

Traffic Signal Optimization Project Phase II

Late Night Signal Operations

Onondaga County Department of Transportation

CHA Project Number: 22845



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This document was prepared with financial assistance for the Federal Highway Administration and the Federal Transit Administration of the U.S. Department of Transportation through the New York State Department of Transportation. The Syracuse Metropolitan Transportation Council is solely responsible for its contents.

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CHAPTER I

OVERVIEW

Currently, there is no widely accepted guideline for implementing late night traffic signal operation; therefore, the decision to implement a specific mode of operation varies widely between jurisdictions. The Manual of Uniform Traffic Control Devices, Latest Edition, does not contain any mention of appropriate times or traffic volumes to use a specific mode of operation.

In providing signal timing operation during late night, low volume hours, there are several operational methodologies available. The following discussion lists the different types of operation that could potentially be used for late night, low volume hours and the advantages and disadvantages of each type of operation.

- **Free Operation**
 - Intersection operates as it currently does during late night hours
 - *Advantage* – Will allow for quicker service of vehicles once detected, resulting in lower traffic delays.
 - *Disadvantage* – Must have vehicle detection on all approaches

- **Yellow/Red Flashing Operation**
 - Intersection operates with flashing yellow on the main street and flashing red on the side street during late night hours.
 - *Advantage* – Studies have shown that this operation produces the least vehicular delay
 - *Disadvantages* – Studies have shown that accident rates (especially right angle accidents) have risen at intersections that are prone to accidents during normal operation, vehicles approaching an intersection from the minor street approach can mistakenly assume all approaches operate with flashing red.

- **Red/Red Flashing Operation**
 - Intersection operates with flashing red on both the main street and side streets during late night hours.
 - *Advantage* – Can be used as a method of “speed control.” Vehicles will be forced to stop at all signalized intersections with this mode of operation.
 - *Disadvantage* - Studies have shown that accident rates (especially right angle accidents) have risen at intersections that are prone to accidents during normal operation, possible increase in the number of rear-end collisions, major movements will experience some delay due to stop and go operation.

- **Rest in Red Operation**
 - Intersection shows red on the main street and side streets all the time until a vehicle is detected.
 - *Advantage* – Can be used as a method of “speed control.” Vehicle detection will be serviced by detectors near stop bar, forcing the vehicles to stop.

- *Disadvantages* – Must have vehicle detection on all approaches, drivers familiar with the area may expect immediate service and may not slow down approaching intersection, creating hazardous situation if there is a service request on another approach.

This study is being progressed as a way to improve traffic flow during hours of low traffic volumes (typically late night hours), reduce needless idle time at signalized intersections, and improve air quality. A number of the intersections being studied are semi-actuated, with no detection on the main street; therefore, there may be times of low volumes that the intersections are requiring vehicles to stop when it may not be necessary to stop. Flashing operation allows vehicles to proceed through an intersection in a much more efficient manner. Even at fully actuated intersections, it may be more efficient to operate the traffic signal in flashing mode during late-night hours. This is due to minimum green and clearance times for each phase (which could run as long as 15 seconds) and how the traffic signal phasing is set up within the controller. Frequently, fully actuated intersections may have to run through its entire phasing even if there are no calls on an approach before it gets back to the main street phase.

A. Study Area

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

- Jamesville Road at Randall Road
- Jamesville Road at Nottingham Road
- Jamesville Road at Woodchuck Hill Road
- Nottingham Road at East Colvin Street
- Old Liverpool Road at Eynsford Drive
- South Bay Road at Pine Grove Road
- Thompson Road at Eastern Avenue

These intersections were chosen by the Onondaga County Department of Transportation as ideal candidates for alternative late-night signal operations based on existing traffic patterns.

The intersections are illustrated in Figures 1.

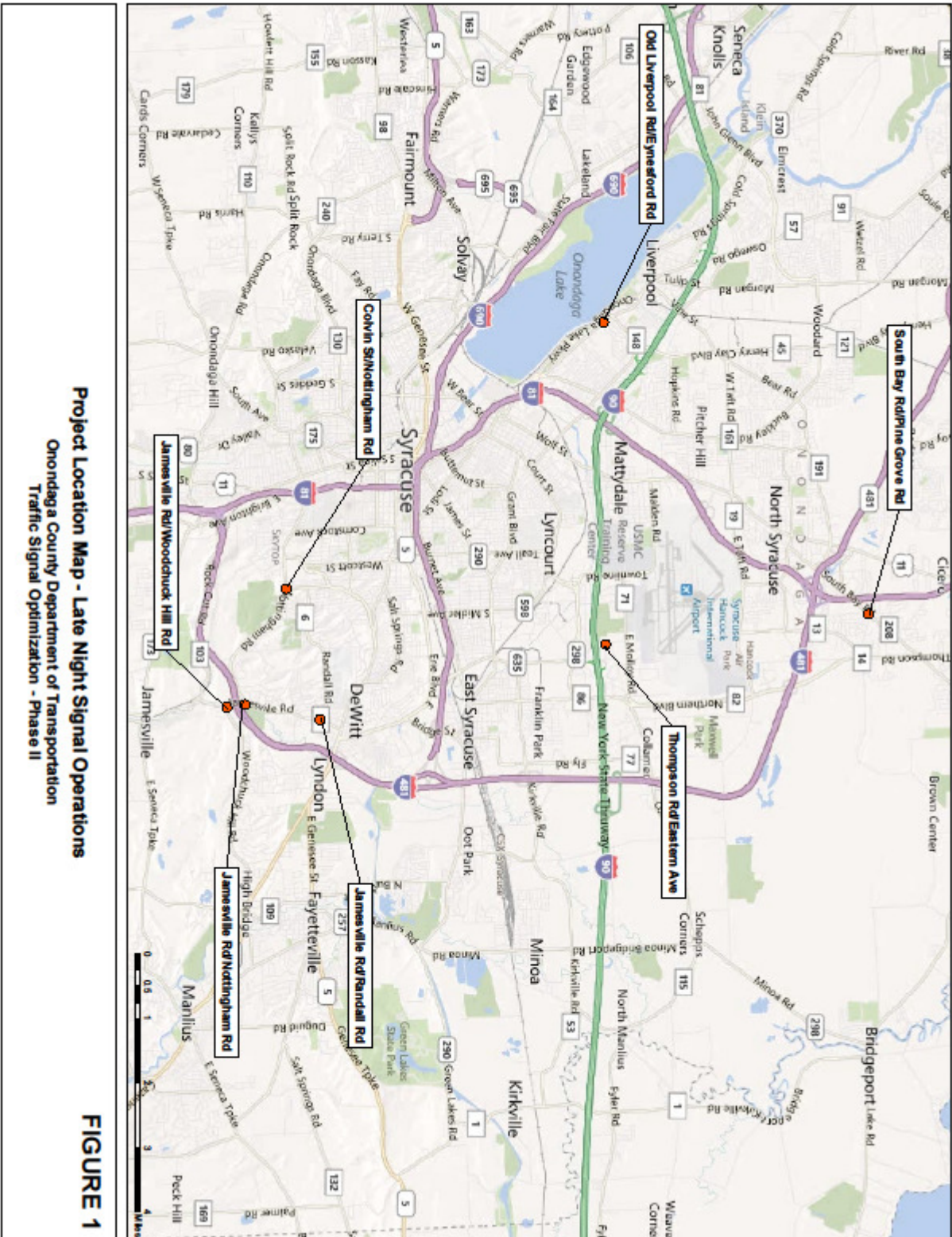
B. Project Purpose

The objective of this study is to improve the movement of vehicles, reduce idle time, conserve energy, and improve air quality. The ideal program contains some or all of the following elements:

- Minimizes crashes
- Has low implementation and maintenance costs
- Has little or no impact on mobility
- Sustains its ability to prevent crashes over time.

In this case, red/yellow or red/red flash has been defined as a very efficient form of signal operation during periods of low traffic volume. However, evidence shows it increases crashes at some locations that are prone to crashes during other parts of the day. Coming down squarely on the side of efficiency-red/yellow or red/red flashing operation may mean more crashes. Weighing in completely on the side of

safety means ignoring opportunities to reduce delay at intersections where flashing operation can function safely. Red/yellow or red/red flashing operation has low implementation and maintenance costs, and its overall impact on mobility is low, since flashing operation is usually in place during periods of very low traffic volume.



Chapter II

LATE NIGHT SIGNAL ANALYSIS

A. Methodology

To meet the project purpose, an evaluation of existing traffic conditions was completed and each intersection was evaluated as to its potential to operate in flashing mode during late night/early morning hours. In order to evaluate each intersection, traffic count data, intersection geometry and intersection detection data was provided by the Syracuse Metropolitan Transportation Council (SMTC) and OCDOT.

The provided traffic data was comprised of 24 hour traffic counts on various approaches to each study area intersection. Each approach for which data was available was analyzed for each of the individual hours between 10 pm and 7 am to determine the average traffic volumes flowing through the intersection. In addition, the general area around each intersection was reviewed for the potential to generate significant volumes of traffic during the late night/early morning hours. Potential generators included retail establishments that operate 24 hours a day, industries with shift changes, and entertainment establishments.

At some of the intersections, data was only provided for both of the approaches of the main street and only one of the approaches for the side street, however the side street approach that was counted was the higher volume approach and would not affect the recommendations.

The final component to the analysis was to review the traffic volumes to determine if an intersection would be a candidate for either red/yellow or red/red flashing operation during late night/early morning hours and which hours the traffic signals could be put on flashing.

This analysis focuses solely on the existing traffic volumes. Prior to making an actual determination on if a traffic signal may be put on an alternative late night/early morning operation, an accident analysis should be performed to determine if there are prevailing accident patterns that would preclude an alternative late-night operation.

B. Old Liverpool Road at Eynsford Drive

This is a three-legged intersection with presence detection on the Eynsford Drive approaches. There are no pedestrian accommodations at the intersection. Minimum recall is set for the Old Liverpool Road northbound and southbound through phases. The geometry of the intersection is as follows:

- Dentist Office 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 is 40 mph Old Liverpool Road and 30 mph on Eynsford Drive. Table II.B presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

Table II.B
Old Liverpool Road at Eynsford Drive

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
Old Liverpool Road EB	141	74	39	32	32	26	51	145	324
Old Liverpool Road WB	137	107	54	46	32	31	58	134	250
Eynsford Drive	15	10	3	5	5	0	1	10	25

Traffic volumes for the dentist office driveway were not provided as this driveway will not have any traffic during late-night operations.

As Table II.B illustrates, traffic volumes drop off significantly between the hours of 12 am and 5 am to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there are not any types of business that could potentially generate large volumes of traffic during the late night/early morning hours. The traffic signal would operate on flashing yellow for the Old Liverpool Road approaches and flashing red for the Eynsford Drive approach.

Subsequent to the collection of traffic data for this intersection, Old Liverpool Road was designated as the commercial vehicle route between the Village of Liverpool and the City of Syracuse. It is likely that traffic volumes may have increased slightly during the late night hours, but not so much to effect the recommendations.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation.

C. Jamesville Road at Woodchuck Hill Road

This is a three-legged intersection which operates as a fully actuated signal with presence detection on the Woodchuck Hill Road and Jamesville Road southbound left turn approaches and point detection on the Jamesville Road through movement approaches. There are no pedestrian accommodations at the intersection. Maximum recall is set for the Jamesville Road northbound and southbound through movement phase. The geometry of the intersection is as follows:

- Woodchuck Hill Road Westbound – exclusive left and right turn lanes
- Jamesville Road Southbound – exclusive left turn lane, two exclusive through lanes
- Jamesville Road Northbound – exclusive through lane, shared through/right turn lane

The posted speed limit on Jamesville Road is 30 mph and 35 mph on Woodchuck Hill Road. Table II.C presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

**Table II.C
Jamesville Road at Woodchuck Hill Road**

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
Jamesville Road NB	61	49	22	17	7	7	20	64	213
Jamesville Road SB*	97	72	38	20	16	14	24	71	115
Woodchuck Hill Road WB	35	26	15	7	5	4	3	7	19

*Note – The southbound volume was recorded south of the intersection and is an approximation of the southbound approach volume

As noted above, the southbound volumes were recorded south of the intersection and are comprised of the Jamesville Road southbound through volumes and Woodchuck Hill Road left turn volumes. Given the relatively low volumes on Woodchuck Hill Road, it is likely that the majority of the southbound traffic is actually travelling south through the intersection and therefore is a good approximation of the southbound approach volume.

Table II.C illustrates that traffic volumes drop off significantly between the hours of 12 am and 5 am to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there is only one business in the area that generates large volumes of traffic throughout the day. The Jamesville Quarry is immediately east of the intersection and generates a significant amount of truck traffic throughout the day; however, the quarry does not typically operate during late night/early morning hours. The traffic signal would operate on flashing yellow for the Jamesville Road approaches and flashing red for the Woodchuck Hill Road approach.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation. In addition, contact should be made with the Jamesville Quarry to make certain that they do not operate during the late night hours.

D. Jamesville Road at Randall Road/Pebble Hill Road

This is a four-legged intersection which operates as a fully actuated 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 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.D presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

**Table II.D
Jamesville Road at Randall Road/Pebble Hill Road**

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
Jamesville Road SB	108	60	36	20	12	9	8	22	45
Jamesville Road NB*	67	42	23	14	8	6	9	38	82
Randall Road EB	30	20	9	7	3	4	7	21	39

*Note – The northbound volume was recorded north of the intersection and is an approximation of the northbound approach volume

Traffic data was not collected on the Pebble Hill Road approach, as this serves a small residential development and would not generate a significant amount of late night/early morning traffic.

As noted above, the northbound volumes were recorded north of the intersection and are comprised of the Jamesville Road northbound through volumes and Randall Road left turning volumes. Given the relatively low volumes on Randall Road, it is likely that the majority of the northbound traffic is actually travelling north through the intersection and is a good approximation of the Jamesville Road northbound approach volume.

Table II.D illustrates that traffic volumes drop off significantly between the hours of 12 am and 6 am to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there are not any types of business that could potentially generate large volumes of traffic during the late night/early morning hours. The traffic signal would operate on flashing yellow for the Jamesville Road approaches and flashing red for the Randall Road and Pebble Hill Road approaches.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation.

E. South Bay Road at Pine Grove Road

This is a four-legged intersection which operates as a semi-actuated 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 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.E presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

**Table II.E
South Bay Road at Pine Grove Road**

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
South Bay Road NB	135	82	47	26	18	11	14	19	95
South Bay Road SB*	95	52	32	14	11	17	37	100	258
Pine Grove Road WB	20	11	6	3	3	3	5	14	49

*Note – The southbound volume was recorded south of the intersection and is an approximation of the southbound approach volume

There were no traffic volumes provided for the Pine Grove Road eastbound approach; however, it is likely that there is very little traffic on this approach between 10 pm and 7 am as the road only serves a small residential development.

As noted above, the southbound volumes were recorded south of the intersection and are comprised of the South Bay Road southbound through volumes and Pine Grove Road left turning volumes. Given the relatively low volumes on Pine Grove Road, it is likely that the majority of the southbound traffic is actually travelling south through the intersection and is a good approximation of the Jamesville Road southbound approach volume.

Table II.E illustrates that traffic volumes drop off significantly between the hours of 12 am and 5 am to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there are not any types of business that could potentially generate large volumes of traffic during the late night/early morning hours. The traffic signal would operate on flashing yellow for the South Bay Road approaches and flashing red for the Pine Grove Road approaches.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation.

F. Jamesville Road at Nottingham Road

This is a three-legged intersection which operates as a fully actuated signal with presence detection on the Nottingham Road and Jamesville Road northbound left turn approaches and point detection on the Jamesville Road through movement approaches. There are no pedestrian accommodations at the intersection. Maximum recall is set for the Jamesville Road northbound and southbound through movement phase. The geometry of the intersection is as follows:

- Nottingham Road Eastbound – exclusive left and right turn lanes
- Jamesville Road Northbound – exclusive left turn lane, two exclusive through lanes
- Jamesville Road Southbound – exclusive through lane, shared through/right turn lane

The posted speed limit on Jamesville Road is 30 mph and 45 mph on Nottingham Road. Table II.F presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

**Table II.F
Jamesville Road at Nottingham Road**

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
Jamesville Road SB	38	25	13	6	4	4	6	17	61
Jamesville Road NB*	47	32	20	10	7	4	3	15	38
Nottingham Road EB	40	31	17	9	6	3	3	11	30

*Note – The northbound volume was recorded north of the intersection and is an approximation of the northbound approach volume

As noted above, the northbound volumes were recorded north of the intersection and are comprised of the Jamesville Road northbound through volumes and Nottingham Road left turning volumes. Given the relatively low volumes on Nottingham Road, it is likely that the majority of the northbound traffic is actually travelling north through the intersection and is a good approximation of the Jamesville Road northbound approach volumes.

Table II.F illustrates that traffic volumes drop off significantly between the hours of 11 pm and 6 am to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there are not any types of business that could potentially generate large volumes of traffic during the late night/early morning hours. The traffic signal would operate on flashing yellow for the Jamesville Road approaches and flashing red for the Nottingham Road approach.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation.

G. Nottingham Road at Colvin Street

This is a four-legged intersection which operates as a semi-actuated signal with full presence detection on the Colvin Street movements. There are no pedestrian accommodations at the intersection. 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.G presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

**Table II.G
Nottingham Road at Colvin Street**

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
Nottingham Road SB	23	17	12	5	3	1	2	5	15
Nottingham Road NB*	29	18	8	5	3	2	2	4	11
Colvin Street EB	35	26	19	7	5	4	2	12	21

*Note – The northbound volume was recorded north of the intersection and is an approximation of the northbound approach volume

There were no traffic volumes provided for the Colvin Street westbound approach; however, it is likely that there is very little traffic on this approach between 10 pm and 7 am, as the road only serves a residential development with connections to many other collector roadways.

As noted above, the northbound volumes were recorded north of the intersection and are comprised of the Nottingham Road northbound through volumes and Colvin Street left turning volumes. Given the relatively low volumes on Colvin Street, it is likely that the majority of the northbound traffic is actually travelling north through the intersection and is a good approximation of the northbound approach volumes.

Also, there is a short stretch of road (Julian Place) that runs between Nottingham Road and Colvin Street west of the intersection 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. Given the placement of the traffic counters, these volumes are not included in the volumes shown in Table II.G. However, given the relatively low traffic volumes in Table II.G, it is likely that these missing volumes would have little impact on the overall approach volumes and would not change the recommendations.

Table II.G illustrates that traffic volumes drop off significantly between the hours of 11 pm and 6 am to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there are two small shopping plazas in the area that generate traffic throughout the day. The two shopping plazas, one right at the intersection and one further north on Nottingham Road, appear not to generate significant volumes of traffic during late night/early morning hours that travel through the intersection given the volumes shown in Table II.G.. The traffic signal would operate on flashing yellow for the Jamesville Road approaches and flashing red for the Colvin Street approach.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation.

H. Thompson Road at Eastern Avenue/Brooklawn Parkway

This is a four-legged intersection which operates as a semi-actuated 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. 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.H presents the traffic volumes on each approach between the hours of 10 pm and 7 am.

**Table II.H
Thompson Road at Eastern Avenue/Brooklawn Parkway**

Approach	10 pm	11 pm	12 am	1 am	2 am	3 am	4 am	5 am	6 am
Thompson Road NB	91	86	57	46	31	25	28	44	95
Thompson Road SB*	98	85	59	70	29	31	42	45	90
Eastern Avenue WB	1	0	1	1	1	3	3	8	29

*Note – The southbound volume was recorded south of the intersection and is an approximation of the southbound approach volume

There were no traffic volumes provided for the Brooklawn Parkway eastbound approach; however, it is likely that there is very little traffic on this approach between 10 pm and 7 am as the road only serves some small office buildings that would generate little or no traffic during the late night/early morning hours.

As noted above, the southbound volumes were recorded south of the intersection and are comprised of the Thompson Road southbound through volumes and left turning volumes from Eastern Avenue and right turning volumes from Brooklawn Parkway. Given the relatively low volumes on Eastern Avenue, it is likely that the majority of the Thompson road southbound traffic is actually travelling south through the intersection and is a good approximation of the Thompson Road southbound approach.

Table II.H illustrates that traffic volumes drop off significantly between the hours of 10 pm and 5 am on Eastern Avenue; however, traffic volumes on Thompson Road remain relatively high until 2 am. From 2:00 am to 5:00 am traffic volumes drop off significantly to the point that there is less than one vehicle per minute traveling through the intersection on any given approach. Review of the area shows that there are not any types of business that could potentially generate large volumes of traffic during the late night/early morning hours. The traffic signal would operate on flashing yellow for the Thompson Road approaches and flashing red for the Eastern Avenue and Brooklawn Parkway approaches.

Prior to any implementation of flashing operation, the accident history of the intersection should be evaluated to determine if there are any prevailing accident patterns that would preclude flashing operation.

CHAPTER III

SUMMARY OF RECOMMENDATIONS

Based on the results of the late night signal analysis of the seven study area intersections, the following recommendations may be considered

❖ General Recommendations

- Prior to the implementation of any type of late night/early morning operations, other than regular operation, an accident analysis should be performed at each intersection to determine if there are accident patterns that would preclude flashing operations.
- Flashing yellow/red operations during late night/early morning hours is the preferred alternative since it will allow the intersection to operate the most efficiently with the least amount of delay. However, if flashing yellow/red operation is not possible, then flashing red/red may be considered an acceptable alternative.

❖ Individual Intersection Recommendations

• **Old Liverpool Road at Eynsford Drive**

- Flashing yellow on Old Liverpool Road and flashing red on Eynsford Drive.
- Hours of operation – 12 am to 5 am

• **Jamesville Road at Woodchuck Hill Road**

- Flashing yellow on Jamesville Road and flashing red on Woodchuck Hill Road.
- Hours of operation – 12 am to 5 am

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

- Flashing yellow on Jamesville Road and flashing red on Randall Road and Pebble Hill Road.
- Hours of operation – 12 am to 6 am

• **South Bay Road at Pine Grove Road**

- Flashing yellow on South Bay Road and flashing red on Pine Grove Road.
- Hours of operation – 12 am to 5 am

• **Jamesville Road at Nottingham Road**

- Flashing yellow on Jamesville Road and flashing red on Nottingham Road.
- Hours of operation – 11 pm to 6 am

- **Nottingham Road at Colvin Street**

- Flashing yellow on Nottingham Road and flashing red on Colvin Street.
- Hours of operation – 11 pm to 6 am

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

- Flashing yellow on Thompson Road and flashing red on Eastern Avenue and Brooklawn Parkway.
- Hours of operation – 2 pm to 5 am