UNWARRANTED TRAFFIC SIGNAL STUDY

CITY OF BINGHAMTON
BROOME COUNTY, NY

June 2016

City of Binghamton
Restoring The Pride

Binghamton City Hall
38 Hawley Street
Binghamton, NY 13901

BMTS

60 Hawley Street
PO Box 1766
Binghamton, NY 13901

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CONTENTS

APPENDICES

INTRODUCTION

The City of Binghamton requested assistance from the Binghamton Metropolitan Transportation Study (BMTS) in 2011 regarding the analysis of its current inventory of traffic signals. Traffic signal maintenance represents a significant cost, and as such, the City requested that BMTS perform a study to determine signal locations that no longer meet federal warrants. The goal of this study will be to identify traffic signals within the City for removal based on a variety of criteria in an effort to improve traffic operation, increase safety, and reduce maintenance costs.

In March 2012, BMTS adopted its current Unified Planning Work Program (UPWP).The UPWP identifies the transportation planning activities that are to be undertaken in the BMTS metropolitan planning area for the State Fiscal Years 2012-2013. The Unwarranted Traffic Signal Study was one of the tasks included in this plan. This project is being carried over from the 2011-2012 UPWP due to staff vacancies.

ANALYSIS CRITERIA

The Federal Highway Administration (FHWA) publishes the Manual on Uniform Traffic Control Devices (MUTCD). This publication defines the standards for traffic control devices on all public streets in the United States. It is published under 23 Code of Federal Regulations (CFR), Part 655, Subpart F. For the purposes of this study the MUTCD 2009 Edition, will be used as the basis for all analysis pertaining to traffic signal use and removal in accordance with federal regulation.

TRAFFIC CONTROL SIGNAL ROLE AND FUNCTION

A traffic control signal's primary role is to assign the right-of-way to the various traffic movements at a given intersection. When properly used, traffic control signals are valuable devices for the control of vehicular and pedestrian traffic. The MUTCD describes the advantages and disadvantages of signals as follows:

"A. They provide for the orderly movement of traffic.
B. They increase the traffic-handling capacity of the intersection if:
1. Proper physical layouts and control measures are used, and
2. The signal operational parameters are reviewed and updated (if needed) on a regular basis (as engineering judgment determines that significant traffic flow and/or land use changes have occurred) to maximize the ability of the traffic control signal to satisfy current traffic demands.
C. They reduce the frequency and severity of certain types of crashes, especially right-angle collisions.
D. They are coordinated to provide for continuous or nearly continuous movement of traffic at a definite speed along a given route under favorable conditions.
E. They are used to interrupt heavy traffic at intervals to permit other traffic, vehicular or pedestrian, to cross."

In addition to these functions, traffic control signals provide emphasis at hazardous locations, control some types of railroad-highway grade crossings, control travel lane use, and supplement certain signs. With the wide variety of functions and roles that traffic control signals perform, the MUTCD has necessarily provided strong and direct guidance for their justification and use.

TRAFFIC CONTROL SIGNAL WARRANTS

The MUTCD states that the selection and use of traffic control signals shall be based on an engineering study. The MUTCD identifies minimum situational warrants that must exist at a given location before a traffic control signal can be considered. The MUTCD further states that even in situations where minimum warrants are met, an engineering study should still be performed to confirm that the installation of a signal would improve overall safety or operation of the intersection. The nine warrants for traffic signal installation identified by the MUTCD are as follows:

Warrant 1, Eight-Hour Vehicular Volume

Warrant 2, Four-Hour Vehicular Volume

Warrant 3, Peak Hour

Warrant 4, Pedestrian Volume

Warrant 5, School Crossing

Warrant 6, Coordinated Signal System

Warrant 7, Crash Experience

Warrant 8, Roadway Network

Warrant 9, Intersection near a Grade Crossing

Refer to the MUTCD 2009 Edition, Chapter 4C for further explanation of these warrants and how they are applied. Traffic control signals that do not meet at least one of these warrants often have a variety of operational and safety related shortcomings that should be addressed.

UNWARRANTED TRAFFIC SIGNALS

The MUTCD addresses unnecessary traffic control signals as follows:

“Traffic control signals are often considered a panacea for all traffic problems at intersections. This belief has led to traffic control signals being installed at many locations where they are not needed, adversely affecting the safety and efficiency of vehicular, bicycle, and pedestrian traffic. Traffic control signals, even when justified by traffic and roadway conditions, can be ill-designed, ineffectively placed, improperly operated, or poorly maintained. Improper or unjustified traffic control signals can result in one or more of the following disadvantages:

A. Excessive delay,
B. Excessive disobedience of the signal indications, i.e. running red lights
C. Increased use of less adequate routes as road users attempt to avoid the traffic control signals,
D. Significant increases in the frequency of collisions (especially rear-end collisions).”

Traffic control signals that have been in place for many years may not meet the warrants outlined by the current edition of the MUTCD. This may be due to demographic change in the area, altered traffic patterns, or updated warrants that are based on a more modern understanding of traffic operation. Locations where signals no longer meet warrants may represent safety hazards to the traveling public, may be causing undue delay for motorists and

require ever scarcer maintenance funds to ensure their proper operation. Due to the many factors that decide if a signal is warranted, and beneficial, it is necessary to study each signal location using the most up to date methodology and understanding of traffic analysis.

TRAFFIC SIGNAL STUDY METHODOLOGY

The City of Binghamton maintains 82 traffic signals. BMTS performed a preliminary analysis on these signals to determine which intersections merited further investigation for removal. Thirty five traffic control signals were selected for further investigation. Refer to table 1.1 for a complete list of the intersections studied. After a finalized list of traffic control signals was developed, BMTS staff compiled pertinent data for warrant analysis.

BMTS conducts traffic counts for all signalized intersections within its metropolitan planning area on a three year reoccurring cycle. The counts are conducted by BMTS staff during the morning (AM) and evening (PM) peak hour period. These time periods typically represent the maximum short term traffic volumes for a given intersection. The peak periods are therefore a pertinent analysis window when determining if the intersection meets signal warrants and is operating properly. The traffic counts were analyzed using multiple traffic analysis software packages. SYNCHRO 8 along with its plugin module Warrants 8, were used to analyze the operation and warrants at all thirty five City of Binghamton traffic signals included in this study. These software packages are based on traffic analysis methods from the 2010 Highway Capacity Manual (HCM), developed by the Transportation Research Board. The HCM is the accepted reference for analyzing traffic operations in the United States.

Vehicular and pedestrian traffic volumes are just four of the nine warrants for signal installation. The remaining five warrants are based on intersection location, classification, accident history, and the proximity of certain trip generators, e.g. schools. BMTS staff evaluated each intersection in the study to determine if it met the criteria for any of the remaining signal warrants. BMTS received input from City officials as well as the City of Binghamton Police Department pertaining to intersection history, and operations. Site visits were conducted at key intersections to observe intersection traffic operation. The New York State Accident Information Location System (ALIS) was used to examine accident history over a three year period for each intersection included in the study.

TRAFFIC SIGNAL REMOVAL RECOMMENDATIONS

Table 1.1 contains BMTS recommendations for signal removal based on the analysis described in this document. Twenty four signals have been recommended for removal. These signals do not meet traffic control signal warrants previously described. Refer to Appendix C for a map of recommended signal removals.

Table 1.1 Traffic Signal Removal Recommendations

Description	Layout	Warrants 2009	Recommendation
Bevier/Brownson	T	NO	Signal should be removed.
Broad/E Frederick	Four Way	NO	Signal should be removed.
Chenango/Robinson	T	NO	Signal should be removed.
Court/Carroll	Four Way	NO	Signal should be removed.
Court/Fayette	Four Way	NO	Signal should be removed.
Court/State	Four Way	YES	Retain the signal.

Table 1.1 Traffic Signal Removal Recommendations (continued)

Description	Layout	Warrants 2009	Recommendation
BC Health Dept.	T	NO	Signal should be removed.
Henry/Carroll	Four Way	NO	Signal should be removed.
Henry/State	Four Way	NO	Signal should be removed.
Henry/Water	Four Way	NO	Signal should be removed.
Henry/Fayette	Four Way	NO	Retain the signal to accommodate stadium traffic.
Leroy/Laurel	Four Way	NO	Signal should be removed.
Leroy/Beethoven	Four Way	NO	Signal should be removed.
Leroy/Chestnut	Four Way	NO	Signal should be removed.
Leroy/St John	Four Way	NO	Signal should be removed.
Leroy/Oak	Four Way	NO	Signal should be removed.
Lewis/State	Four Way	YES	Retain the signal.
Prospect/Mygatt	Four Way	NO	Signal should be removed.
Riverside/Beethoven	Four Way	YES	Retain the signal due to proximity to Hospital.
Riverside/Kneeland	Four Way	YES	Retain the signal due to proximity to Hospital.
Riverside/Murray	Four Way	NO	Signal should be removed.
Riverside/Oak	Four Way	YES	Retain the signal.
Robinson/Broad	Four Way	NO	Retain the signal due to accident history.
Robinson/Fairview	Four Way	NO	Signal should be removed.
Robinson/Griswold	Four Way	NO	Signal should be removed.
Robinson/Mason	Four Way	NO	Signal should be removed.
Robinson/Moeller	Four Way	NO	Signal should be removed.
Schubert/Beethoven	Four Way	NO	Signal should be removed.
Tompkins/Jackson	Four Way	YES	Retain the signal.
Tompkins/Webster	Four Way	YES	Retain the signal.
Vestal/Mary	Four Way	NO	Signal should be removed.
Vestal/Mill	Four Way	NO	Retain the signal due to proximity to school.
Vestal/Tremont	Four Way	NO	Signal should be removed.
State/Eldredge	Four Way	NO	Signal should be removed.
E Fredrick St/Moeller	Four Way	NO	Retain the signal due to proximity to school.

TRAFFIC SIGNAL REMOVAL PROCEDURE

Per the MUTCD, traffic signal removal should be accomplished using the following steps:

A. Determine the appropriate traffic control to be used after removal of the signal.
B. Remove any sight-distance restrictions as necessary.
C. Inform the public of the removal study.
D. Flash or cover the signal heads for a minimum of 90 days, and install the appropriate stop control or other traffic control devices.

E. Remove the signal if the engineering data collected during the removal study period confirms that the signal is no longer needed.

STOP CONTROL RECOMMENDATIONS

If traffic signals are removed per recommendation, the intersections in question will become stop controlled through signage. The preferred stop condition for the majority of intersections is known as Two Way Stop Control (TWSC). This configuration allows traffic on the higher volume, or major, road to flow uncontrolled while traffic on the intersecting minor street is controlled by stop sign. Where there is a T-intersection, a One Way Stop Control (OWSC) is preferred and will also allow traffic on the higher volume road to flow uncontrolled. In some cases it is necessary to provide stop control measures on all legs of an intersection. This condition is known as All Way Stop Control (AWSC). The MUTCD indicates that an engineering study should be used to justify an AWSC. The following items are considered when determining suitability of an AWSC intersection:

- Traffic Volumes
- Accident History
- Pedestrian Volume
- Sight distance
- Intersection Operation

Table 1.2 contains recommendations for appropriate traffic control devices for intersections undergoing signal removal. These recommendations are based on the AWSC criteria shown above.

Table 1.2 Intersection Traffic Control Recommendations

Description	Major Street	Layout	Recommended Stop Condition	Accident History	Traffic Volume Warrant
Bevier/Brownson	Bevier	T	OWSC	N	N
Broad/E Frederick	Broad	Four Way	TWSC	N	N
Chenango/Robinson	Robinson	T	OWSC	N	N
Court/Carroll	Court	Four Way	TWSC	N	N
Court/Fayette	Court	Four Way	TWSC	N	N
BC Health Dept.	Front	T	OWSC	N	N
Henry/Carroll	Henry	Four Way	TWSC	N	N
Henry/State	Henry	Four Way	TWSC	N	N
Henry/Water	Henry	Four Way	TWSC	N	N
Leroy/Laurel	Leroy	Four Way	Intersection Island	N	N
Leroy/Beethoven	Beethoven	Four Way	Intersection Island	Y	N
Leroy/Chestnut	Leroy	Four Way	Intersection Island	N	N
Leroy/St John	Leroy	Four Way	Intersection Island	N	N
Leroy/Oak	Leroy	Four Way	Intersection Island	N	N
Prospect/Mygatt	Prospect	Four Way	TWSC	N	N
Riverside/Murray	Riverside	Four Way	TWSC	N	N
Robinson/Fairview	Robinson	Four Way	TWSC	N	N
Robinson/Griswold	Robinson	Four Way	TWSC	N	N
Robinson/Mason	Robinson	Four Way	TWSC	N	N

Table 1.2 Intersection Traffic Control Recommendations (continued)

Description	Major Street	Layout	Recommended Stop Condition	Accident History	Traffic Volume Warrant
Robinson/Moeller	Robinson	Four Way	TWSC	N	N
Schubert/Beethoven	Beethoven	Four Way	TWSC	N	N
Vestal/Mary	Vestal	Four Way	AWSC	Y	N
Vestal/Tremont	Vestal	Four Way	TWSC	N	N
State/Eldredge	State	Four Way	TWSC	N	N

OWSC – One Way Stop Control, TWSC – Two Way Stop Control,
AWSC – All Way Stop Control, Intersection Island – Refer to Traffic Calming Recommendations

LEROY STREET TRAFFIC CALMING RECOMMENDATIONS

Leroy Street is classified as a local road within the City and is residential in nature. It runs parallel with two urban arterials in Riverside Drive and Main Street and may act as a reliever street in the event of heavy traffic on either. BMTS is recommending removal of five traffic control signals on Leroy Street. With the removal of these signals, and the recommended Two Way Stop Control being placed, traffic along Leroy will be forced to stop less frequently. This may lead to higher operating speeds. Parking is currently permitted on both side of Leroy Street and minimum widths exist in these areas. Maintaining safe operating speeds for motorists is critical to safety in this corridor. The Institute of Transportation Engineers (ITE) publication *Traffic Calming, State of the Practice* lists neighborhood intersection islands as the most effective way to reduce operating speeds at locations warranting TWSC or AWSC. A central island is placed in the intersection in lieu of stop signs, and thus forces drivers to slow down and navigate the intersection in a counter clockwise direction. These intersection measures eliminate the need for AWSC and TWSC as well as reducing control delay at a given intersection. They also offer opportunity for the addition of green space and landscaping in this residential portion of the City. Most importantly these measures are safer than TWSC and AWSC intersections. ITE found that intersection islands reduced intersection collisions by 70% when compared to traditional stop control. Intersection islands also cost less than signalized intersections. Initial construction costs range from $10,000-$25,000 per intersection, compared to $200,000 and more for a typical traffic signal replacement. This measure is recommended for the intersections at Leroy and Laurel, Beethoven, Chestnut, St. John and Oak Street. Refer to Appendix E for examples of neighborhood intersection islands.

Several other methods for traffic calming might also be employed. These include additional pavement markings such as a centerline stripe and lane edge stripes. Narrowing travel lanes tends to reduce operating speed. Narrowing intersection approaches through the use of bulbouts tends to lower operating speed as well as increase pedestrian safety. Intersection warning signage might be appropriate at higher volume intersections.

STUDY CONCLUSION

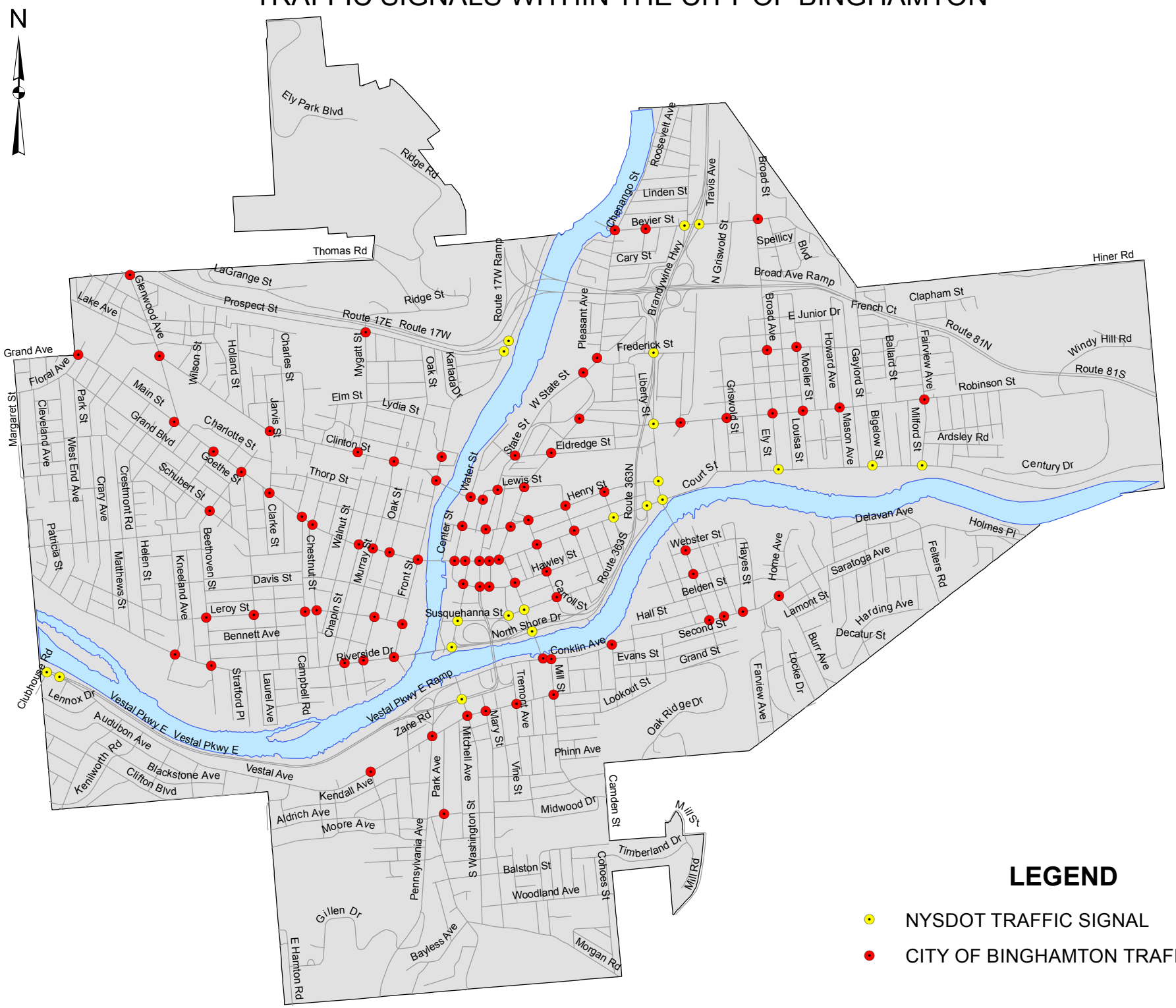
Traffic control signals require maintenance, electrical power, and have a limited service life. The 2012 Traffic Signal Maintenance Consolidation Study conducted by BMTS lists the annual maintenance requirement for each signal as approximately 50 hours. The removal of the recommended traffic control signals would save City personnel approximately 1,200 hours per

year of preventive and responsive maintenance labor. This would allow City staff to direct preventive maintenance efforts to the remaining warranted traffic control signals. Removing the recommended 24 signals would save approximately $14,400 per year in electrical operating costs. The Transportation Research Board lists the estimated service life of various components of a traffic control signal as between 1.4 and 24.6 years. These components include bulbs, signs, signal heads, controller cabinets, detector loops etc. It is costly to continue to maintain traffic control signals, particularly those that are unwarranted and inefficient. The City has the justification based on this engineering study to remove the recommended signals and in the process make more efficient use of public funds and provide safer and more efficient intersections within the City of Binghamton.

Appendix A

City of Binghamton Traffic Signals

TRAFFIC SIGNALS WITHIN THE CITY OF BINGHAMTON



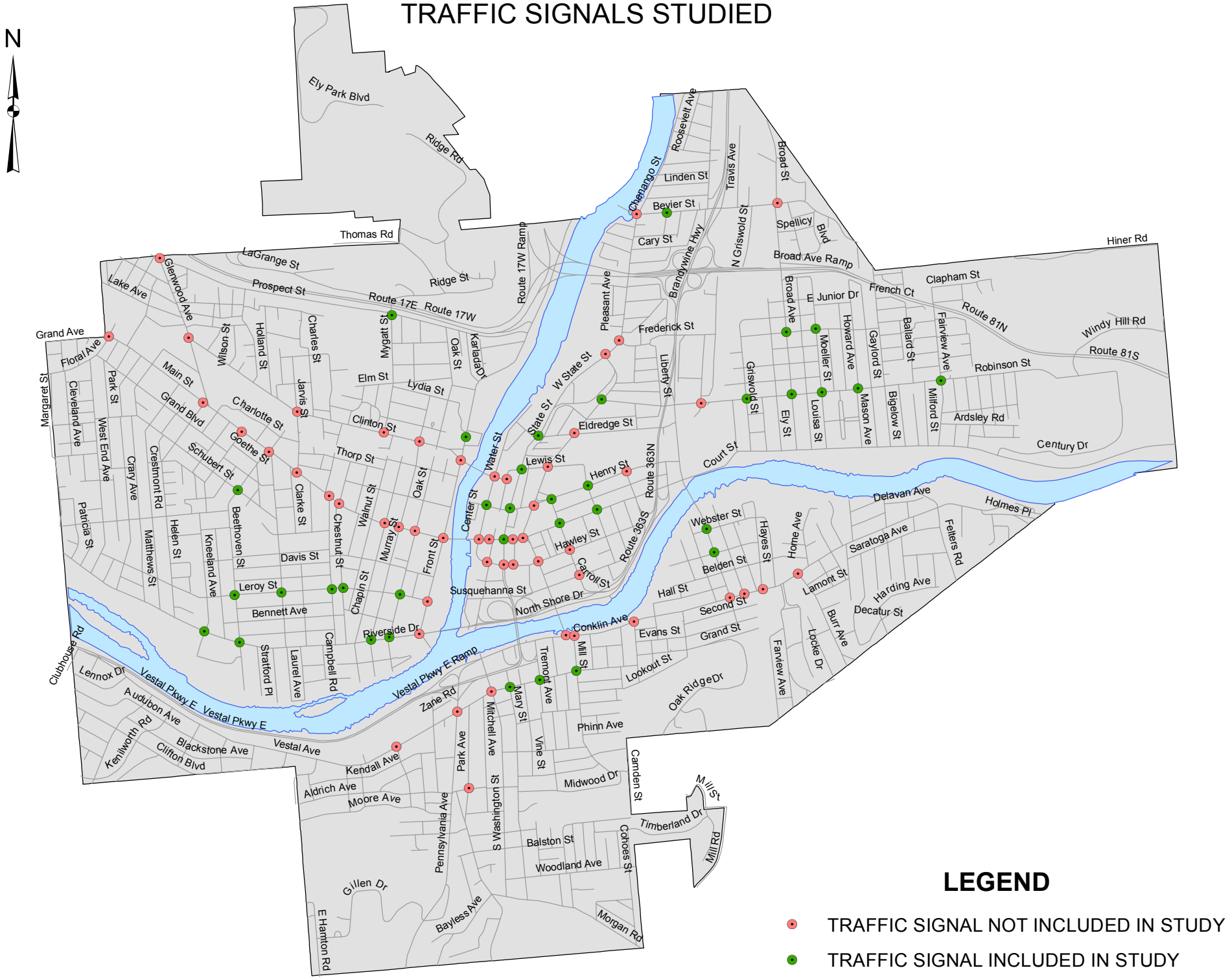
LEGEND

- NYSDOT TRAFFIC SIGNAL
- CITY OF BINGHAMTON TRAFFIC SIGNAL

Appendix B

Traffic Signals Studied

TRAFFIC SIGNALS STUDIED



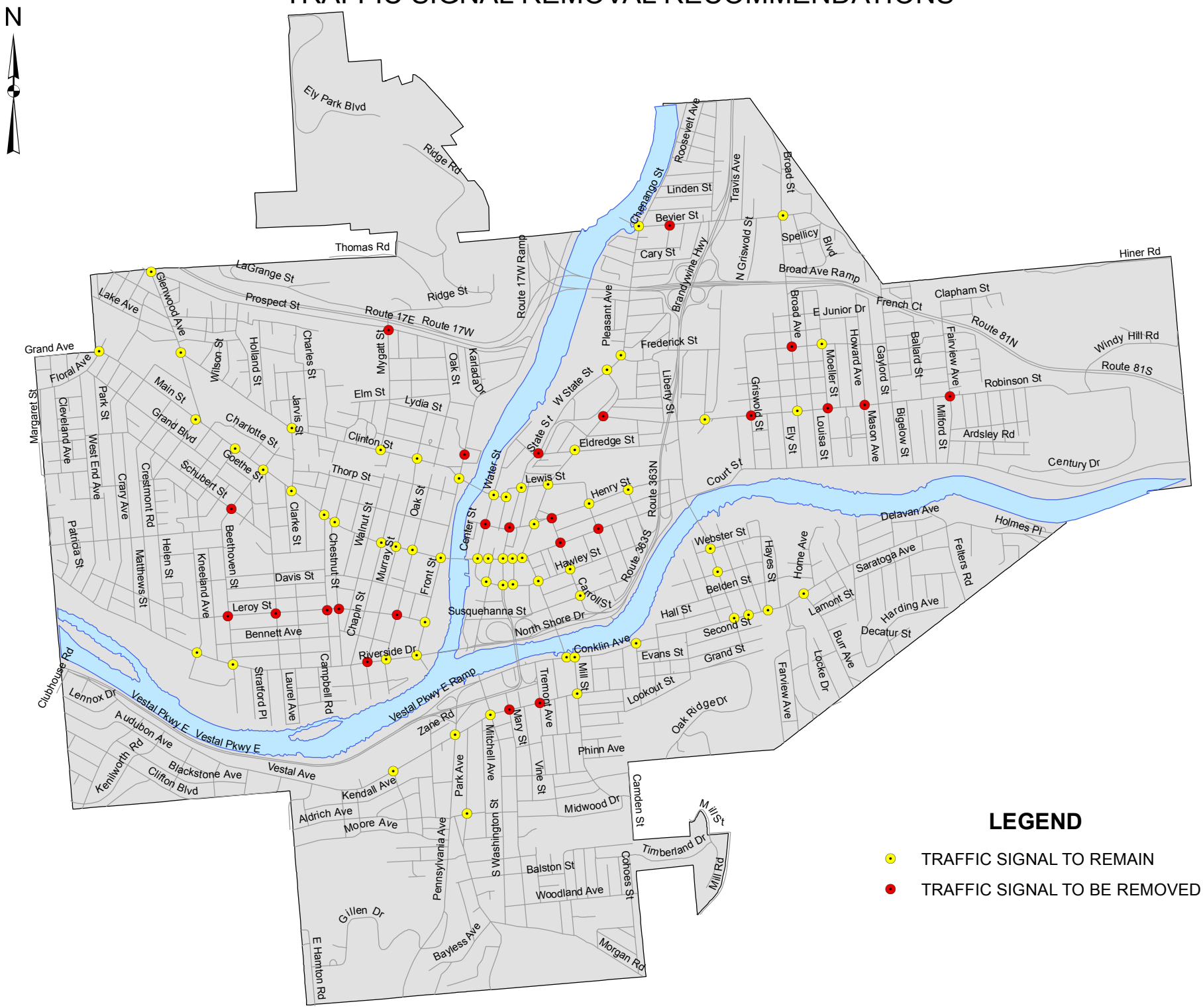
LEGEND

- TRAFFIC SIGNAL NOT INCLUDED IN STUDY
- TRAFFIC SIGNAL INCLUDED IN STUDY

Appendix C

Traffic Signal Removal Recommendations

TRAFFIC SIGNAL REMOVAL RECOMMENDATIONS



Appendix D

Emergency Vehicle Traffic Signal

An emergency-vehicle traffic control signal is a special traffic control signal that assigns the right-of-way to an authorized emergency vehicle. An emergency-vehicle traffic control signal may be installed at a location that does not meet other traffic signal warrants such as at an intersection or other location to permit direct access from a building housing the emergency vehicle.

According to MUTCD, “The following size signal indications should be used for emergency-vehicle traffic control signals: 12-inch diameter for steady red and steady yellow circular signal indications and any arrow indications, and 8-inch diameter for green or flashing yellow circular signal indications.” MUTCD also mentions that a sign should also be used to let people know that this is an “Emergency Signal”. As described in MUTCD, “An “EMERGENCY SIGNAL” sign shall be mounted adjacent to a signal face on each major street approach. If an overhead signal face is provided, the EMERGENCY SIGNAL sign shall be mounted adjacent to the overhead signal face.”

Fig: City Hall Fire Station (On State Street)

The signal on State Street, in front of City Hall Fire station is operating on flashing yellow mode. But there is no sign there. There should be an “Emergency Signal” sign adjacent to the signal to comply with MUTCD. Since this is a mid-block signal, it should be checked if it follows the criteria below as suggested in MUTCD-

A. The signal indication, between emergency-vehicle actuations, shall be either green or flashing yellow. If the flashing yellow signal indication is used instead of the green signal indication, it shall be displayed in the normal position of the green signal indication, while the steady red and steady yellow signal indications shall be displayed in their normal positions.

B. When an emergency-vehicle actuation occurs, a steady yellow change interval followed by a steady red interval shall be displayed to traffic on the major street.

C. A yellow change interval is not required following the green interval for the emergency-vehicle driveway.

Appendix E

Neighborhood Intersection Islands


YIELD
ALL WAY
YIELD


YIELD
ALL WAY


Google