12.1	10.0	21.6	3.1	0.8	21.3	20.8	18.7	16.4	17.1	15.6
Level of Service	B	B	A	C	A	A	C	C	B	B	B	B
Approach Delay (s)		11.3			7.1			20.3			16.8	
Approach LOS		B			A			C			B	

Intersection Summary			
HCM Average Control Delay	13.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.4%	ICU Level of Service	D
Analysis Period (min)	15		

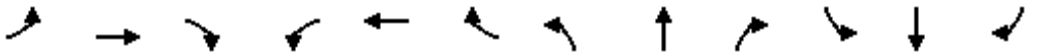
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	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	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1750	1842	1566	1750	1842	1566	1711	1842	1531	1711	1781	
Flt Permitted	0.37	1.00	1.00	0.10	1.00	1.00	0.73	1.00	1.00	0.73	1.00	
Satd. Flow (perm)	676	1842	1566	180	1842	1566	1321	1842	1531	1306	1781	
Volume (vph)	15	582	452	1116	726	43	756	45	238	16	26	7
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	633	491	1213	789	47	822	49	259	17	28	8
RTOR Reduction (vph)	0	0	141	0	0	16	0	0	162	0	5	0
Lane Group Flow (vph)	16	633	350	1213	789	31	822	49	97	17	31	0
Turn Type	Perm		Perm	pm+pt		Perm	Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	35.1	35.1	35.1	84.1	84.1	84.1	54.3	54.3	54.3	54.3	54.3	
Effective Green, g (s)	37.0	37.0	37.0	86.0	86.0	86.0	56.0	56.0	56.0	56.0	56.0	
Actuated g/C Ratio	0.25	0.25	0.25	0.57	0.57	0.57	0.37	0.37	0.37	0.37	0.37	
Clearance Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	5.7	5.7	5.7	5.7	5.7	
Vehicle Extension (s)	3.5	3.5	3.5	2.0	3.5	3.5	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	167	454	386	574	1056	898	493	688	572	488	665	
v/s Ratio Prot		0.34		c0.63	0.43			0.03			0.02	
v/s Ratio Perm	0.02		0.22	c0.58		0.02	c0.62		0.06	0.01		
v/c Ratio	0.10	1.39	0.91	2.11	0.75	0.03	1.67	0.07	0.17	0.03	0.05	
Uniform Delay, d1	43.6	56.5	54.8	54.7	23.9	13.9	47.0	30.3	31.4	29.8	30.0	
Progression Factor	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	0.3	190.5	24.6	506.8	3.0	0.0	309.2	0.0	0.1	0.0	0.0	
Delay (s)	43.9	247.0	79.5	561.5	26.9	13.9	356.2	30.3	31.5	29.9	30.0	
Level of Service	D	F	E	F	C	B	F	C	C	C	C	
Approach Delay (s)		172.0			343.1			267.6			29.9	
Approach LOS		F			F			F			C	

Intersection Summary			
HCM Average Control Delay	275.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.92		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	151.0%	ICU Level of Service	H
Analysis Period (min)	15		

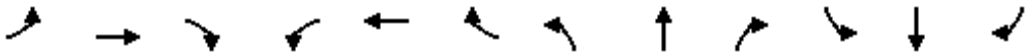
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	1.00	0.95		1.00		1.00	0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	0.99	1.00
Satd. Flow (prot)		4916	1531	1711	3421		1711		1531	1628	3403	1601
Flt Permitted		1.00	1.00	0.95	1.00		0.25		1.00	0.95	0.99	1.00
Satd. Flow (perm)		4916	1531	1711	3421		459		1531	1628	3403	1601
Volume (vph)	0	2377	284	106	741	0	282	0	433	294	402	351
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2584	309	115	805	0	307	0	471	320	437	382
RTOR Reduction (vph)	0	0	173	0	0	0	0	0	0	0	0	100
Lane Group Flow (vph)	0	2584	136	115	805	0	307	0	471	244	513	282
Turn Type			Perm	Prot			custom		custom	Perm		Perm
Protected Phases		6		5	2		3		5 8		4	
Permitted Phases			6				8		3	4	4	4
Actuated Green, G (s)		42.0	42.0	4.0	51.0		37.0		47.0	25.0	25.0	25.0
Effective Green, g (s)		44.0	44.0	5.0	53.0		39.0		48.0	27.0	27.0	27.0
Actuated g/C Ratio		0.44	0.44	0.05	0.53		0.39		0.48	0.27	0.27	0.27
Clearance Time (s)		6.0	6.0	5.0	6.0		3.0			6.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0	1.0	2.0		1.0			1.0	1.0	1.0
Lane Grp Cap (vph)		2163	674	86	1813		279		735	440	919	432
v/s Ratio Prot		c0.53		c0.07	0.24		c0.09		0.31			
v/s Ratio Perm			0.09				c0.34			0.15	0.15	0.18
v/c Ratio		1.19	0.20	1.34	0.44		1.10		0.64	0.55	0.56	0.65
Uniform Delay, d1		28.0	17.2	47.5	14.4		28.4		19.5	31.3	31.4	32.3
Progression Factor		0.99	1.62	1.05	0.96		1.60		1.59	1.00	1.00	1.00
Incremental Delay, d2		88.0	0.1	190.3	0.5		71.8		0.9	0.9	0.4	2.7
Delay (s)		115.9	28.0	240.3	14.4		117.1		32.0	32.2	31.8	35.0
Level of Service		F	C	F	B		F		C	C	C	D
Approach Delay (s)		106.5			42.6			65.6			33.0	
Approach LOS		F			D			E			C	

Intersection Summary			
HCM Average Control Delay	76.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.4%	ICU Level of Service	G
Analysis Period (min)	15		

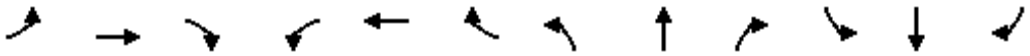
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1655		3319	1740	
Flt Permitted	0.23	1.00	1.00	0.08	1.00	1.00	0.34	1.00		0.25	1.00	
Satd. Flow (perm)	409	3500	1531	148	3500	1531	619	1655		882	1740	
Volume (vph)	238	2342	165	227	808	188	140	118	246	1124	190	112
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	259	2546	179	247	878	204	152	128	267	1222	207	122
RTOR Reduction (vph)	0	0	53	0	0	104	0	75	0	0	21	0
Lane Group Flow (vph)	259	2546	126	247	878	100	152	320	0	1222	308	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			Perm		
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6		6	2		2	8			4		
Actuated Green, G (s)	58.2	48.0	48.0	55.8	46.8	46.8	28.0	28.0		28.0	28.0	
Effective Green, g (s)	59.2	50.0	50.0	56.8	48.8	48.8	30.0	30.0		30.0	30.0	
Actuated g/C Ratio	0.59	0.50	0.50	0.57	0.49	0.49	0.30	0.30		0.30	0.30	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	362	1750	766	209	1708	747	186	497		265	522	
v/s Ratio Prot	0.07	c0.73		c0.09	0.25			0.19			0.18	
v/s Ratio Perm	0.36		0.08	0.58		0.07	0.25			c1.39		
v/c Ratio	0.72	1.45	0.16	1.18	0.51	0.13	0.82	0.64		4.61	0.59	
Uniform Delay, d1	11.8	25.0	13.6	48.2	17.5	14.0	32.5	30.4		35.0	29.8	
Progression Factor	1.05	0.96	0.82	1.15	1.00	1.56	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	205.0	0.0	112.6	0.8	0.3	22.4	2.1		1633.7	1.2	
Delay (s)	12.9	229.0	11.3	168.0	18.4	22.1	54.8	32.5		1668.7	31.0	
Level of Service	B	F	B	F	B	C	D	C		F	C	
Approach Delay (s)		197.2			46.8			38.7			1321.3	
Approach LOS		F			D			D			F	

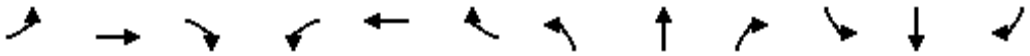
Intersection Summary			
HCM Average Control Delay	424.4	HCM Level of Service	F
HCM Volume to Capacity ratio	2.40		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	144.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.94		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	1801	1531	1711	1801	1531	1711	3226		1711	1701	
Flt Permitted	0.62	1.00	1.00	0.15	1.00	1.00	0.24	1.00		0.35	1.00	
Satd. Flow (perm)	1117	1801	1531	266	1801	1531	426	3226		632	1701	
Volume (vph)	52	349	129	213	203	603	180	209	128	752	408	236
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	57	379	140	232	221	655	196	227	139	817	443	257
RTOR Reduction (vph)	0	0	106	0	0	423	0	85	0	0	19	0
Lane Group Flow (vph)	57	379	34	232	221	232	196	281	0	817	681	0
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	23.8	23.8	23.8	35.9	35.9	35.9	31.4	22.5		58.8	45.9	
Effective Green, g (s)	25.9	25.9	25.9	38.0	38.0	38.0	33.7	24.8		61.1	48.2	
Actuated g/C Ratio	0.24	0.24	0.24	0.35	0.35	0.35	0.31	0.23		0.57	0.45	
Clearance Time (s)	6.1	6.1	6.1	4.0	6.1	6.1	4.0	6.3		4.0	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	270	436	370	204	639	543	241	747		686	766	
v/s Ratio Prot		0.21		c0.09	0.12		0.07	0.09		c0.36	0.40	
v/s Ratio Perm	0.05		0.02	c0.32		0.15	0.19			c0.32		
v/c Ratio	0.21	0.87	0.09	1.14	0.35	0.43	0.81	0.38		1.19	0.89	
Uniform Delay, d1	32.4	39.0	31.5	30.5	25.4	26.3	29.7	34.6		19.7	27.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	16.6	0.1	104.8	0.3	0.5	18.5	0.3		100.0	12.2	
Delay (s)	32.8	55.6	31.6	135.4	25.7	26.8	48.2	35.0		119.7	39.2	
Level of Service	C	E	C	F	C	C	D	C		F	D	
Approach Delay (s)		47.5			49.3			39.6			82.5	
Approach LOS		D			D			D			F	

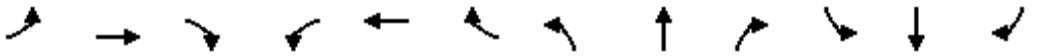
Intersection Summary			
HCM Average Control Delay	61.0	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	107.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	95.0%	ICU Level of Service	F
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.3	3.0	3.5	3.3	3.3	3.3	3.3	3.0	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.91	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	3500	1531	1652	3500	1531	1711	3307		1652	3199	
Flt Permitted	0.20	1.00	1.00	0.29	1.00	1.00	0.38	1.00		0.33	1.00	
Satd. Flow (perm)	349	3500	1531	506	3500	1531	691	3307		577	3199	
Volume (vph)	245	835	42	64	695	114	51	250	72	170	277	372
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	266	908	46	70	755	124	55	272	78	185	301	404
RTOR Reduction (vph)	0	0	24	0	0	80	0	26	0	0	229	0
Lane Group Flow (vph)	266	908	22	70	755	44	55	324	0	185	476	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			pm+pt		
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	44.1	35.9	35.9	30.8	26.6	26.6	13.2	13.2		24.4	24.4	
Effective Green, g (s)	46.1	37.9	37.9	32.8	28.6	28.6	15.2	15.2		26.4	26.4	
Actuated g/C Ratio	0.57	0.47	0.47	0.41	0.36	0.36	0.19	0.19		0.33	0.33	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	418	1648	721	266	1243	544	130	624		285	1049	
v/s Ratio Prot	c0.11	0.26		0.01	0.22			0.10		c0.06	0.15	
v/s Ratio Perm	c0.26		0.01	0.09		0.03	0.08			c0.15		
v/c Ratio	0.64	0.55	0.03	0.26	0.61	0.08	0.42	0.52		0.65	0.45	
Uniform Delay, d1	11.1	15.2	11.4	14.8	21.3	17.2	28.8	29.4		20.9	21.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	3.2	0.6	0.0	0.5	1.1	0.1	2.2	0.7		5.0	0.3	
Delay (s)	14.2	15.8	11.5	15.3	22.4	17.3	31.0	30.1		25.9	21.7	
Level of Service	B	B	B	B	C	B	C	C		C	C	
Approach Delay (s)		15.3			21.3			30.2			22.6	
Approach LOS		B			C			C			C	

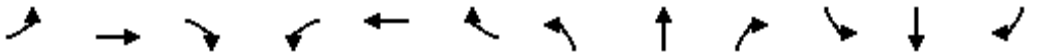
Intersection Summary			
HCM Average Control Delay	20.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.62		
Actuated Cycle Length (s)	80.5	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.1%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3421	1531	1711	3421	1531	1711	1801	1531	1711	1801	1531
Flt Permitted	0.21	1.00	1.00	0.30	1.00	1.00	0.49	1.00	1.00	0.53	1.00	1.00
Satd. Flow (perm)	370	3421	1531	536	3421	1531	886	1801	1531	946	1801	1531
Volume (vph)	135	884	42	64	647	116	51	251	72	48	277	313
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	147	961	46	70	703	126	55	273	78	52	301	340
RTOR Reduction (vph)	0	0	23	0	0	84	0	0	48	0	0	113
Lane Group Flow (vph)	147	961	23	70	703	42	55	273	30	52	301	227
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	29.1	29.1	29.1	19.1	19.1	19.1	23.5	23.5	23.5	23.5	23.5	23.5
Effective Green, g (s)	29.1	29.1	29.1	19.1	19.1	19.1	23.5	23.5	23.5	23.5	23.5	23.5
Actuated g/C Ratio	0.48	0.48	0.48	0.32	0.32	0.32	0.39	0.39	0.39	0.39	0.39	0.39
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	310	1643	735	169	1078	483	344	698	594	367	698	594
v/s Ratio Prot	0.05	c0.28			0.21			0.15			c0.17	
v/s Ratio Perm	0.18		0.01	0.13		0.03	0.06		0.02	0.05		0.15
v/c Ratio	0.47	0.58	0.03	0.41	0.65	0.09	0.16	0.39	0.05	0.14	0.43	0.38
Uniform Delay, d1	10.2	11.4	8.3	16.3	17.9	14.6	12.1	13.4	11.6	12.0	13.6	13.3
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	1.1	0.5	0.0	1.6	1.4	0.1	1.0	1.6	0.2	0.8	1.9	1.9
Delay (s)	11.3	11.9	8.3	18.0	19.3	14.7	13.1	15.0	11.7	12.8	15.6	15.2
Level of Service	B	B	A	B	B	B	B	B	B	B	B	B
Approach Delay (s)		11.7			18.6			14.1			15.2	
Approach LOS		B			B			B			B	

Intersection Summary			
HCM Average Control Delay	14.7	HCM Level of Service	B
HCM Volume to Capacity ratio	0.52		
Actuated Cycle Length (s)	60.6	Sum of lost time (s)	8.0
Intersection Capacity Utilization	59.2%	ICU Level of Service	B
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	4.0	3.3	3.3	4.0	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3500	1531	1711	3500	1531	1711	1946	1531	1711	1946	1531
Flt Permitted	0.15	1.00	1.00	0.62	1.00	1.00	0.60	1.00	1.00	0.69	1.00	1.00
Satd. Flow (perm)	265	3500	1531	1118	3500	1531	1085	1946	1531	1237	1946	1531
Volume (vph)	25	192	105	170	1070	30	456	100	60	17	204	136
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	27	209	114	185	1163	33	496	109	65	18	222	148
RTOR Reduction (vph)	0	0	70	0	0	20	0	0	33	0	0	8
Lane Group Flow (vph)	27	209	44	185	1163	13	496	109	32	18	222	140
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	25.2	25.2	25.2	25.2	25.2	25.2	31.8	31.8	31.8	31.8	31.8	31.8
Effective Green, g (s)	27.2	27.2	27.2	27.2	27.2	27.2	34.8	34.8	34.8	34.8	34.8	34.8
Actuated g/C Ratio	0.39	0.39	0.39	0.39	0.39	0.39	0.50	0.50	0.50	0.50	0.50	0.50
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0	7.0	7.0	7.0
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Lane Grp Cap (vph)	103	1360	595	434	1360	595	539	967	761	615	967	761
v/s Ratio Prot		0.06			c0.33			0.06			0.11	
v/s Ratio Perm	0.10		0.03	0.17		0.01	c0.46		0.02	0.01		0.09
v/c Ratio	0.26	0.15	0.07	0.43	0.86	0.02	0.92	0.11	0.04	0.03	0.23	0.18
Uniform Delay, d1	14.6	13.9	13.5	15.7	19.6	13.2	16.3	9.4	9.0	9.0	10.0	9.7
Progression Factor	1.00	1.00	1.00	0.81	0.88	0.59	1.00	1.00	1.00	1.00	1.00	1.00
Incremental Delay, d2	6.1	0.2	0.2	3.0	7.0	0.1	21.4	0.1	0.0	0.0	0.2	0.2
Delay (s)	20.7	14.2	13.7	15.7	24.2	7.8	37.7	9.4	9.1	9.0	10.2	9.9
Level of Service	C	B	B	B	C	A	D	A	A	A	B	A
Approach Delay (s)		14.5			22.7			30.4			10.0	
Approach LOS		B			C			C			B	

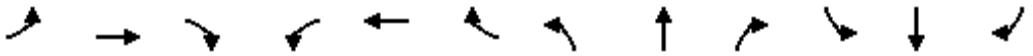
Intersection Summary			
HCM Average Control Delay	21.7	HCM Level of Service	C
HCM Volume to Capacity ratio	0.89		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	87.2%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.5	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0	4.0		4.0		4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00		1.00	1.00	1.00	1.00	1.00	
Frt		1.00	0.85		0.97		1.00	1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00		0.98		0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1715	1566		1718		1711	1801	1531	1711	1800	
Flt Permitted		0.72	1.00		0.91		0.44	1.00	1.00	0.19	1.00	
Satd. Flow (perm)		1304	1566		1594		785	1801	1531	334	1800	
Volume (vph)	233	1	195	2	2	1	1	662	252	113	545	2
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	1	212	2	2	1	1	720	274	123	592	2
RTOR Reduction (vph)	0	0	124	0	1	0	0	0	126	0	0	0
Lane Group Flow (vph)	0	254	88	0	4	0	1	720	148	123	594	0
Turn Type	Perm		Perm	Perm			Perm		Perm	pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8		8	4			2		2	6	6	
Actuated Green, G (s)		20.8	20.8		20.8		46.5	46.5	46.5	57.2	57.2	
Effective Green, g (s)		22.8	22.8		22.8		48.5	48.5	48.5	59.2	59.2	
Actuated g/C Ratio		0.25	0.25		0.25		0.54	0.54	0.54	0.66	0.66	
Clearance Time (s)		6.0	6.0		6.0		6.0	6.0	6.0	3.0	6.0	
Vehicle Extension (s)		2.5	2.5		2.5		3.5	3.5	3.5	3.0	3.5	
Lane Grp Cap (vph)		330	397		404		423	971	825	322	1184	
v/s Ratio Prot								c0.40		0.03	c0.33	
v/s Ratio Perm		c0.19	0.06		0.00		0.00		0.10	0.22		
v/c Ratio		0.77	0.22		0.01		0.00	0.74	0.18	0.38	0.50	
Uniform Delay, d1		31.2	26.6		25.2		9.6	15.9	10.6	10.8	7.9	
Progression Factor		1.00	1.00		1.00		0.85	1.05	1.81	1.93	0.78	
Incremental Delay, d2		9.9	0.2		0.0		0.0	4.9	0.5	0.7	1.5	
Delay (s)		41.1	26.8		25.2		8.2	21.7	19.6	21.6	7.6	
Level of Service		D	C		C		A	C	B	C	A	
Approach Delay (s)		34.6			25.2			21.1			10.0	
Approach LOS		C			C			C			A	

Intersection Summary			
HCM Average Control Delay	20.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.74		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	70.7%	ICU Level of Service	C
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	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	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1750	1842	1566	1750	1842	1566	1711	1842	1531	1711	1754	
Flt Permitted	0.25	1.00	1.00	0.08	1.00	1.00	0.62	1.00	1.00	0.74	1.00	
Satd. Flow (perm)	457	1842	1566	154	1842	1566	1115	1842	1531	1340	1754	
Volume (vph)	4	755	782	698	722	7	376	18	1268	39	40	18
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	4	821	850	759	785	8	409	20	1378	42	43	20
RTOR Reduction (vph)	0	0	202	0	0	3	0	0	276	0	13	0
Lane Group Flow (vph)	4	821	648	759	785	5	409	20	1102	42	50	0
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt		Perm	Perm		
Protected Phases		2		1	6		3	8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	42.1	42.1	42.1	74.1	74.1	74.1	55.4	55.4	55.4	25.0	25.0	
Effective Green, g (s)	44.0	44.0	44.0	76.0	76.0	76.0	57.1	57.1	57.1	26.7	26.7	
Actuated g/C Ratio	0.31	0.31	0.31	0.54	0.54	0.54	0.40	0.40	0.40	0.19	0.19	
Clearance Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	4.0	5.7	5.7	5.7	5.7	
Vehicle Extension (s)	3.5	3.5	3.5	2.0	3.5	3.5	3.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	143	574	488	400	992	843	563	745	620	254	332	
v/s Ratio Prot		0.45		c0.38	0.43		0.14	0.01			0.03	
v/s Ratio Perm	0.01		0.41	c0.65		0.00	0.16		c0.72	0.03		
v/c Ratio	0.03	1.43	1.33	1.90	0.79	0.01	0.73	0.03	1.78	0.17	0.15	
Uniform Delay, d1	33.7	48.5	48.5	58.8	26.2	15.1	32.9	25.3	42.0	47.9	47.7	
Progression Factor	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	0.1	203.6	160.9	413.2	4.5	0.0	4.6	0.0	356.2	0.1	0.1	
Delay (s)	33.8	252.1	209.5	471.9	30.7	15.1	37.6	25.3	398.2	48.0	47.8	
Level of Service	C	F	F	F	C	B	D	C	F	D	D	
Approach Delay (s)		230.0			246.4			312.4			47.9	
Approach LOS		F			F			F			D	

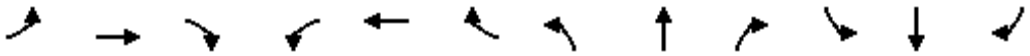
Intersection Summary			
HCM Average Control Delay	260.2	HCM Level of Service	F
HCM Volume to Capacity ratio	1.83		
Actuated Cycle Length (s)	141.1	Sum of lost time (s)	8.0
Intersection Capacity Utilization	136.6%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.5	3.5	3.3	3.5	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.93		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1678		1750	1842	1531	1750	1842	1531
Flt Permitted	0.28	1.00	1.00	0.64	1.00		0.48	1.00	1.00	0.40	1.00	1.00
Satd. Flow (perm)	512	1801	1531	1144	1678		892	1842	1531	728	1842	1531
Volume (vph)	141	125	222	162	179	149	61	419	83	76	326	26
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	153	136	241	176	195	162	66	455	90	83	354	28
RTOR Reduction (vph)	0	0	174	0	40	0	0	0	41	0	0	8
Lane Group Flow (vph)	153	136	67	176	317	0	66	455	49	83	354	20
Turn Type	Perm		Perm	Perm			pm+pt		Perm	pm+pt		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4			2		2	6		6
Actuated Green, G (s)	23.1	23.1	23.1	23.1	23.1		51.6	46.6	46.6	52.2	46.9	46.9
Effective Green, g (s)	25.1	25.1	25.1	25.1	25.1		52.6	48.6	48.6	53.2	48.9	48.9
Actuated g/C Ratio	0.28	0.28	0.28	0.28	0.28		0.58	0.54	0.54	0.59	0.54	0.54
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	143	502	427	319	468		559	995	827	479	1001	832
v/s Ratio Prot		0.08			0.19		0.01	c0.25		c0.01	0.19	
v/s Ratio Perm	c0.30		0.04	0.15			0.06		0.03	0.09		0.01
v/c Ratio	1.07	0.27	0.16	0.55	0.68		0.12	0.46	0.06	0.17	0.35	0.02
Uniform Delay, d1	32.5	25.3	24.5	27.7	28.9		8.3	12.6	9.8	8.5	11.6	9.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		0.88	0.95	0.78	0.88	0.95	0.91
Incremental Delay, d2	95.2	0.3	0.2	2.1	3.9		0.0	1.5	0.1	0.1	0.8	0.0
Delay (s)	127.6	25.6	24.6	29.7	32.7		7.3	13.5	7.8	7.6	11.9	8.7
Level of Service	F	C	C	C	C		A	B	A	A	B	A
Approach Delay (s)		54.6			31.7			12.0			10.9	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	27.2	HCM Level of Service	C
HCM Volume to Capacity ratio	0.64		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	66.5%	ICU Level of Service	C
Analysis Period (min)	15		

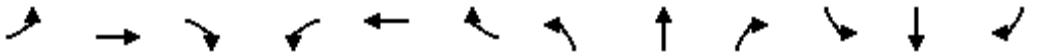
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	3319	3500	1531	1711	1575		3319	1750	
Flt Permitted	0.32	1.00	1.00	0.95	1.00	1.00	0.75	1.00		0.37	1.00	
Satd. Flow (perm)	573	3500	1531	3319	3500	1531	1350	1575		1277	1750	
Volume (vph)	46	397	379	1031	823	43	129	9	261	43	7	4
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	50	432	412	1121	895	47	140	10	284	47	8	4
RTOR Reduction (vph)	0	0	302	0	0	20	0	208	0	0	3	0
Lane Group Flow (vph)	50	432	110	1121	895	27	140	86	0	47	9	0
Turn Type	pm+pt		Perm	Prot		Perm	Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2			6	8			4		
Actuated Green, G (s)	25.0	22.0	22.0	31.0	50.0	50.0	22.0	22.0		22.0	22.0	
Effective Green, g (s)	26.0	24.0	24.0	30.0	52.0	52.0	24.0	24.0		24.0	24.0	
Actuated g/C Ratio	0.29	0.27	0.27	0.33	0.58	0.58	0.27	0.27		0.27	0.27	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	191	933	408	1106	2022	885	360	420		341	467	
v/s Ratio Prot	0.01	0.12		c0.34	c0.26			0.05			0.01	
v/s Ratio Perm	0.07		0.07			0.02	c0.10			0.04		
v/c Ratio	0.26	0.46	0.27	1.01	0.44	0.03	0.39	0.20		0.14	0.02	
Uniform Delay, d1	23.4	27.6	26.1	30.0	10.8	8.2	27.0	25.6		25.1	24.3	
Progression Factor	1.00	1.00	1.00	1.08	1.17	2.11	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	1.7	1.6	29.9	0.7	0.1	3.1	1.1		0.8	0.1	
Delay (s)	23.7	29.3	27.7	62.3	13.2	17.3	30.1	26.7		26.0	24.4	
Level of Service	C	C	C	E	B	B	C	C		C	C	
Approach Delay (s)		28.2			40.0			27.8			25.6	
Approach LOS		C			D			C			C	

Intersection Summary			
HCM Average Control Delay	35.2	HCM Level of Service	D
HCM Volume to Capacity ratio	0.63		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	71.2%	ICU Level of Service	C
Analysis Period (min)	15		

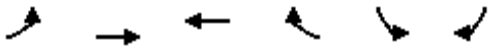
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	1.00	0.95		1.00		1.00	0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	0.98	1.00
Satd. Flow (prot)		4916	1531	1711	3421		1711		1531	1628	3348	1601
Flt Permitted		1.00	1.00	0.95	1.00		0.39		1.00	0.95	0.98	1.00
Satd. Flow (perm)		4916	1531	1711	3421		700		1531	1628	3348	1601
Volume (vph)	0	845	112	243	1202	0	301	0	327	313	173	236
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	918	122	264	1307	0	327	0	355	340	188	257
RTOR Reduction (vph)	0	0	85	0	0	0	0	0	5	0	0	37
Lane Group Flow (vph)	0	918	37	264	1307	0	327	0	350	170	358	220
Turn Type			Perm	Prot			custom		custom	Perm		Perm
Protected Phases		6		5	2		3		5 8		4	
Permitted Phases			6				8		3	4	4	4
Actuated Green, G (s)		25.3	25.3	13.0	43.3		34.7		53.7	23.7	23.7	23.7
Effective Green, g (s)		27.3	27.3	14.0	45.3		36.7		54.7	25.7	25.7	25.7
Actuated g/C Ratio		0.30	0.30	0.16	0.50		0.41		0.61	0.29	0.29	0.29
Clearance Time (s)		6.0	6.0	5.0	6.0		3.0			6.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0	1.0	2.0		1.0			1.0	1.0	1.0
Lane Grp Cap (vph)		1491	464	266	1722		364		931	465	956	457
v/s Ratio Prot		0.19		c0.15	c0.38		c0.07		0.23			
v/s Ratio Perm			0.02				c0.30			0.10	0.11	0.14
v/c Ratio		0.62	0.08	0.99	0.76		0.90		0.38	0.37	0.37	0.48
Uniform Delay, d1		26.9	22.4	37.9	18.0		24.1		9.0	25.6	25.7	26.6
Progression Factor		1.24	1.90	1.04	1.28		1.09		1.13	1.00	1.00	1.00
Incremental Delay, d2		1.7	0.3	41.5	2.0		23.2		0.1	0.2	0.1	0.3
Delay (s)		34.9	42.7	81.2	25.0		49.6		10.2	25.8	25.8	26.9
Level of Service		C	D	F	C		D		B	C	C	C
Approach Delay (s)		35.9			34.4			29.1			26.2	
Approach LOS		D			C			C			C	

Intersection Summary			
HCM Average Control Delay	32.3	HCM Level of Service	C
HCM Volume to Capacity ratio	0.84		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	74.5%	ICU Level of Service	D
Analysis Period (min)	15		

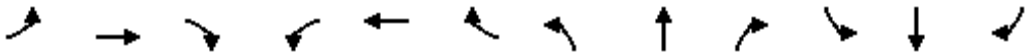
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.5	3.3	3.3	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.94	
Flt Protected	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (prot)	3319	3500	3500	1531	3185	
Flt Permitted	0.95	1.00	1.00	1.00	0.97	
Satd. Flow (perm)	3319	3500	3500	1531	3185	
Volume (vph)	169	501	1333	236	261	180
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	184	545	1449	257	284	196
RTOR Reduction (vph)	0	0	0	98	160	0
Lane Group Flow (vph)	184	545	1449	159	320	0
Turn Type	Prot			Perm		
Protected Phases	1	6	2		4	
Permitted Phases		1		2		
Actuated Green, G (s)	7.6	64.4	53.8	53.8	13.6	
Effective Green, g (s)	6.6	66.4	55.8	55.8	15.6	
Actuated g/C Ratio	0.07	0.74	0.62	0.62	0.17	
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	4.0	1.0	
Lane Grp Cap (vph)	243	2582	2170	949	552	
v/s Ratio Prot	c0.06	0.16	c0.41		c0.10	
v/s Ratio Perm				0.10		
v/c Ratio	0.76	0.21	0.67	0.17	0.58	
Uniform Delay, d1	40.9	3.7	11.1	7.3	34.2	
Progression Factor	0.79	1.10	0.30	0.02	1.00	
Incremental Delay, d2	10.8	0.0	1.1	0.3	0.9	
Delay (s)	43.1	4.0	4.5	0.4	35.1	
Level of Service	D	A	A	A	D	
Approach Delay (s)		13.9	3.9		35.1	
Approach LOS		B	A		D	

Intersection Summary			
HCM Average Control Delay	11.5	HCM Level of Service	B
HCM Volume to Capacity ratio	0.66		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	64.8%	ICU Level of Service	C
Analysis Period (min)	15		

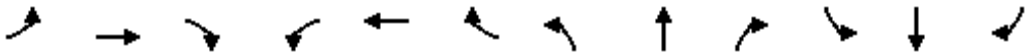
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.88		1.00	0.93	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1629		3319	1715	
Flt Permitted	0.07	1.00	1.00	0.31	1.00	1.00	0.63	1.00		0.40	1.00	
Satd. Flow (perm)	134	3500	1531	565	3500	1531	1136	1629		1410	1715	
Volume (vph)	53	690	22	125	1525	148	115	50	167	279	63	53
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	58	750	24	136	1658	161	125	54	182	303	68	58
RTOR Reduction (vph)	0	0	10	0	0	55	0	143	0	0	42	0
Lane Group Flow (vph)	58	750	14	136	1658	106	125	93	0	303	84	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			Perm		
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6		6	2		2	8			4		
Actuated Green, G (s)	55.7	51.6	51.6	59.3	53.4	53.4	17.5	17.5		17.5	17.5	
Effective Green, g (s)	56.7	53.6	53.6	60.3	55.4	55.4	19.5	19.5		19.5	19.5	
Actuated g/C Ratio	0.63	0.60	0.60	0.67	0.62	0.62	0.22	0.22		0.22	0.22	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	139	2084	912	441	2154	942	246	353		306	372	
v/s Ratio Prot	0.01	0.21		c0.02	c0.47			0.06			0.05	
v/s Ratio Perm	0.25		0.01	0.19		0.07	0.11			c0.21		
v/c Ratio	0.42	0.36	0.02	0.31	0.77	0.11	0.51	0.26		0.99	0.23	
Uniform Delay, d1	11.5	9.4	7.4	5.8	12.6	7.1	31.0	29.3		35.2	29.0	
Progression Factor	0.95	0.89	0.80	0.67	0.95	0.65	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.7	0.5	0.0	0.1	1.8	0.2	0.6	0.1		48.6	0.1	
Delay (s)	11.5	8.8	6.0	4.0	13.9	4.8	31.6	29.4		83.7	29.2	
Level of Service	B	A	A	A	B	A	C	C		F	C	
Approach Delay (s)		8.9			12.4			30.2			67.7	
Approach LOS		A			B			C			E	

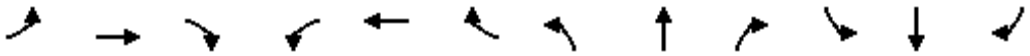
Intersection Summary			
HCM Average Control Delay	20.0	HCM Level of Service	C
HCM Volume to Capacity ratio	0.81		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	80.9%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.96		1.00	0.99	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	1801	1531	1711	1801	1531	1711	3293		1711	1787	
Flt Permitted	0.12	1.00	1.00	0.63	1.00	1.00	0.12	1.00		0.22	1.00	
Satd. Flow (perm)	220	1801	1531	1135	1801	1531	214	3293		389	1787	
Volume (vph)	281	187	207	82	376	534	66	418	139	365	685	38
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	305	203	225	89	409	580	72	454	151	397	745	41
RTOR Reduction (vph)	0	0	113	0	0	321	0	27	0	0	2	0
Lane Group Flow (vph)	305	203	112	89	409	259	72	578	0	397	784	0
Turn Type	pm+pt		Perm	Perm		Perm	pm+pt			pm+pt		
Protected Phases	5	2			6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	48.7	48.7	48.7	26.7	26.7	26.7	34.5	31.4		58.5	51.4	
Effective Green, g (s)	50.8	50.8	50.8	28.8	28.8	28.8	36.8	33.7		60.8	53.7	
Actuated g/C Ratio	0.42	0.42	0.42	0.24	0.24	0.24	0.31	0.28		0.51	0.45	
Clearance Time (s)	4.0	6.1	6.1	6.1	6.1	6.1	4.0	6.3		4.0	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	318	765	650	273	434	369	105	928		453	802	
v/s Ratio Prot	c0.14	0.11			0.23		0.02	0.18		c0.17	c0.44	
v/s Ratio Perm	c0.26		0.07	0.08		0.17	0.19			0.28		
v/c Ratio	0.96	0.27	0.17	0.33	0.94	0.70	0.69	0.62		0.88	0.98	
Uniform Delay, d1	34.5	22.3	21.4	37.4	44.6	41.5	36.2	37.4		22.3	32.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	39.1	0.2	0.1	0.7	29.0	5.9	17.0	1.3		17.1	26.1	
Delay (s)	73.6	22.5	21.5	38.1	73.6	47.4	53.2	38.7		39.4	58.5	
Level of Service	E	C	C	D	E	D	D	D		D	E	
Approach Delay (s)		43.4			56.6			40.3			52.1	
Approach LOS		D			E			D			D	

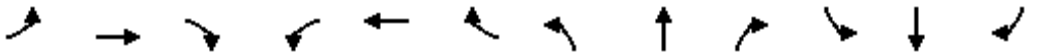
Intersection Summary					
HCM Average Control Delay	49.5	HCM Level of Service	D		
HCM Volume to Capacity ratio	0.97				
Actuated Cycle Length (s)	119.6	Sum of lost time (s)	12.0		
Intersection Capacity Utilization	90.7%	ICU Level of Service	E		
Analysis Period (min)	15				
c Critical Lane Group					



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.3	3.0	3.5	3.3	3.3	3.3	3.3	3.0	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.95		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	3500	1531	1652	3500	1531	1711	3254		1652	3203	
Flt Permitted	0.16	1.00	1.00	0.14	1.00	1.00	0.19	1.00		0.16	1.00	
Satd. Flow (perm)	283	3500	1531	237	3500	1531	343	3254		278	3203	
Volume (vph)	415	1643	54	79	671	162	31	472	229	187	400	520
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	451	1786	59	86	729	176	34	513	249	203	435	565
RTOR Reduction (vph)	0	0	29	0	0	124	0	59	0	0	233	0
Lane Group Flow (vph)	451	1786	30	86	729	52	34	703	0	203	767	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			pm+pt		
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	56.2	49.1	49.1	30.5	27.4	27.4	19.0	19.0		31.0	31.0	
Effective Green, g (s)	58.2	51.1	51.1	32.5	29.4	29.4	21.0	21.0		33.0	33.0	
Actuated g/C Ratio	0.59	0.52	0.52	0.33	0.30	0.30	0.21	0.21		0.33	0.33	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	508	1803	789	122	1037	454	73	689		203	1066	
v/s Ratio Prot	c0.22	c0.51		0.02	0.21			0.22		c0.08	0.24	
v/s Ratio Perm	0.30		0.02	0.21		0.03	0.10			c0.25		
v/c Ratio	0.89	0.99	0.04	0.70	0.70	0.11	0.47	1.02		1.00	0.72	
Uniform Delay, d1	23.1	23.8	11.9	30.3	31.0	25.4	34.2	39.1		30.1	29.0	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	17.0	19.0	0.0	16.9	2.5	0.2	4.6	39.5		63.2	2.4	
Delay (s)	40.1	42.8	11.9	47.2	33.5	25.6	38.8	78.6		93.3	31.4	
Level of Service	D	D	B	D	C	C	D	E		F	C	
Approach Delay (s)		41.4			33.3			76.9			41.8	
Approach LOS		D			C			E			D	

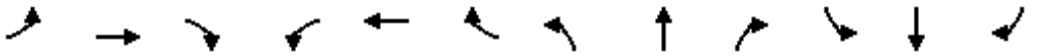
Intersection Summary			
HCM Average Control Delay	45.3	HCM Level of Service	D
HCM Volume to Capacity ratio	0.99		
Actuated Cycle Length (s)	99.2	Sum of lost time (s)	12.0
Intersection Capacity Utilization	99.2%	ICU Level of Service	F
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3421	1531	1711	3421	1531	1711	1801	1531	1711	1801	1531
Flt Permitted	0.19	1.00	1.00	0.27	1.00	1.00	0.39	1.00	1.00	0.32	1.00	1.00
Satd. Flow (perm)	343	3421	1531	494	3421	1531	700	1801	1531	568	1801	1531
Volume (vph)	128	859	54	79	811	68	31	472	230	142	400	253
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	139	934	59	86	882	74	34	513	250	154	435	275
RTOR Reduction (vph)	0	0	32	0	0	42	0	0	34	0	0	75
Lane Group Flow (vph)	139	934	27	86	882	32	34	513	216	154	435	200
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	24.1	24.1	24.1	17.0	17.0	17.0	26.2	26.2	26.2	26.2	26.2	26.2
Effective Green, g (s)	24.1	24.1	24.1	17.0	17.0	17.0	26.2	26.2	26.2	26.2	26.2	26.2
Actuated g/C Ratio	0.41	0.41	0.41	0.29	0.29	0.29	0.45	0.45	0.45	0.45	0.45	0.45
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	215	1414	633	144	998	446	315	809	688	255	809	688
v/s Ratio Prot	0.03	c0.27			c0.26			c0.28			0.24	
v/s Ratio Perm	0.23		0.02	0.17		0.02	0.05		0.14	0.27		0.13
v/c Ratio	0.65	0.66	0.04	0.60	0.88	0.07	0.11	0.63	0.31	0.60	0.54	0.29
Uniform Delay, d1	12.9	13.8	10.2	17.7	19.7	14.9	9.3	12.4	10.3	12.1	11.7	10.2
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	6.5	1.2	0.0	6.5	9.4	0.1	0.7	3.8	1.2	10.2	2.6	1.1
Delay (s)	19.5	15.0	10.2	24.2	29.1	15.0	10.0	16.1	11.5	22.3	14.2	11.2
Level of Service	B	B	B	C	C	B	A	B	B	C	B	B
Approach Delay (s)		15.3			27.7			14.4			14.7	
Approach LOS		B			C			B			B	

Intersection Summary			
HCM Average Control Delay	18.3	HCM Level of Service	B
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	58.3	Sum of lost time (s)	12.0
Intersection Capacity Utilization	75.6%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	4.0	3.3	3.3	4.0	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0
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
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	1.00	0.85		1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00		0.99	1.00
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1946	1531		1934	1531
Flt Permitted	0.56	1.00	1.00	0.16	1.00	1.00	0.60	1.00	1.00		0.91	1.00
Satd. Flow (perm)	1017	3500	1531	293	3500	1531	1089	1946	1531		1777	1531
Volume (vph)	174	1081	498	92	282	34	199	351	216	21	149	39
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	189	1175	541	100	307	37	216	382	235	23	162	42
RTOR Reduction (vph)	0	0	243	0	0	17	0	0	23	0	0	28
Lane Group Flow (vph)	189	1175	298	100	307	20	216	382	212	0	185	14
Turn Type	Perm		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases		2			6			8			4	
Permitted Phases	2		2	6		6	8		8	4		4
Actuated Green, G (s)	36.5	36.5	36.5	36.5	36.5	36.5	20.5	20.5	20.5		20.5	20.5
Effective Green, g (s)	38.5	38.5	38.5	38.5	38.5	38.5	23.5	23.5	23.5		23.5	23.5
Actuated g/C Ratio	0.55	0.55	0.55	0.55	0.55	0.55	0.34	0.34	0.34		0.34	0.34
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0	6.0	7.0	7.0	7.0		7.0	7.0
Vehicle Extension (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0
Lane Grp Cap (vph)	559	1925	842	161	1925	842	366	653	514		597	514
v/s Ratio Prot		0.34			0.09			0.20				
v/s Ratio Perm	0.19		0.19	c0.34		0.01	c0.20		0.14		0.10	0.01
v/c Ratio	0.34	0.61	0.35	0.62	0.16	0.02	0.59	0.58	0.41		0.31	0.03
Uniform Delay, d1	8.7	10.7	8.8	10.8	7.8	7.2	19.3	19.2	17.9		17.2	15.6
Progression Factor	1.00	1.00	1.00	1.23	1.03	1.45	1.00	1.00	1.00		1.00	1.00
Incremental Delay, d2	1.6	1.5	1.2	14.8	0.2	0.0	3.0	1.6	0.7		0.4	0.0
Delay (s)	10.3	12.1	10.0	28.0	8.2	10.4	22.2	20.8	18.7		17.6	15.6
Level of Service	B	B	A	C	A	B	C	C	B		B	B
Approach Delay (s)		11.3			12.8			20.6			17.3	
Approach LOS		B			B			C			B	

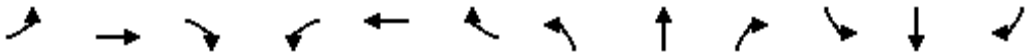
Intersection Summary			
HCM Average Control Delay	14.2	HCM Level of Service	B
HCM Volume to Capacity ratio	0.61		
Actuated Cycle Length (s)	70.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.0%	ICU Level of Service	D
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.5	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3
Total Lost time (s)		4.0	4.0		4.0			4.0	4.0	4.0	4.0	
Lane Util. Factor		1.00	1.00		1.00			1.00	1.00	1.00	1.00	
Frt		1.00	0.85		1.00			1.00	0.85	1.00	1.00	
Flt Protected		0.95	1.00		0.98			1.00	1.00	0.95	1.00	
Satd. Flow (prot)		1711	1566		1771			1801	1531	1711	1801	
Flt Permitted		0.75	1.00		0.89			1.00	1.00	0.10	1.00	
Satd. Flow (perm)		1350	1566		1611			1801	1531	185	1801	
Volume (vph)	517	0	169	4	7	0	0	604	346	202	667	0
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	562	0	184	4	8	0	0	657	376	220	725	0
RTOR Reduction (vph)	0	0	44	0	0	0	0	0	230	0	0	0
Lane Group Flow (vph)	0	562	140	0	12	0	0	657	146	220	725	0
Turn Type	Perm		Perm	Perm			Perm		Perm	pm+pt		
Protected Phases		8			4			2		1	6	
Permitted Phases	8		8	4			2		2	6	6	
Actuated Green, G (s)		33.0	33.0		33.0			34.0	34.0	47.0	47.0	
Effective Green, g (s)		34.0	34.0		34.0			35.0	35.0	48.0	48.0	
Actuated g/C Ratio		0.38	0.38		0.38			0.39	0.39	0.53	0.53	
Clearance Time (s)		5.0	5.0		5.0			5.0	5.0	3.0	5.0	
Vehicle Extension (s)		2.5	2.5		2.5			3.5	3.5	3.0	3.5	
Lane Grp Cap (vph)		510	592		609			700	595	251	961	
v/s Ratio Prot								0.36		c0.09	0.40	
v/s Ratio Perm		c0.42	0.09		0.01				0.10	c0.38		
v/c Ratio		1.10	0.24		0.02			0.94	0.25	0.88	0.75	
Uniform Delay, d1		28.0	19.1		17.6			26.5	18.6	21.7	16.4	
Progression Factor		1.00	1.00		1.00			0.73	0.50	1.45	0.69	
Incremental Delay, d2		70.7	0.2		0.0			21.1	0.9	24.2	4.7	
Delay (s)		98.7	19.3		17.6			40.5	10.2	55.6	16.1	
Level of Service		F	B		B			D	B	E	B	
Approach Delay (s)		79.1			17.6			29.5			25.3	
Approach LOS		E			B			C			C	

Intersection Summary			
HCM Average Control Delay	41.5	HCM Level of Service	D
HCM Volume to Capacity ratio	0.96		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	88.7%	ICU Level of Service	E
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.5	3.5	3.5	3.5	3.5	3.5	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	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	0.97	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00	
Satd. Flow (prot)	1750	1842	1566	1750	1842	1566	1711	1842	1531	1711	1782	
Flt Permitted	0.29	1.00	1.00	0.10	1.00	1.00	0.73	1.00	1.00	0.72	1.00	
Satd. Flow (perm)	527	1842	1566	175	1842	1566	1320	1842	1531	1290	1782	
Volume (vph)	15	740	427	1167	660	42	1392	57	774	18	27	7
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	16	804	464	1268	717	46	1513	62	841	20	29	8
RTOR Reduction (vph)	0	0	105	0	0	17	0	0	289	0	4	0
Lane Group Flow (vph)	16	804	359	1268	717	29	1513	62	552	20	33	0
Turn Type	Perm		Perm	pm+pt		Perm	Perm		Perm	Perm		
Protected Phases		2		1	6			8			4	
Permitted Phases	2		2	6		6	8		8	4		
Actuated Green, G (s)	36.1	36.1	36.1	72.1	72.1	72.1	66.3	66.3	66.3	66.3	66.3	
Effective Green, g (s)	38.0	38.0	38.0	74.0	74.0	74.0	68.0	68.0	68.0	68.0	68.0	
Actuated g/C Ratio	0.25	0.25	0.25	0.49	0.49	0.49	0.45	0.45	0.45	0.45	0.45	
Clearance Time (s)	5.9	5.9	5.9	3.0	5.9	5.9	5.7	5.7	5.7	5.7	5.7	
Vehicle Extension (s)	3.5	3.5	3.5	2.0	3.5	3.5	2.0	2.0	2.0	2.0	2.0	
Lane Grp Cap (vph)	134	467	397	422	909	773	598	835	694	585	808	
v/s Ratio Prot		0.44		c0.64	0.39			0.03			0.02	
v/s Ratio Perm	0.03		0.23	c0.84		0.02	c1.15		0.36	0.02		
v/c Ratio	0.12	1.72	0.90	3.00	0.79	0.04	2.53	0.07	0.80	0.03	0.04	
Uniform Delay, d1	43.1	56.0	54.2	61.2	31.5	19.6	41.0	23.2	35.1	22.8	22.8	
Progression Factor	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	0.5	333.7	23.6	908.5	4.7	0.0	693.5	0.0	5.9	0.0	0.0	
Delay (s)	43.6	389.7	77.9	969.6	36.3	19.6	734.5	23.2	41.0	22.8	22.8	
Level of Service	D	F	E	F	D	B	F	C	D	C	C	
Approach Delay (s)		272.7			618.6			474.8			22.8	
Approach LOS		F			F			F			C	

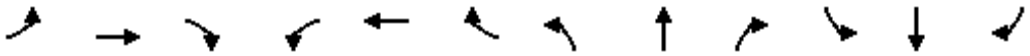
Intersection Summary			
HCM Average Control Delay	476.0	HCM Level of Service	F
HCM Volume to Capacity ratio	2.75		
Actuated Cycle Length (s)	150.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	197.4%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group

Movement	NBL	NBT	NBR	SBL	SBT	SBR	NEL	NET	NER	SWL	SWT	SWR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.5	3.5	3.3	3.5	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0		4.0	4.0	4.0	4.0	4.0	4.0
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00		1.00	1.00	1.00	1.00	1.00	1.00
Frt	1.00	1.00	0.85	1.00	0.92		1.00	1.00	0.85	1.00	1.00	0.85
Flt Protected	0.95	1.00	1.00	0.95	1.00		0.95	1.00	1.00	0.95	1.00	1.00
Satd. Flow (prot)	1711	1801	1531	1711	1661		1750	1842	1531	1750	1842	1531
Flt Permitted	0.46	1.00	1.00	0.69	1.00		0.20	1.00	1.00	0.29	1.00	1.00
Satd. Flow (perm)	823	1801	1531	1244	1661		370	1842	1531	529	1842	1531
Volume (vph)	188	94	126	51	108	115	151	511	244	228	648	11
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	204	102	137	55	117	125	164	555	265	248	704	12
RTOR Reduction (vph)	0	0	99	0	54	0	0	0	121	0	0	2
Lane Group Flow (vph)	204	102	38	55	188	0	164	555	144	248	704	10
Turn Type	Perm		Perm	Perm			pm+pt		Perm	pm+pt		Perm
Protected Phases		8			4		5	2		1	6	
Permitted Phases	8		8	4			2		2	6		6
Actuated Green, G (s)	22.7	22.7	22.7	22.7	22.7		50.9	43.3	43.3	53.7	44.7	44.7
Effective Green, g (s)	24.7	24.7	24.7	24.7	24.7		51.9	45.3	45.3	54.7	46.7	46.7
Actuated g/C Ratio	0.27	0.27	0.27	0.27	0.27		0.58	0.50	0.50	0.61	0.52	0.52
Clearance Time (s)	6.0	6.0	6.0	6.0	6.0		3.0	6.0	6.0	3.0	6.0	6.0
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0		2.0	3.0	3.0	2.0	3.0	3.0
Lane Grp Cap (vph)	226	494	420	341	456		315	927	771	430	956	794
v/s Ratio Prot		0.06			0.11		0.04	0.30		c0.05	c0.38	
v/s Ratio Perm	c0.25		0.02	0.04			0.26		0.09	0.30		0.01
v/c Ratio	0.90	0.21	0.09	0.16	0.41		0.52	0.60	0.19	0.58	0.74	0.01
Uniform Delay, d1	31.5	25.1	24.3	24.8	26.7		12.5	15.9	12.3	10.4	16.9	10.5
Progression Factor	1.00	1.00	1.00	1.00	1.00		1.04	0.90	0.62	1.01	1.02	1.01
Incremental Delay, d2	34.6	0.2	0.1	0.2	0.6		0.7	2.7	0.5	0.5	2.2	0.0
Delay (s)	66.1	25.3	24.4	25.0	27.3		13.7	17.0	8.1	11.0	19.4	10.6
Level of Service	E	C	C	C	C		B	B	A	B	B	B
Approach Delay (s)		43.8			26.9			14.0			17.1	
Approach LOS		D			C			B			B	

Intersection Summary			
HCM Average Control Delay	21.5	HCM Level of Service	C
HCM Volume to Capacity ratio	0.75		
Actuated Cycle Length (s)	90.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	78.9%	ICU Level of Service	D
Analysis Period (min)	15		

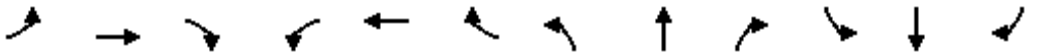
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	0.97	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.86		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	3319	3500	1531	1711	1586		3319	1693	
Flt Permitted	0.29	1.00	1.00	0.95	1.00	1.00	0.71	1.00		0.16	1.00	
Satd. Flow (perm)	531	3500	1531	3319	3500	1531	1287	1586		542	1693	
Volume (vph)	158	1139	122	273	670	228	361	38	477	221	28	32
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	172	1238	133	297	728	248	392	41	518	240	30	35
RTOR Reduction (vph)	0	0	79	0	0	140	0	183	0	0	22	0
Lane Group Flow (vph)	172	1238	54	297	728	108	392	376	0	240	43	0
Turn Type	pm+pt		Perm	Prot		Perm	Perm			Perm		
Protected Phases	5	2		1	6			8			4	
Permitted Phases	2		2			6	8			4		
Actuated Green, G (s)	46.4	37.8	37.8	11.2	40.4	40.4	34.0	34.0		34.0	34.0	
Effective Green, g (s)	48.4	40.8	40.8	10.2	43.4	43.4	37.0	37.0		37.0	37.0	
Actuated g/C Ratio	0.48	0.41	0.41	0.10	0.43	0.43	0.37	0.37		0.37	0.37	
Clearance Time (s)	3.0	7.0	7.0	3.0	7.0	7.0	7.0	7.0		7.0	7.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	347	1428	625	339	1519	664	476	587		201	626	
v/s Ratio Prot	0.04	c0.35		c0.09	c0.21			0.24			0.03	
v/s Ratio Perm	0.20		0.04			0.07	0.30			c0.44		
v/c Ratio	0.50	0.87	0.09	0.88	0.48	0.16	0.82	0.64		1.19	0.07	
Uniform Delay, d1	15.3	27.1	18.2	44.3	20.2	17.2	28.5	26.0		31.5	20.4	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.4	7.3	0.3	20.9	1.1	0.5	14.9	5.3		125.6	0.2	
Delay (s)	15.7	34.4	18.4	65.2	21.3	17.8	43.4	31.3		157.1	20.6	
Level of Service	B	C	B	E	C	B	D	C		F	C	
Approach Delay (s)		31.0			30.9			36.3			128.0	
Approach LOS		C			C			D			F	

Intersection Summary					
HCM Average Control Delay	39.4	HCM Level of Service	D		
HCM Volume to Capacity ratio	1.04				
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	16.0		
Intersection Capacity Utilization	92.4%	ICU Level of Service	F		
Analysis Period (min)	15				

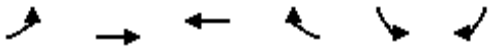
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.3	3.7	3.7	3.7
Total Lost time (s)		4.0	4.0	4.0	4.0		4.0		4.0	4.0	4.0	4.0
Lane Util. Factor		0.91	1.00	1.00	0.95		1.00		1.00	0.91	0.91	1.00
Frt		1.00	0.85	1.00	1.00		1.00		0.85	1.00	1.00	0.85
Flt Protected		1.00	1.00	0.95	1.00		0.95		1.00	0.95	0.99	1.00
Satd. Flow (prot)		4916	1531	1711	3421		1711		1531	1628	3403	1601
Flt Permitted		1.00	1.00	0.95	1.00		0.25		1.00	0.95	0.99	1.00
Satd. Flow (perm)		4916	1531	1711	3421		459		1531	1628	3403	1601
Volume (vph)	0	2377	284	106	741	0	282	0	433	294	402	351
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	0	2584	309	115	805	0	307	0	471	320	437	382
RTOR Reduction (vph)	0	0	173	0	0	0	0	0	0	0	0	100
Lane Group Flow (vph)	0	2584	136	115	805	0	307	0	471	244	513	282
Turn Type			Perm	Prot			custom		custom	Perm		Perm
Protected Phases		6		5	2		3		5 8		4	
Permitted Phases			6				8		3	4	4	4
Actuated Green, G (s)		42.0	42.0	4.0	51.0		37.0		47.0	25.0	25.0	25.0
Effective Green, g (s)		44.0	44.0	5.0	53.0		39.0		48.0	27.0	27.0	27.0
Actuated g/C Ratio		0.44	0.44	0.05	0.53		0.39		0.48	0.27	0.27	0.27
Clearance Time (s)		6.0	6.0	5.0	6.0		3.0			6.0	6.0	6.0
Vehicle Extension (s)		2.0	2.0	1.0	2.0		1.0			1.0	1.0	1.0
Lane Grp Cap (vph)		2163	674	86	1813		279		735	440	919	432
v/s Ratio Prot		c0.53		c0.07	0.24		c0.09		0.31			
v/s Ratio Perm			0.09				c0.34			0.15	0.15	0.18
v/c Ratio		1.19	0.20	1.34	0.44		1.10		0.64	0.55	0.56	0.65
Uniform Delay, d1		28.0	17.2	47.5	14.4		28.4		19.5	31.3	31.4	32.3
Progression Factor		0.99	1.62	1.05	0.96		1.60		1.59	1.00	1.00	1.00
Incremental Delay, d2		88.0	0.1	190.3	0.5		71.8		0.9	0.9	0.4	2.7
Delay (s)		115.9	28.0	240.3	14.4		117.1		32.0	32.2	31.8	35.0
Level of Service		F	C	F	B		F		C	C	C	D
Approach Delay (s)		106.5			42.6			65.6			33.0	
Approach LOS		F			D			E			C	

Intersection Summary			
HCM Average Control Delay	76.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.15		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	12.0
Intersection Capacity Utilization	107.4%	ICU Level of Service	G
Analysis Period (min)	15		

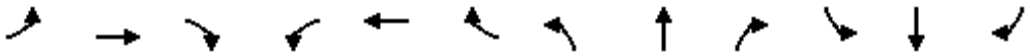
c Critical Lane Group



Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations						
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.5	3.3	3.3	3.5
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	
Lane Util. Factor	0.97	0.95	0.95	1.00	0.97	
Frt	1.00	1.00	1.00	0.85	0.99	
Flt Protected	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (prot)	3319	3500	3500	1531	3298	
Flt Permitted	0.95	1.00	1.00	1.00	0.96	
Satd. Flow (perm)	3319	3500	3500	1531	3298	
Volume (vph)	408	2290	948	262	942	87
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	443	2489	1030	285	1024	95
RTOR Reduction (vph)	0	0	0	161	7	0
Lane Group Flow (vph)	443	2489	1030	124	1112	0
Turn Type	Prot			Perm		
Protected Phases	1	6	2		4	
Permitted Phases		1		2		
Actuated Green, G (s)	15.6	60.0	41.4	41.4	28.0	
Effective Green, g (s)	14.6	62.0	43.4	43.4	30.0	
Actuated g/C Ratio	0.15	0.62	0.43	0.43	0.30	
Clearance Time (s)	3.0	6.0	6.0	6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	4.0	1.0	
Lane Grp Cap (vph)	485	2170	1519	664	989	
v/s Ratio Prot	0.13	c0.71	0.29		c0.34	
v/s Ratio Perm				0.08		
v/c Ratio	0.91	1.15	0.68	0.19	1.12	
Uniform Delay, d1	42.1	19.0	22.7	17.4	35.0	
Progression Factor	1.00	1.00	0.88	1.77	1.00	
Incremental Delay, d2	21.2	72.1	2.2	0.5	69.3	
Delay (s)	63.3	91.1	22.1	31.4	104.3	
Level of Service	E	F	C	C	F	
Approach Delay (s)		86.9	24.1		104.3	
Approach LOS		F	C		F	

Intersection Summary			
HCM Average Control Delay	75.1	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	99.6%	ICU Level of Service	F
Analysis Period (min)	15		

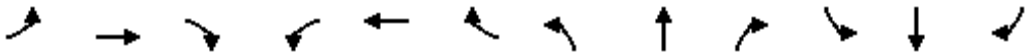
c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3	3.3	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	1.00		0.97	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.90		1.00	0.94	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	3500	1531	1711	3500	1531	1711	1655		3319	1740	
Flt Permitted	0.23	1.00	1.00	0.08	1.00	1.00	0.34	1.00		0.25	1.00	
Satd. Flow (perm)	409	3500	1531	148	3500	1531	619	1655		882	1740	
Volume (vph)	238	2342	165	227	808	188	140	118	246	1124	190	112
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	259	2546	179	247	878	204	152	128	267	1222	207	122
RTOR Reduction (vph)	0	0	53	0	0	104	0	75	0	0	21	0
Lane Group Flow (vph)	259	2546	126	247	878	100	152	320	0	1222	308	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			Perm		
Protected Phases	1	6		5	2			8			4	
Permitted Phases	6		6	2		2	8			4		
Actuated Green, G (s)	58.2	48.0	48.0	55.8	46.8	46.8	28.0	28.0		28.0	28.0	
Effective Green, g (s)	59.2	50.0	50.0	56.8	48.8	48.8	30.0	30.0		30.0	30.0	
Actuated g/C Ratio	0.59	0.50	0.50	0.57	0.49	0.49	0.30	0.30		0.30	0.30	
Clearance Time (s)	3.0	6.0	6.0	3.0	6.0	6.0	6.0	6.0		6.0	6.0	
Vehicle Extension (s)	1.0	4.0	4.0	1.0	4.0	4.0	1.0	1.0		1.0	1.0	
Lane Grp Cap (vph)	362	1750	766	209	1708	747	186	497		265	522	
v/s Ratio Prot	0.07	c0.73		c0.09	0.25			0.19			0.18	
v/s Ratio Perm	0.36		0.08	0.58		0.07	0.25			c1.39		
v/c Ratio	0.72	1.45	0.16	1.18	0.51	0.13	0.82	0.64		4.61	0.59	
Uniform Delay, d1	11.8	25.0	13.6	48.2	17.5	14.0	32.5	30.4		35.0	29.8	
Progression Factor	1.05	0.96	0.82	1.15	1.00	1.56	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.5	205.0	0.0	112.6	0.8	0.3	22.4	2.1		1633.7	1.2	
Delay (s)	12.9	229.0	11.3	168.0	18.4	22.1	54.8	32.5		1668.7	31.0	
Level of Service	B	F	B	F	B	C	D	C		F	C	
Approach Delay (s)		197.2			46.8			38.7			1321.3	
Approach LOS		F			D			D			F	

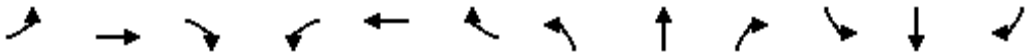
Intersection Summary			
HCM Average Control Delay	424.4	HCM Level of Service	F
HCM Volume to Capacity ratio	2.40		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	144.0%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.95		1.00	1.00	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.98		1.00	0.95	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1711	1801	1531	1711	1801	1531	1711	3347		1711	1711	
Flt Permitted	0.57	1.00	1.00	0.11	1.00	1.00	0.13	1.00		0.11	1.00	
Satd. Flow (perm)	1031	1801	1531	193	1801	1531	230	3347		204	1711	
Volume (vph)	41	538	107	213	284	663	297	756	128	739	443	220
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	45	585	116	232	309	721	323	822	139	803	482	239
RTOR Reduction (vph)	0	0	66	0	0	331	0	11	0	0	15	0
Lane Group Flow (vph)	45	585	50	232	309	390	323	950	0	803	706	0
Turn Type	Perm		Perm	pm+pt		Perm	pm+pt			pm+pt		
Protected Phases		2		1	6		3	8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	31.3	31.3	31.3	43.3	43.3	43.3	46.0	29.0		64.0	43.0	
Effective Green, g (s)	33.4	33.4	33.4	45.4	45.4	45.4	48.3	31.3		66.3	45.3	
Actuated g/C Ratio	0.28	0.28	0.28	0.38	0.38	0.38	0.40	0.26		0.55	0.38	
Clearance Time (s)	6.1	6.1	6.1	4.0	6.1	6.1	4.0	6.3		4.0	6.3	
Vehicle Extension (s)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	288	503	427	175	683	581	303	875		503	648	
v/s Ratio Prot		0.32		c0.09	0.17		0.15	0.28		c0.41	0.41	
v/s Ratio Perm	0.04		0.03	c0.42		0.25	0.28			c0.47		
v/c Ratio	0.16	1.16	0.12	1.33	0.45	0.67	1.07	1.09		1.60	1.09	
Uniform Delay, d1	32.5	43.2	32.2	58.1	27.8	30.9	35.5	44.2		36.1	37.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	0.3	93.4	0.1	180.6	0.5	3.0	70.3	56.4		277.6	62.2	
Delay (s)	32.8	136.6	32.3	238.6	28.3	34.0	105.7	100.6		313.7	99.4	
Level of Service	C	F	C	F	C	C	F	F		F	F	
Approach Delay (s)		114.1			70.2			101.9			212.3	
Approach LOS		F			E			F			F	

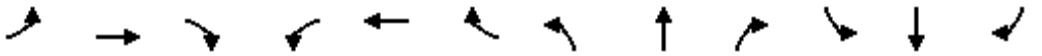
Intersection Summary			
HCM Average Control Delay	130.4	HCM Level of Service	F
HCM Volume to Capacity ratio	1.45		
Actuated Cycle Length (s)	119.7	Sum of lost time (s)	8.0
Intersection Capacity Utilization	119.4%	ICU Level of Service	H
Analysis Period (min)	15		
c Critical Lane Group			



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Lane Width	3.0	3.5	3.3	3.0	3.5	3.3	3.3	3.3	3.3	3.0	3.5	3.3
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0		4.0	4.0	
Lane Util. Factor	1.00	0.95	1.00	1.00	0.95	1.00	1.00	0.95		1.00	0.95	
Frt	1.00	1.00	0.85	1.00	1.00	0.85	1.00	0.97		1.00	0.92	
Flt Protected	0.95	1.00	1.00	0.95	1.00	1.00	0.95	1.00		0.95	1.00	
Satd. Flow (prot)	1652	3500	1531	1652	3500	1531	1711	3332		1652	3219	
Flt Permitted	0.11	1.00	1.00	0.31	1.00	1.00	0.22	1.00		0.18	1.00	
Satd. Flow (perm)	188	3500	1531	530	3500	1531	400	3332		316	3219	
Volume (vph)	541	862	67	117	1152	295	74	459	97	200	452	519
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	588	937	73	127	1252	321	80	499	105	217	491	564
RTOR Reduction (vph)	0	0	36	0	0	147	0	18	0	0	207	0
Lane Group Flow (vph)	588	937	37	127	1252	174	80	586	0	217	848	0
Turn Type	pm+pt		Perm	pm+pt		Perm	Perm			pm+pt		
Protected Phases	5	2		1	6			8		7	4	
Permitted Phases	2		2	6		6	8			4		
Actuated Green, G (s)	61.0	48.9	48.9	39.1	31.0	31.0	16.0	16.0		27.0	27.0	
Effective Green, g (s)	63.0	50.9	50.9	41.1	33.0	33.0	18.0	18.0		29.0	29.0	
Actuated g/C Ratio	0.63	0.51	0.51	0.41	0.33	0.33	0.18	0.18		0.29	0.29	
Clearance Time (s)	4.0	6.0	6.0	4.0	6.0	6.0	6.0	6.0		4.0	6.0	
Vehicle Extension (s)	3.0	4.5	4.5	3.0	4.5	4.5	3.0	3.0		3.0	3.0	
Lane Grp Cap (vph)	499	1782	779	309	1155	505	72	600		185	934	
v/s Ratio Prot	c0.31	0.27		0.03	0.36			0.18		c0.08	0.26	
v/s Ratio Perm	c0.44		0.02	0.14		0.11	0.20			c0.26		
v/c Ratio	1.18	0.53	0.05	0.41	1.08	0.35	1.11	0.98		1.17	0.91	
Uniform Delay, d1	39.2	16.5	12.4	18.8	33.5	25.3	41.0	40.8		33.2	34.2	
Progression Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00		1.00	1.00	
Incremental Delay, d2	99.5	0.5	0.0	0.9	52.3	0.7	139.6	30.6		120.5	12.3	
Delay (s)	138.7	16.9	12.4	19.7	85.8	26.0	180.6	71.3		153.7	46.5	
Level of Service	F	B	B	B	F	C	F	E		F	D	
Approach Delay (s)		61.5			69.6			84.1			64.8	
Approach LOS		E			E			F			E	

Intersection Summary			
HCM Average Control Delay	67.9	HCM Level of Service	E
HCM Volume to Capacity ratio	1.14		
Actuated Cycle Length (s)	100.0	Sum of lost time (s)	8.0
Intersection Capacity Utilization	112.7%	ICU Level of Service	H
Analysis Period (min)	15		

c Critical Lane Group



Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Total Lost time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	1711	3421	1531	1711	3421	1531	1711	1801	1531	1711	1801	1531
Flt Permitted	0.15	1.00	1.00	0.24	1.00	1.00	0.23	1.00	1.00	0.22	1.00	1.00
Satd. Flow (perm)	263	3421	1531	440	3421	1531	408	1801	1531	390	1801	1531
Volume (vph)	233	1066	67	117	919	203	74	459	97	59	451	100
Peak-hour factor, PHF	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Adj. Flow (vph)	253	1159	73	127	999	221	80	499	105	64	490	109
RTOR Reduction (vph)	0	0	28	0	0	98	0	0	41	0	0	24
Lane Group Flow (vph)	253	1159	45	127	999	123	80	499	64	64	490	85
Turn Type	pm+pt		Perm	Perm		Perm	Perm		Perm	Perm		Perm
Protected Phases	7	4			8			2			6	
Permitted Phases	4		4	8		8	2		2	6		6
Actuated Green, G (s)	35.4	35.4	35.4	23.4	23.4	23.4	23.0	23.0	23.0	23.0	23.0	23.0
Effective Green, g (s)	35.4	35.4	35.4	23.4	23.4	23.4	23.0	23.0	23.0	23.0	23.0	23.0
Actuated g/C Ratio	0.53	0.53	0.53	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35	0.35
Clearance Time (s)	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
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)	315	1824	816	155	1206	540	141	624	530	135	624	530
v/s Ratio Prot	c0.10	0.34			0.29			c0.28			0.27	
v/s Ratio Perm	c0.33		0.03	0.29		0.08	0.20		0.04	0.16		0.06
v/c Ratio	0.80	0.64	0.06	0.82	0.83	0.23	0.57	0.80	0.12	0.47	0.79	0.16
Uniform Delay, d1	12.1	10.9	7.5	19.6	19.7	15.1	17.7	19.6	14.8	17.0	19.5	15.0
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	13.7	0.7	0.0	27.4	4.8	0.2	15.5	10.3	0.5	11.5	9.6	0.6
Delay (s)	25.8	11.7	7.5	47.0	24.5	15.4	33.2	29.9	15.3	28.4	29.1	15.7
Level of Service	C	B	A	D	C	B	C	C	B	C	C	B
Approach Delay (s)		13.9			25.1			28.1			26.8	
Approach LOS		B			C			C			C	

Intersection Summary			
HCM Average Control Delay	21.9	HCM Level of Service	C
HCM Volume to Capacity ratio	0.78		
Actuated Cycle Length (s)	66.4	Sum of lost time (s)	8.0
Intersection Capacity Utilization	79.5%	ICU Level of Service	D
Analysis Period (min)	15		
c Critical Lane Group			

APPENDIX D
ARCHAEOLOGICAL MEMO

Hamilton

Planning and Economic
Development Department

Memorandum

To:

From: Joseph Muller, Cultural Heritage Planner
Community Planning and Design Section
Planning Division

Phone: 905-546-2424 Ext. 1214 **Fax:** 905-643-7250

Date: February 11, 2009 **File:**

Subject: **Proposed Ancaster Transportation Master Plan:**
City of Hamilton Archaeology Management Plan
Evaluation of archaeological Potential

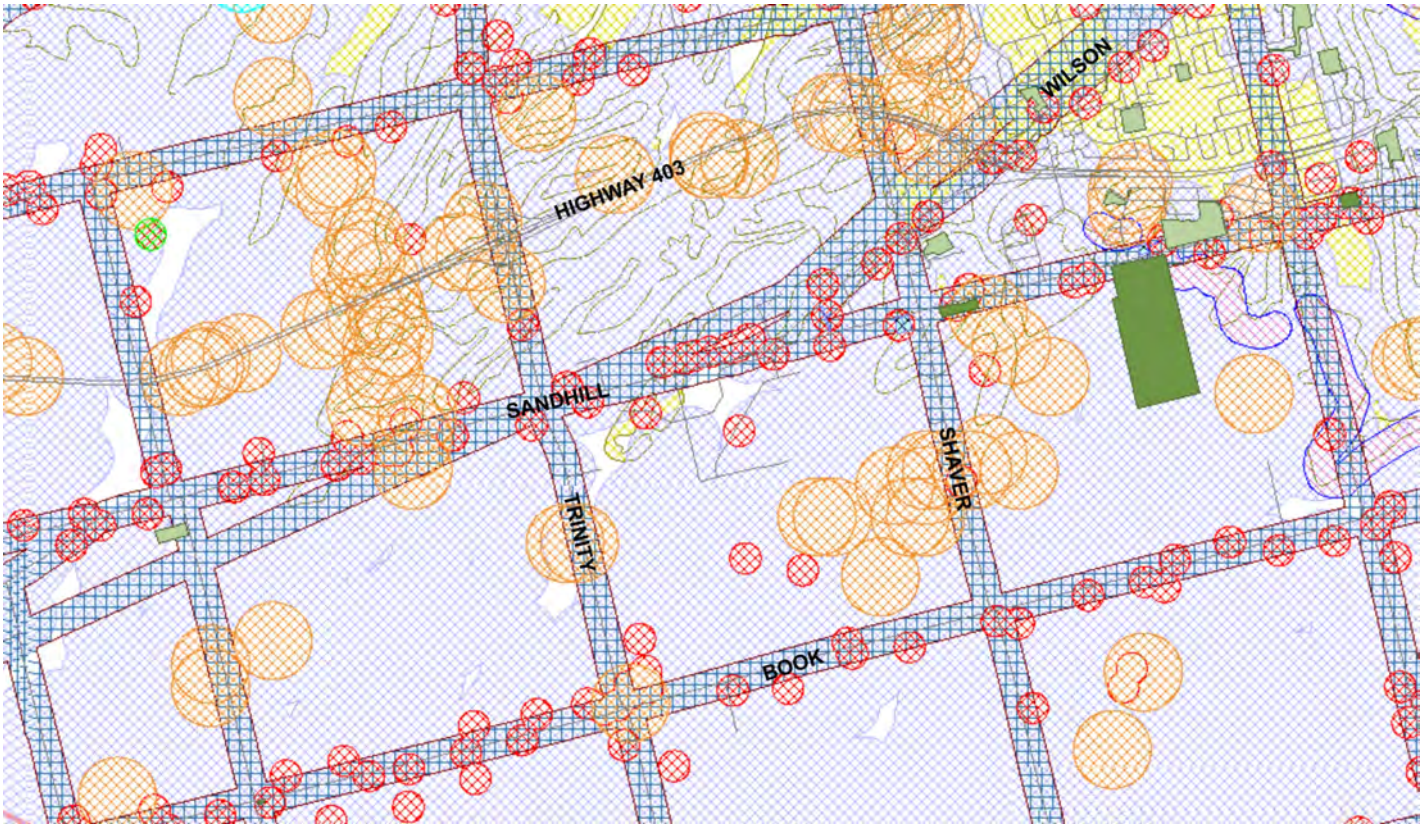
The following comments are provided by the Community Planning and Design Section:

As requested, Heritage Staff have compiled archeological evaluations of the Ancaster area. The evaluations identify the applicable archaeological potential criteria that the Ministry of Culture and the City of Hamilton use and a mapping of the archaeological potential criteria for the applicable area. While many of the areas show surface disturbance, archaeological potential is presumed to exist except where displaced by extant buildings or other development. The legend below includes the layers used to determine the archaeological potential of each area:

Archaeological Potential Legend:

- Streetcenterline (17,659)
- Railway Line (1,396)
- Major Lakes (4)
- Escarpment (166)
- Archae_Sites (735)
- HAMP_Archae_Sites_catch250m (735)
- HAMP_UnReg_Archae_Sites_Jan07_catch250m
- HAMP_Historic_Activity (3,565)
- HAMP_Historic_Activity_catch100m (2,509)
- HAMP_Soil_Types_Sand (630)
- HAMP_Unusual_Landforms_catch100m (1)
- HAMP_Historic_Transportation_catch100m (1)
- HAMP_Water_catch_Lakes (1)
- HAMP_Historic_Urban_Boundary (7)
- Heritage (584)
- Cemeteries (110)
- Parks (477)
- Land Parcels (292,723)

Western Ancaster

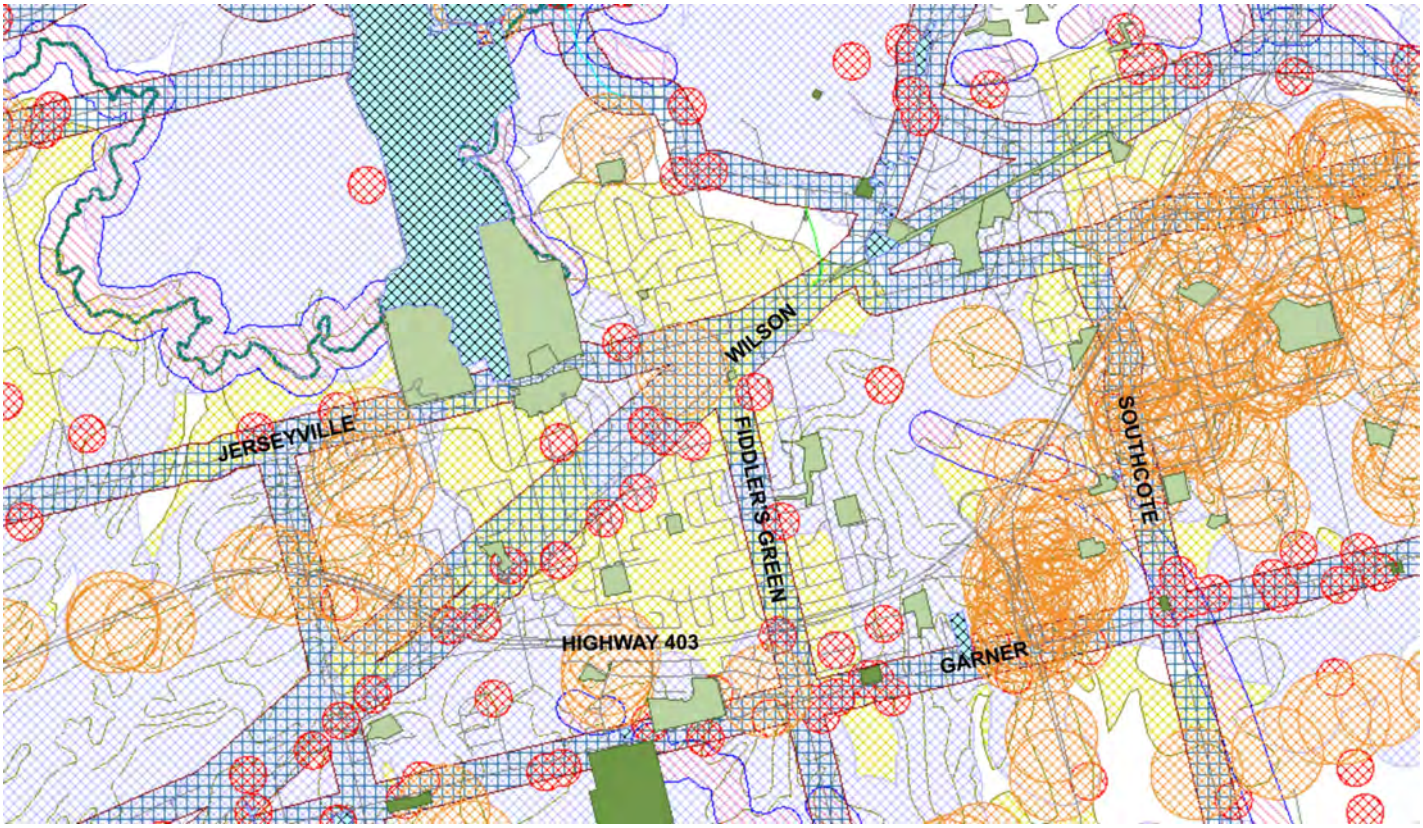


The subject property meets seven of the 11 criteria used by the City of Hamilton and Ministry of Culture for determining archaeological potential:

1) Within 250 metres of a known archaeological site/in an area dense with archaeological sites;
2) Within 300 metres of water or prehistoric water, or 200 metres of a secondary watercourse;
3) Documentary evidence, local knowledge or oral history associates the property with historic activities, events or occupations;
4) On well-drained, sandy soil within a clay/stone matrix;
5) Associated with unusual landforms;
6) Within 100 metres of a historic transportation corridor; and,
7) A property designated under the *Ontario Heritage Act*.

These criteria define the property as having archaeological potential.

Central Ancaster

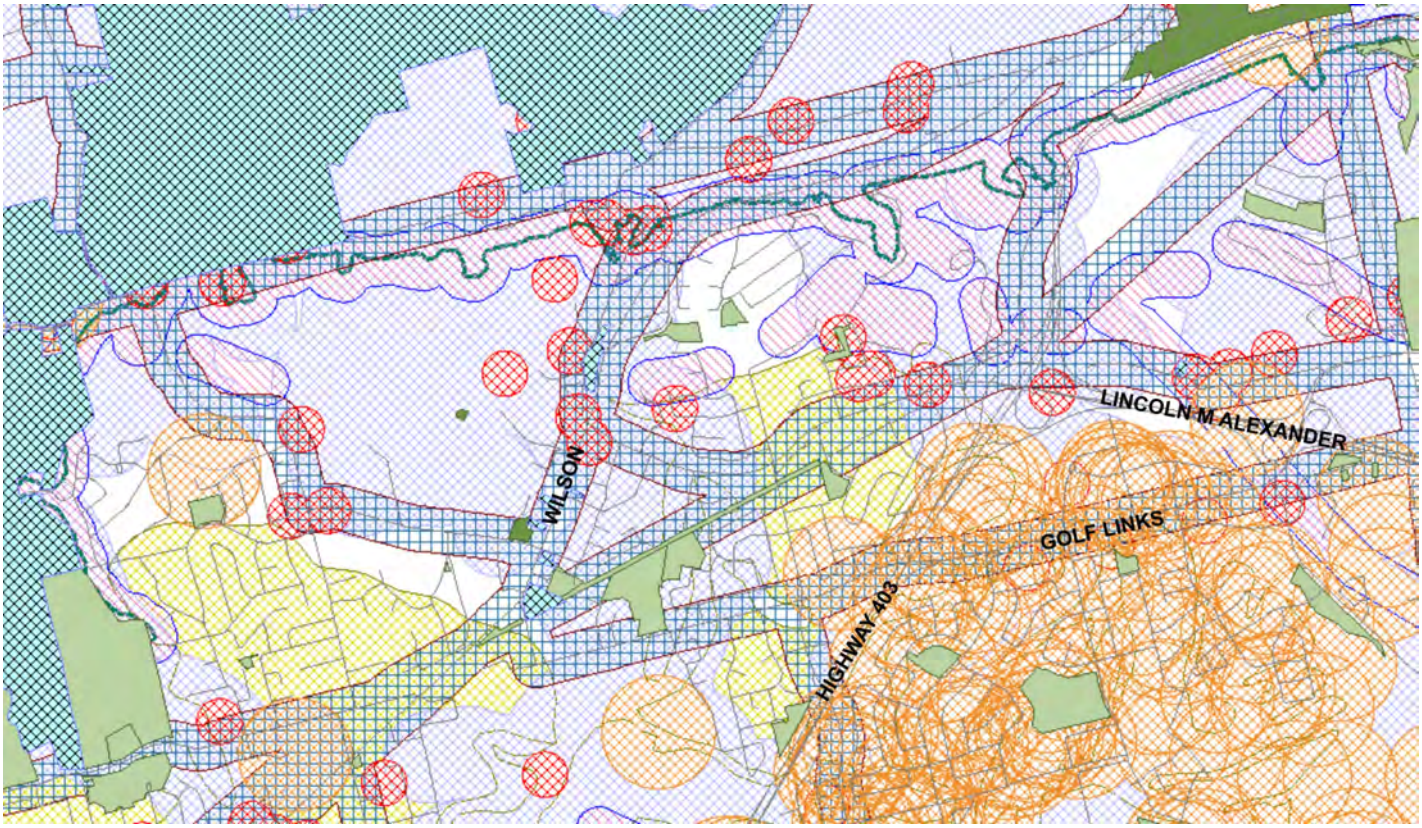


The subject property meets eight of the 11 criteria used by the City of Hamilton and Ministry of Culture for determining archaeological potential:

1) Within 250 metres of a known archaeological site/in an area dense with archaeological sites;
2) Within 300 metres of water or prehistoric water, or 200 metres of a secondary watercourse;
3) Documentary evidence, local knowledge or oral history associates the property with historic activities, events or occupations;
4) In an area of elevated topography;
5) On well-drained, sandy soil within a clay/stone matrix;
6) Associated with unusual landforms;
7) Within 100 metres of a historic transportation corridor; and,
8) A property designated under the *Ontario Heritage Act*.

These criteria define the property as having archaeological potential.

Northwestern Ancaster

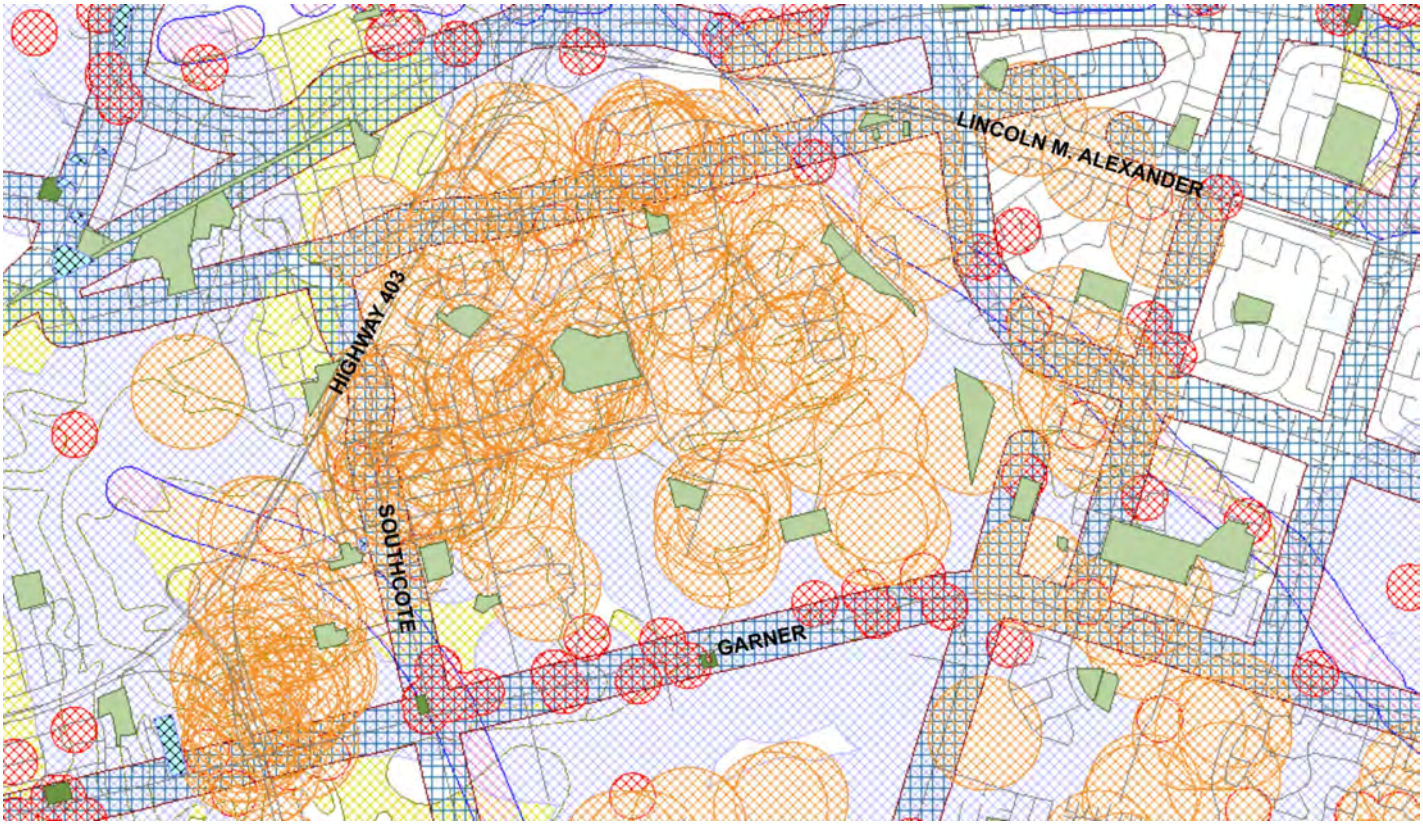


The subject property meets eight of the 11 criteria used by the City of Hamilton and Ministry of Culture for determining archaeological potential:

1) Within 250 metres of a known archaeological site/in an area dense with archaeological sites;
2) Within 300 metres of water or prehistoric water, or 200 metres of a secondary watercourse;
3) Documentary evidence, local knowledge or oral history associates the property with historic activities, events or occupations;
4) In an area of elevated topography
5) On well-drained, sandy soil within a clay/stone matrix;
6) Associated with unusual landforms;
7) Within 100 metres of a historic transportation corridor; and,
8) A property designated under the *Ontario Heritage Act.*

These criteria define the property as having archaeological potential.

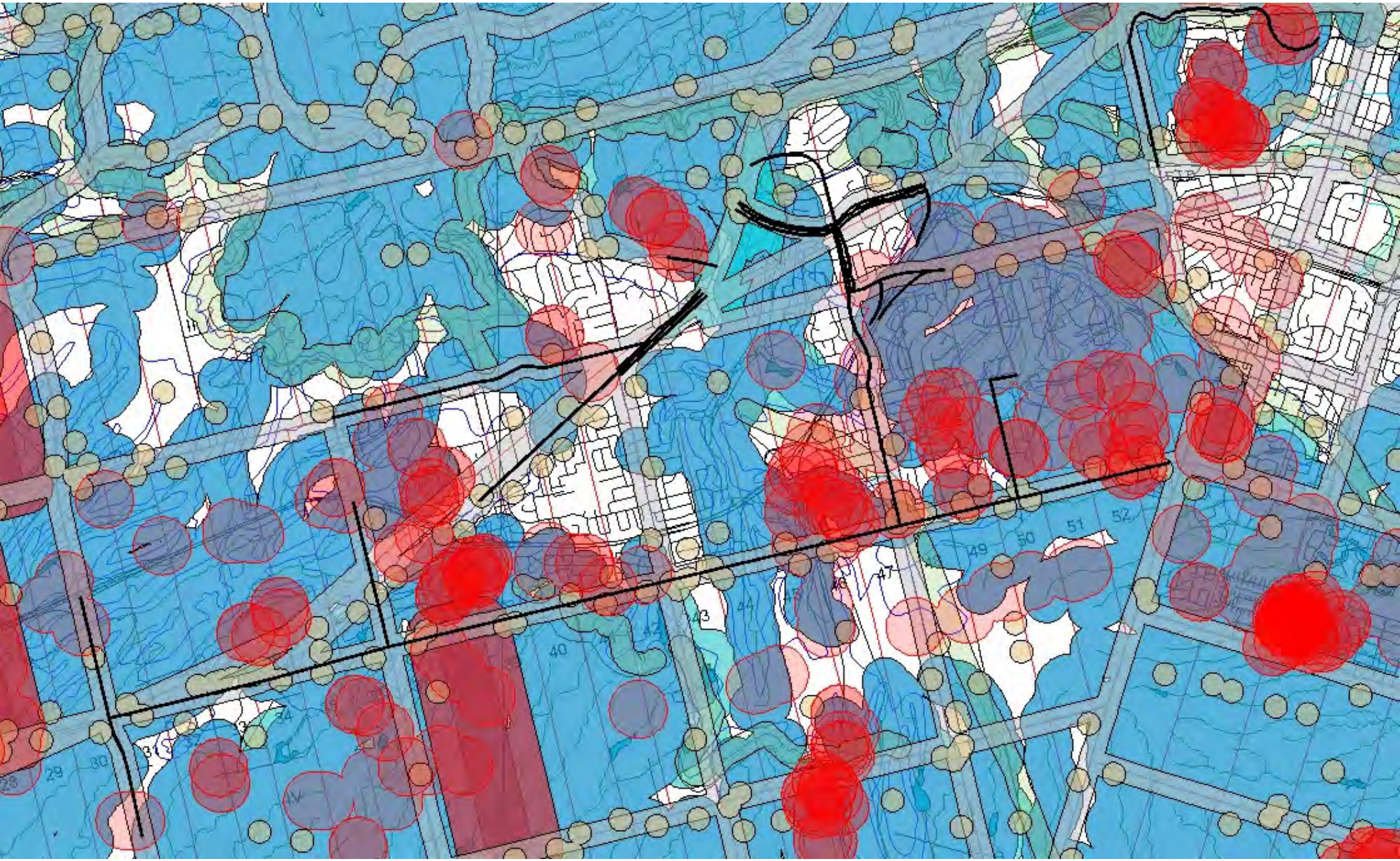
Southeastern Ancaster



The subject property meets eight of the 11 criteria used by the City of Hamilton and Ministry of Culture for determining archaeological potential:

1) Within 250 metres of a known archaeological site/in an area dense with archaeological sites;
2) Within 300 metres of water or prehistoric water, or 200 metres of a secondary watercourse;
3) Documentary evidence, local knowledge or oral history associates the property with historic activities, events or occupations;
4) In an area of elevated topography
5) On well-drained, sandy soil within a clay/stone matrix;
6) Associated with unusual landforms;
7) Within 100 metres of a historic transportation corridor; and,
8) A property designated under the *Ontario Heritage Act.*

These criteria define the property as having archaeological potential.



Note: Updated archaeology mapping provided by the City of Hamilton March 17, 2011