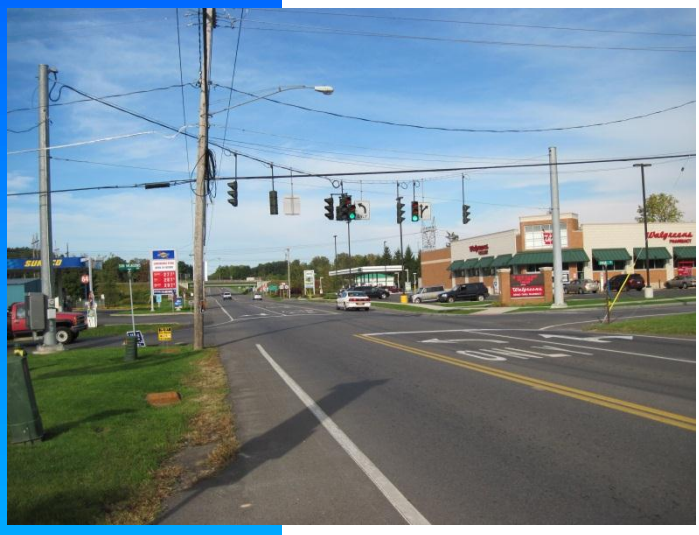
Traffic Signal Optimization Project Phase II

Isolated Intersections

Onondaga County Department of Transportation

CHA Project Number: 22845



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July 2012

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OVERVIEW

Traffic signals affect the lives of Onondaga County citizens every day. Every signalized intersection in Onondaga County addresses a wide variety of needs. The signal must be effective and functional for a wide variety of users that include pedestrians, automobiles, bicyclists, transit, and large trucks. Signalized intersections provide for the organized control of conflicting traffic movements in a safe manner; however, these intersections can be a source of frustration for motorists due to delays. As Onondaga County continues to develop, travel patterns have changed over the years, leading to outdated traffic signal timings that account for a significant amount of delay on roadways throughout the county. By updating signal timings and installing new technology, benefits can be achieved at a relatively low cost. Updated signal timings and equipment have the potential to reduce vehicular delay and thereby improve air quality through reduced emissions and less time spent idling at an intersection. This report summarizes the results of the studies conducted at various Onondaga County Department of Transportation (OCDOT) controlled intersections throughout Onondaga County.

A. Study Area

The Onondaga County Department of Transportation Traffic Signal Optimization Project – Phase II includes the following isolated intersections:

- Buckley Road at 7th North Street
- Downer Street at Crego Road
- Grand Avenue at Fay Road
- Howlett Hill Road at Cedarvale Road
- Jamesville Road at Randall Road
- Kirkville Road at Fremont Road
- Kirkville Road at Fly Road
- Milton Avenue at Hinsdale Road
- Nottingham Road at East Colvin Street
- Old Liverpool Road at Eynsford Drive
- South Bay Road at Airport Boulevard
- South Bay Road at Church Street
- South Bay Road at Lawrence Avenue
- South Bay Road at Pine Grove Road
- South Bay Road at East Circle Drive
- South Bay Road at Frontage Road
- Thompson Road at Eastern Avenue
- Van Buren Road at Brickyard Road/Jones Road
- Vine Street at Commerce Boulevard
- West Taft Road at Allen Road

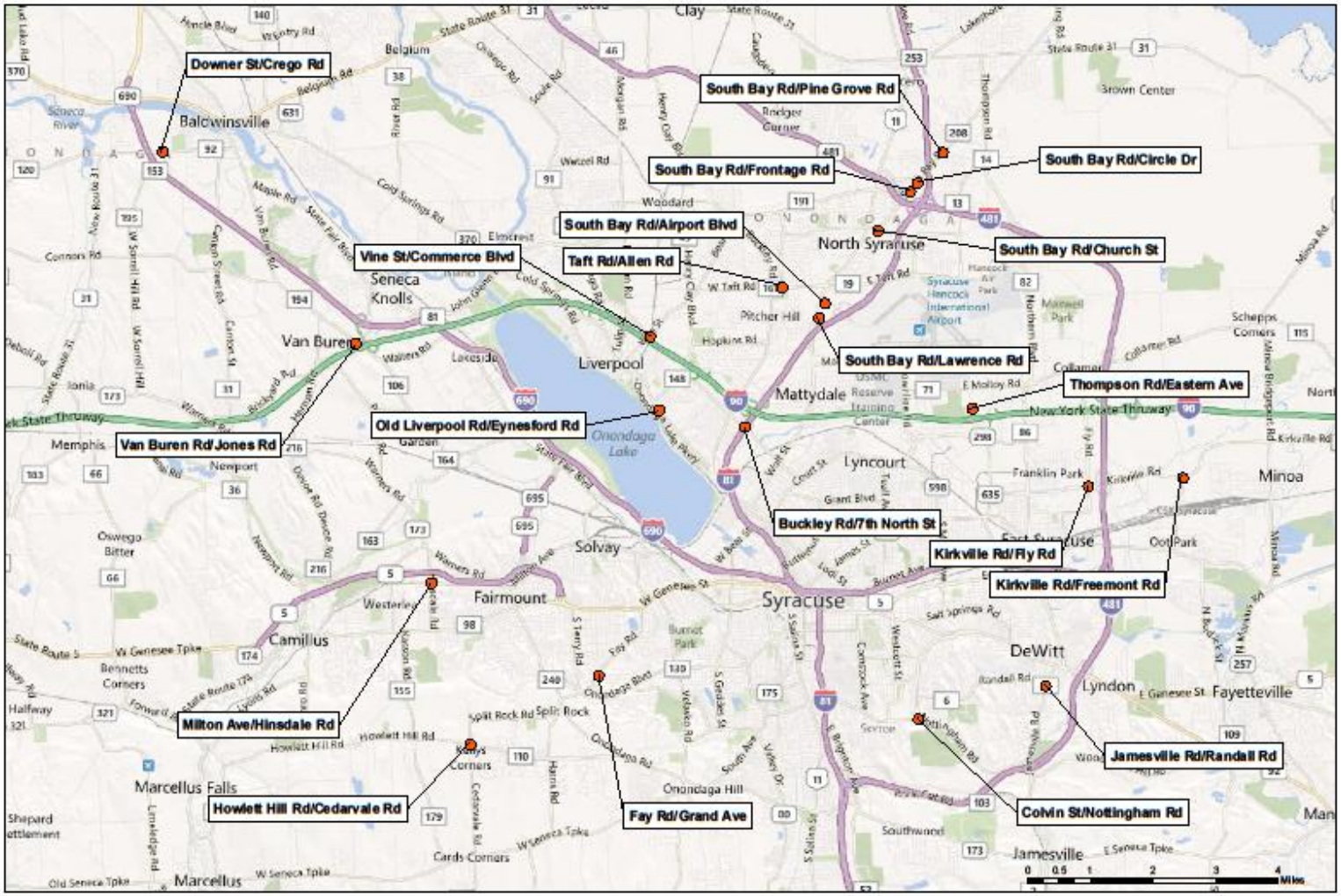
These intersections are illustrated in Figure 1.

B. Project Purpose

Traffic signal optimization is a cost effective way to improve the flow of traffic along a corridor. At signalized intersections, it is important for the signal timing plans to match existing traffic patterns at each intersection. The optimizing of traffic signals is a way to maximize the capacity of the intersection without having to perform costly infrastructure improvements. Benefits from signal optimization include:

- Reduction in travel time and delays
- Reduction in stops and traffic slow downs could reduce accident potential
- Reduction in fuel consumption (i.e., less idling time) and vehicle emissions
- Potential to delay/eliminate the need for intersection widening

This project is part of an overall goal of the Onondaga County Department of Transportation to evaluate the operations of all of its traffic signals. This project is the second phase of a multi-phase project.



Project Location Map - Isolated Intersections

Onondaga County Department of Transportation
Traffic Signal Optimization - Phase II

FIGURE 1

Chapter II

ISOLATED INTERSECTION ANALYSIS

To meet the project purpose, an evaluation of existing conditions was completed and new signal timing plans were developed. In order to develop new timing plans for each intersection, traffic count data, existing signal timing data, and intersection geometry were provided by the Syracuse Metropolitan Transportation Council (SMTC) and OCDOT. The intersections were analyzed using the traffic analysis software SYNCHRO 7 using the information provided by the SMTC and OCDOT. The existing operations were documented so that a comparison could be made to future proposed changes. The study area intersections were than evaluated using different signal timing parameters, signal phasing sequences and detection types to improve the overall performance of the individual intersections.

This project is the second phase of a multi-phase project being conducted by the Onondaga County Department of Transportation to evaluate the operations at all of its signalized intersections.

A. Methodology

Traffic data, including peak hour turning movement volumes, traffic signal timing and phasing data, intersection geometric data, and photographs were provided to CHA in order to develop SYNCHRO models for the existing conditions at the intersections that are included within the study area. These models were used to determine existing weekday AM and PM peak hour levels of service (LOS) for all the study area intersections. The individual intersections were then optimized using different signal timing parameters. The existing levels of service were used for comparison purposes to establish the benefits of optimizing the operation of the intersection.

Prior to developing the new signal timing plans, it was important to understand and validate the existing conditions at each intersection. By using the data that was provided and knowledge of the existing conditions observed in the field, a model of each intersection was built for each peak period using SYNCHRO. Existing cycle lengths and phase times were obtained from the existing timing plans that were provided by OCDOT and then field verified.

The existing conditions of the signals along each corridor were analyzed in a manner consistent with the Highway Capacity Manual 2000 methodologies. CHA then performed an operational analysis for each isolated intersection. The capacity analyses were consistent with the Highway Capacity Manual 2000 methodology when comparing improvement options. Existing and proposed signal phasing and sequencing were analyzed as well as identifying other possible operational improvements, such as pavement marking changes, signal control equipment additions and/or upgrades, etc. Consideration was given to compliance issues with the FHWA Manual on Uniform Traffic Control Devices (MUTCD). In discussions with OCDOT staff, it was determined that the development of optimized signal plans should be accomplished with a minimal amount of infrastructure investment (new signal heads, controllers, detection, etc). Consequently, where possible, all existing signal equipment was maintained and only as a last resort was new signal equipment proposed.

Minimum green times and yellow and all red clearance intervals were reviewed for each intersection to determine if these intervals are within industry standards. Onondaga County Department of

Transportation signal timing standards were utilized to evaluate minimum green times and clearance intervals. Minimum green times are based upon the FHWA classification of the roadways at each intersection. The yellow and all red clearance times are based on the approach speeds of the intersecting roadways and the widths of the intersections. Maximum green times are based upon taking the optimized Synchro maximum green times and multiplying them by 1.5. This value is then compared to the minimum actuated green time for each type of roadways as shown in the Onondga County Department of Transportation Traffic Signal Timing Standards, and whichever number is greater, that shall be used as the maximum green time for that phase.

Passage times were determined by using the existing speed limits on the intersecting roadways and estimating the length of the detection zones shown in the intersection plans that were provided to CHA. Where plans were not available, OCDOT provided additional information, or detection zones were assumed based on detector layouts at similar intersections.

Pedestrian clearance times, for intersections where there is concurrent pedestrian timings, were reviewed to determine if they meet the guidelines contained in the FHWA Signal Timing Manual. The Manual of Uniform Traffic Control Devices (MUTCD) currently states that that the pedestrian clearance interval must be calculated assuming the distance from the curb to the far side of the opposing travel way, or to a median of sufficient width for pedestrians to wait. Note that previous editions of the MUTCD only required the clearance time to be as long as needed for the pedestrian to reach the center of the farthest traveled lane.

The pedestrian clearance time was computed as the crossing distance divided by the walking speed. The speed of pedestrians is a critical assumption in determining this parameter. The MUTCD recommends a walking speed value of 4.0 feet per second (ft/sec). The Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities recommended use of 3.0 ft/sec. Recent studies suggest that a speed of 3.5 ft/sec be used to calculate the pedestrian clearance duration for curb to curb clearance. For the purposes of this study, a walking speed of 3.5 ft/sec was used to calculate the required pedestrian clearance interval.

New timing plans were then developed for each intersection using the data previously collected and the results of the existing conditions analysis. Two timing plans were developed for each intersection — an AM and PM peak hour plan. The development of these timing plans began with an evaluation of each intersection. A review of yellow and all red clearances was performed to determine if existing clearance intervals were within OCDOT standards and minimum green times and vehicle extension intervals were also reviewed. Finally, cycle lengths were determined for each intersection for each of the proposed timing plans. This was accomplished by the use of SYNCHRO cycle length evaluations, knowledge gained from field observations, and professional judgment. After the cycle lengths were determined, the optimal phase split times were established. This data was entered into the SYNCHRO models and then the phase sequences were evaluated to determine the optimal level of service, thus reducing vehicle stops and delay.

In some cases, the minor roadways are anticipated to have a higher delay than what currently exists. The reason for this is to improve the flow of traffic on the major street so that a larger volume of traffic would have less delay. In all cases, the overall intersection delay is less than what currently exists. Also, at many of the intersections, the overall cycle lengths were shortened, with corresponding decreases in individual phase times.

The final component to the timing plans was to prepare coding sheets for each intersection. CHA transferred the proposed timing plans from the SYNCHRO model into a format compatible with OCDOT's traffic signal timing program (Microsoft Excel spreadsheets).

B. List of Study Area Intersections

The following is a list of isolated intersections that were included in the Phase II of the study along with their unique Onondaga County Department of Transportation signal number

OCDOT Signal No. 1	Buckley Road at 7th North Street
OCDOT Signal No. 6	Jamesville Road at Woodchuck Hill Road
OCDOT Signal No. P11	South Bay Road at Circle Drive
OCDOT Signal No. P11A	South Bay Road at Frontage Road
OCDOT Signal No. 15	South Bay Road at Airport Boulevard
OCDOT Signal No. 18	Van Buren Road at Brickyard Road/Jones Road
OCDOT Signal No. 21	Kirkville Road at Fly Road
OCDOT Signal No. 22	Kirkville Road at Fremont Road
OCDOT Signal No. P22	South Bay Road at Chestnut Street
OCDOT Signal No. 25	Fay Road at Grand Avenue
OCDOT Signal No. 34	Jamesville Road at Randall Road
OCDOT Signal No. 37	Milton Avenue at Hinsdale Road
OCDOT Signal No. 38	West Taft Road at Allen Road
OCDOT Signal No. 43	Nottingham Road at Colvin Street
OCDOT Signal No. 48	Howlett Hill Road at Cedarvale Road
OCDOT Signal No. 69	South Bay Road at Lawrence Road
OCDOT Signal No. 76	Thompson Road at Eastern Avenue
OCDOT Signal No. 70	Vine Street at Commerce Boulevard
OCDOT Signal No. 85	South Bay Road at Pinegrove Road
OCDOT Signal No. 87	Old Liverpool Road at Eynsford Drive

C. Howlett Hill Road at Cedarvale Road

This is a four-legged intersection which operates as a semi-actuated, two-phase signal with presence detection on the Cedarvale Road approaches. There are no pedestrian accommodations at the intersection. Maximum recall is set for the Howlett Hill Road and Cedarvale Road phases. The signal currently operates on a maximum 60 second cycle for the entire day. The geometry of the intersection is as follows:

- Howlett Hill Road Eastbound – single lane from which all movements are made
- Howlett Hill Road Westbound – single lane from which all movements are made
- Cedarvale Road Northbound – single lane from which all movements are made
- Cedarvale Road Southbound – single lane from which all movements are made

The posted speed limit on both roadways is 35 mph. Table II.C presents the results of the level of service for the existing and proposed conditions.

Table II.C
Howlett Hill Road at Cedarvale Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Howlett Hill Rd/Cedarvale Rd				
EB LTR	B(11.8)	A(4.2)	B(11.2)	A(5.8)
WB LTR	A(9.2)	A(3.5)	B(10.1)	A(5.3)
NB LTR	B(15.6)	C(34.5)	B(15.3)	C(26.9)
SB LTR	B(14.7)	C(29.8)	B(17.3)	C(35.0)
Overall	B(12.0)	B(11.1)	B(12.7)	B(14.3)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Change yellow clearance interval from 3 seconds to 2.5 seconds for both phases. This is based upon the width of the intersection and the prevailing speed.
- Change the red clearance interval for Cedarvale Road from 2 seconds to 2.5 seconds. This is based upon the width of the intersection and the prevailing speed.
- Have maximum recall on the Howlett Hill Road phase only as this is the road with the highest traffic volumes, with minimal volumes on Cedarvale Road.
- Set the passage time on the Cedarvale Road phase to 1 second. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Leave cycle length at 60 seconds for AM and PM peak hours

D. Milton Avenue at Hinsdale Road

This is a four-legged intersection which operates as a fully actuated, five phase signal with railroad pre-emption and full presence detection on all movements. Minimum recall is set for the Milton Avenue

eastbound and westbound movements. There are no pedestrian accommodations at the intersection. The signal currently operates on a maximum 115 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Milton Avenue Eastbound – exclusive left turn lane, shared through/right turn lane
- Milton Avenue Westbound – exclusive left turn lane, shared through/right turn lane
- Hinsdale Road Northbound – exclusive left turn lane, shared through/right turn lane
- Hinsdale Road Southbound – exclusive left turn, through and right turn lanes

The posted speed limit on Milton Avenue is 40 mph and 30 mph on Hinsdale Road. Table II.D presents the results of the level of service for the existing and proposed conditions.

Table II.D
Milton Avenue at Hinsdale Road

Intersection	AM		PM		Saturday	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
Milton Ave/Hinsdale Rd						
EB L	D(52.1)	C(33.7)	C(33.5)	C(30.2)	C(26.4)	C(21.2)
EB T/R	D(35.0)	C(32.2)	D(42.6)	D(43.9)	D(39.7)	D(35.7)
WB L	C(23.7)	C(25.3)	C(28.8)	C(27.0)	C(24.7)	B(19.9)
WB T/R	D(47.7)	E(61.3)	D(49.1)	D(53.2)	D(45.4)	D(42.3)
NB L	B(13.0)	B(17.5)	B(13.5)	B(13.9)	B(14.2)	B(13.2)
NB T/R	D(39.5)	D(45.8)	C(32.1)	C(33.3)	C(34.6)	D(37.9)
SB L	B(16.0)	C(23.3)	B(15.4)	B(16.6)	B(15.3)	B(16.1)
SB T	C(24.5)	C(29.2)	D(35.1)	D(35.1)	C(25.4)	C(25.0)
SB R	A(2.6)	A(1.7)	A(2.0)	A(1.7)	A(2.5)	A(2.2)
Overall	D(35.9)	D(36.7)	C(30.2)	C(30.6)	C(30.2)	C(28.9)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Change yellow clearance interval from 3.8 seconds to 3.0 seconds for all Milton Avenue phases and 2.5 seconds for Hinsdale Road approaches.
- Change all red clearance interval from 1.2 seconds to the following:
    - Milton Avenue EB and WB and Hinsdale Rd NB left turn movements – 1.5 seconds
    - Milton Avenue EB and WB through movements – 2.0 seconds
    - Hinsdale Rd NB through movement – 2.5 seconds
    - Hinsdale Rd SB left turn movement – 3.0 seconds
    - Hinsdale Rd SB through movement – 3.5 seconds
- Reduce the minimum green on the Hinsdale Rd SB left turn phases to 5 seconds.
- Set the passage time on the Milton Avenue phases to 1.5 seconds and 1.0 seconds on the Hinsdale Road phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for AM and PM peak hours and 60 seconds for the Saturday peak hour.

E. Fay Road at Grand Avenue/Sheraton Road

This is a four-legged intersection which operates as a fully actuated, four phase signal with presence detection on all movements. There are no pedestrian accommodations at the intersection. Minimum recall is set, for the Fay Road eastbound and Grand Avenue westbound movements. The signal currently operates on a maximum 88 second cycle during the AM peak hour and 123 seconds during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Fay Road Eastbound – exclusive left turn lane, shared through/right turn lane
- Grand Avenue Westbound – exclusive left turn lane, shared through/right turn lane
- Sheraton Road Northbound – single lane from which all movements are made
- Fay Road Southbound – exclusive right turn lane, shared through/left turn lane

The posted speed limit on Fay Road southbound and Sheraton Road is 30 mph and 35 mph on Fay Road northbound and Grand Avenue. Table II.E presents the results of the level of service for the existing and proposed conditions.

Table II.E
Fay Road at Grand Avenue/Sheraton Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Fay Rd/Grand Ave/Sheraton Rd				
EB L	A(8.4)	A(6.4)	A(6.0)	A(4.85
EB T/R	B(10.6)	A(8.0)	A(7.0)	A(5.4)
WB L	A(8.0)	A(6.0)	A(6.0)	A(5.0)
WB T/R	B(10.1)	A(9.6)	C(24.2)	B(17.0)
NB L/T/R	B(19.2)	B(16.0)	C(27.6)	B(19.2)
SB L/T	C(26.8)	C(21.0)	C(31.5)	B(19.9)
SB R	A(1.8)	A(1.4)	A(2.7)	A(2.5)
Overall	B(11.0)	A(8.7)	B(14.6)	B(10.4)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set the minimum green times on the Fay Road and Grand Avenue through phases from 8 seconds to 10 seconds.
- Set the minimum green times for the Fay Road EB and Grand Avenue WB left turn phases and the Sheraton Road movement to 5 seconds.
- Change the yellow clearance intervals from 4 seconds to 2.5 seconds for all phases except the Grand Avenue left turn phase, which should be set at 2.0 seconds.
- Change the all red clearance interval from 2 seconds to 2.5 seconds for all through movement phases and to 1.5 seconds for the Fay Road westbound left turn phase.
- Set the passage time on the eastbound and westbound phases to 1.5 seconds and 1.0 seconds on the northbound and southbound phases. This passage time is based on the prevailing speed limits and the length of the detection zones.

- Change the cycle length to 60 seconds for AM and PM peak hours

F. Van Buren Road at Brickyard Road/Jones Road

This is a four-legged intersection which operates as a semi-actuated, six phase signal with full presence detection on the Brickyard Road and Jones Road approaches and on the left turn movements on Van Buren Road. No recall is set, so any signal phase can be skipped if no calls exist. There are no pedestrian accommodations at the intersection. The signal currently operates on a maximum 100 second cycle with different phase timings for each of the peak hours. The geometry of the intersection is as follows:

- Brickyard Road Northbound – exclusive left turn lane, shared through/right turn lane
- Jones Road Southbound – exclusive left turn lane, exclusive through, channelized right turn lane
- Van Buren Road Westbound – excusive left turn, through and right turn lanes
- Van Buren Road Eastbound – exclusive left turn lane, shared through/right turn lane

The posted speed limit on Brickyard Road is 55 mph, 40 mph on Jones Road and 35 mph on the northbound approach of Van Buren Road and 55 mph on the southbound approach of Van Buren Road. Table II.F presents the results of the level of service for the existing and proposed conditions.

Table II.F
Van Buren Road at Brickyard Road/Jones Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Van Buren Rd/Brickyard Rd/Jones Rd				
EB L	C(30.8)	C(27.7)	C(25.6)	C(23.9)
EB T/R	B(19.5)	B(17.9)	B(19.6)	B(16.5)
WB L	C(33.8)	C(31.4)	C(27.3)	C(24.8)
WB T	C(31.2)	C(26.1)	C(24.2)	C(20.3)
WB R	A(5.9)	A(6.3)	A(4.0)	A(3.7)
NB L	C(33.8)	C(31.6)	C(28.2)	C(25.2)
NB T/R	C(24.1)	B(19.6)	C(21.5)	B(19.0)
SB L	C(31.4)	C(29.8)	C(24.2)	C(23.3)
SB T/R	B(13.1)	B(11.2)	B(12.5)	B(11.3)
Overall	B(19.8)	B(17.2)	B(16.9)	B(15.2)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Change minimum green times from 5 seconds to 10 seconds for all through phases.
- Change the yellow clearance interval from 4 seconds to 3 seconds for all phases except Van Buren Road westbound, which should be set to 2.5 seconds.
- Change all red phase from 1 second for all phases to 1.5 seconds for Van Buren Road left turn and Jones Road through phases, 2.0 seconds for the Van Buren Road eastbound left, westbound

through and Brickyard through phases and 2.5 seconds for Van Buren Road westbound through phase.

- Set the passage time on the Jones Road and Brickyard Road phases to 1.5 seconds and also the Van Buren Road left turn phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Recommend reducing the speed from 55 mph to 40 mph on the Brickyard Road and Van Buren Road eastbound approaches as these roads transition into 35 and 40 mph speed limits once going through the intersection.
- Change the cycle length to 65 seconds for AM peak hour and 60 seconds for the PM peak hour.

The recommendations above are based on a 55 mph speed limit for Brickyard Road and Van Buren Road eastbound.

G. Kirkville Road at Fly Road

This is a four-legged intersection which operates as a fully actuated, four phase signal with full presence detection on all movements. There are no pedestrian accommodations at the intersection. Minimum recall is set for the Kirkville Road eastbound and westbound through phases. The signal currently operates on a maximum 112 second cycle during the AM peak hour and 140 second cycle during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Kirkville Road Eastbound – exclusive left turn lane, exclusive through lane, shared through/right turn lane
- Kirkville Road Westbound – exclusive left and right turn lanes, two exclusive through lanes
- Fly Road Northbound – excusive left turn lane, shared through/right turn lane
- Fly Road Southbound – exclusive double left turn lanes, shared through/right turn lane

The posted speed limit on Kirkville Road westbound and Fly Road south bound is 45 mph and 40 mph on Kirkville Road eastbound and Fly Road northbound. Table II.G presents the results of the level of service for the existing and proposed conditions.

Table II.G
Kirkville Road at Fly Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Kirkville Rd/Fly Rd				
EB L	D(41.7)	D(39.0)	E(58.6)	E(62.1)
EB T/R	C(27.9)	C(27.5)	F(85.8)	D(45.4)
WB L	D(43.2)	D(40.3)	E(59.2)	E(63.2)
WB T	C(23.9)	C(23.7)	C(32.8)	C(27.6)
WB R	A(5.9)	A(6.4)	A(6.7)	A(5.6)
NB L	B(19.5)	B(17.0)	B(19.5)	C(22.5)
NB T/R	C(33.2)	C(27.4)	D(50.6)	D(53.4)
SB L	D(36.4)	C(34.9)	D(48.2)	D(52.1)
SB T/R	C(23.2)	C(20.6)	C(23.3)	C(25.7)
Overall	C(23.0)	C(22.2)	E(55.5)	D(42.6)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Change all red phase from 2 seconds to 2.5 seconds for the Fly Road and Kirkville Road through phases and 1.5 seconds for the Fly Road northbound and Kirkville Road westbound left turn phases.
- Reduce the minimum green on the all left turn phases to 5 seconds and 10 seconds for the through movement phases.
- Set the passage time on all movements to 1.5 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 80 seconds for the PM peak hour.

H. Kirkville Road at Fremont Road

This is a four-legged intersection which operates as a fully actuated, six phase signal with full presence detection on all movements. There is a crosswalk across the westbound approach of Kirkville Road with pedestrian signals. No recall is set, so any signal phase can be skipped if no calls exist. The signal currently operates on a maximum 144.5 second cycle during the AM peak hour and 141.5 second cycle during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Kirkville Road Eastbound – exclusive left, through and right turn lanes
- Kirkville Road Westbound – exclusive left turn lane, shared through/right turn lane
- Fremont Road Northbound – exclusive double left turn lanes, shared through/right turn lane
- Fremont Road Southbound – exclusive left turn lane, shared through/right turn lane

The posted speed limit on both roadways is 45 mph on Kirkville Road and Fremont Road southbound and 35 mph on Fremont Road northbound. Table II.H presents the results of the level of service for the existing and proposed conditions.

Table II.H
Kirkville Road at Fremont Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Kirkville Rd/Fremont Rd				
EB L	C(32.1)	C(27.8)	B(18.4)	B(15.3)
EB T	D(35.5)	C(30.4)	D(47.3)	D(35.9)
EB R	A(2.4)	A(2.3)	A(5.3)	A(5.3)
WB L	C(23.8)	C(20.2)	C(21.3)	B(16.8)
WB T/R	E(62.2)	D(51.8)	C(28.6)	C(24.0)
NB L	D(50.4)	D(51.1)	D(40.7)	D(39.2)
NB T/R	C(22.8)	C(23.9)	C(22.5)	C(22.1)
SB L	E(57.9)	E(57.9)	D(48.4)	D(45.2)
SB T/R	D(52.2)	D(54.1)	D(40.6)	D(42.6)
Overall	D(40.4)	D(38.0)	C(28.0)	C(24.8)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Change yellow clearance time to 3.0 seconds for all phases with the exception of the Fremont Road northbound phases which should be set at 2.5 seconds.
- Set all red phase to 2 seconds for all phases with the exception of the Fremont Road southbound left turn phase which should be set to 1.5 seconds and 2.5 seconds for the Fremont Road northbound through phase.
- Set the minimum green on the all left turn phases to 5 seconds and 10 seconds for the through movement phases.
- Set the passage time on the Fremont Road northbound phases to 1.5 seconds and 2.0 seconds for all other phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for the AM peak hour and 70 seconds for the PM peak hour.

I. Jamesville Road at Randall Road/Pebble Hill Road

This is a four-legged intersection which operates as a fully actuated, four phase signal with full presence detection on all approaches. There is a continuous sidewalk along the east side of Jamesville Road and crosswalks across the northbound approach of Jamesville Road, the eastbound approach of Randall Road and the westbound approach of Pebble Hill Road with pedestrian signals. Minimum recall is on for the Jamesville Road northbound and southbound through phases. The signal currently operates on a maximum 100 second cycle during the AM peak hour and 144 seconds during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Randall Road Eastbound – single lane from which all movements are made
- Pebble Hill Road Westbound – single lane from which all movements are made
- Jamesville Road Northbound – single lane from which all movements are made
- Jamesville Road Southbound – exclusive right turn lane, shared through/left turn lane

The posted speed limit on both roadways is 30 mph. Table II.I presents the results of the level of service for the existing and proposed conditions.

Table II.I
Jamesville Road at Randall Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Jamesville Rd/Randall Rd				
EB L/T/R	E(60.7)	E(63.1)	D(38.9)	D(35.3)
WB L/T/R	D(38.2)	E(72.2)	D(46.0)	D(41.3)
NB L/T/R	C(34.3)	D(36.3)	C(23.8)	C(25.7)
SB L/T	B(16.1)	B(20.0)	C(21.9)	C(23.7)
SB R	A(3.3)	A(2.5)	A(3.2)	A(3.9)
Overall	C(30.2)	C(32.2)	C(22.8)	C(22.8)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set minimum green times to 10 seconds for Jamesville Road through phases and Randal Road phase.
- Set yellow clearance interval to 2.5 seconds for all phases.
- Set all red phase to 2.5 seconds for all Jamesville Road phases and 2.0 seconds for Randall Road and Pebble Hill Road phases..
- Set the passage time on all phases to 1.0 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the pedestrian clearance intervals from 7 seconds to 13 seconds for all phases.
- Change the cycle length to 110 seconds for the AM peak hour and 80 seconds for the PM peak hour.

J. West Taft Road at Allen Road

This is a four-legged intersection which operates as a fully actuated, three phase signal with presence detection on the retail driveway movement and video detection on all other movements. There are no pedestrian accommodations at the intersection. Minimum recall is set for the West Taft Road eastbound and westbound through phases. The signal currently operates on a maximum 98 second cycle. The geometry of the intersection is as follows:

- West Taft Road Eastbound – exclusive left and through lanes, shared through/right turn lane
- West Taft Road Westbound – shared through/left turn lane, shared through/right turn lane

- Retail Driveway Northbound – single lane from which all movements are made
- Allen Road Southbound – shared through/left turn lane, exclusive right turn lane

The posted speed limit on both roadways is 35 mph. Table II.J presents the results of the level of service for the existing and proposed conditions.

Table II.J
West Taft Road at Allen Road

Intersection	AM		PM		Saturday	
	Existing	Proposed	Existing	Proposed	Existing	Proposed
West Taft Rd/Allen Rd						
EB L	A(9.2)	A(7.5)	B(16.7)	B(13.1)	A(7.4)	A(6.9)
EB T/R	A(8.9)	A(7.3)	A(7.8)	A(5.8)	A(5.9)	A(5.5)
WB L/T/R	C(21.1)	B(16.3)	C(24.7)	B(17.2)	B(17.9)	B(14.7)
NB L/T/R	B(16.5)	B(12.0)	C(26.0)	C(20.6)	C(24.0)	B(17.0)
SB L/T	C(30.4)	C(24.2)	D(38.1)	C(27.7)	C(29.6)	C(22.4)
SB R	A(5.6)	A(54.8)	A(8.4)	A(5.1)	A(6.2)	A(3.1)
Overall	B(15.4)	B(12.2)	B(17.4)	B(12.5)	B(12.7)	B(10.8)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set the minimum green time to 10 seconds for the Allen Road phase, 5 seconds for the West Taft Road left turn phases and the driveway phase.
- Set the yellow clearance interval to 2.5 seconds for all phases.
- Set all red phase to 2.5 seconds for the West Taft Road through phases and 2.0 seconds for all other phases.
- Set the passage time on all phases to 1.5 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Set the West Taft Road through phases to minimum recall
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour and 60 seconds for the Saturday peak hour.

K. East Colvin Street at Nottingham Road

This is a four-legged intersection which operates as a semi-actuated, two phase traffic signal with full presence detection on the Colvin Street movements. There are no pedestrian accommodations at the intersection. The signal currently operates on a maximum 86 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- East Colvin Street Eastbound – single lane from which all movements are made
- East Colvin Street Westbound – single lane from which all movements are made
- Nottingham Road Northbound – single lane from which all movements are made

- Nottingham Road Southbound – single lane from which all movements are made

The posted speed limit on both roadways is 30 mph. Table II.K presents the results of the level of service for the existing and proposed conditions.

Table II.K
East Colvin Street at Nottingham Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
E. Colvin St/Nottingham Rd				
EB L/T/R	E(66.7)	B(16.6)	E(66.7)	B(10.0)
WB L/T/R	B(15.2)	C(20.8)	B(12.7)	C(20.5)
NB L/T/R	F(151.0)	A(8.0)	C(21.1)	A(5.0)
SB L/T/R	C(24.0)	A(4.0)	B(13.8)	A(4.1)
Overall	E(73.1)	A(8.4)	D(38.0)	A(7.7)

There is a short stretch of road (Julian Place) that runs between Nottingham Road and Colvin Street west of the intersection (see aerial below) that reduces the number of left turns from Colvin Street eastbound to Nottingham Road northbound and right turns from Nottingham Road southbound to Colvin Street westbound. There has been consideration to closing this short section of Julian Place so these traffic volumes would have to go through the East Colvin Street/Nottingham Road intersections. An additional analysis has been performed to identify the impacts if Julian place were to be closed and no additional changes are made. The existing conditions shown in Table II.K.1is as the intersection exists today.

Nottingham Road at East Colvin Street

Table II.K.1
East Colvin Street at Nottingham Road
With Julian Place Closed

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
E. Colvin St/Nottingham Rd				
EB L/T/R	E(66.7)	F(101.0)	E(66.7)	D(40.0)
WB L/T/R	B(15.2)	C(20.3)	B(12.7)	B(11.5)
NB L/T/R	F(151.0)	E(64.8)	C(21.1)	B(18.3)
SB L/T/R	C(24.0)	B(12.8)	B(13.8)	B(14.1)
Overall	E(73.1)	D(44.6)	D(38.0)	C(22.1)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set the minimum green times to 10 seconds for both phases.
- Set the yellow clearance intervals to 2.5 seconds for all phases
- Set the all red interval to 2.5 seconds for all phases..
- Set the passage time on all phases to 1.0 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for the AM peak hour and 60 seconds for the PM peak hour.
- Set the maximum recall to the Nottingham Road phase.

With the removal of the gas station that was located on the southwest corner of the intersection, the county will need to consider the reconstruction of this intersection as a long term project (it is likely that an exclusive eastbound left turn lane and an exclusive southbound right turn lane would be needed). It is clear from the analysis that the existing intersection geometry is barely sufficient to accommodate the AM peak hour traffic volumes that will occur if the short stretch of Julian Place is closed.

L. Thompson Road at Eastern Avenue/Brooklawn Parkway

This is a four-legged intersection which operates as a semi-actuated, two-phase traffic signal with full presence detection on Eastern Boulevard and Brooklawn Parkway and presence detection on the left turn movements on Thompson Road. There are no pedestrian accommodations at the intersection. No recall is set, so any signal phase can be skipped if no calls exist. The signal currently operates on a maximum 61.5 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Brooklawn Parkway Eastbound – exclusive left turn lane, shared through/right turn lane
- Eastern Avenue Westbound – exclusive left turn lane, shared through/right turn lane
- Thompson Road Northbound – exclusive left turn lane, shared through/right turn lane
- Thompson Road Southbound – exclusive left turn lane, shared through/right turn lane

The posted speed limit on Thompson Road is 40 mph and 30 mph on Eastern Avenue and Brooklawn Parkway. Table II.L presents the results of the level of service for the existing and proposed conditions.

Table II.L
Thompson Road at Eastern Avenue/Brooklawn Parkway

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Thompson Rd/Eastern Ave/Brooklawn Pkwy				
EB L	B(17.3)	C(24.7)	B(17.9)	B(16.2)
EB T/R	B(11.6)	B(16.1)	A(7.4)	A(7.3)
WB L	C(20.2)	C(26.8)	C(23.0)	C(21.3)
WB T/R	B(15.0)	C(21.5)	B(10.6)	B(10.2)
NB L	A(4.7)	A(3.0)	A(5.6)	A(4.5)
NB T/R	B(10.6)	A(6.2)	A(7.0)	A(5.9)
SB L	A(4.7)	A(3.0)	A(5.5)	A(4.5)
SB T/R	A(5.2)	A(3.3)	A(9.0)	A(7.6)
Overall	A(9.0)	A(6.0)	A(9.4)	A(8.1)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Reduce the minimum green on the Thompson Road through phases to 5 seconds.
- Change the yellow clearance time on the eastbound and westbound phases to 2.5 seconds and 3.0 seconds for the Thompson Road phase.
- Change the all red clearance time to 2.5 seconds on the eastbound and westbound phases and 2.0 seconds for the Thompson Road phase.
- Set the passage time to 1.0 seconds for the eastbound and westbound phases and 1.5 seconds for the northbound and southbound phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.
- Set the minimum recall to the Thompson Road phase.

M. Commerce Boulevard at Vine Street

This is a three-legged intersection which operates as a semi-actuated, three phase traffic signal with full presence detection on the Commerce Boulevard approach. There are no pedestrian accommodations at the intersection. Minimum recall is set for the Vine Street northbound and southbound movements. The signal currently operates on a maximum 74 second cycle during the AM peak hour and 84 seconds during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Commerce Boulevard Eastbound – single lane from which all movements are made
- Vine Street Northbound – single lane from which all movements are made

- Vine Street Southbound – single lane from which all movements are made

The posted speed limit on both roadways is 40 mph. Table II.M presents the results of the level of service for the existing and proposed conditions.

Table II.M
Commerce Boulevard at Vine Street

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Commerce Blvd/Vine St				
EB L/R	C(27.2)	C(21.3)	C(30.1)	C(32.5)
NB L/T	C(23.3)	B(19.0)	D(35.7)	B(15.4)
SB T/R	B(16.3)	B(14.1)	D(40.4)	C(24.6)
Overall	C(21.6)	B(17.7)	D(36.5)	C(24.4)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Increase the minimum green on the Commerce Boulevard phase to 10 seconds.
- Set the yellow clearance interval to 3.0 seconds for all phases.
- Set the all red interval to 2.0 seconds for the Vine Street phase and 1.5 seconds for the Commerce Boulevard phase
- Set the passage time to 1.5 seconds for all phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

N. Old Liverpool Road at Eynsford Drive

This is a four-legged intersection which operates as a semi-actuated, three phase traffic signal with presence detection on Eynsford Drive. There are no pedestrian accommodations at the intersection. Minimum recall is set for the Old Liverpool Road northbound and southbound through phases. The signal currently operates on a maximum 93 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Retail Driveway Eastbound – single lane from which all movements are made
- Eynsford Drive Westbound – single lane from which all movements are made
- Old Liverpool Road Northbound – shared through/left turn lane, shared through/right turn lane
- Old Liverpool Road Southbound – shared through/left turn lane, shared through/right turn lane

The posted speed limit on Old Liverpool Road is 40 mph and 30 mph on Eynsford Drive. Table II.N presents the results of the level of service for the existing and proposed conditions.

Table II.N
Old Liverpool Road at Eynsford Drive

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Old Liverpool Rd/Eynsford Dr				
EB L/T/R	A(0.0)	A(0.0)	C(25.2)	C(28.7)
WB L/T/R	C(21.5)	C(25.6)	B(19.6)	C(24.8)
NB L/T/R	B(12.4)	A(5.6)	B(12.3)	A(5.2)
SB L/T/R	A(4.6)	A(2.4)	A(3.8)	A(1.9)
Overall	A(9.0)	A(5.0)	A(9.2)	A(4.7)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set the yellow clearance interval to 3.0 seconds for the Old Liverpool Road phases and 2.5 seconds for the Eynsford Drive phase.
- Set the all red interval to 1.5 seconds for the Old Liverpool Road phases.
- Set the passage time to 1.5 seconds for the Old Liverpool Road phases and 1.0 seconds for the Eynsford Drive phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Set the signal to maximum recall for the Old Liverpool Road through phase.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

O. Downer Street at Crego Road/NW Sorrell Hill Road

This is a four-legged intersection which operates as a semi-actuated, three phase traffic signal with presence detection on the left turn lanes on Downer Street and presence detection on the Crego Road and NW Sorrell Hill Road approaches. There is a continuous sidewalk on the northwest corner of the intersection in front of the Walgreens Pharmacy; however, there are no other pedestrian accommodations at the intersection. Minimum recall is set for the Downer Street eastbound and westbound through phases. The signal currently operates on a maximum 85 second cycle during the AM peak hour and 105 second cycle during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Downer Street Eastbound – exclusive left turn lane, shared through/right turn lane
- Downer Street Westbound – exclusive left turn lane, shared through/right turn lane
- NW Sorrell Hill Road Northbound – single lane from which all movements are made
- Crego Road Southbound – single lane from which all movements are made

The posted speed limit on Downer Road is 40 mph and 30 mph on Crego Road and NW Sorrell Hill Road. Table II.O presents the results of the level of service for the existing and proposed conditions. The OCDOT has requested that the proposed analysis include a concurrent pedestrian movement across Downer Street on the east side of the intersection as a new cross-walk with pedestrian signals will be installed soon.

Table II.O
Downer Street at Crego Road/NW Sorrell Hill Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Downer St/Crego Rd/NW Sorrell Hill Rd				
EB L	A(6.9)	A(4.1)	A(7.4)	A(4.6)
EB T/R	B(13.0)	A(8.5)	B(16.0)	A(9.4)
WB L	A(6.7)	A(4.0)	A(6.4)	A(4.1)
WB T/R	B(15.0)	A(9.2)	B(18.1)	B(10.4)
NB L/T/R	B(18.7)	D(52.4)	C(30.5)	F(106)
SB L/T/R	A(7.0)	B(11.0)	B(11.1)	B(13.9)
Overall	B(12.6)	B(13.7)	B(14.8)	B(16.9)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set the minimum green time to 5.0 seconds for Downer Street left turn movements and side street phases and 10.0 seconds for the Downer Street through phases.
- Change the yellow clearance time on all phases to 3.0 seconds for the Downer Street phases and 2.5 seconds for the side street phases.
- Change the all red clearance time to 1.0 seconds for Downer Street left turn phases, 1.5 seconds for Downer Street through phases and 2.0 seconds for the side street phases.
- Set maximum recall to the Downer Street through phases.
- Set the passage time to 1.5 seconds for the eastbound and westbound phases and 1.0 seconds for the northbound and southbound phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

P. Buckley Road at 7th North Street

This is a four-legged intersection which operates as a fully actuated, four phase traffic signal with presence detection on all movements. There are no pedestrian accommodations at the intersection. Minimum recall is set for the Buckley Road northbound and southbound through phases. The signal currently operates on a maximum 169 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- 7th North Street Eastbound – shared through/left turn lane, shared through/right turn lane
- 7th North Street Westbound – shared through/left turn lane, exclusive through and right turn lanes
- Buckley Road Northbound – exclusive left turn and through lanes, shared through/right turn lane
- Buckley Road Southbound – exclusive left turn lane, shared through/right turn lane

The posted speed limit on 7th North Street is 40 mph and 35 mph on Buckley Road. Table II.P presents the results of the level of service for the existing and proposed conditions.

Table II.P
Buckley Road at 7th North Street

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
Buckley Rd/7th North St				
EB L/T/R	E(62.2)	D(50.2)	F(101.0)	F(91.3)
WB L/T	E(59.1)	D(48.4)	F(111.4)	F(99.3)
WB R	A(3.3)	A(3.2)	A(4.2)	A(4.1)
NB L	D(53.3)	D(43.4)	E(71.8)	E(74.2)
NB T/R	E(56.6)	D(42.2)	F(85.1)	F(90.4)
SB L	E(73.4)	E(58.5)	F(121.4)	F(113.1)
SB T/R	E(72.2)	D(47.0)	F(91.0)	F(90.7)
Overall	D(51.8)	D(40.8)	F(90.3)	F(85.0)

XX(XX) – LOS(delay)

It should be noted that this intersection is operating at its capacity during the PM peak hour and any minor changes in signal timings impacts the overall level of service.

Recommended improvements to the signal timing include the following:

- Set the yellow clearance interval to 2.5 seconds for the Buckley Road phases and 3.0 seconds for the 7th North Street phases.
- Set the all red clearance time to 2.0 seconds for all phases with the exception of Buckley Road through phases which should be set to 3.5 seconds.
- Reduce the minimum green on the Buckley Road left turn phases to 5 seconds and increase the minimum green time to 10 seconds for the Buckley Road northbound through and the 7th North Street westbound through phases.
- Set the passage time on all phases to 1.5 seconds for all phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for the AM peak hour and 120 seconds for the PM peak hour.

Q. South Bay Road at Airport Boulevard

This is a four-legged intersection which operates as a semi-actuated, three phase signal with presence detection on Airport Boulevard and the Retail Driveway approaches and on the South Bay Road southbound left turn movement. There are no pedestrian accommodations at the intersection. Minimum recall is set for the South Bay Road northbound and southbound through phases. The signal currently operates on a maximum 127 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Retail Driveway Eastbound – single lane from which all movements are made
- Airport Boulevard Westbound – exclusive left and right turn lanes
- South Bay Road Northbound – two exclusive through lanes, channelized right turn lane
- South Bay Road Southbound – exclusive left turn lane, two exclusive through lanes

The posted speed limit on South Bay Road northbound is 40 mph, 35 mph on South Bay Road southbound and 45 mph on Airport Boulevard. Table II.Q presents the results of the level of service for the existing and proposed conditions.

Table II.Q
South Bay Road at Airport Boulevard

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
South Bay Rd/Airport Blvd				
EB L/T/R	C(20.7)	C28.8)	C(24.4)	C(26.1)
WB L	C(30.1)	D(35.6)	D(37.8)	D(35.2)
WB R	B(11.8)	B(13.3)	B(11.5)	B(11.1)
NB T	C(22.9)	B(12.4)	B(19.3)	B(12.7)
SB L	C(30.2)	D(42.5)	D(38.6)	D(39.0)
SB T	B(11.3)	A(6.6)	A(8.2)	A(5.7)
Overall	B(18.2)	B(14.3)	B(17.5)	B(12.8)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Reduce the minimum green on the eastbound left, westbound left and eastbound phases to 5 seconds. Set the minimum green times on the South Bay Road through phases and the Airport Boulevard phase to 10 seconds.
- Set the yellow clearance interval to 2.5 seconds for the South Bay Road southbound phases and 3.0 seconds for all other phases.
- Set the all red clearance time to 1.5 seconds for the South Bay Road southbound left turn phase, the Airport Boulevard phase, and the driveway phase, 2.0 seconds for the South Bay Road northbound phase and 2.5 seconds for the South Bay Road southbound through phase.
- Set the passage time on all phases to 1.5 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

R. South Bay Road at Church Street/Centerville Place

This is a four-legged intersection which operates as a fully actuated, four phase traffic signal with presence detection on all movements. There are sidewalks on all corners of the intersection and there are also marked crosswalks across the northbound, southbound and westbound approaches with pedestrian signals. No recall is set, so any signal phase can be skipped if no calls exist. The signal currently operates

on a maximum 104 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Centerville Place Eastbound – exclusive left turn lane, shared through/right turn lane
- Church Street Westbound – exclusive left, through and right turn lanes
- South Bay Road Northbound – exclusive left turn lane, shared through/right turn lane
- South Bay Road Southbound – exclusive left turn lane, shared through/right turn lane

The posted speed limit on South Bay Road is 35 mph and 30 mph on Church Street and Centerville Place. Table II.R presents the results of the level of service for the existing and proposed conditions.

Table II.R
South Bay Road at Church Street/Centerville Place

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
South Bay Rd/Church St/Centerville Pl				
EB L	C(34.1)	C(32.2)	D(51.2)	D(53.5)
EB T/R	C(25.9)	C(24.1)	C(29.8)	C(31.3)
WB L	C(34.1)	C(32.4)	D(45.4)	D(51.9)
WB T	C(28.0)	C(25.7)	D(44.5)	D(48.9)
WB R	A(5.4)	A(4.8)	A(6.7)	A(6.3)
NB L	D(35.9)	C(32.6)	D(47.1)	D(52.3)
NB T/R	C(23.1)	C(22.6)	D(47.5)	D(36.0)
SB L	C(34.1)	C(31.5)	D(50.0)	E(59.7)
SB T/R	C(20.7)	C(21.2)	C(24.7)	C(22.0)
Overall	C(24.3)	C(23.4)	D(37.7)	C(34.6)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Set the minimum green for all through phases to 10 seconds.
- Change the yellow clearance time to 2.5 seconds for all phases.
- Set the all red clearance phase to 2.5 seconds for the Church Street and Centerville Place phases.
- Set the passage time to 1.5 seconds for the South Bay Road phases and 1.0 seconds for the Church Street and Centerville Place phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the pedestrian clearance interval from 12 seconds to 17 seconds.
- Set the controller to minimum recall on the South Bay Road northbound and southbound through phases.
- Change the cycle length to 70 seconds for the AM peak hour and 90 seconds for the PM peak hour.

S. South Bay Road at Lawrence Road

This is a four-legged intersection which operates as a semi-actuated, three phase signal with presence detection on the Lawrence Road eastbound and westbound approaches. There are no pedestrian accommodations at the intersection. Maximum recall is set for the South Bay Road northbound phase. The traffic signal is split phased for the northbound and southbound South Bay Road movements. The signal currently operates on a maximum 81 second cycle for the AM peak hour and 131 seconds for the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Lawrence Road Eastbound – single lane from which all movements are made
- Lawrence Road Westbound – single lane from which all movements are made
- South Bay Road Northbound – shared through/left turn lane, shared through/right turn lane
- South Bay Road Southbound – shared through/left turn lane, shared through/right turn lane

The posted speed limit on South Bay Road is 40 mph and 30 mph on Lawrence Road. Table II.S presents the results of the level of service for the existing and proposed conditions.

Table II.S
South Bay Road at Lawrence Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
South Bay Rd/Lawrence Rd				
EB L/T/R	C(27.0)	D(39.4)	D(53.6)	E(59.6)
WB L/T/R	B(16.1)	B(19.8)	D(51.9)	E(56.4)
NB L/T/R	B(18.9)	B(17.5)	C(24.1)	C(26.5)
SB L/T/R	C(25.5)	C(21.5)	D(42.2)	C(26.9)
Overall	C(22.5)	C(20.9)	C(34.0)	C(31.5)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Reduce the minimum green on the South Bay Road phases to 10 seconds and 5 seconds for the Lawrence Road phases.
- Change the yellow clearance interval for the Lawrence Road phases to 2.5 seconds and 3.0 seconds for the South Bay Road phases.
- Set the all red clearance interval for the South Bay Road phases to 1.5 seconds and 2.5 seconds for the Lawrence Road phase.
- Set the passage time to 1.5 seconds for the South Bay Road phases and 1.0 seconds for the Lawrence Road phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

T. South Bay Road at Pine Grove Road

This is a four-legged intersection which operates as a semi-actuated, two phase traffic signal with presence detection on the Pine Grove Road eastbound and westbound approaches. There are no pedestrian accommodations at the intersection. Minimum recall is set for the South Bay Road northbound and southbound phases. The signal currently operates on a maximum 55 second cycle during the AM peak hour and 50 seconds during the PM peak hour with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Pine Grove Road Eastbound – single lane from which all movements are made
- Pine Grove Road Westbound – single lane from which all movements are made
- South Bay Road Northbound – single lane from which all movements are made
- South Bay Road Southbound – single lane from which all movements are made

The posted speed limit on South Bay Road is 45 mph and 30 mph on Pine Grove Road. Table II.T presents the results of the level of service for the existing and proposed conditions.

Table II.T
South Bay Road at Pine Grove Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
South Bay Rd/Pine Grove Rd				
EB L/T/R	B(10.3)	B(15.6)	A(8.9)	B(19.2)
WB L/T/R	C(21.9)	D(46.4)	C(24.5)	E(70.3)
NB L/T/R	A(8.5)	A(6.9)	F(122.6)	C(26.1)
SB L/T/R	B(15.7)	B(11.3)	B(14.0)	B(10.7)
Overall	B(13.8)	B(13.4)	E(74.7)	C(26.9)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Reduce the minimum green for the South Bay Road through phase to 10 seconds and 5 seconds for the Pine Grove Road phase.
- Set the yellow clearance time to 3.0 seconds for the South Bay Road phase and 2.5 seconds for the Pine Grove Road phase.
- Set the all red clearance time to 2.0 seconds for the South Bay Road phase and 3.0 seconds for the Pine Grove Road phase.
- Set the passage time to 2 seconds for South Bay Road phase and 1.0 second for the Pine Grove Road phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 90 seconds for the PM peak hour.

U. South Bay Road at East Circle Drive

This is a three-legged intersection which operates as a semi-actuated, three phase signal with presence detection on the East Circle Drive approach and the South Bay Road northbound left turn lane. There are no pedestrian accommodations at the intersection. Maximum recall is set for the South Bay Road northbound and southbound through phases. The signal currently operates on a maximum 77 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- East Circle Drive Eastbound – exclusive left and right turn lanes
- South Bay Road Northbound – exclusive left turn and through lanes
- South Bay Road Southbound – exclusive through lane, shared through/right turn lane

The posted speed limit on South Bay Road is 45 mph and 30 mph on East Circle Drive. Table II.U presents the results of the level of service for the existing and proposed conditions.

Table II.U
South Bay Road at East Circle Drive

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
South Bay Rd/East Circle Dr				
EB L	C(33.7)	B(18.9)	F(118.9)	C(22.8)
EB R	B(10.7)	A(8.4)	A(7.2)	A(4.3)
NB L	A(6.0)	A(4.9)	A(9.3)	B(15.6)
NB T	A(5.3)	A(6.0)	B(10.4)	C(20.8)
SB T/R	B(13.1)	B(10.5)	B(11.3)	B(15.5)
Overall	B(14.7)	B(10.8)	D(37.7)	B(18.5)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Reduce the minimum green for the South Bay Road through phase to 10 seconds and 5 seconds for the South Bay Road northbound left turn and the East Circle Drive phases.
- Set the yellow clearance time to 2.5 seconds for the East Circle Drive phase.
- Set the all red clearance time to 1.0 seconds for the East Circle Drive phase.
- Set the passage time to 1.5 seconds for South Bay Road phases and 1.0 second for the East Circle Drive phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

V. South Bay Road at Frontage Road

This is a three-legged intersection which operates as a semi-actuated, three phase traffic signal with presence detection on the Frontage Road approach and the South Bay Road northbound left turn lane. There are no pedestrian accommodations at the intersection. Maximum recall is set for the South Bay Road northbound and southbound through movement phases. The signal currently operates on a maximum 79 second cycle with different timings for each of the peak hours. The geometry of the intersection is as follows:

- Frontage Road Eastbound – exclusive left and right turn lanes
- South Bay Road Northbound – exclusive left turn and through lanes
- South Bay Road Southbound – exclusive through lane, shared through/right turn lane

The posted speed limit on South Bay Road is 45 mph and 30 mph on Frontage Road. Table II.V presents the results of the level of service for the existing and proposed conditions.

Table II.V
South Bay Road at Frontage Road

Intersection	AM		PM	
	Existing	Proposed	Existing	Proposed
South Bay Rd/Frontage Rd				
EB L	C(27.5)	B(11.5)	C(28.1)	B(14.8)
EB R	A(6.6)	A(3.8)	B(19.6)	A(8.8)
NB L	A(1.6)	A(2.0)	A(4.6)	A(3.5)
NB T	A(1.1)	A(1.4)	A(2.9)	A(2.0)
SB T/R	A(6.6)	A(6.5)	A(8.2)	A(9.4)
Overall	A(5.1)	A(4.8)	A(8.8)	A(6.0)

XX(XX) – LOS(delay)

Recommended improvements to the signal timing include the following:

- Reduce the minimum green for the South Bay Road through phases to 10 seconds and 5 seconds for the South Bay Road northbound left and Frontage Road phases.
- Set the yellow clearance time to 2.5 seconds for the Frontage Road phase.
- Set the all red clearance time to 1.0 seconds for the South Bay Road northbound left turn phase and 1.5 seconds for the South Bay Road northbound and southbound though phases.
- Set the passage time to 1.5 seconds for South Bay Road phases and 1.0 second for the Frontage Road phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 65 seconds for the PM peak hour.

CHAPTER III

SUMMARY OF RECOMMENDATIONS

Based on the results of the signal timing analysis of the isolated study area intersections, the following is a summary of the recommendations.

❖ General Recommendations

- For the semi-actuated intersections, the traffic signal should rest in green for the main street through phases when there are no vehicle detections on the side streets.
- For the semi-actuate intersections, the main street through phase should be set to maximum recall during the peak hours (7-9 am and 4-6 pm) and minimum recall during off-peak hours.

❖ Howlett Hill Road at Cedarvale Road

- Change yellow clearance interval from 3 seconds to 2.5 seconds for both phases. This is based upon the width of the intersection and the prevailing speed.
- Change the red clearance interval for Cedarvale Road from 2 seconds to 2.5 seconds. This is based upon the width of the intersection and the prevailing speed.
- Have maximum recall on the Howlett Hill Road phase only as this is the road with the highest traffic volumes, with minimal volumes on Cedarvale Road.
- Set the passage time on the Cedarvale Road phase to 1 second. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Leave cycle length at 60 seconds for AM and PM peak hours

❖ Milton Avenue at Hinsdale Road

- Change yellow clearance interval from 3.8 seconds to 3.0 seconds for all Milton Avenue phases and 2.5 seconds for Hinsdale Road approaches.
- Change all red clearance interval from 1.2 seconds to the following:
  - Milton Avenue EB and WB and Hinsdale Rd NB left turn movements – 1.5 seconds
  - Milton Avenue EB and WB through movements – 2.0 seconds
  - Hinsdale Rd NB through movement – 2.5 seconds
  - Hinsdale Rd SB left turn movement – 3.0 seconds
  - Hinsdale Rd SB through movement – 3.5 seconds
- Reduce the minimum green on the Hinsdale Rd SB left turn phases to 5 seconds.
- Set the passage time on the Milton Avenue phases to 1.5 seconds and 1.0 seconds on the Hinsdale Road phases. This passage time is based on the prevailing speed limits and the length of the detection zones.

- Change the cycle length to 80 seconds for AM and PM peak hours and 60 seconds for the Saturday peak hour.

❖ **Fay Road at Grand Avenue/Sheraton Road**

- Set the minimum green times on the Fay Road and Grand Avenue through phases from 8 seconds to 10 seconds.
- Set the minimum green times for the Fay Road EB and Grand Avenue WB left turn phases and the Sheraton Road movement to 5 seconds.
- Change the yellow clearance intervals from 4 seconds to 2.5 seconds for all phases except the Grand Avenue left turn phase, which should be set at 2.0 seconds.
- Change the all red clearance interval from 2 seconds to 2.5 seconds for all through movement phases and to 1.5 seconds for the Fay Road westbound left turn phase.
- Set the passage time on the eastbound and westbound phases to 1.5 seconds and 1.0 seconds on the northbound and southbound phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for AM and PM peak hours

❖ **Van Buren Road at Brickyard Road/Jones Road**

- Change minimum green times from 5 seconds to 10 seconds for all through phases.
- Change the yellow clearance interval from 4 seconds to 3 seconds for all phases except Van Buren Road westbound, which should be set to 2.5 seconds.
- Change all red phase from 1 second for all phases to 1.5 seconds for Van Buren Road left turn and Jones Road through phases, 2.0 seconds for the Van Buren Road eastbound left, westbound through and Brickyard through phases and 2.5 seconds for Van Buren Road westbound through phase.
- Set the passage time on the Jones Road and Brickyard Road phases to 1.5 seconds and also the Van Buren Road left turn phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Recommend reducing the speed from 55 mph to 40 mph on the Brickyard Road and Van Buren Road eastbound approaches as these roads transition into 35 and 40 mph speed limits once going through the intersection.
- Change the cycle length to 65 seconds for AM peak hour and 60 seconds for the PM peak hour.

❖ **Kirkville Road at Fly Road**

- Change all red phase from 2 seconds to 2.5 seconds for the Fly Road and Kirkville Road through phases and 1.5 seconds for the Fly Road northbound and Kirkville Road westbound left turn phases.
- Reduce the minimum green on the all left turn phases to 5 seconds and 10 seconds for the through movement phases.
- Set the passage time on all movements to 1.5 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.

- Change the cycle length to 60 seconds for the AM peak hour and 80 seconds for the PM peak hour.

❖ **Kirkville Road at Fremont Road**

- Change yellow clearance time to 3.0 seconds for all phases with the exception of the Fremont Road northbound phases which should be set at 2.5 seconds.
- Set all red phase to 2 seconds for all phases with the exception of the Fremont Road southbound left turn phase which should be set to 1.5 seconds and 2.5 seconds for the Fremont Road northbound through phase.
- Set the minimum green on the all left turn phases to 5 seconds and 10 seconds for the through movement phases.
- Set the passage time on the Fremont Road northbound phases to 1.5 seconds and 2.0 seconds for all other phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for the AM peak hour and 70 seconds for the PM peak hour.

❖ **Jamesville Road at Randall Road/Pebble Hill Road**

- Set minimum green times to 10 seconds for Jamesville Road through phases and Randall Road phase.
- Set yellow clearance interval to 2.5 seconds for all phases.
- Set all red phase to 2.5 seconds for all Jamesville Road phases and 2.0 seconds for Randall Road and Pebble Hill Road phases.
- Set the passage time on all phases to 1.0 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the pedestrian clearance intervals from 7 seconds to 13 seconds for all phases.
- Change the cycle length to 110 seconds for the AM peak hour and 80 seconds for the PM peak hour.

❖ **West Taft Road at Allen Road**

- Set the minimum green time to 10 seconds for the Allen Road phase, 5 seconds for the West Taft Road left turn phases and the driveway phase.
- Set the yellow clearance interval to 2.5 seconds for all phases.
- Set all red phase to 2.5 seconds for the West Taft Road through phases and 2.0 seconds for all other phases.
- Set the passage time on all phases to 1.5 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Set the West Taft Road through phases to minimum recall
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour and 60 seconds for the Saturday peak hour.

❖ **East Colvin Street at Nottingham Road**

- Set the minimum green times to 10 seconds for both phases.

- Set the yellow clearance intervals to 2.5 seconds for all phases
- Set the all red interval to 2.5 seconds for all phases..
- Set the passage time on all phases to 1.0 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for the AM peak hour and 60 seconds for the PM peak hour.
- Set the maximum recall to the Nottingham Road phase.

❖ **Thompson Road at Eastern Avenue/Brooklawn Parkway**

- Reduce the minimum green on the Thompson Road through phases to 5 seconds.
- Change the yellow clearance time on the eastbound and westbound phases to 2.5 seconds and 3.0 seconds for the Thompson Road phase.
- Change the all red clearance time to 2.5 seconds on the eastbound and westbound phases and 2.0 seconds for the Thompson Road phase.
- Set the passage time to 1.0 seconds for the eastbound and westbound phases and 1.5 seconds for the northbound and southbound phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.
- Set the minimum recall to the Thompson Road phase.

❖ **Commerce Boulevard at Vine Street**

- Increase the minimum green on the Commerce Boulevard phase to 10 seconds.
- Set the yellow clearance interval to 3.0 seconds for all phases.
- Set the all red interval to 2.0 seconds for the Vine Street phase and 1.5 seconds for the Commerce Boulevard phase
- Set the passage time to 1.5 seconds for all phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

❖ **Old Liverpool Road at Eynsford Drive**

- Set the yellow clearance interval to 3.0 seconds for the Old Liverpool Road phases and 2.5 seconds for the Eynsford Drive phase.
- Set the all red interval to 1.5 seconds for the Old Liverpool Road phases.
- Set the passage time to 1.5 seconds for the Old Liverpool Road phases and 1.0 seconds for the Eynsford Drive phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Set the signal to maximum recall for the Old Liverpool Road through phase.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

❖ **Downer Street at Crego Road/NW Sorrell Hill Road**

- Set the minimum green time to 5.0 seconds for Downer Street left turn movements and side street phases and 10.0 seconds for the Downer Street through phases.
- Change the yellow clearance time on all phases to 3.0 seconds for the Downer Street phases and 2.5 seconds for the side street phases.
- Change the all red clearance time to 1.0 seconds for Downer Street left turn phases, 1.5 seconds for Downer Street through phases and 2.0 seconds for the side street phases.
- Set maximum recall to the Downer Street through phases.
- Set the passage time to 1.5 seconds for the eastbound and westbound phases and 1.0 seconds for the northbound and southbound phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

❖ **Buckley Road at 7th North Street**

- Set the yellow clearance interval to 2.5 seconds for the Buckley Road phases and 3.0 seconds for the 7th North Street phases.
- Set the all red clearance time to 2.0 seconds for all phases with the exception of Buckley Road through phases which should be set to 3.5 seconds.
- Reduce the minimum green on the Buckley Road left turn phases to 5 seconds and increase the minimum green time to 10 seconds for the Buckley Road northbound through and the 7th North Street westbound through phases.
- Set the passage time on all phases to 1.5 seconds for all phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 80 seconds for the AM peak hour and 120 seconds for the PM peak hour.

❖ **South Bay Road at Airport Boulevard**

- Reduce the minimum green on the eastbound left, westbound left and eastbound phases to 5 seconds. Set the minimum green times on the South Bay Road through phases and the Airport Boulevard phase to 10 seconds.
- Set the yellow clearance interval to 2.5 seconds for the South Bay Road southbound phases and 3.0 seconds for all other phases.
- Set the all red clearance time to 1.5 seconds for the South Bay Road southbound left turn phase, the Airport Boulevard phase, and the driveway phase, 2.0 seconds for the South Bay Road northbound phase and 2.5 seconds for the South Bay Road southbound through phase.
- Set the passage time on all phases to 1.5 seconds. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

❖ **South Bay Road at Church Street/Centerville Place**

- Set the minimum green for all through phases to 10 seconds.
- Change the yellow clearance time to 2.5 seconds for all phases.
- Set the all red clearance phase to 2.5 seconds for the Church Street and Centerville Place phases.
- Set the passage time to 1.5 seconds for the South Bay Road phases and 1.0 seconds for the Church Street and Centerville Place phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the pedestrian clearance interval from 12 seconds to 17 seconds.
- Set the controller to minimum recall on the South Bay Road northbound and southbound through phases.
- Change the cycle length to 70 seconds for the AM peak hour and 90 seconds for the PM peak hour.

❖ **South Bay Road at Lawrence Road**

- Reduce the minimum green on the South Bay Road phases to 10 seconds and 5 seconds for the Lawrence Road phases.
- Change the yellow clearance interval for the Lawrence Road phases to 2.5 seconds and 3.0 seconds for the South Bay Road phases.
- Set the all red clearance interval for the South Bay Road phases to 1.5 seconds and 2.5 seconds for the Lawrence Road phase.
- Set the passage time to 1.5 seconds for the South Bay Road phases and 1.0 seconds for the Lawrence Road phases. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

❖ **South Bay Road at Pine Grove Road**

- Reduce the minimum green for the South Bay Road through phase to 10 seconds and 5 seconds for the Pine Grove Road phase.
- Set the yellow clearance time to 3.0 seconds for the South Bay Road phase and 2.5 seconds for the Pine Grove Road phase.
- Set the all red clearance time to 2.0 seconds for the South Bay Road phase and 3.0 seconds for the Pine Grove Road phase.
- Set the passage time to 2 seconds for South Bay Road phase and 1.0 second for the Pine Grove Road phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 90 seconds for the PM peak hour.

❖ **South Bay Road at East Circle Drive**

- Reduce the minimum green for the South Bay Road through phase to 10 seconds and 5 seconds for the South Bay Road northbound left turn and the East Circle Drive phases.
- Set the yellow clearance time to 2.5 seconds for the East Circle Drive phase.

- Set the all red clearance time to 1.0 seconds for the East Circle Drive phase.
- Set the passage time to 1.5 seconds for South Bay Road phases and 1.0 second for the East Circle Drive phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 60 seconds for the PM peak hour.

❖ **South Bay Road at Frontage Road**

- Reduce the minimum green for the South Bay Road through phases to 10 seconds and 5 seconds for the South Bay Road northbound left and Frontage Road phases.
- Set the yellow clearance time to 2.5 seconds for the Frontage Road phase.
- Set the all red clearance time to 1.0 seconds for the South Bay Road northbound left turn phase and 1.5 seconds for the South Bay Road northbound and southbound through phases.
- Set the passage time to 1.5 seconds for South Bay Road phases and 1.0 second for the Frontage Road phase. This passage time is based on the prevailing speed limits and the length of the detection zones.
- Change the cycle length to 60 seconds for the AM peak hour and 65 seconds for the PM peak hour.