

Traffic Signal Optimization Project

City of New Haven, CT



FINAL REPORT

JUNE 2015



**CDM
Smith**

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Section 1

Introduction

1.1 Study Background

The South Central Regional Council of Governments (SCRCOG) is the designated Metropolitan Planning Organization (MPO) for the New Haven area. The SCRCOG has undertaken the Signal Optimization Project at the request for the City of New Haven to improve traffic flow along three (3) commuter corridors into New Haven i.e. Whalley Avenue, Whitney Avenue, and Dixwell Avenue. CDM Smith is the prime consultant to assist the SCRCOG and the City of New Haven on this project.

1.2 Study Purpose

The purpose of this study is to work with the City of New Haven to improve traffic flow and operations along the three (3) corridors during weekday morning, weekday mid-day, and weekday evening peak periods. Currently, drivers experience delay during peak periods while commuting into New Haven during the morning peak period and leaving New Haven during the evening peak period.

The specific study objectives are:

- Review existing traffic flow and operations in the subject corridors.
- Obtain current traffic volume conditions during the analysis time periods.
- Obtain travel time measurements under current conditions.
- Optimize traffic signals timings and synchronize traffic flow between intersections.
- Assist the City in field implementation of the traffic signal timings.
- Conduct travel time measurements after field implementation of revised traffic signal timings and offset data.

1.3 Study Area

The following is a list of intersections within the study area by corridor:

Whalley Avenue

1. Whalley Avenue and Ella Grasso Boulevard
2. Whalley Avenue and Ellsworth Avenue
3. Whalley Avenue and Norton Street
4. Whalley Avenue and Winthrop Avenue

5. Whalley Avenue and Sherman Parkway
6. Whalley Avenue and Orchard Street
7. Whalley Avenue and Sperry Street
8. Whalley Avenue and Dwight Street

Whitney Avenue

1. Whitney Avenue and Trumbull Street
2. Whitney Avenue and Sachem Street
3. Whitney Avenue and Humphrey Street
4. Whitney Avenue and Edwards Street
5. Whitney Avenue and Cottage Street
6. Whitney Avenue and Willow Street
7. Whitney Avenue and Canner Street
8. Whitney Avenue and Huntington Street/Worthington Hooker School
9. Whitney Avenue and East Rock Road

Dixwell Avenue

1. Dixwell Avenue and Sperry Street
2. Dixwell Avenue and Shopping Center/New Haven Public Library
3. Dixwell Avenue and Henry Street
4. Dixwell Avenue and Munson Street
5. Dixwell Avenue and Division Street
6. Dixwell Avenue and Bassett Street

Figures 1.1, 1.2, and 1.3 show the locations in the Whalley Avenue, Whitney Avenue, and Dixwell Avenue corridors respectively.

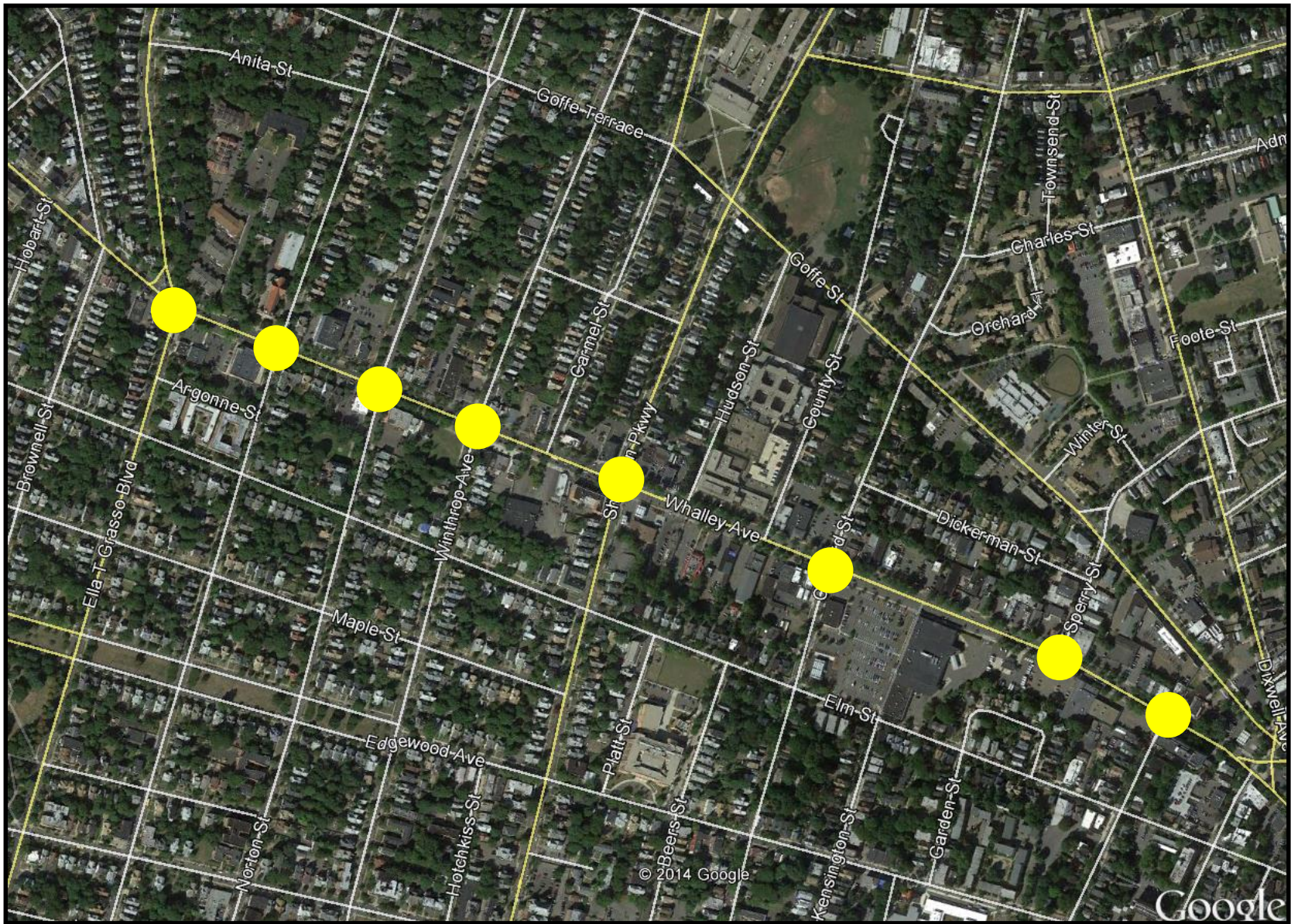


Figure 1-1: Whalley Avenue Corridor

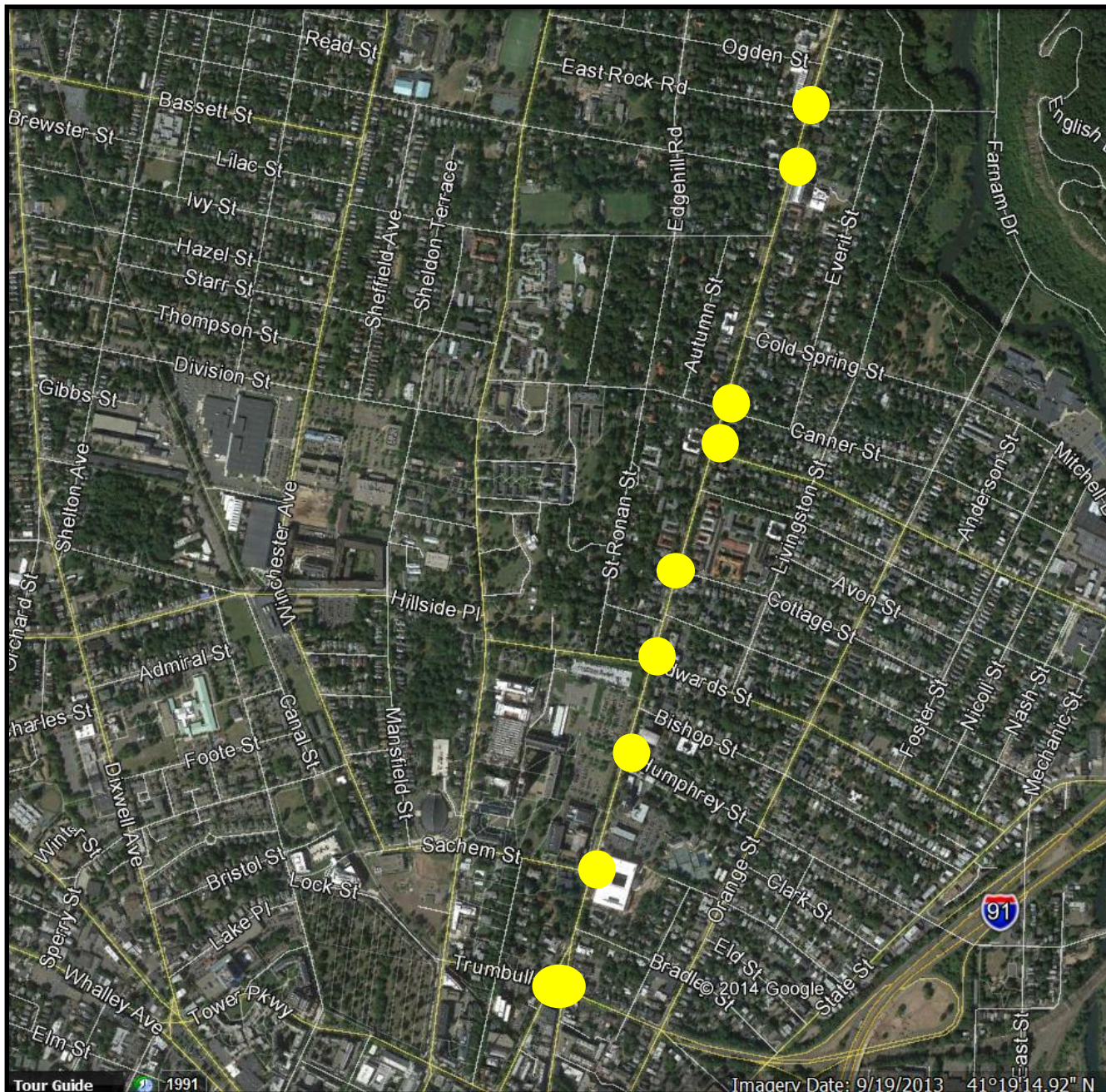


Figure 1-2: Whitney Avenue Corridor

1.4 Meetings with City

During the course of this project, the following meetings were held with the City of New Haven:

- February 19, 2015 – Meeting to discuss traffic volumes
- May 8, 2015 – Follow-up meeting to discuss traffic volumes
- June 19, 2015 – Meeting with the City to discuss implementation observations

1.5 Report Outline

The report is divided into chapters which focus on each of the corridors. Within each chapter the following is described:

- Description of the corridor
- Intersection spacing
- Existing travel time data
- Existing (2015) traffic volumes
- Traffic signal optimization
- Level of service (LOS) analysis
- Field implementation of timings
- Before and after travel time results

Section 2

Whalley Avenue Corridor

This chapter focusses on the Whalley Avenue corridor.

2.1 Description of the Corridor

Whalley Avenue is a four-lane roadway oriented in an east-west direction. Land use along Whalley Avenue is a mix of retail, residential, and commercial uses. The posted speed limit on Whalley Avenue is 25 miles per hour. Parking is generally allowed on both sides along Whalley Avenue. The following is a list of signalized intersections in the Whalley Avenue corridor within the project limits:

- Whalley Avenue and Ella Grasso Boulevard
- Whalley Avenue and Ellsworth Avenue
- Whalley Avenue and Norton Street
- Whalley Avenue and Winthrop Avenue
- Whalley Avenue and Sherman Parkway
- Whalley Avenue and Orchard Street
- Whalley Avenue and Sperry Street
- Whalley Avenue and Dwight Street

Exclusive pedestrian signal phases are provided at several locations on Whalley Avenue.

2.2 Intersection Spacing

Table 2.1 provides intersection spacing along the Whalley Avenue corridor.

Table 2.1 Intersection Spacing (in feet)

Intersection	Distance (in feet)
Ella Grasso Boulevard	
Ellsworth Avenue	470
Norton Street	450
Winthrop Avenue	460
Sherman Parkway	655
Orchard Street	970
Sperry Street	1,065
Dwight Street	520

2.3 Existing Travel Times

Travel time runs were conducted on the Whalley Avenue corridor during the analysis peak hour periods. Tables 2.2 and 2.3 summarize the travel time runs by direction during the weekday morning and weekday evening peak hour periods respectively.

Table 2.2 Average Travel Times - Weekday Morning Peak Period

Intersection	Average Travel Time (in mm:ss)	
	Eastbound	Westbound
Ella Grasso Boulevard	-	00:18.4
Ellsworth Avenue	00:21.3	00:20.9
Norton Street	00:26.6	00:32.7
Winthrop Avenue	00:15.0	00:27.1
Sherman Parkway	00:28.3	00:36.3
Orchard Street	00:31.5	00:37.1
Sperry Street	00:37.2	00:19.1
Dwight Street	00:36.8	-
TOTAL TRAVEL TIME	03:17	03:12

Table 2.3 Average Travel Times - Weekday Evening Peak Period

Intersection	Average Travel Time (in mm:ss)	
	Eastbound	Westbound
Ella Grasso Boulevard	-	00:30.2
Ellsworth Avenue	00:25.9	00:27.7
Norton Street	00:27.3	00:23.1
Winthrop Avenue	00:13.7	00:23.1
Sherman Parkway	00:57.4	01:02.6
Orchard Street	01:02.5	01:28.1
Sperry Street	00:33.5	00:21.9
Dwight Street	00:36.2	-
TOTAL TRAVEL TIME	04:16	04:37

As indicated by the travel time runs, the peak traffic flow in the corridor is in the eastbound direction during the weekday morning peak hour period and in the westbound direction during the weekday evening peak hour period.

2.4 Existing (2015) Traffic Volumes

Manual turning movement counts were conducted at the eight (8) intersections along Whalley Avenue during the weekday morning, weekday mid-day, and weekday evening peak hour periods. These counts were conducted on Tuesday, December 9 and Wednesday, December 10, 2014.

Figures 2.1, 2.2, and 2.3 represent balanced traffic volumes during the weekday morning, weekday mid-day, and weekday evening peak hour periods respectively.

2.5 Traffic Signal Optimization

Traffic signal optimization was conducted using SYNCHRO 8 software. A SYNCHRO network was created for the Whalley Avenue corridor with current intersection geometry and signal timings for each peak period. Pedestrian signal phases and timings were added at appropriate locations. The Whalley Avenue system was reviewed to determine appropriate intersection groupings for improving traffic signal coordination. The intersection groupings were developed based on:

- Intersection spacing
- Existing traffic volumes
- Land use characteristics i.e. major traffic generators

The following intersection groupings are proposed for the Whalley Avenue system:

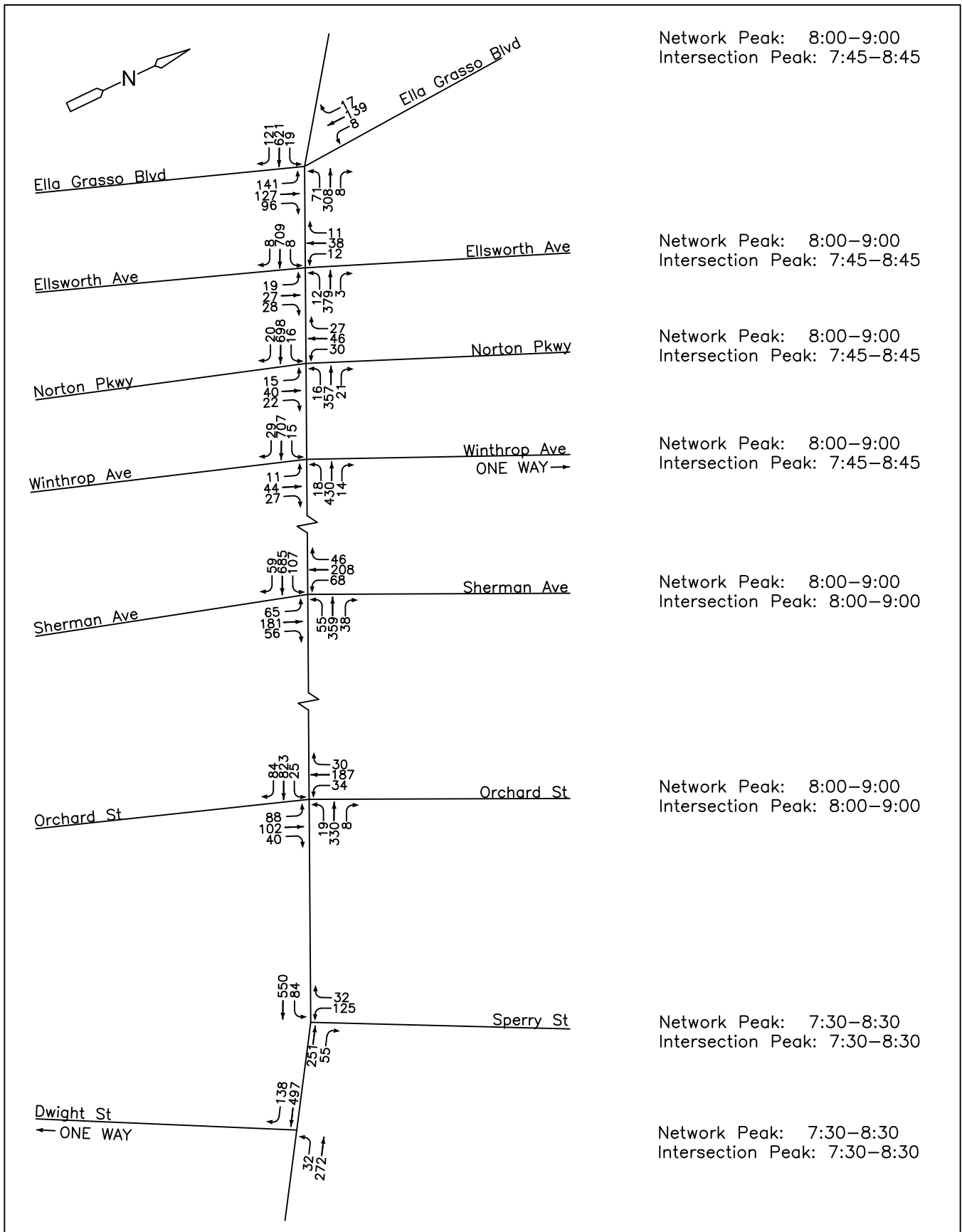
Group A

- Whalley Avenue and Ella Grasso Boulevard
- Whalley Avenue and Ellsworth Avenue
- Whalley Avenue and Norton Street
- Whalley Avenue and Winthrop Avenue
- Whalley Avenue and Sherman Parkway
- Whalley Avenue and Orchard Street

Group B

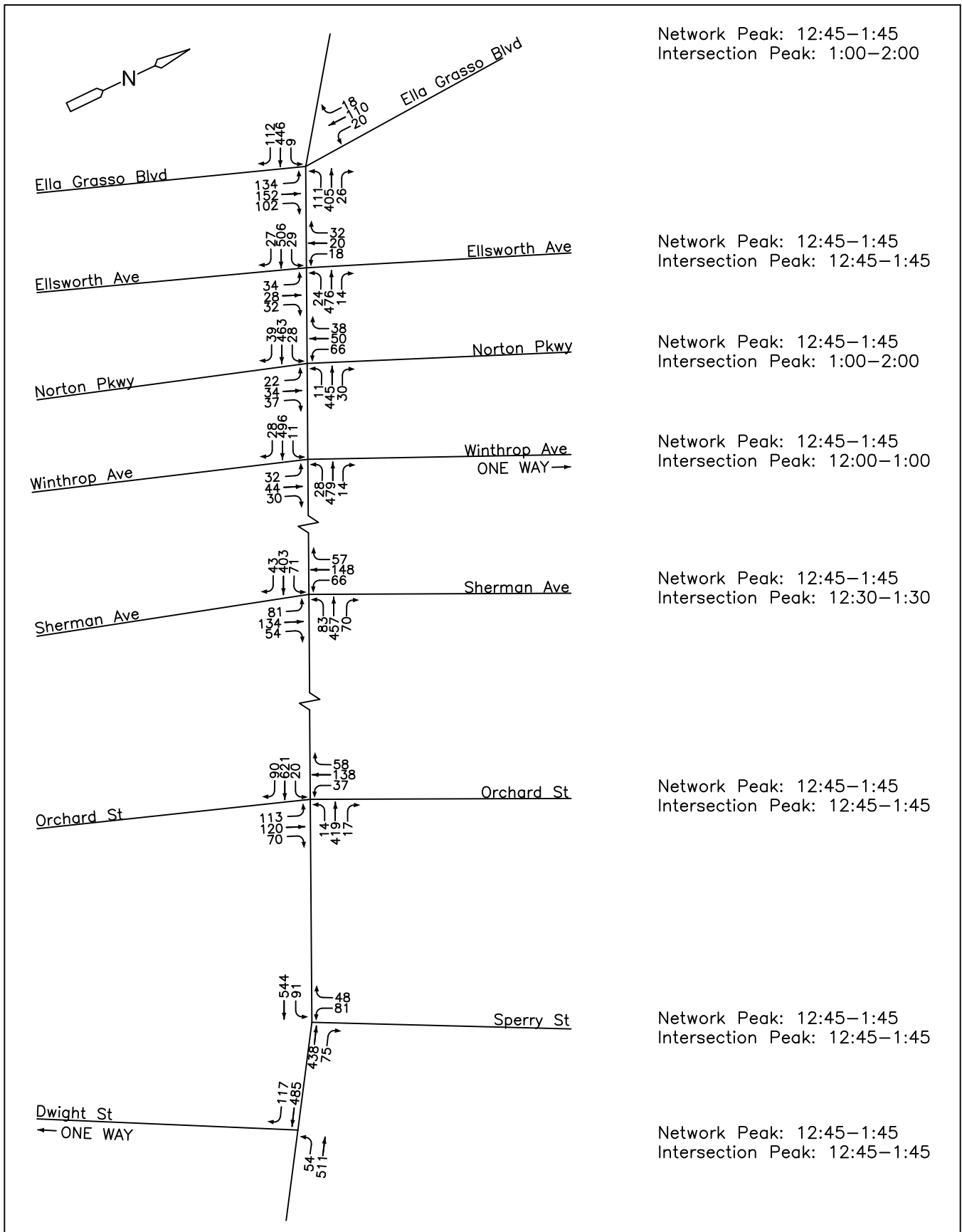
- Whalley Avenue and Sperry Street
- Whalley Avenue and Dwight Street

Once the intersection groupings were determined, a network cycle length was selected for each peak period and intersection grouping. Using that cycle length, traffic signal timings were obtained at each location and for each peak period. Traffic signal timings were developed with and without the pedestrian phase to estimate the amount of time that can be shifted to other signal phases when the pedestrian phase is not activated. The following section describes the results of the level of service analysis.



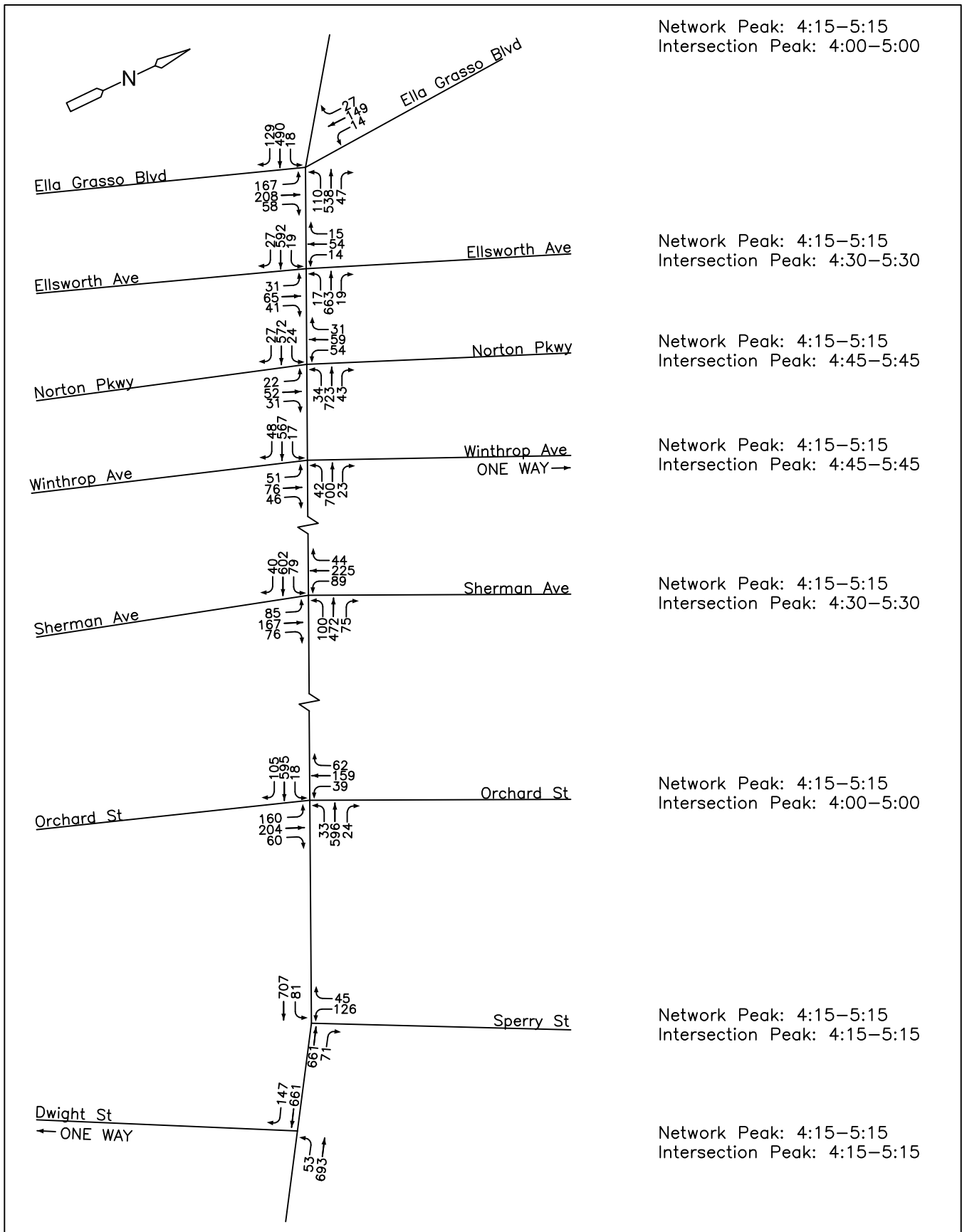
WHALLEY AVENUE

Figure 2-1
 Weekday Morning Peak Hour
 Traffic Volumes
 Data Recorded January 2015



WHALLEY AVENUE

Figure 2-2
 Weekday Mid-Day Peak Hour
 Traffic Volumes
 Data Recorded January 2015



WHALLEY AVENUE

Figure 2-3
 Weekday Evening Peak Hour
 Traffic Volumes
 Data Recorded January 2015

2.6 Level of Service Analysis

Tables 2.4, 2.5, and 2.6 summarize the levels of service analysis under weekday morning, weekday mid-day, and weekday evening peak hour periods respectively.

Table 2.4 Level of Service Analysis – Weekday Morning Peak Period

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whalley Avenue and Ella T Grasso Boulevard ¹	NB	15.5	B	90.0	46.8	D	100.0	43.7	D	100.0
	SB	36.0	D		39.3	D		36.9	D	
	EB	62.0	E		14.0	B		14.9	B	
	WB	19.5	B		6.4	A		2.4	A	
	OVERALL	39.3	D		22.3	C		20.8	C	
Whalley Avenue and Ellsworth Avenue ¹	NB	38.0	D	80.0	51.1	D	100.0	51.3	D	100.0
	SB	36.2	D		48.0	D		48.1	D	
	EB	3.6	A		1.4	A		1.4	A	
	WB	3.2	A		1.3	A		3.4	A	
	OVERALL	7.6	A		7.2	A		7.9	A	
Whalley Avenue and Norton Parkway ¹	NB	39.9	D	90.0	45.2	D	100.0	45.2	D	100.0
	SB	46.8	D		53.8	D		53.7	D	
	EB	4.7	A		2.2	A		2.6	A	
	WB	4.0	A		9.3	A		5.5	A	
	OVERALL	10.6	B		11.7	B		10.9	B	
Whalley Avenue and Winthrop Avenue ¹	NB	40.9	D	80.0	53.6	D	100.0	53.6	D	100.0
	EB	3.3	A		1.1	A		1.1	A	
	WB	3.0	A		1.7	A		1.7	A	
	OVERALL	5.8	A		5.1	A		5.1	A	
Whalley Avenue and Sherman Parkway ¹	NB	30.9	C	90.0	53.4	D	100.0	54.7	D	100.0
	SB	30.7	C		52.6	D		53.9	D	
	EB	21.8	C		13.1	B		15.5	B	
	WB	19.7	B		26.1	C		10.8	B	
	OVERALL	24.3	C		29.3	C		27.2	C	
Whalley Avenue and Orchard Street ¹	NB	13.1	B	80.0	32.3	C	100.0	25.0	C	100.0
	SB	35.9	D		72.7	E		52.5	D	
	EB	27.9	C		9.3	A		14.6	B	
	WB	18.6	B		10.9	B		13.8	B	
	OVERALL	25.0	C		23.7	C		22.4	C	
Whalley Avenue and Sperry Street ²	SB	20.2	C	45.0	53.7	D	90.0	43.8	D	90.0
	EB	5.7	A		4.7	A		5.8	A	
	WB	12.2	B		18.5	B		17.1	B	
	OVERALL	10.0	B		16.9	B		15.5	B	

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whalley Avenue and Dwight Street ²	EB	26.3	C	90.0	15.1	B	90.0	0.1	A	90.0
	WB	0.4	A		0.1	A		1.7	A	
	OVERALL	17.6	B		10.0	B		1.1	A	

1. Note: Intersection grouped as part of Group A

2. Note: Intersection grouped as part of Group B

Table 2.5 Level of Service Analysis – Weekday Mid-day Peak Period

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whalley Avenue and Ella T Grasso Boulevard ¹	NB	12.8	B	80.0	23.9	C	90.0	25.5	C	90.0
	SB	31.5	C		43.1	D		49.7	D	
	EB	38.7	D		28.1	C		24.5	C	
	WB	20.9	C		9.3	A		6.9	A	
	OVERALL	25.7	C		22.3	C		21.3	C	
Whalley Avenue and Ellsworth Avenue ¹	NB	32.6	C	70.0	45.6	D	90.0	45.8	D	90.0
	SB	31.4	C		42.7	D		42.9	D	
	EB	4.1	A		1.1	A		3.5	A	
	WB	4.1	A		2.0	A		2.6	A	
	OVERALL	8.2	A		7.8	A		9.1	A	
Whalley Avenue and Norton Parkway ¹	NB	31.8	C	80.0	37.2	D	90.0	36.6	D	90.0
	SB	40.6	D		49.6	D		48.3	D	
	EB	5.8	A		3.9	A		8.9	A	
	WB	5.6	A		1.6	A		2.0	A	
	OVERALL	12.2	B		11.4	B		13.5	B	
Whalley Avenue and Winthrop Avenue ¹	NB	35.4	D	70.0	26.5	C	90.0	26.5	C	90.0
	EB	3.9	A		4.0	A		5.5	A	
	WB	4.0	A		5.4	A		13.6	B	
	OVERALL	7.2	A		6.9	A		11.3	B	
Whalley Avenue and Sherman Parkway ¹	NB	36.2	D	80.0	47.3	D	90.0	46.6	D	90.0
	SB	38.0	D		50.6	D		49.6	D	
	EB	15.1	B		7.5	A		7.2	A	
	WB	15.2	B		8.2	A		10.4	B	
	OVERALL	22.3	C		21.3	C		21.7	C	

		Existing Conditions			Optimized Cycle			Optimized No Ped		
Intersection	Movement	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whalley Avenue and Orchard Street ¹	NB	11.4	B	70.0	18.2	B	90.0	22.5	C	90.0
	SB	28.1	C		44.9	D		45.1	D	
	EB	21.3	C		17.6	B		13.9	B	
	WB	18.0	B		3.3	A		17.7	B	
	OVERALL	19.6	B		17.7	B		20.9	C	
Whalley Avenue and Sperry Street ²	SB	41.2	D	80.0	48.6	D	90.0	45.7	D	90.0
	EB	3.9	A		1.9	A		5.0	A	
	WB	22.9	C		28.3	C		19.7	B	
	OVERALL	15.5	B		17.5	B		15.1	B	
Whalley Avenue and Dwight Street ²	EB	19.0	B	80.0	4.7	A	90.0	2.7	A	90.0
	WB	0.6	A		0.6	A		0.6	A	
	OVERALL	9.6	A		2.6	A		1.6	A	

1. Note: Intersection grouped as part of Group A

2. Note: Intersection grouped as part of Group B

Table 2.6 Level of Service Analysis – Weekday Evening Peak Period

		Existing Conditions			Optimized Cycle			Optimized No Ped		
Intersection	Movement	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whalley Avenue and Ella T Grasso Boulevard ¹	NB	15.9	B	90.0	48.6	D	100.0	43.0	D	100.0
	SB	41.6	D		51.6	D		45.9	D	
	EB	88.1	F		16.7	B		18.3	B	
	WB	23.1	C		5.5	A		5.7	A	
	OVERALL	44.4	D		22.8	C		21.7	C	
Whalley Avenue and Ellsworth Avenue ¹	NB	38.8	D	80.0	52.8	D	100.0	52.7	D	100.0
	SB	34.0	C		44.9	D		44.8	D	
	EB	5.2	A		4.6	A		1.8	A	
	WB	5.4	A		1.7	A		1.8	A	
	OVERALL	10.3	B		10.4	B		9.4	A	
Whalley Avenue and Norton Parkway ¹	NB	33.7	C	90.0	41.4	D	100.0	40.5	D	100.0
	SB	43.2	D		59.8	E		57.5	E	
	EB	6.5	A		9.4	A		3.4	A	
	WB	7.6	A		2.5	A		11.1	B	
	OVERALL	12.7	B		13.5	B		15.2	B	

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whalley Avenue and Winthrop Avenue ¹	NB	61.7	E	80.0	53.9	D	100.0	53.9	D	100.0
	EB	4.5	A		3.2	A		7.2	A	
	WB	5.1	A		5.3	A		11.1	B	
	OVERALL	12.1	B		10.7	B		15.0	B	
Whalley Avenue and Sherman Parkway ¹	NB	28.7	C	90.0	48.3	D	100.0	42.9	D	100.0
	SB	31.0	C		59.5	E		51.9	D	
	EB	23.3	C		20.4	C		19.6	B	
	WB	21.3	C		10.3	B		12.3	B	
	OVERALL	24.9	C		28.7	C		26.8	C	
Whalley Avenue and Orchard Street ¹	NB	14.7	B	80.0	36.8	D	100.0	27.7	C	100.0
	SB	44.0	D		65.6	E		52.8	D	
	EB	22.2	C		24.1	C		13.8	B	
	WB	21.5	C		12.8	B		16.0	B	
	OVERALL	23.5	C		28.7	C		22.6	C	
Whalley Avenue and Sperry Street ²	SB	57.1	E	90.0	47.1	D	90.0	44.6	D	90.0
	EB	4.6	A		6.0	A		6.4	A	
	WB	21.5	C		27.1	C		16.1	B	
	OVERALL	17.3	B		19.2	B		14.6	B	
Whalley Avenue and Dwight Street ²	EB	20.2	C	90.0	11.8	B	90.0	1.9	A	90.0
	WB	0.6	A		0.2	A		0.2	A	
	OVERALL	11.1	B		6.4	A		1.1	A	

1. Note: Intersection grouped as part of Group A

2. Note: Intersection grouped as part of Group B

The following is a list of observations from the levels of service analysis results:

- The recommended network cycle length is 100 seconds for the weekday morning and evening peak hour periods for Group A.
- The recommended network cycle length is 90 seconds for the weekday morning and evening peak hour periods for Group B.
- For the weekday mid-day peak hour period, a network cycle length of 90 seconds is recommended for Groups A and B.
- The overall level of service at the intersections in the Whalley Avenue corridor is at LOS D or better.

2.7 Field Implementation of Signal Timings

Revised traffic signal data (cycle length and signal timings) was provided to the City for field implementation. The City imported the SYNCHRO data into the Whalley Avenue system and field implemented the signal timings. The City uses a NAZTEC 2070 controller system and the traffic signal data from SYNCHRO was modified for import into the NAZTEC system.

2.8 Before and After Travel Time Runs

After field implementation of traffic signal data, travel time runs were conducted in the Whalley Avenue corridor during each peak hour period. **Tables 2.7** and **2.8** show results of the after travel time runs and compare these results with the before travel time runs i.e. before field implementation.

Table 2.7 Average Travel Times - Weekday Morning Peak Period

Intersection	Before Travel Time (in mm:ss)		After Travel Time (in mm:ss)		Percent Difference	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
Ella Grasso Boulevard	-	00:18.4	-	00:23.5	-	+6%
Ellsworth Avenue	00:21.3	00:20.9	00:20.8	00:10.0	0%	-14%
Norton Street	00:26.6	00:32.7	00:17.6	00:20.5	-11%	-13%
Winthrop Avenue	00:15.0	00:27.1	00:10.0	00:30.3	-7%	+3%
Sherman Parkway	00:28.3	00:36.3	00:14.0	00:32.7	-16%	-3%
Orchard Street	00:31.5	00:37.1	00:26.4	00:46.8	-5%	+10%
Sperry Street	00:37.2	00:19.1	00:34.2	00:23.2	-3%	+4%
Dwight Street	00:36.8	-	00:13.0	-	-24%	-
TOTAL TRAVEL TIME	03:17	03:12	02:16	03:07	-31%	-3%

Table 2.8 Average Travel Times - Weekday Evening Peak Period

Intersection	Before Travel Time (in mm:ss)		After Travel Time (in mm:ss)		Percent Difference	
	Eastbound	Westbound	Eastbound	Westbound	Eastbound	Westbound
Ella Grasso Boulevard	-	00:30.2	-	00:25.6	-	-4%
Ellsworth Avenue	00:25.9	00:27.7	00:14.6	00:23.8	-14%	-4%
Norton Street	00:27.3	00:23.1	00:12.2	00:36.8	-17%	+17%
Winthrop Avenue	00:13.7	00:23.1	00:18.6	00:30.6	-7%	+8%
Sherman Parkway	00:57.4	01:02.6	00:36.4	00:50.1	-18%	-19%
Orchard Street	01:02.5	01:28.1	00:54.6	00:53.4	-11%	-40%
Sperry Street	00:33.5	00:21.9	00:31.4	00:20.2	-2%	-2%
Dwight Street	00:36.2	-	00:17.4	-	-	-20%
TOTAL TRAVEL TIME	04:16	04:37	03:05	04:00	-28%	-13%

The following is a list of observations from the travel time run results:

- The total travel time in the Whalley Avenue corridor reduces by **31** percent in the eastbound direction (peak direction) and **3** percent in the westbound direction during the weekday morning peak period.
- The total travel time in the Whalley Avenue corridor reduces by **28** percent in the eastbound direction and **13** percent in the westbound direction (peak direction) during the weekday evening peak period.

Section 3

Whitney Avenue Corridor

This chapter focusses on the Whitney Avenue corridor.

3.1 Description of the Corridor

Whitney Avenue is a four-lane roadway oriented in a north-south direction. Land use along Whitney Avenue is a mix of educational, institutional, and residential uses. The posted speed limit on Whitney Avenue is 25 miles per hour. During the weekday morning peak period, parking is allowed in the northbound direction but prohibited in the southbound direction on Whitney Avenue. During the weekday mid-day peak period, parking is allowed on both sides of Whitney Avenue. During the weekday evening peak period, parking is prohibited in the northbound direction but allowed in the southbound direction on Whitney Avenue. The following is a list of signalized intersections in the Whitney Avenue corridor within the project limits:

- Whitney Avenue and Trumbull Street
- Whitney Avenue and Sachem Street
- Whitney Avenue and Humphrey Street
- Whitney Avenue and Edwards Street
- Whitney Avenue and Cottage Street
- Whitney Avenue and Willow Street
- Whitney Avenue and Canner Street
- Whitney Avenue and Huntington Street/Worthington Hooker School
- Whitney Avenue and East Rock Road

Exclusive pedestrian signal phases are provided at several locations on Whitney Avenue.

3.2 Intersection Spacing

Table 3.1 provides intersection spacing along the Whitney Avenue corridor.

Table 3.1 Intersection Spacing (in feet)

Intersection	Distance (in feet)
Trumbull Street	-
Sachem Street	900
Humphrey Street	925
Edwards Street	700
Cottage Street	720
Willow Street	925
Canner Street	330
Huntington St./W.H. School	1,840
East Rock Road	480

3.3 Existing Travel Times

Travel time runs were conducted on the Whitney Avenue corridor during the analysis peak hour periods. **Tables 3.2** and **3.3** summarize the travel time runs by direction during the weekday morning and weekday evening peak hour periods respectively.

Table 3.2 Average Travel Times - Weekday Morning Peak Period

Intersection	Average Travel Time (in mm:ss)	
	Eastbound	Westbound
Trumbull Street	-	01:03.1
Sachem Street	00:24.3	00:42.4
Humphrey Street	00:47.3	00:35.7
Edwards Street	00:26.9	00:36.2
Cottage Street	00:17.4	00:22.5
Willow Street	00:28.3	00:17.9
Canner Street	00:12.5	01:08.0
Huntington St./W.H. School	01:06.7	00:38.5
East Rock Road	00:16.2	-
TOTAL TRAVEL TIME	04:00	05:24

Table 3.3 Average Travel Times - Weekday Evening Peak Period

Intersection	Average Travel Time (in mm:ss)	
	Eastbound	Westbound
Trumbull Street	-	00:27.0
Sachem Street	00:48.0	00:41.6
Humphrey Street	00:51.9	00:41.7
Edwards Street	00:40.0	00:39.0
Cottage Street	00:18.8	00:23.0
Willow Street	00:28.1	00:10.5
Canner Street	00:19.6	01:14.9
Huntington St./W.H. School	00:58.9	00:31.2
East Rock Road	00:16.0	-
TOTAL TRAVEL TIME	04:41	04:49

3.4 Existing (2015) Traffic Volumes

Manual turning movement counts were conducted at the nine (9) intersections along Whitney Avenue during the weekday morning, weekday mid-day, and weekday evening peak hour periods. These counts were conducted on Wednesday, March 18; Thursday, March 19; and Thursday, April 30, 2015.

Figures 3.1, 3.2, and 3.3 represent balanced traffic volumes during the weekday morning, weekday mid-day, and weekday evening peak hour periods respectively.

3.5 Traffic Signal Optimization

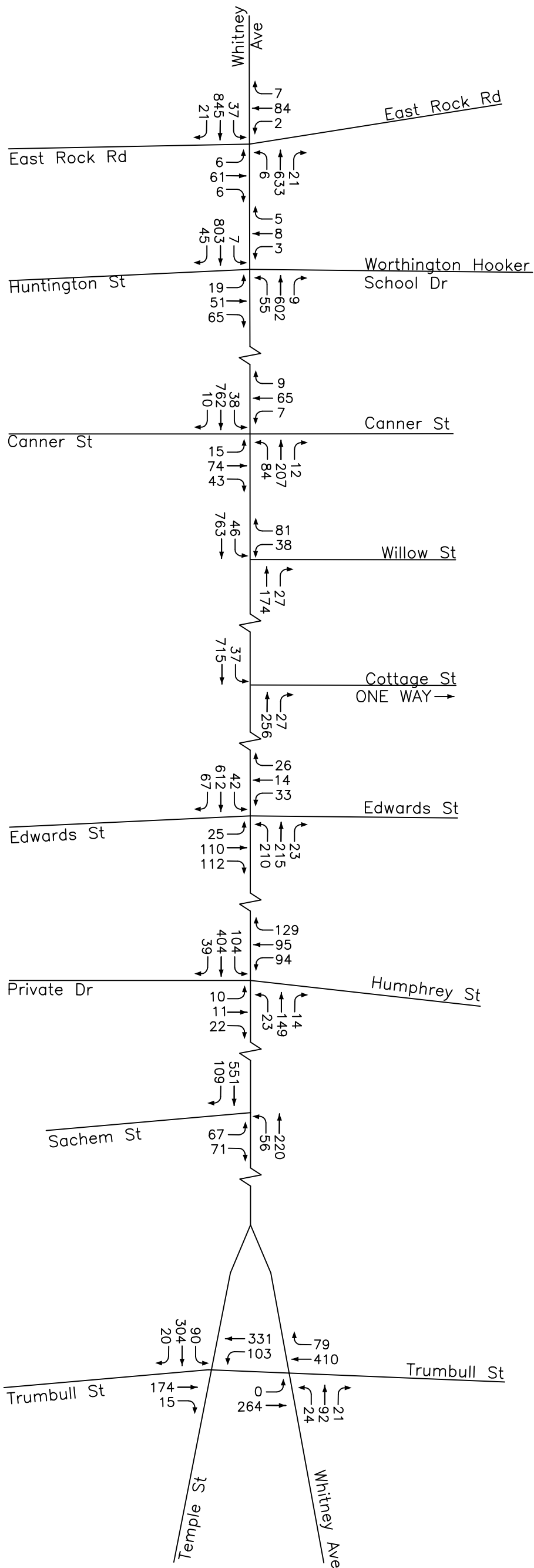
Traffic signal optimization was conducted using SYNCHRO 8 software as discussed in Chapter 2. The following intersection groupings are proposed for the Whitney Avenue system:

Group A

- Whitney Avenue and Huntington Street/Worthington Hooker School
- Whitney Avenue and East Rock Road

Group B

- Whitney Avenue and Sachem Street
- Whitney Avenue and Humphrey Street
- Whitney Avenue and Edwards Street
- Whitney Avenue and Cottage Street
- Whitney Avenue and Willow Street
- Whitney Avenue and Canner Street



Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

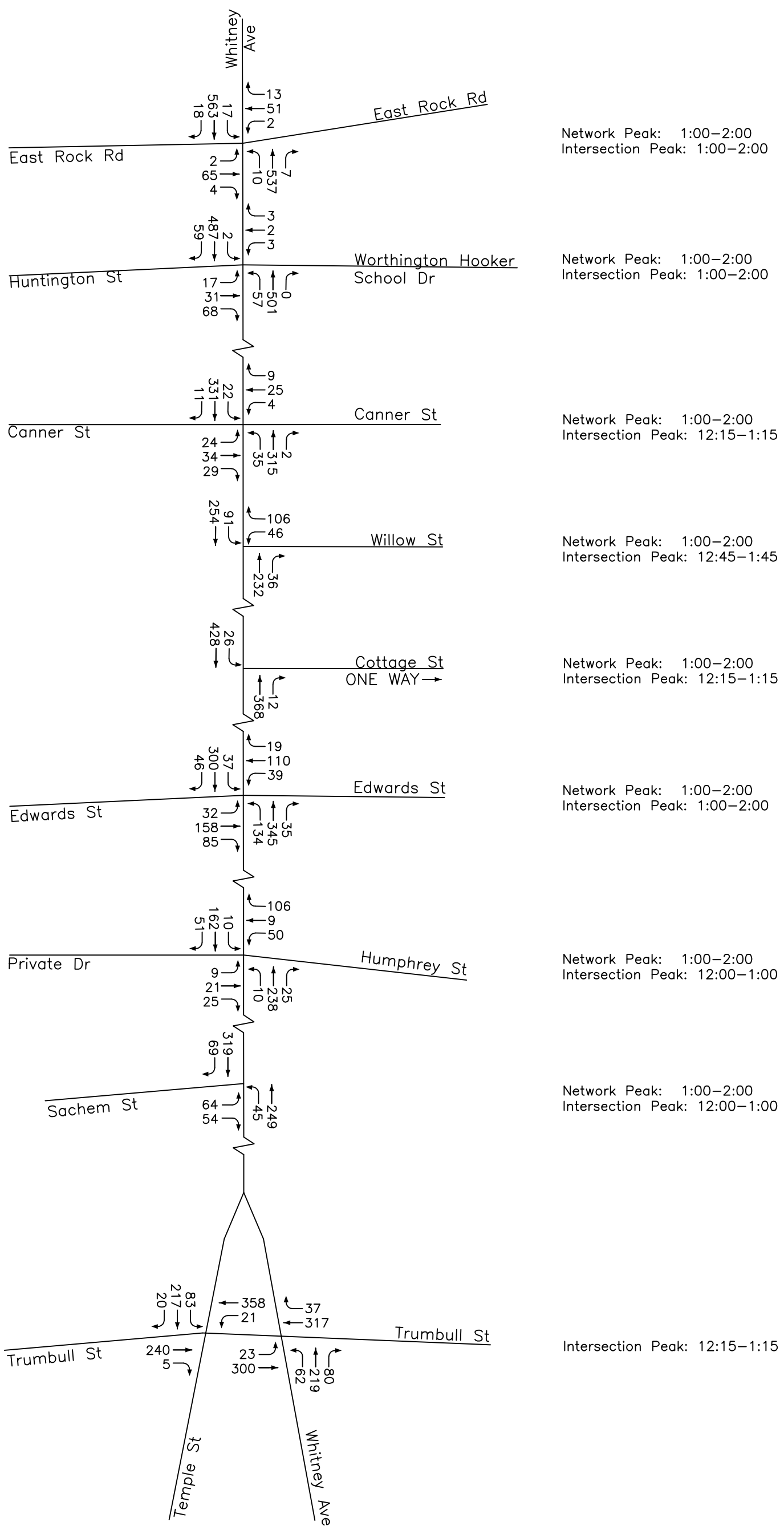
Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

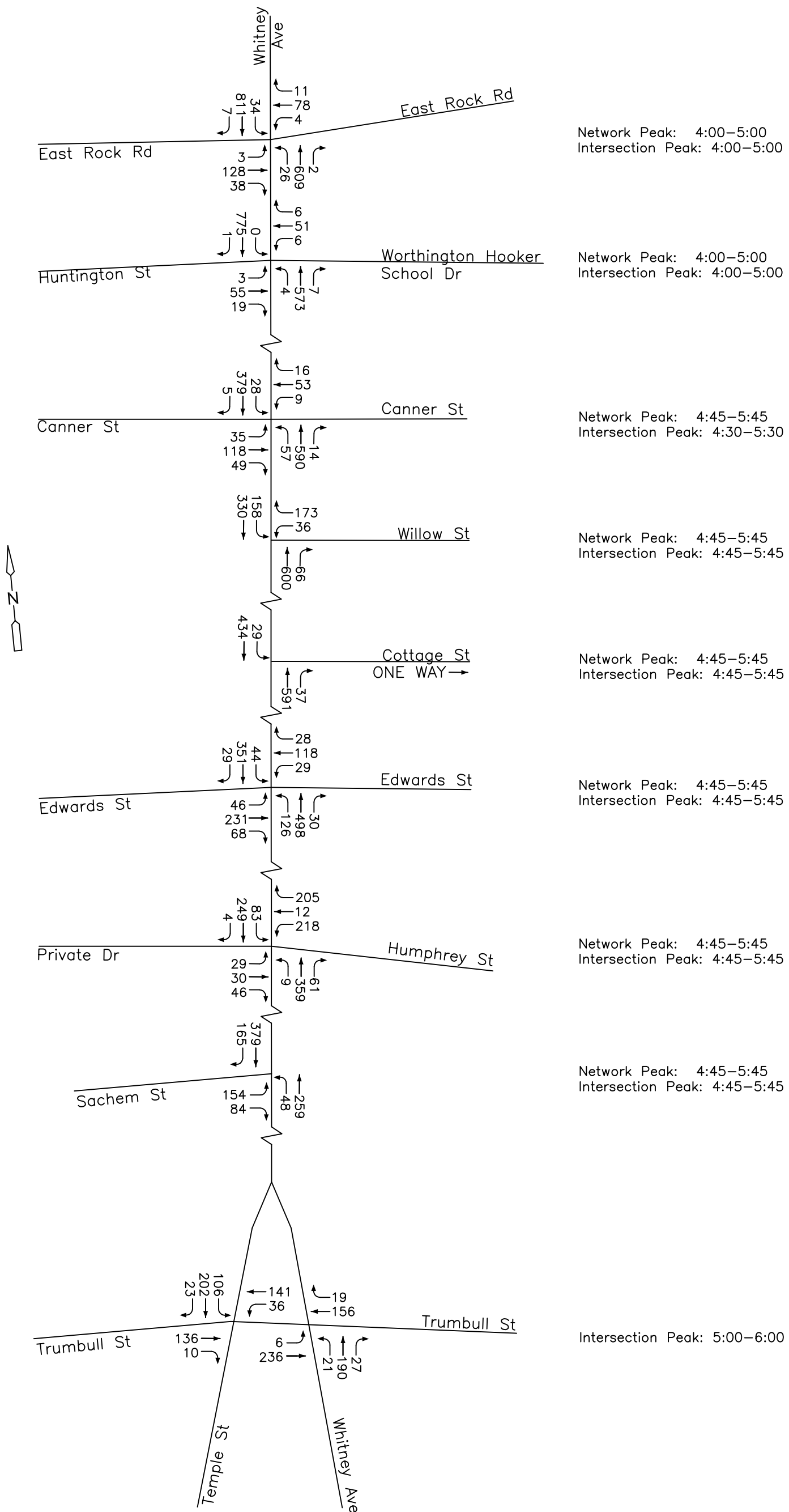
Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

Network Peak: 8:00-9:00
Intersection Peak: 8:00-9:00

Intersection Peak: 7:15-8:15





Once the intersection groupings were determined, a network cycle length was selected for each peak period and intersection grouping. Using that cycle length, traffic signal timings were obtained at each location and for each peak period. Traffic signal timings were developed with and without the pedestrian phase to estimate the amount of time that can be shifted to other signal phases when the pedestrian phase is not activated.

It is important to note that the Whitney Avenue/Trumbull Street intersection is part of a separate signal system tied into the I-91 Ramps/Trumbull Street/Orange Street intersection. Therefore, this intersection was not analyzed for levels of service. The following section describes the results of the level of service analysis.

3.6 Level of Service Analysis

Tables 3.4, 3.5, and 3.6 summarize the levels of service analysis under weekday morning, weekday mid-day, and weekday evening peak hour periods respectively.

Table 3.4 Level of Service Analysis – Weekday Morning Peak Period

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whitney Avenue and East Rock Road ¹	NB	19.8	B	90.0	6.0	A	90.0	10.5	B	90.0
	SB	7.4	A		4.8	A		6.5	A	
	EB	38.7	D		67.2	E		42.4	D	
	WB	47.4	D		100.8	F		53.9	D	
	OVERALL	18.2	B		19.1	B		15.2	B	
Whitney Avenue and Huntington Street ¹	NB	14.4	B	90.0	5.7	A	90.0	12.1	B	90.0
	SB	11.8	B		5.5	A		4.5	A	
	EB	29.0	C		78.4	E		50.5	D	
	WB	20.2	C		36.0	D		31.1	C	
	OVERALL	14.5	B		12.4	B		12.0	B	
Whitney Avenue and Canner Street ²	NB	9.6	A	90.0	4.7	A	90.0	8.1	A	90.0
	SB	12.7	B		7.7	A		21.7	C	
	EB	32.3	C		55.7	E		49.1	D	
	WB	25.1	C		38.9	D		36.2	D	
	OVERALL	14.9	B		14.5	B		22.1	C	
Whitney Avenue and Willow Street ²	NB	10.5	B	90.0	9.2	A	90.0	9.2	A	90.0
	SB	6.4	A		1.9	A		8.8	A	
	WB	43.2	D		42.9	D		42.9	D	
	OVERALL	12.0	B		8.6	A		13.4	B	
Whitney Avenue and Cottage Street ²	NB	0.3	A	90.0	0.3	A	90.0	0.3	A	90.0
	SB	0.2	A		0.2	A		0.2	A	
	OVERALL	0.2	A		0.2	A		0.2	A	

		Existing Conditions			Optimized Cycle			Optimized No Ped		
Intersection	Movement	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whitney Avenue and Edwards Street ²	NB	13.6	B	90.0	9.5	A	90.0	14.7	B	90.0
	SB	24.2	C		8.9	A		27.7	C	
	EB	42.2	D		70.6	E		48.4	D	
	WB	26.3	C		34.7	C		28.0	C	
	OVERALL	24.4	C		21.7	C		27.5	C	
Whitney Avenue and Private Drive / Humphrey Street ²	NB	12.1	B	90.0	15.6	B	90.0	15.2	B	90.0
	SB	11.1	B		7.7	A		22.4	C	
	EB	25.4	C		21.8	C		20.1	C	
	WB	56.9	E		44.0	D		39.0	D	
	OVERALL	24.9	C		20.1	C		25.5	C	
Whitney Avenue and Sachem Street ²	NB	4.4	A	90.0	3.5	A	90.0	4.3	A	90.0
	SB	8.0	A		28.8	C		18.5	B	
	EB	55.3	E		65.9	E		54.8	D	
	OVERALL	12.8	B		26.6	C		19.1	B	

1. Note: Intersection grouped as part of Group A
2. Note: Intersection grouped as part of Group B

Table 3.5 Level of Service Analysis – Weekday Mid-day Peak Period

		Existing Conditions			Optimized Cycle			Optimized No Ped		
Intersection	Movement	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whitney Avenue and East Rock Road ¹	NB	10.2	B	80.0	3.9	A	90.0	6.3	A	90.0
	SB	9.3	A		5.9	A		8.0	A	
	EB	40.2	D		86.5	F		48.4	D	
	WB	42.2	D		99.3	F		51.1	D	
	OVERALL	13.7	B		16.0	B		12.6	B	
Whitney Avenue and Huntington Street ¹	NB	11.8	B	90.0	6.9	B	90.0	9.2	A	90.0
	SB	21.9	C		7.1	A		8.7	A	
	EB	30.2	C		72.8	E		48.6	D	
	WB	20.2	C		35.1	D		29.8	C	
	OVERALL	18.3	B		14.9	B		13.8	B	
Whitney Avenue and Canner Street ²	NB	6.5	A	90.0	5.8	A	90.0	6.6	A	90.0
	SB	8.0	A		4.7	A		11.5	A	
	EB	26.7	C		50.5	D		49.6	D	
	WB	22.2	C		38.6	D		38.1	D	
	OVERALL	10.1	B		11.8	B		14.9	B	

		Existing Conditions			Optimized Cycle			Optimized No Ped		
Intersection	Movement	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whitney Avenue and Willow Street ²	NB	13.3	B	80.0	12.2	B	90.0	14.6	B	90.0
	SB	6.4	A		5.2	A		1.7	A	
	WB	38.3	D		43.3	D		43.3	D	
	OVERALL	15.4	B		15.5	B		14.7	B	
Whitney Avenue and Cottage Street ²	NB	0.3	A	80.0	0.0	A	90.0	0.2	A	90.0
	SB	0.6	A		0.6	A		0.6	A	
	OVERALL	0.5	A		0.4	A		0.4	A	
Whitney Avenue and Edwards Street ²	NB	36.7	D	120.0	24.2	C	90.0	29.2	C	90.0
	SB	121.9	F		58.8	E		38.7	D	
	EB	34.3	C		104.9	F		49.6	D	
	WB	37.4	D		192.5	F		68.9	E	
	OVERALL	62.6	E		76.6	E		42.2	D	
Whitney Avenue and Private Drive / Humphrey Street ²	NB	9.9	A	80.0	7.7	A	90.0	5.8	A	90.0
	SB	8.2	A		7.3	A		9.4	A	
	EB	26.8	C		30.6	C		30.5	C	
	WB	41.0	D		46.7	D		46.4	D	
	OVERALL	17.9	B		18.4	B		18.2	B	
Whitney Avenue and Sachem Street ²	NB	3.4	A	80.0	3.6	A	90.0	3.5	A	90.0
	SB	14.4	B		27.6	C		19.1	A	
	EB	46.0	D		50.3	D		53.2	D	
	OVERALL	14.9	B		22.4	C		18.3	B	

1. Note: Intersection grouped as part of Group A

2. Note: Intersection grouped as part of Group B

Table 3.6 Level of Service Analysis – Weekday Evening Peak Period

		Existing Conditions			Optimized Cycle			Optimized No Ped		
Intersection	Movement	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whitney Avenue and East Rock Road ¹	NB	11.3	B	90.0	5.6	A	90.0	13.3	B	90.0
	SB	35.4	D		14.2	B		20.5	C	
	EB	37.8	D		225.4	F		65.0	E	
	WB	32.9	C		107.6	F		44.6	D	
	OVERALL	26.2	C		38.2	D		23.8	C	

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Whitney Avenue and Huntington Street ¹	NB	5.3	A	90.0	1.7	A	90.0	4.2	A	90.0
	SB	25.7	C		7.6	A		5.6	A	
	EB	24.5	C		39.6	D		53.6	D	
	WB	22.6	C		37.3	D		47.0	D	
	OVERALL	17.3	B		8.4	A		9.8	A	
Whitney Avenue and Canner Street ²	NB	10.0	B	90.0	2.2	A	90.0	16.7	B	90.0
	SB	14.8	B		5.5	A		15.7	B	
	EB	33.4	C		60.7	E		48.1	D	
	WB	22.6	C		34.4	C		30.5	C	
	OVERALL	15.7	B		14.0	B		22.0	C	
Whitney Avenue and Cottage Street ²	NB	8.7	A	90.0	9.0	A	90.0	11.0	B	90.0
	SB	6.6	A		5.5	A		23.8	C	
	WB	110.8	F		42.1	D		42.1	D	
	OVERALL	25.2	C		13.3	B		21.0	C	
Whitney Avenue and Edwards Street ²	NB	14.2	B	90.0	10.3	B	90.0	8.9	A	90.0
	SB	23.1	C		13.8	B		13.5	B	
	EB	36.4	D		43.7	D		44.5	D	
	WB	27.2	C		32.1	C		32.4	C	
	OVERALL	22.5	C		20.6	C		20.1	C	
Whitney Avenue and Private Drive / Humphrey Street ²	NB	9.5	A	90.0	33.6	C	90.0	17.9	B	90.0
	SB	11.5	B		16.9	B		31.2	C	
	EB	25.1	C		13.3	B		12.4	B	
	WB	173.2	F		36.1	D		33.2	C	
	OVERALL	67.0	E		28.7	C		26.0	C	
Whitney Avenue and Sachem Street ²	NB	14.8	A	90.0	13.9	B	90.0	6.9	A	90.0
	SB	12.5	B		59.3	E		20.0	B	
	EB	52.8	D		39.9	D		54.0	D	
	OVERALL	22.2	C		41.7	D		23.8	C	

1. Note: Intersection grouped as part of Group A

2. Note: Intersection grouped as part of Group B

The following is a list of observations from the levels of service analysis results:

- The recommended network cycle length is 90 seconds for Groups A and B.
- The overall level of service at the intersections in the Whitney Avenue corridor is at LOS D or better.

3.7 Field Implementation of Signal Timings

Revised traffic signal data (cycle length and signal timings) was provided to the City for field implementation. The City imported the SYNCHRO data into the Whitney Avenue system and field implemented the signal timings. The City uses a NAZTEC 2070 controller system and the traffic signal data from SYNCHRO was modified for import into the NAZTEC system.

3.8 Before and After Travel Time Runs

After field implementation of traffic signal data, travel time runs were conducted in the Whitney Avenue corridor during each peak hour period. **Tables 3.7** and **3.8** show results of the after travel time runs and compare these results with the before travel time runs i.e. before field implementation.

Table 3.7 Average Travel Times - Weekday Morning Peak Period

Intersection	Before Travel Time (in mm:ss)		After Travel Time (in mm:ss)		Percent Difference	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
Trumbull Street	-	01:03.1	-	00:49.2	-	-22%
Sachem Street	00:24.3	00:42.4	00:23.2	00:20.0	-1%	-4%
Humphrey Street	00:47.3	00:35.7	00:23.2	00:21.0	-22%	-15%
Edwards Street	00:26.9	00:36.2	00:21.0	00:24.8	-7%	-11%
Cottage Street	00:17.4	00:22.5	00:18.0	00:18.5	+1%	-4%
Willow Street	00:28.3	00:17.9	00:23.5	00:13.0	-6%	-27%
Canner Street	00:12.5	01:08.0	00:16.0	00:38.5	+5%	-44%
Huntington St./W.H. School	01:06.7	00:38.5	00:47.0	00:13.2	-30%	-26%
East Rock Road	00:16.2	-	00:22.5	-	+8%	-
TOTAL TRAVEL TIME	04:00	05:24	03:15	03:18	-19%	-39%

Table 3.8 Average Travel Times - Weekday Evening Peak Period

Intersection	Before Travel Time (in mm:ss)		After Travel Time (in mm:ss)		Percent Difference	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
Trumbull Street	-	00:27.0	-	00:26.5	-	-1%
Sachem Street	00:48.0	00:41.6	00:50.0	00:39.2	+2%	-3%
Humphrey Street	00:51.9	00:41.7	00:59.8	00:22.2	+7%	-78%
Edwards Street	00:40.0	00:39.0	00:46.8	00:30.3	+7%	-9%
Cottage Street	00:18.8	00:23.0	00:18.5	00:22.8	0%	0%
Willow Street	00:28.1	00:10.5	00:28.5	00:09.3	0%	-1%
Canner Street	00:19.6	01:14.9	00:18.3	00:58.5	+1%	-23%
Huntington St./W.H. School	00:58.9	00:31.2	00:43.2	00:16.0	-13%	-16%
East Rock Road	00:16.0	-	00:22.5	-	+8%	-
TOTAL TRAVEL TIME	04:41	04:49	04:47	03:45	+2%	-22%

The following is a list of observations from the travel time run results:

- The total travel time in the Whitney Avenue corridor reduces by **19** percent in the northbound direction and **39** percent in the southbound direction (peak direction) during the weekday morning peak period.
- The total travel time in the Whitney Avenue corridor shows a slight increase by **2** percent in the northbound direction (peak direction) and reduces by **22** percent in the southbound direction during the weekday evening peak period.

Section 4

Dixwell Avenue Corridor

This chapter focusses on the Dixwell Avenue corridor.

4.1 Description of the Corridor

Dixwell Avenue is a two-lane roadway oriented in a north-south direction. Land use along Dixwell Avenue is a mix of institutional, commercial, and residential uses. The posted speed limit on Dixwell Avenue is 25 miles per hour. Parking is typically allowed on both sides of Dixwell Avenue except near intersections. The following is a list of signalized intersections in the Dixwell Avenue corridor within the project limits:

- Dixwell Avenue and Sperry Street
- Dixwell Avenue and Shopping Center/New Haven Public Library
- Dixwell Avenue and Henry Street
- Dixwell Avenue and Munson Street
- Dixwell Avenue and Division Street
- Dixwell Avenue and Bassett Street

Exclusive pedestrian signal phases are provided at several locations on Dixwell Avenue.

4.2 Intersection Spacing

Table 4.1 provides intersection spacing along the Dixwell Avenue corridor.

Table 4.1 Intersection Spacing (in feet)

Intersection	Distance (in feet)
Sperry Street	-
Shopping Center/N.H. Public Library	583
Henry Street	928
Munson Street	720
Division Street	1,525
Bassett Street	2,030

4.3 Existing Travel Times

Travel time runs were conducted on the Dixwell Avenue corridor during the analysis peak hour periods. Tables 4.2 and 4.3 summarize the travel time runs by direction during the weekday morning and weekday evening peak hour periods respectively.

Table 4.2 Average Travel Times - Weekday Morning Peak Period

Intersection	Average Travel Time (in mm:ss)	
	Northbound	Southbound
Sperry Street	-	00:30.0
Shopping Center/N.H. Public Library	00:15.7	00:23.8
Henry Street	00:48.1	00:46.6
Munson Street	00:57.1	01:10.4
Division Street	00:40.8	01:03.6
Bassett Street	00:54.0	-
TOTAL TRAVEL TIME	03:36	03:54

Table 4.3 Average Travel Times - Weekday Evening Peak Period

Intersection	Average Travel Time (in mm:ss)	
	Northbound	Southbound
Sperry Street	-	00:44.2
Shopping Center/N.H. Public Library	00:15.5	00:29.9
Henry Street	00:59.5	00:41.0
Munson Street	00:38.9	01:12.2
Division Street	01:10.3	00:56.4
Bassett Street	01:31.0	-
TOTAL TRAVEL TIME	04:35	04:04

As indicated by the travel time runs, the peak traffic flow in the corridor is in the southbound direction during the weekday morning peak hour period and in the northbound direction during the weekday evening peak hour period.

4.4 Existing (2015) Traffic Volumes

Manual turning movement counts were conducted at the seven (7) intersections along Dixwell Avenue during the weekday morning, weekday mid-day, and weekday evening peak hour periods. These counts were conducted on Wednesday, December 10 and Thursday, December 11, 2014.

Figures 4.1, 4.2, and 4.3 represent balanced traffic volumes during the weekday morning, weekday mid-day, and weekday evening peak hour periods respectively.

4.5 Traffic Signal Optimization

Traffic signal optimization was conducted using SYNCHRO 8 software as discussed in Chapter 2. The following intersection groupings are proposed for the Dixwell Avenue system:

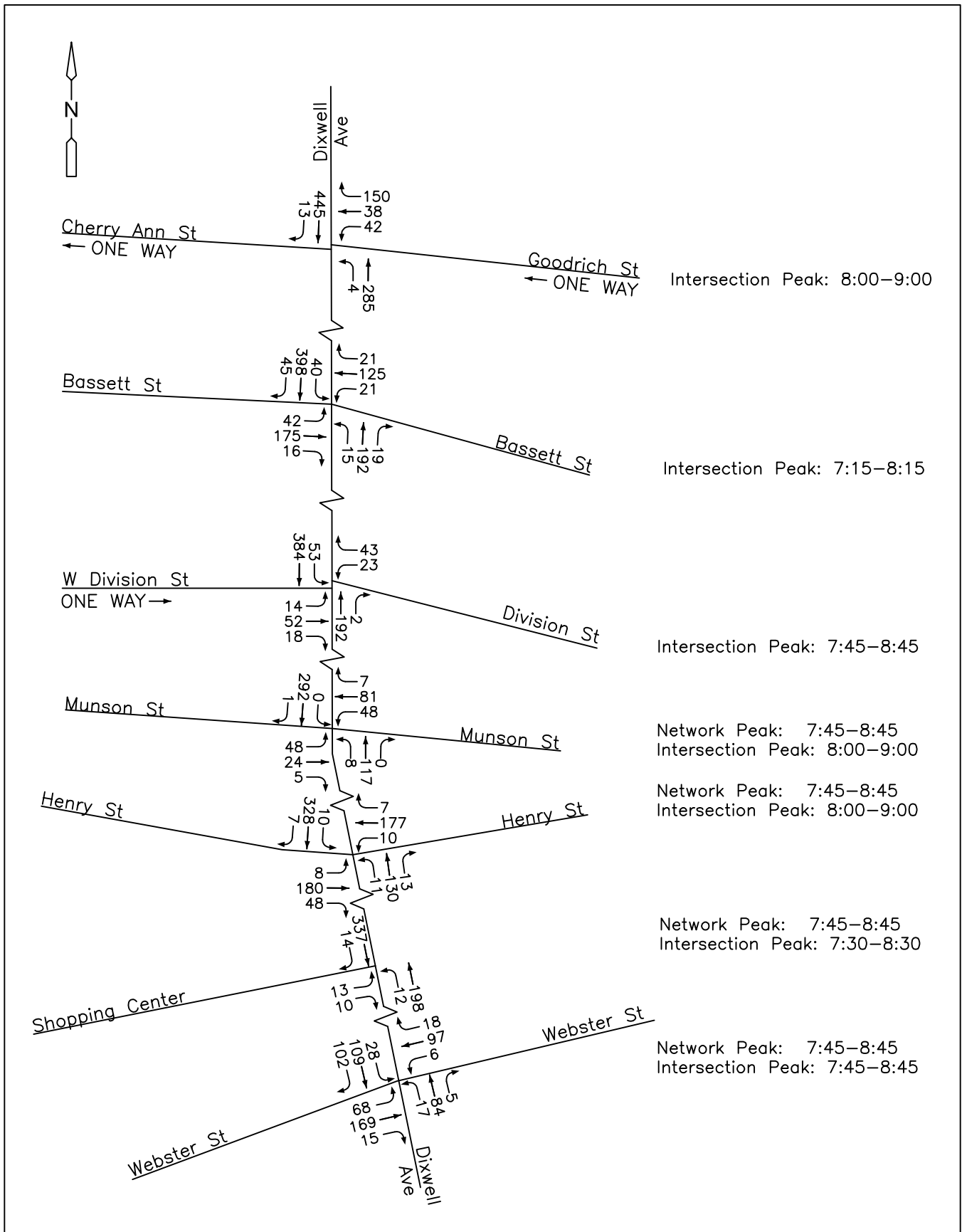
Group A

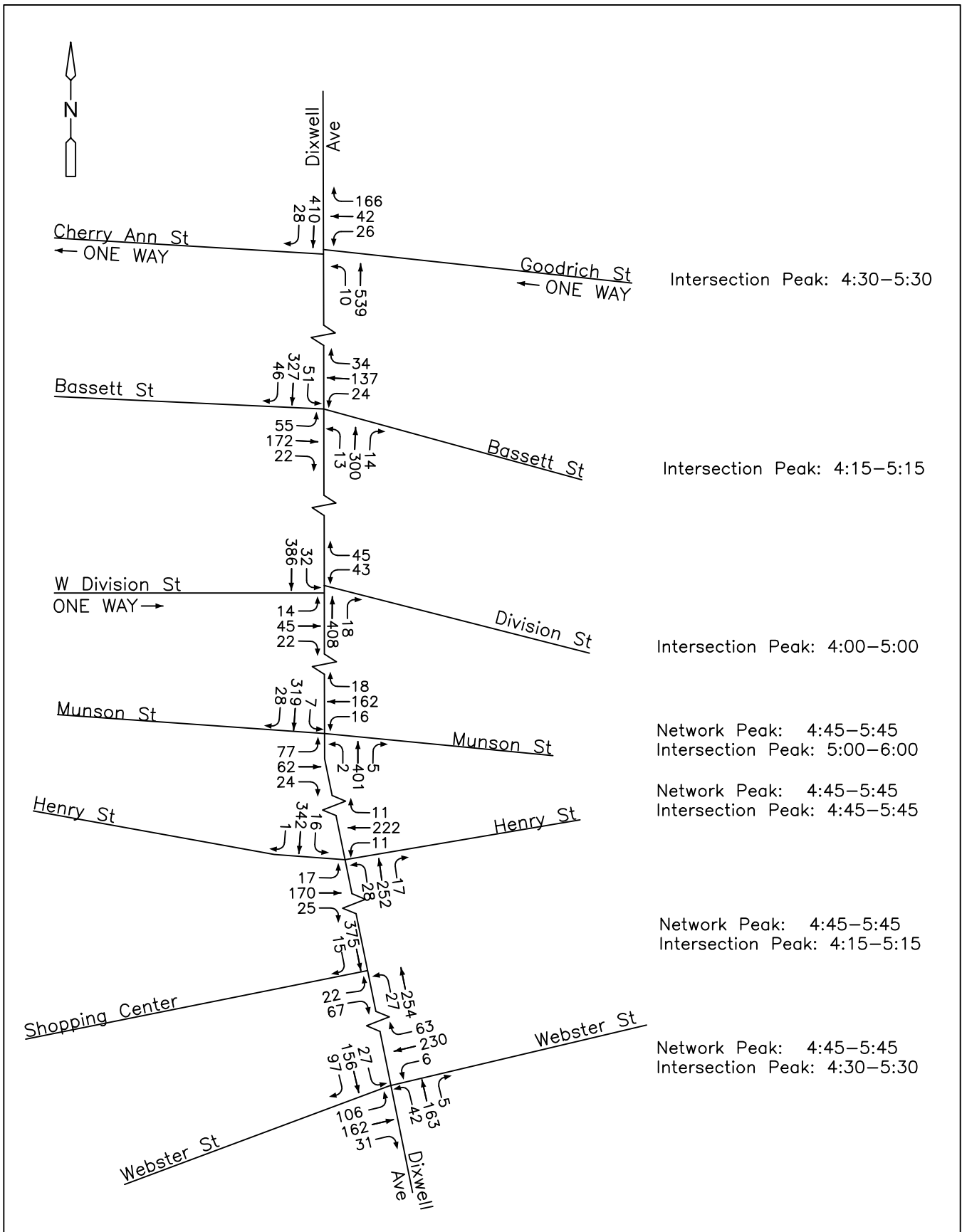
- Dixwell Avenue and Bassett Street

Group B

- Dixwell Avenue and Sperry Street
- Dixwell Avenue and Shopping Center/New Haven Public Library
- Dixwell Avenue and Henry Street
- Dixwell Avenue and Munson Street
- Dixwell Avenue and Division Street

Once the intersection groupings were determined, a network cycle length was selected for each peak period and intersection grouping. Using that cycle length, traffic signal timings were obtained at each location and for each peak period. Traffic signal timings were developed with and without the pedestrian phase to estimate the amount of time that can be shifted to other signal phases when the pedestrian phase is not activated. The following section describes the results of the level of service analysis.





4.6 Level of Service Analysis

Tables 4.4, 4.5, and 4.6 summarize the levels of service analysis under weekday morning, weekday mid-day, and weekday evening peak hour periods respectively.

Table 4.4 Level of Service Analysis – Weekday Morning Peak Period

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Dixwell Avenue and Bassett Street ¹	NB	9.6	A	80.0	7.3	A	80.0	6.8	A	80.0
	SB	12.5	B		10.4	B		9.7	A	
	EB	35.7	D		38.3	D		44.2	D	
	WB	29.6	C		30.8	C		33.4	C	
	OVERALL	19.3	B		18.7	B		19.8	B	
Dixwell Avenue and Division Street ²	NB	10.2	B	80.0	5.1	A	100.0	5.4	A	100.0
	SB	17.2	B		12.3	B		12.3	B	
	EB	43.8	D		57.0	E		57.0	E	
	WB	41.4	D		54.5	D		54.5	D	
	OVERALL	21.7	C		21.1	C		21.1	C	
Dixwell Avenue and Munson Street ²	NB	16.3	B	90.0	20.8	C	100.0	22.3	C	100.0
	SB	27.5	C		28.6	C		28.6	C	
	EB	41.0	D		47.9	D		47.9	D	
	WB	22.3	C		21.2	C		21.2	C	
	OVERALL	26.0	C		28.1	C		28.4	C	
Dixwell Avenue and Henry Street ²	NB	8.8	A	90.0	5.6	A	100.0	5.1	A	100.0
	SB	13.8	B		5.4	A		25.6	C	
	EB	42.1	D		48.8	D		46.8	D	
	WB	38.1	D		44.2	D		42.6	D	
	OVERALL	25.7	C		25.4	C		31.5	C	
Dixwell Avenue and NHFPL Ped Crossing ²	NB	0.2	A	80.0	0.2	A	50.0	0.2	A	50.0
	SB	0.3	A		0.3	A		0.3	A	
	OVERALL	0.3	A		0.3	A		0.3	A	
Dixwell Avenue and Webster Street ²	NB	22.3	C	90.0	24.2	C	100.0	17.2	B	100.0
	SB	28.2	C		17.3	B		21.1	C	
	EB	13.4	B		14.3	B		21.7	C	
	WB	10.8	B		11.6	B		17.4	B	
	OVERALL	19.0	B		16.1	B		20.2	C	

1. Note: Intersection grouped as part of Group A

2. Note: Intersection grouped as part of Group B

Table 4.5 Level of Service Analysis – Weekday Mid-day Peak Period

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Dixwell Avenue and Bassett Street ¹	NB	8.8	A	70.0	6.4	A	80.0	7.6	A	80.0
	SB	10.1	B		7.7	A		9.0	A	
	EB	32.5	C		63.5	E		48.4	D	
	WB	27.7	C		40.7	D		35.8	D	
	OVERALL	17.1	B		23.7	C		20.8	C	
Dixwell Avenue and Division Street ²	NB	7.4	A	70.0	0.9	A	90.0	0.9	A	90.0
	SB	9.0	A		8.3	A		8.3	A	
	EB	33.8	C		46.1	D		46.1	D	
	WB	33.3	C		45.6	D		45.6	D	
	OVERALL	12.1	B		11.4	B		11.4	B	
Dixwell Avenue and Munson Street ²	NB	26.2	D	100.0	25.3	C	90.0	33.4	C	90.0
	SB	28.3	C		29.1	C		29.1	C	
	EB	44.4	D		46.8	D		46.8	D	
	WB	25.6	C		19.6	B		19.6	B	
	OVERALL	29.7	C		28.7	C		30.8	C	
Dixwell Avenue and Henry Street ²	NB	4.8	A	80.0	2.4	A	90.0	2.9	A	90.0
	SB	5.0	A		1.6	A		1.6	A	
	EB	43.0	D		49.0	D		48.8	D	
	WB	36.0	D		41.2	D		41.1	D	
	OVERALL	15.4	B		15.0	B		15.2	B	
Dixwell Avenue and NHFPL Ped Crossing ²	NB	0.2	A	70.0	0.2	A	45.0	0.2	A	45.0
	SB	0.2	A		0.2	A		0.2	A	
	OVERALL	0.2	A		0.2	A		0.2	A	
Dixwell Avenue and Webster Street ²	NB	13.3	B	80.0	20.6	C	90.0	13.5	B	90.0
	SB	14.8	B		14.2	B		25.3	C	
	EB	20.2	C		15.3	B		23.1	C	
	WB	17.5	B		13.5	B		20.2	C	
	OVERALL	16.2	B		15.9	B		21.1	C	

1. Note: Intersection grouped as part of Group A2. Note: Intersection grouped as part of Group B

Table 4.6 Level of Service Analysis – Weekday Evening Peak Period

Intersection	Movement	Existing Conditions			Optimized Cycle			Optimized No Ped		
		Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)	Delay (sec/veh)	LOS	Cycle Length (sec)
Dixwell Avenue and Bassett Street ¹	NB	18.8	B	80.0	11.6	B	80.0	10.0	A	80.0
	SB	18.0	B		12.8	B		11.1	B	
	EB	22.7	C		33.2	C		47.1	D	
	WB	21.5	C		28.8	C		35.1	D	
	OVERALL	19.7	B		19.1	B		21.7	C	
Dixwell Avenue and Division Street ²	NB	15.9	B	80.0	4.1	A	100.0	4.1	A	100.0
	SB	16.9	B		13.4	B		13.4	B	
	EB	42.4	D		60.0	E		60.0	E	
	WB	43.0	D		59.1	E		59.1	E	
	OVERALL	20.7	C		17.0	B		17.0	B	
Dixwell Avenue and Munson Street ²	NB	53.9	D	90.0	80.3	F	100.0	81.8	F	100.0
	SB	37.6	D		49.5	D		49.5	D	
	EB	98.3	F		112.7	F		112.7	F	
	WB	24.7	C		24.1	C		24.1	C	
	OVERALL	52.4	D		68.1	E		68.6	E	
Dixwell Avenue and Henry Street ²	NB	9.1	A	90.0	5.6	A	100.0	7.3	A	100.0
	SB	2.4	A		1.6	A		15.5	B	
	EB	46.0	D		52.4	D		50.3	D	
	WB	42.6	D		47.6	D		46.3	D	
	OVERALL	21.8	C		23.1	C		27.4	C	
Dixwell Avenue and NHFPL	NB	0.2	A	80.0	0.2	A	50.0	0.2	A	50.0
	SB	0.3	A		0.3	A		0.3	A	
	OVERALL	0.3	A		0.3	A		0.3	A	
Dixwell Avenue and Webster Street ²	NB	18.0	B	90.0	35.4	D	100.0	24.2	C	100.0
	SB	19.1	B		16.3	B		27.6	C	
	EB	24.7	C		12.0	B		19.6	B	
	WB	20.5	C		10.9	B		17.3	B	
	OVERALL	20.8	C		17.1	B		21.6	C	

1. Note: Intersection grouped as part of Group A2. Note: Intersection grouped as part of Group B

The following is a list of observations from the levels of service analysis results:

- The recommended network cycle length is 80 seconds for Group A.
- The recommended network cycle length is 90 seconds during the weekday mid-day peak hour period and 100 seconds for the weekday morning and evening peak hour periods for Group B.
- The overall level of service at the intersections in the Dixwell Avenue corridor is at LOS D or better for all intersections except the Dixwell Avenue/Munson Street intersection which is anticipated to operate at LOS E under weekday evening peak hour period.

4.7 Field Implementation of Signal Timings

Revised traffic signal data (cycle length and signal timings) was provided to the City for field implementation. The City imported the SYNCHRO data into the Dixwell Avenue system and field implemented the signal timings. The City uses a NAZTEC 2070 controller system and the traffic signal data from SYNCHRO was modified for import into the NAZTEC system.

4.8 Before and After Travel Time Runs

After field implementation of traffic signal data, travel time runs were conducted in the Dixwell Avenue corridor during each peak hour period. **Tables 4.7** and **4.8** show results of the after travel time runs and compare these results with the before travel time runs i.e. before field implementation.

Table 4.7 Average Travel Times - Weekday Morning Peak Period

Intersection	Before Travel Time (in mm:ss)		After Travel Time (in mm:ss)		Percent Difference	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
Sperry Street	-	00:30.0	-	00:31.0	-	-1%
Shopping Ctr./N.H. Public Library	00:15.7	00:23.8	00:16.8	00:25.4	-1%	-1%
Henry Street	00:48.1	00:46.6	00:34.0	00:25.6	-13%	-20%
Munson Street	00:57.1	01:10.4	00:31.8	01:00.4	-21%	-14%
Division Street	00:40.8	01:03.6	00:40.6	01:12.8	0%	-14%
Bassett Street	00:54.0	-	00:53.4	-	-1%	-
TOTAL TRAVEL TIME	03:36	03:54	02:57	03:35	-18%	-8%

Table 4.8 Average Travel Times - Weekday Evening Peak Period

Intersection	Before Travel Time (in mm:ss)		After Travel Time (in mm:ss)		Percent Difference	
	Northbound	Southbound	Northbound	Southbound	Northbound	Southbound
Sperry Street	-	00:44.2	-	00:40.2	-	-4%
Shopping Ctr./N.H. Public Library	00:15.5	00:29.9	00:21.3	00:27.0	+8%	-10%
Henry Street	00:59.5	00:41.0	00:25.5	00:23.8	-28%	-17%
Munson Street	00:38.9	01:12.2	01:00.8	01:25.0	+55%	+18%
Division Street	01:10.3	00:56.4	00:37.3	00:59.5	-47%	+2%
Bassett Street	01:31.0	-	01:23.5	-	-9%	-
TOTAL TRAVEL TIME	04:35	04:04	03:48	03:56	-17%	-3%

The following is a list of observations from the travel time run results:

- The total travel time in the Dixwell Avenue corridor reduces by **18** percent in the northbound direction and by **8** percent in the southbound direction (peak direction) during the weekday morning peak period.
- The total travel time in the Dixwell Avenue corridor reduces by **17** percent in the northbound direction (peak direction) and by **3** percent in the southbound direction during the weekday evening peak period.

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