# Traffic Signal Evaluation Study

In

Chemung County,

Village of Elmira Heights,

and Village of Horseheads

Prepared for:

Elmira-Chemung Transportation Council

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**June 20, 2012**

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# Acknowledgements

The time and input from the Project Advisory Group provided the foundation and guidance for this study is greatly appreciated. The Project Advisory Group members include:

| | | |
|---|---|---|
| **Andrew Avery** | Commissioner | Chemung County Department of Public Works |
| **Jay Schissell** | Director | Elmira-Chemung Transportation Council |
| **Jean Cazoria** | Superintendent | Village of Elmira Heights Street Department |
| **Matthew Mustico** | Superintendent | Town of Elmira Highway Department (Representing Village of Horseheads) |
| **David Battle** | Traffic Signal Foreman | City of Elmira Department of Public Works |

In addition, the Project Advisory Group would like to thank the following people for their assistance on this project:

| | | |
|---|---|---|
| **Paul McAnany** | Acting Regional Traffic Engineer | NYSDOT Region 6 |
| **Marty Butler** | Traffic Signal Engineer | NYSDOT Region 6 |

*Provided input and insight on State traffic signal systems and the permit signals process.*

**Michael Perry** Transportation Analyst Elmira-Chemung Transportation Council
*Provided the accident summaries for all 25 signal locations.*

**Richard Vary** Engineer City of Elmira/Chemung County
*Provided the GIS mapping and coverage areas for this project.*

Appendix G includes the Project Advisory Group's meeting minutes.

# I. Study Objectives

Economic development and sustainability of an area is strengthened by a transportation system that facilitates movement of goods and services, which can increase area-wide growth. A well maintained, mechanically consistent and integrated traffic signal system along urban arterials and collectors often results in increased capacity and safety of a roadway network.

The goal of this Traffic Signal Evaluation Study is to develop a plan for upgrading Chemung County traffic signals with the objective of improving the transportation network to support economic development and sustainability. In March 2000, a Traffic Signal Study was completed for the City of Elmira. The objective of the City of Elmira study supported improvement of Chemung County's transportation network through upgrades to traffic signals and traffic signal network communications. This Traffic Signal Evaluation Study continues that effort.

**Study Objectives:**

- **Conduct an inventory of 25 traffic signal locations in Chemung County, Village of Elmira Heights, and Village of Horseheads.**
- **Identify obsolete equipment for upgrade.**
- **Review operations and safety of intersections, assessing compliance with the Manual of Uniform Traffic Control Devices and industry standards of practice for improved driver, bicycle, and pedestrian safety.**
- **Examine needs for traffic signals at each intersection.**
- **Develop recommendations for upgrading traffic signals and communication network with an implementation program developed to obtain funding.**
- **Prioritize recommendations for budgetary and funding purposes.**

# II. Study Scope

Chemung County is located in the Southern Tier of New York State. The study area encompasses several population centers; the City of Elmira, the Village of Elmira Heights, the Village of Horseheads and the Towns surrounding these municipalities, including the Town of Big Flats in the vicinity of the Arnot Mall and the Elmira-Corning Regional Airport.

This study evaluated 23 signalized intersections and 2 driver feedback sign locations in Chemung County, as identified in the **Signal Locations** list (**Provided on the following page**) and illustrated in the **Intersection Location Map, Figure 1.** The project workflow for this study included the inventory of existing traffic signal equipment/systems and the development of an improvement implementation program to meet the study objectives.

## TRAFFIC SIGNAL EVALUATION STUDY
## SIGNAL LOCATIONS

**Chemung County and New York State Department of Transportation (NYSDOT)**

1. Kahler Rd (County Route 63) & Daniel Zenker Dr (County Route 80)
2. Big Flats Rd (County Route 64) & Tops/Sam's Club Dwy
3. Big Flats Rd (County Route 64) & Chambers Rd (County Route 35) - **NYSDOT**
4. Big Flats Rd (County Route 64) & Lowes Dwy
5. Big Flats Rd (County Route 64) & Target/Best Buy Dwy
6. Big Flats Rd (County Route 64) & Kohl's Dwy
7. Chambers Rd (County Route 35) & Arnot Rd (County Route 75)
8. Chambers Rd (County Route 35) & Arnot Mall Dwy
9. Colonial Dr (County Route 74) & I-86 Exit 51 Ramp - **NYSDOT**
10. Upper Oakwood Ave (County Route 58) & Grand Central Ave (County Route 66)
11. Fairview Rd (County Route 19) & Lake St (County Route 65)
12. East 14th St (County Route 39) & Lake St (County Route 65)
13. East McCanns Blvd & Lake St (County Route 65)
14. Broadway (County Route 79) – North of Sycamore St (*Driver Feedback Sign*)
15. Broadway (County Route 79) & Pennsylvania Ave (County Route 69) - **NYSDOT**
16. Pennsylvania Ave (County Route 69) & Cedar St (County Route 84)
17. South Main St (County Route 28) – South of Curtis St (*Driver Feedback Sign*)

**Village of Horseheads and NYSDOT**

18. Gardner Rd & Westlake St (Flashing Signal)
19. Grand Central Ave & Sayre St (Removed Flashing Signal)
20. Chemung St & Center St
21. Chemung St & Grand Central Ave - **NYSDOT**

**Village of Elmira Heights**

22. Oakwood Ave. & West 13th St
23. East 13th St & Elmwood Ave/Elmira Heights Fire Dept. Firehouse
24. East 13th St & Grand Central Ave
25. Grand Central Ave & East McCanns Blvd

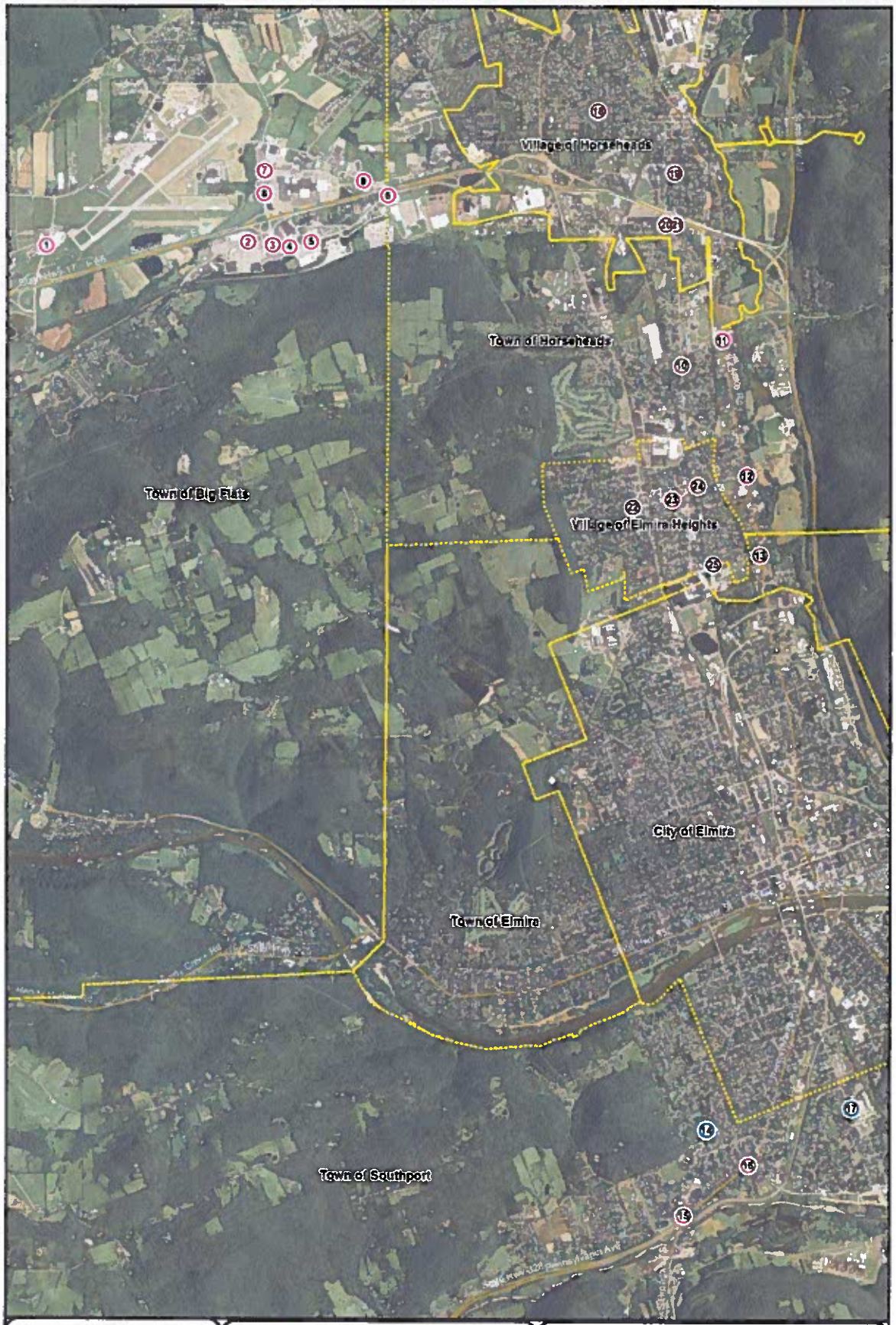


**Figure 1**

Chemung County, Village of Elmira Heights and Village of Horseheads

Traffic Signal Evaluation Study
Interconnect Location Map

# III. Traffic Signal System Inventory and Study Data Collection

## A. Traffic Signal Equipment Inventory

The foundation for this traffic signal evaluation study was an inventory and assessment of the existing traffic signal equipment currently in operation in the study area. The following process was conducted to collect the information needed to evaluate the traffic signal system.

1. Create Computerized Database and correlated GIS Mapping

The following steps were used to create the database:

- Establish spatial coordinates for each study intersection using the center of intersecting streets.
- Determine categories of equipment to inventory.
- Identify specific equipment factors to inventory for each category.
- Build a database that would augment the County's existing GIS using ArcGIS, the same system used by the County.
- Establish a rating system to provide a consistent, objective grading scale to be applied to all intersections.
- Summarize the results of individual category ratings and the overall rating of each intersection.

Traffic Signal Inventory Rating System

The traffic signal inventory rating scheme guided the prioritization of intersection upgrades. This rating scheme evaluated the traffic signal infrastructure categories by Equipment Type and Equipment Condition factors which were given a numerical value, as identified in the Inventory Database Design and Data Dictionary, **Table 1**.

The following traffic signal infrastructure categories were evaluated:

- Controllers/Cabinets
- Power Source
- Traffic Signal Poles
- Detectors
- Signal Heads
- Pullboxes

The Equipment Type inventory ratings involved identification of the specific traffic signal infrastructure category equipment types that were physically present at each study intersection and rating them based on whether or not the equipment type met current design standards or standard industry practices.

For each Equipment Type factor, rating values in multiples of ten where applied. For example:

- The operation portions of the traffic signal, controller/cabinets and traffic signal heads, have a rating up to 50.
- The poles, detectors and pullbox categories have a rating scale up to 40.
- The power category has a rating scale to 30.

The Equipment Condition inventory rating involved assessment of the physical condition of each traffic signal Equipment Type identified at each study intersection and rating them based on the quality of their physical condition, from 1 - Poor quality to 9 - Excellent quality.

For each Equipment Condition factor, a rating was applied using values of one to nine. For example:

- '1 - Poor' = equipment that is beyond the end of its useful life and shows signs of rust, wear, overuse, and or multiple coats of paint.
- '9 - Excellent' = equipment that is relatively new, installed within the last 5+ years.

The values assigned to the specific Equipment Type and Equipment Condition factors were totaled, resulting in a numerical ranking value from 0 to 314; with 0 representing the worst rating and 314 representing the best rating. This rating scheme identified the traffic signals from least to most in need of upgrade.

The inventory and associated ratings where compiled in an equipment inventory database compatible with ArcGIS, the GIS platform currently utilized by the County. The complete Traffic Signal Inventory and Rating is contained in **Appendix A.**

2. Conduct Site Visits

Site visits were conducted at each of the twenty-five signal locations and included:

- Equipment inventories,
- Intersection sketches,
- Photographs of intersection features including the controller, cabinet, and each intersection approach.

The information gathered from the Site Visits was input into the inventory database.

3. Review Existing Traffic Signal Documentation and Records

Limited record plan information was found in the controller cabinets and/or was available for review from New York State or Chemung County. Therefore, aerial images available via the internet from New York State's GIS Clearinghouse Pictometry, Bing Maps and Google Maps were accessed and reviewed for supplemental information.

**Table 1**

**Chemung County, Village of Elmira Heights and Village of Horseheads**
**Traffic Signal Evaluation Study**
**Inventory Database Design and Data Dictionary**

| | Field Name | Description | Type | Width | Valid Values | Notes |
|---|---|---|---|---|---|---|
| GENERAL INFO | ID | Intersection ID | C | 5 | 0-99999 | State CLASS Node ID |
| | CITY ID | City Intersection ID | C | 2 | 0-64 | |
| | INST DATE | Install Date | D | | | Date of install |
| | MOD DATE | Last Modification Date | D | | | Date of mod |
| | INST TYPE | Installation Type | C | 10 | Span, Mast Arm, Both | Span Wire and/or mast arm |
| CONTROLLER/ CABINET INFO | CONT TYPE | Controller Type | C | 11 | Flash, E-M, Bot, State, Micro | |
| | CONT MAKE | Controller Make/Model | C | 15 | Cecuso-Hinde Safetran 179/2070U | |
| | CAB MOUNT | Cabinet Mounting | C | 7 | Pole, Ground | |
| | CAB MAKE | Cabinet Make/Model | C | 15 | C-H, Econ., Marbette, Safetran 179, Model 303, Model 332 | |
| | CONT CONFIG | Controller/Cabinet Configuration | N | 3 | 10=E-M(1 Dial) 20=E-M(3Dial) 30=Sol St 40=Micro 50=NTCIP | |
| | CONT COND | Controller/Cabinet Condition | N | 2 | 1=Poor 3=Fair 5=Good 7=Very Good 9=Excellent | |
| | CONT RATING | Controller/Cabinet Rating | N | 3 | 0-99 | Rating = Config + Condition |
| POLE INFO | POLE WOOD | Pole Qty (wood) | N | 3 | 0-10 | |
| | POLE BEAM | Pole Qty (steel I-Beam) | N | 3 | 0-10 | |
| | POLE SPAN | Pole Qty (steel span) | N | 3 | 0-10 | |
| | POLE MAST | Pole Qty (steel mast) | N | 3 | 0-10 | |
| | POLE PDSIG | Pole Qty (ped signal) | N | 3 | 0-10 | |
| | POLE PDBUT | Pole Qty (ped button) | N | 3 | 0-10 | |
| | POLE TYPE | Pole Type | N | 3 | 10=Wood 20=I-Beam 30=Embedded 40=Anchor Base | |
| | POLE COND | Pole Condition | N | 2 | 1=Poor 3=Fair 5=Good 7=Very Good 9=Excellent | |
| | POLE RATING | Pole Rating | N | 3 | 0-99 | Rating = Type + Condition |
| SIGNAL HEAD INFO | SBALL RED8 | Red Signal Ball Qty (8") | N | 3 | 0-40 | |
| | SBALL YEL8 | Yellow Signal Ball Qty (8") | N | 3 | 0-40 | |
| | SBALL GRN8 | Green Signal Ball Qty (8") | N | 3 | 0-40 | |
| | SBALL RD12 | Red Signal Ball Qty (12") | N | 3 | 0-40 | |
| | SBALL YL12 | Yellow Signal Ball Qty (12") | N | 3 | 0-40 | |
| | SBALL GR12 | Green Signal Ball Qty (12") | N | 3 | 0-40 | |
| | SARRW RD12 | Red Signal Arrow Qty (12") | N | 3 | 0-40 | |
| | SARRW YL12 | Yellow Signal Arrow Qty (12") | N | 3 | 0-40 | |
| | SARRW GR12 | Green Signal Arrow Qty (12") | N | 3 | 0-40 | |
| | PBG WORD | Ped Signal Qty (Words) | N | 3 | 0-20 | WALK/DONT WALK |
| | PBG SYM | Ped Signal Qty (Symbols) | N | 3 | 0-20 | WALKING PERSON/HAND |
| | PBG FWORD | Ped Sig Qty (FiberOpt Words) | N | 3 | 0-20 | Fiber Optic/WALK/DONT WALK |
| | PBG FSYM | Ped Sig Qty (FiberOpt Symbol) | N | 3 | 0-20 | Fiber Optic/WALKING PERSON/HAND |
| | DSCNT HNGR | Disconnect Hanger Qty | N | 3 | 0-10 | |
| | SIG CONFIG | Signal Section Configuration | N | 3 | 10=All 8" (1 face/approach) 20=Mixed 8" &12" (1 face/approach) 30=All 12" (1face/approach) 40=2 faces/approach (either size) | |
| | SIG COND | Signal Condition | N | 2 | 1=Poor 3=Fair 5=Good 7=Very Good 9=Excellent | |
| | SIG RATING | Signal Sections Rating | N | 3 | 0-99 | Rating = Configuration + Condition |
| POWER INFO | PWR OH | Power Source OH | Bool | 1 | Y/N | |
| | PWR UG | Power Source UG | Bool | 1 | Y/N | |
| | PWR METER | Power Meter | Bool | 1 | Y/N | |
| | METER ID | Power Meter ID Number | C | 10 | 0-9999999999 | |
| | METER ACCT | Meter Account Number | C | 10 | 0-9999999999 | |
| | PWR DSCNT | Power Disconnect | C | 10 | None, Fused, Dis. Bot | |
| | PWR DCODE | Power Disconnect Code | N | 3 | 00=Direct Wired 10= Fused 20=Disconnect Box | |
| | PWR COND | Power Source Condition | N | 2 | 1=Poor 3=Fair 5=Good 7=Very Good 9=Excellent | |
| | PWR RATING | Power Rating | N | 3 | 0-99 | Rating = Disconnect Code + Condition |
| DETECTOR INFO | DET VLOOP | Vehicle Detector Qty (Loop) | N | 3 | 0-20 | |
| | DET VMICRO | Vehicle Detector Qty (Microwave) | N | 3 | 0-10 | |
| | DET VSONIC | Vehicle Detector Qty (Sonic) | N | 3 | 0-10 | |
| | DET VMAG | Vehicle Detector Qty (Mag) | N | 3 | 0-10 | |
| | DET VCOV | Vehicle Detector Coverage | C | 5 | None, Semi, Full | |
| | DET PED | Pedestrian Detector Qty | N | 3 | 0-10 | |
| | DET PREMPT | Emer. Pre-empt | Bool | 1 | Y/N | |
| | DET CONFIG | Veh/Ped Detector Configuration | N | 3 | 00=No Detection 10=Semi-Act: no peds 20=Semi-Act w/peds 30=Full Act no peds 40= full Act w/peds | + 10 if no sidewalk |
| | DET COND | Veh/Ped Detector Condition | N | 2 | 1=Poor 3=Fair 5=Good 7=Very Good 9=Excellent | |
| | DET RATING | Veh/Ped Detector Rating | N | 3 | 0-99 | Rating = Configuration + Condition |
| PULLBOX INFO | PULL SMALL | Pullbox Qty (Small) | N | 3 | 0-10 | small pullbox is 30" diameter and smaller |
| | PULL BIG | Pullbox Qty (Large) | N | 3 | 0-10 | large pullbox is larger than 30 |
| | CONDUIT X | Conduit Cross (# legs) | N | 3 | 0-10 | Number of streets conduit crosses at intersection |
| | PULL CONFG | Pullbox Configuration | N | 3 | 10=No Pullboxes 20=2 or less 30=3 to 4 40=More than 4 | |
| | PULLCOND | Pullbox Condition | N | 2 | 1=Poor 3=Fair 5=Good 7=Very Good 9=Excellent | |
| | PULL RATING | Pullbox Rating | N | 3 | 0-99 | Rating = Configuration + Condition |
| | TOTAL RATING | Overall Rating | N | 3 | 0-294 | Rating = Sum(Controller, pole, Signal, Power, Det, Pullbox Ratings); -50 poor condition-need's replacement ASAP -290 excellent condition (new installation) |

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## B. Existing Shared Services and Cross-Functioning

The municipalities of Chemung County and the NYSDOT have a long-standing, informal working relationship sharing traffic signal support services, as documented in the "County Highway Services Study" dated December 2010. Most of the traffic signal equipment Countywide, reflects NYSDOT standards; therefore, NYSDOT expertise has been utilized to assist with the operation and maintenance of the traffic signals owned, operated and maintained by the municipalities.

Also, Chemung County DPW, as well as the Villages of Elmira Heights and Horseheads, utilize the City of Elmira DPW traffic signal crew and equipment to operate and maintain their respective traffic signals.

The traffic signal shop is located in the City DPW facility on Linden Place Extension. It houses work space for equipment testing, repair and equipment inventory and spare parts. Additionally, it houses office space and files containing maintenance records and schematics for most of the County intersections.

The City also stores larger items such as traffic signal heads and poles at the DPW facility and has a lift truck for routine traffic signal maintenance. The City has an electrician on staff with assistance as needed from the DPW staff; however, the personnel divide their time between traffic signals and other City electrical tasks, like street lighting and building electrical maintenance duties. More involved maintenance work is subcontracted to an electrical contractor.

## C. Existing Communication and Coordination Systems

The City of Elmira DPW and NYSDOT have separate, distinct communication and coordination schemes in their respective traffic signal systems. The City has a central computer system with fifty traffic signals connected to the DPW office building via a fiber optic communication backbone. **Figure 2** depicts the City's Existing Interconnect network for the traffic signal system.

NYSDOT has a hardwire interconnect for the traffic signals controlling the I-86 frontage roads and adjacent intersections in the vicinity of Center Street and Grand Central Avenue in the Village of Horseheads. The system has an on-street master controller connected to each traffic signal and the master controller is connected to the NYSDOT Traffic Signal Maintenance Shop on Chemung Street. Two study intersections are part of this interconnected traffic signal system.

## D. Traffic Volumes for Traffic Signal Warrant Assessment

Traffic volume data was obtained from the NYSDOT local road database using the on-line "Traffic Data Viewer". The information available through the Traffic Data Viewer covered many of the County and Town roads within the project area road network. Additional traffic volume information for the commercial driveways in the Town of Big Flats commercial area was obtained from intersection turning movement counts from the "Big Flats-Horseheads Transportation Network Planning Study" transportation corridor study. The traffic volume information assumed for each intersection is provided in **Appendix B**.

## E. Accident Summaries for Traffic Signal Locations

The Elmira-Chemung Transportation Council provided study intersection accident summaries for the latest three-year time period. Accident screening of the study intersections is summarized in the Accident Analysis Traffic Data and Accident Summary Tables provided in **Appendix C.**

## F. Operational Observations

As part of the traffic signal inventory field work, traffic operations were observed for readily apparent operational issues at each intersection. This included how well traffic moved through the intersection, noted traffic conflicts, and peculiar geometric features that may be atypical to current standards of practice. These observations are included in the Intersection Inventory Summary provided in **Appendix D.**

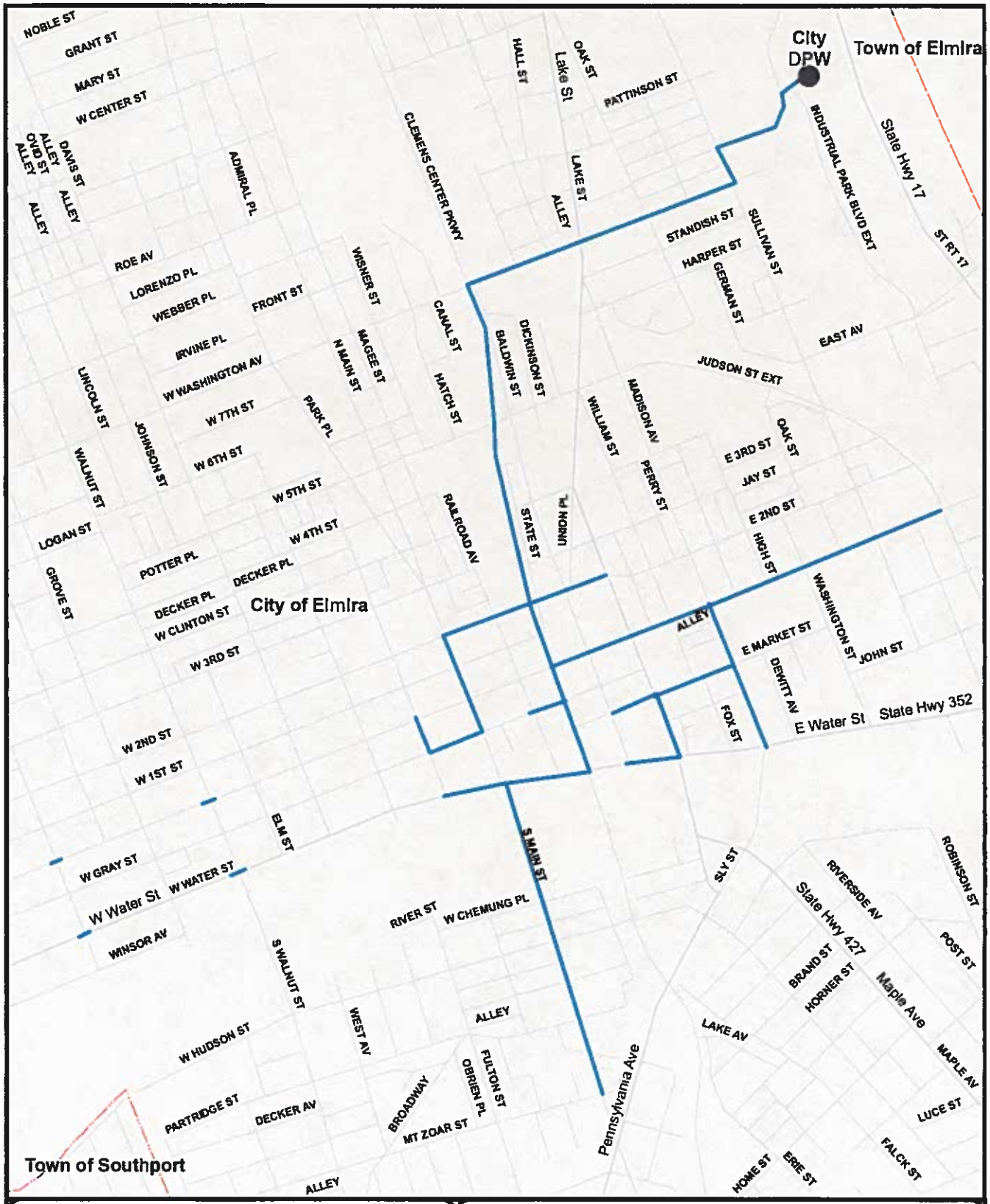


**Figure 2**

Chemung County, Village of Elmira Heights and Village of Horseheads

Traffic Signal Evaluation Study
Existing Interconnect

Path: H:\Projects\111008-Chemung_Cnty_Signal_Eval\GIS\MXD\vFigure Interconnect existing.mxd

# IV. Traffic Signal System Evaluation

## A. Traffic Signal Assessment and Evaluation

1. Traffic Signal Prioritization

Using the rating scheme as discussed on page 4, a ranking of Poor, Fair, Good or Very Good was determined based on the following:

*Poor* - a score less than 190
*Fair* - a score between 190 and 230
*Good* - a score between 230 and 260
*Very Good* - a score over 260

The resulting ranking was called the **First Rule**, which was based primarily on the condition of the signal and the degree to which the signal met locally observed standards.

However, it was noted that newer controllers installed at an older signal system skewed the ranking, therefore, it was determined that a **Second Rule** was necessary to account for general age of the overall installation as follows:

*Poor* - age over 25 years
*Fair* - age between 15 and 25 years
*Good* - age between 5 and 15 years
*Very Good* - less than 5 year

To correlate the two rules, a composite or program ranking was developed using condition and age in terms of Poor, Fair, Good or Very Good as follows:

*Poor* - scored a 1
*Fair* - scored a 2
*Good* - scored a 3
*Very Good* - scored a 4

Examples of First and Second Rule correlation and composite rankings:

- The intersection of Chemung Street & Central Avenue rated Very Good under the First Rule and Very Good under the Second Rule; therefore its composite score was 4 + 4 = 8.
- The intersection of Sayer Street & Grand Central Avenue rated Poor under the First Rule and Poor under the Second Rule; therefore its composite score was 1 + 1 = 2.

**Composite rankings are defined as follows:**

- 2 = Poor
- 3-4 = Fair
- 5-6 = Good
- 7-8 = Very Good

The composite rankings where used as a guide for developing the upgrade program discussed in **Section** VI of this report.

The Program Ranking Summary table in **Appendix E** provides the study intersection rankings.

2. Communication and Coordination Systems

The City's fiber optic system enables monitoring of the traffic signals on the network. The system is capable of adding additional devices in the future, such as Closed Circuit Television (CCTV) cameras, to enhance traffic management capabilities. The City utilizes 'Streetwise' software as the central computer software to monitor and coordinate the traffic signals on the network. The traffic signal timings and parameters of each controller are maintained in the City's database.

NYSDOT interconnect provides monitoring and remote adjustment of traffic signal timings, as part of a traffic signal system, on frontage roads north and south of the Viaduct, and on Chemung Street. NYSDOT anticipates expanding or adding other networks in the area as projects develop and funding becomes available. NYSDOT also uses 'Streetwise' software to monitor and coordinate traffic signals on the interconnected system. The traffic signal timings and parameters of the controllers are stored in a statewide database maintained by the NYSDOT Main Office in Albany.

Differences in these two databases may create minor operational glitches in the traffic signals that overlap between these two agencies.

## B. Traffic Signal Operation and Maintenance

The operation and maintenance of traffic signals by the City, as a shared service between the various agencies, is considered an appropriate and encouraged use of resources for the 103 non-NYSDOT traffic signals located throughout Chemung County; 80 in the City, 4 in the Village of Horseheads, 4 in the Village of Elmira Heights and 15 in Chemung County.

## C. Traffic Signal Warrant Review

NYSDOT traffic count data for the local roadways was used to estimate traffic volumes at the study intersections. Many traffic signal warrants are based solely on traffic volumes. To assess if warrants were traffic volume based, the highest 1-hour, 4-hour and 8-hour traffic volumes were extracted from available count information. At locations where only AADT volumes were available, percentages were applied to the AADT volume to estimate the peak hour volume (approximately 9%), the 4-hour volume (approximately 34%), and the 8-hour volume (approximately 60%).

For the commercial driveways, peak-hour volumes from the driveway count sheet provided from the "Big Flats-Horseheads Transportation Network Planning Study" were used. A peak hour percentage of the AADT was applied to the driveway volumes to estimate the 4-hour driveway volume (factor of 3.78) and 8-hour driveway volume (factor of 6.67).

Volumes were compared to the MUTCD threshold volumes for Peak Hour, 4-Hour, and 8-Hour Traffic Signal Warrants.

The following intersections did not meet the volume thresholds for one of the intersection streets:

- *#1 Kahler Road/Daniel Zenker Drive* – Chemung County may perform an additional traffic signal warrant study, if desired. However, the need may be a function of development in the airport area or employment fluctuations for the business served by the traffic signal.
- *#6 Big Flats Road/Kohl's Plaza Driveway* – Driveway volume was not available for this intersection, however, size of the development would warrant the traffic signal at this intersection. Chemung County may perform additional study, if desired.
- *#9 Colonial Drive/I-86 WB Exit Ramp* – Traffic signal should remain to ensure traffic on the ramp will not be impeded by traffic on Colonial Drive. Also, there is potential for development in this area that may increase traffic volume on Colonial Drive in the future.
- *#20 Chemung Street/Center Street* – No traffic volume data was available for Center Street, however, this traffic signal is part of the NYSDOT interconnect system. Therefore, it is assumed to meet warrants.

The following intersections did not meet the volume threshold for either of the intersection streets, or, volume data was not available:

- *#18 Gardner Road/Westlake Road* and *#19 Grand Central Avenue/Sayre Street* – Both of these traffic signals were not operating at the beginning of this study. The Village of Horseheads has decommissioned both traffic signals and will be removing all existing equipment. Both intersections do not meet warrants based on traffic volume estimates.
- *#23 East 13th Street/ Elmwood Avenue/ Elmira Heights Firehouse* – The Village of Elmira Heights may perform an additional traffic signal warrant study, if desired. However, this traffic signal also serves as facilitated access for the Fire Department and is warranted on that basis.

A summary of the warrant review results is included in **Appendix B.**

## D. Safety and Intersection Operation Assessment

1. Accident History Screening

The accident occurrences for each of the study intersections were reduced to an accident rate and then compared to the Statewide average (SWA) accident rate. From this comparison it was noted that twenty out of twenty-five intersections had accident rates exceeding the SWA accident rate. A further review of the accident information noted the following four intersections had an accident rate significantly above the Statewide average, i.e. exceeding the SWA accident rate by 0.50.

- *#3 Big Flats Road/Chambers Road* – This is a high traffic volume intersection. The predominant accident types at this intersection were 'left turn' and 'rear end' accidents, which may be attributable to traffic signal operation.
- *#8 Chambers Road/Arnot Mall Driveway* – The accident types were in several categories indicating several causes, including the traffic signal operation, the geometry of the intersection, and adjacent driveway conflicts.

- *#16 Pennsylvania Avenue/Cedar Street* – The accident types at this intersection included 'right angle' and 'rear end' accidents indicating traffic signal operation and skewed geometry of the intersection could be a factor.
- *#18 Gardner Road/Westlake Street* – This intersection is in transition from flashing operation to four-way stop. Also, the intersection traffic volume is low skewing the intersection accident rate. In addition, traffic signal warrants are not met.

2. Safety Assessment from Field Observations and Review of Intersection Geometry

Intersection Geometry Figures illustrating intersection geometry is provided in **Appendix D.** The following study intersections were observed to have safety issues likely related to intersection geometry (Skewed, and/or offset alignments):

- *#3* Big Flats Rd (CR 64) & Chambers Rd (CR 35)
- *#4* Big Flats Rd (CR 64) & Lowes Driveway
- *#5* Big Flats Rd (CR 64) & Target/Best Buy Driveway
- *#8* Chambers Rd (CR 35) & Arnot Mall
- *#11* Fairview Rd (CR 19) & Lake St (CR 65)
- *#13* East McCanns Blvd & Lake St (CR 65)
- *#16* Pennsylvania Ave (CR 69) & Cedar St (CR 84)

**Appendix C** includes an Accident Summary table that provides study intersection accident rates and Statewide accident rates for each study intersection.

# V. Standards of Design, Operation and Maintenance Practice

## A. Traffic Signal Components of the Signal System

1. Standards for Upgrade of Intersection Components

There are several design practice types for traffic signal installations, which are generally dependent on:

- Jurisdictional Agency Standards and/or Preference.
- Intersection Geometry.
- Size of Intersection.
- Proximity of Utility Facilities.

For Chemung County and the municipalities within the County, NYSDOT standards are typically used by default given the high level of complexity associated with developing unique agency specific standards.

Additionally, the Manual of Uniform Traffic Control Devices provides guidance for design and placement of the traffic signal heads for proper operation of the intersection. The signal heads can be mounted to a span cable or a mast arm to provide proper position over the corresponding lanes of control.

The three predominant signal types used in this region are:

- Diagonal Span with Upper Tether (**Figure 3**)
- Box Span with Upper Tether (**Figure 4**)
- Mast Arm on Each Corner (**Figure 5**)

These signal installation types are depicted on page 16, along with a list of common components that would be considered the standard scope for each installation. In general each intersection will include:

- A Model 2070L controller and Model 330 cabinet as standard.
- All intersections will be fully actuated by detector loops in the pavement.
- A Pullbox on each corner and conduit between the pullboxes on three of the four sides of the intersection.
- Advance loop detection will be provided in areas with approach speeds higher than 40 mph or where queuing of traffic is an issue.
- Traffic signal poles and foundations to NYSDOT standards.
- Backplates installed to traffic signal heads to reduce sun glare and improve visibility of traffic signals, except for traffic signals facing south.
- All intersections should have capability to operate with local emergency vehicle preempt and traffic signal coordination systems.

2. Standards of Practice to Expand the Traffic Signal Communication and Coordination Systems

These systems are tailored for the needs and requirements of a region or municipality based on the model used for operation of traffic signal and traffic management systems. Future plans for each system must take into account future needs yet build upon the existing network, as long as the existing network is well supported by the industry.

A second factor in considering expansion of the communication system is the cost to add on to current technology. There are many advantages to having a fiber optic system to interconnect all the traffic signals within a region; for example, the ability to receive full-motion video, long distances can be reached, no monthly operational fees, and low maintenance costs. However, the disadvantages are in the cost to expand the system and connect more remote locations.

There are cost effective solutions that complement the current system operation and technology. These technologies include:

- Leased Lines (telephone & cable)
- Wireless Options; spread spectrum radio, microwave, unlicensed wireless local area network (Wi-Fi), or licensed Worldwide Interoperability for Microwave Access (WiMAX).

The advantage to a leased line option is the initial low cost to deploy because the telephone or cable provider has already built the infrastructure. The disadvantage to a leased line option is recurring monthly fees and maintenance depends on the service provider's response and schedule.

Wireless system advantages include no costly underground/overhead infrastructure to build, rapidly deployable, and effective for temporary or short term installations. These systems can transmit the same data as a fiber optic line, however, there are some limitations defined by the number and amount of channels operating at the same time. Disadvantages of wireless options are that spread spectrum radio and microwave systems require line of sight and may be subject to interference. Wi-Fi is also limited by the service area and security issues can reduce the attractiveness of this option.

However, of all of the wireless options, the WiMAX system can be a licensable network that is upgradeable to provide the proper coverage area, and a secure network.

## B. Standard of Traffic Signal Operation and Maintenance

The "Traffic Control Systems Handbook", FHWA, 2005, outlines the best practices to operate and maintain a traffic signal system implementing a traffic signal management program. Activities include continual update of traffic signal timing plans, recording of maintenance activities, and review of traffic signal system performance. This information is used to assure the system is operating as intended, predicts future maintenance needs, and to analyze the cost of operating and maintaining the system.

**Figure 3 - Diagonal Span with Upper Tether**

- New 330 cabinet and 2070L Controller
- Two traffic signal span poles
- One span with upper tether
- 12" Traffic Signal heads with potential backplates and disconnect hangers
- Span mounted overhead signs
- Box out intersection with pullboxes and conduit on three crossings
- Detection:
  - Fully-actuated – loops on all approaches
  - Advance loops and pullboxes where queuing / speed issues exist
- Fire Vehicle Preempt capable
- Time-Based Coordination, Hardwire interconnect, Wireless, Closed-loop system
- Disconnect switch for connecting Power Generator

**Figure 4 - Box-Out Span with Upper Tether**

- New 330 cabinet and 2070L Controller
- Four traffic signal span poles
- Four spans with upper tether
- 12" Traffic Signal heads with potential backplates and disconnect hangers
- Span mounted overhead signs
- Box out intersection with pullboxes and conduit on three crossings
- Detection:
  - Fully-actuated – loops on all approaches
  - Advance loops and pullboxes where queuing /speed issues exist
- Fire Vehicle Preempt capable
- Time-Based Coordination, Hardwire interconnect, Wireless, Closed-loop system
- Disconnect switch for connecting Power Generator

**Figure 5 - Mast Arm on Each Corner**

- New 330 cabinet and 2070L Controller
- Two to four traffic signal mast arm poles
- 12" Traffic Signal heads with potential backplates and mast arm brackets
- Mast arm mounted overhead signs
- Box out intersection with pullboxes and conduit on three crossings
- Detection:
  - Fully-actuated – loops on all approaches
  - Advance loops and pullboxes where queuing / speed issues exist
- Fire Vehicle Preempt capable
- Time-Based Coordination, Hardwire interconnect, Wireless, Closed-loop system
- Disconnect switch for connecting Power Generator

# VI. Traffic Signal System Recommendation and Program

## A. Recommendation for Traffic Signal System Upgrade

1. Traffic Signal Installations

Based on feedback from the Project Advisory Group, a majority of the traffic signal installation upgrades will be limited to single and diagonal spanwire configurations. However, it is possible that additional infrastructure in the form of signal poles may be required due to intersection geometry and/or installation of a span or mast arm box-out configuration. Therefore, the cost estimate for the overall program includes a 25% increase in signal pole quantity.

Based on the composite/program ranking 'Poor' or 'Fair', the following traffic signals where programmed for complete replacement:

- Fairview Rd (CR 19) & Lake St (CR 65)
- East 13th St & Grand Central Ave
- East 14th St (CR 39) & Lake St (CR 65)
- Upper Oakwood Ave (CR 58) & Grand Central Ave
- Chambers Rd (CR 35) & Arnot Mall
- Pennsylvania Ave (CR 69) & Cedar St (CR 84)
- East McCanns Blvd & Lake St (CR 65)
- Oakwood Ave & West 13th St
- East 13th St & Elmwood Ave
- Grand Central Ave & East McCanns Blvd
- Gardner Rd & Westlake St
- Sayer St & Grand Central Ave (CR 66)

The following traffic signals with 'Good' or 'Very Good' rankings were identified for modification to align with standard traffic signal installation practices:

- Chemung St & Grand Central Ave
- Kahler Rd (CR 63) & Daniel Zenker Dr (CR 80)
- CR 64 & Chambers Rd (CR 35)
- Broadway (CR 79) & Pennsylvania Ave (CR 69)
- CR 64 & Target Dwy
- CR 64 & Kohls Dwy
- CR 64 & Lowes Dwy
- Colonial Dr (CR 74) & I-86 Exit 51 Ramp
- Chemung St & Center St
- CR 64 & Tops/Sams Dwy
- Chambers Rd (CR 35) & Arnot Rd (CR 75)

2. Locations for Advance Detection
Advance detection is desirable for the intersections with approach speeds above 40 mph and/or at locations where long queues may form during peak operating conditions. Candidate intersections for this application include:

- Big Flats Rd & Chambers Rd
- Big Flats Rd & Kohl's Plaza Dwy
- Chambers Rd & Arnot Rd
- Chambers Rd & Arnot Mall Dwy

To accommodate the advance detection, additional pullboxes, conduit, and detector loops are included in the program for these intersections that currently do not have advance detection.

3. Emergency Vehicle Preempt
Assuming all fire and medical emergency vehicles in the County will eventually be equipped with preempt capabilities, the program will include emergency preempt equipment at all the study intersections except *#1 Kahler Road/Daniel Zenker Drive*, given its remote proximity to the other network intersections.

## B. Recommendation for Communication System Upgrade

**Figure 6, Existing and Proposed Interconnect**, illustrates the current and future WiMAX coverage areas and potential hardwire interconnect routes to tie in the study intersections. The State has also made the right-of-way along I-86 available for communication providers to install fiber optic trunk-line(s) along the corridor in exchange for reserving some fiber for State agency use. This will facilitate potential connection of traffic signals adjacent to this corridor with the City of Elmira traffic signal system.

The WiMAX connection would require an upfront one-time cost of about $5,000 per intersection for wireless router equipment and connection to the traffic signal system at the control center and about $10,000 per intersection to connect each traffic signal controller. Total cost for WiMAX connection of 25 intersections would be approximately $375,000.

Based on recent construction of a fiber optic network extension, the cost to install a fiber optic cable with splice boxes and connection to traffic signals is about $60 to $70 per linear foot. Extending the fiber optic network from the existing network north along Grand Central Avenue, a length of approximately 8,000 linear feet, the cost to connect intersection #25 - Grand Central Avenue / East McCanns Boulevard would be around $500,000. If the entire network shown as potential fiber optic interconnect in **Figure 6** was implemented, the length would be almost 9 miles at a cost of $3.3 to $3.8 million.

Based on costs for each communication system type, the Project Advisory Group agreed WiMAX technology would be the most cost effective communication solution. Additionally, it was noted there is an existing WiMAX system serving several public agencies within Chemung County. This licensed communication system is operated by Integrated Systems. The system has the available capacity and ability to expand and serve as the communication network for data and video transmission for traffic signal intersections not connected to the City's fiber optic network.

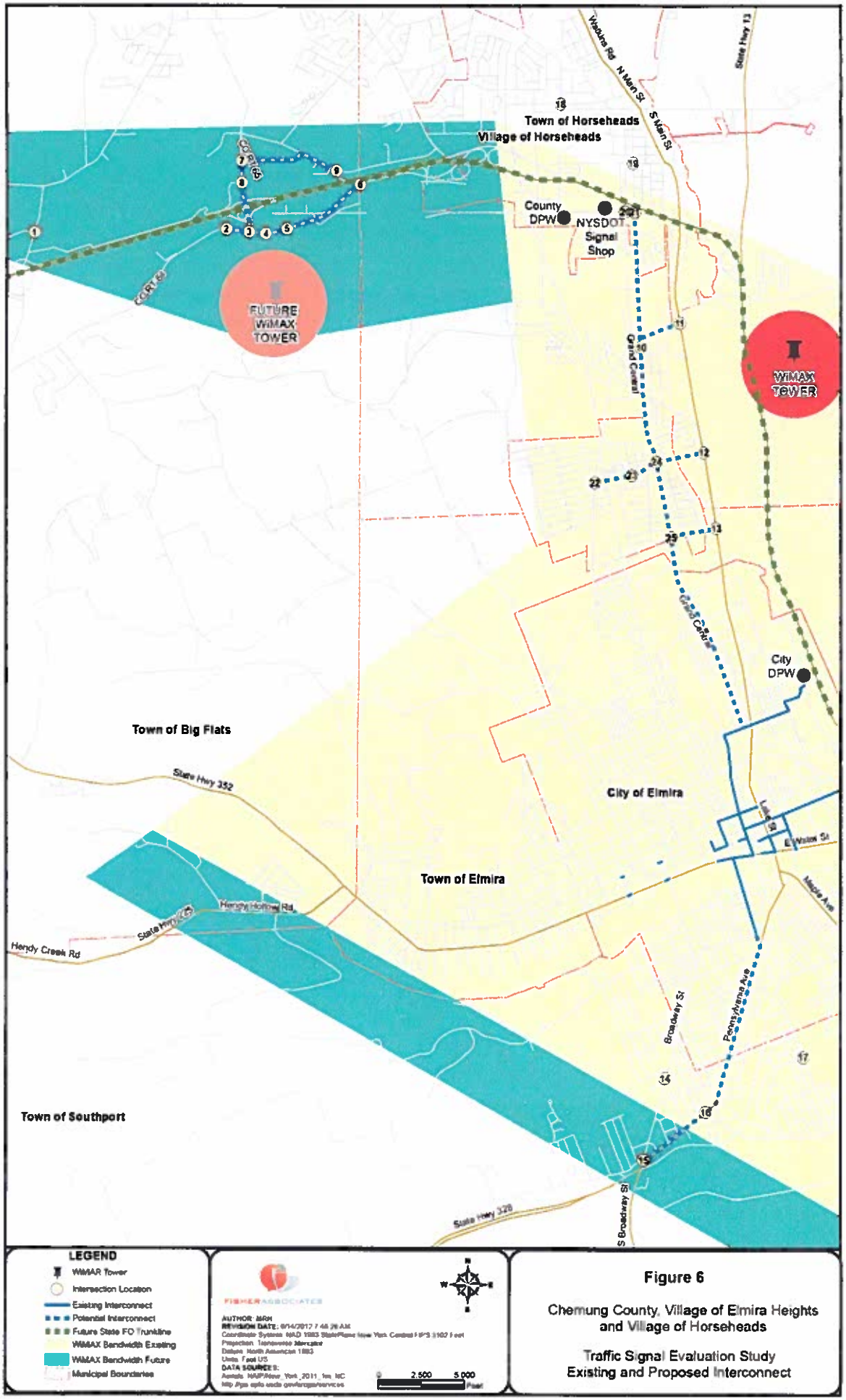


**Figure 6**

Chemung County, Village of Elmira Heights and Village of Horseheads

Traffic Signal Evaluation Study
Existing and Proposed Interconnect

## C. Recommended Traffic Signal Operation and Maintenance

The municipalities should continue to utilize shared services for the operation and maintenance of the traffic signals owned by each municipal entity. The typical mechanism to provide shared services for traffic signal operation and maintenance is an agreement outlining the responsibilities and costs associated with the annual maintenance of the anticipated work. NYSDOT has had this mechanism in place for many years in the form of a Permit Traffic Signal Agreement. The actual ownership of the traffic signal is by a municipality or a private entity that is responsible for replacement or upgrade costs, while the operation and maintenance is NYSDOT responsibility for an annual fee. The municipalities should formalize the shared services so that operation and maintenance are defined for the City of Elmira DPW traffic signal crews. For example routine maintenance might include replacing the signal lights and failed detector loops.

Another possible arrangement would be for Chemung County DPW to take ownership, operation, and maintenance responsibility for all traffic signals in Chemung County that are not owned by the State. An example of this arrangement is in Monroe County, New York where the traffic signals in the City of Rochester, and the County road system, are owned, operated and maintained by the County.

## D. Recommended Program and Cost Estimate

The overall cost to implement the improvements outlined above will be approximately $3.5 million over a five year implementation horizon. The recommended program divides this cost into three phases of approximately $1.1 to 1.3 million per phase.

Phase 1, would replace all of the 'Poor' ranked signals from the composite score. Phase 2 would replace the traffic signals ranked 'Fair' and include minor upgrades to a few of the traffic signal ranked 'Good'. The remaining traffic signal, communication and system upgrades would occur in Phase 3.

It is assumed that Phases 1, 2 and 3 upgrades will be implemented in 2015, 2017 and 2019 respectively.

**Figure 7**, Phased Implementation, identifies the intersections for upgrade in each implementation Phase. Table 2, Program Cost Estimate, presents a summary of the program costs by implementation phase for each Municipality. Included in the program are escalation costs and engineering costs.

Program Cost and Prioritization detail by intersection is contained in **Appendix F**.

## E. Cost / Benefit Considerations

Through research and discussion with other agencies, it was determined the most tangible benefit of conducting routine maintenance and equipment upgrades results from minimizing the amount of work that needs to be conducted on an emergency call-out. In specific discussions with two Municipal Engineers they noted that:

- Unexpected repair work happened during non-regular work schedules about 70% of the time.
- It is approximately 6 times more expensive, from a labor perspective, to fix a signal failure during an emergency call-out verses doing routine maintenance and upgrades.

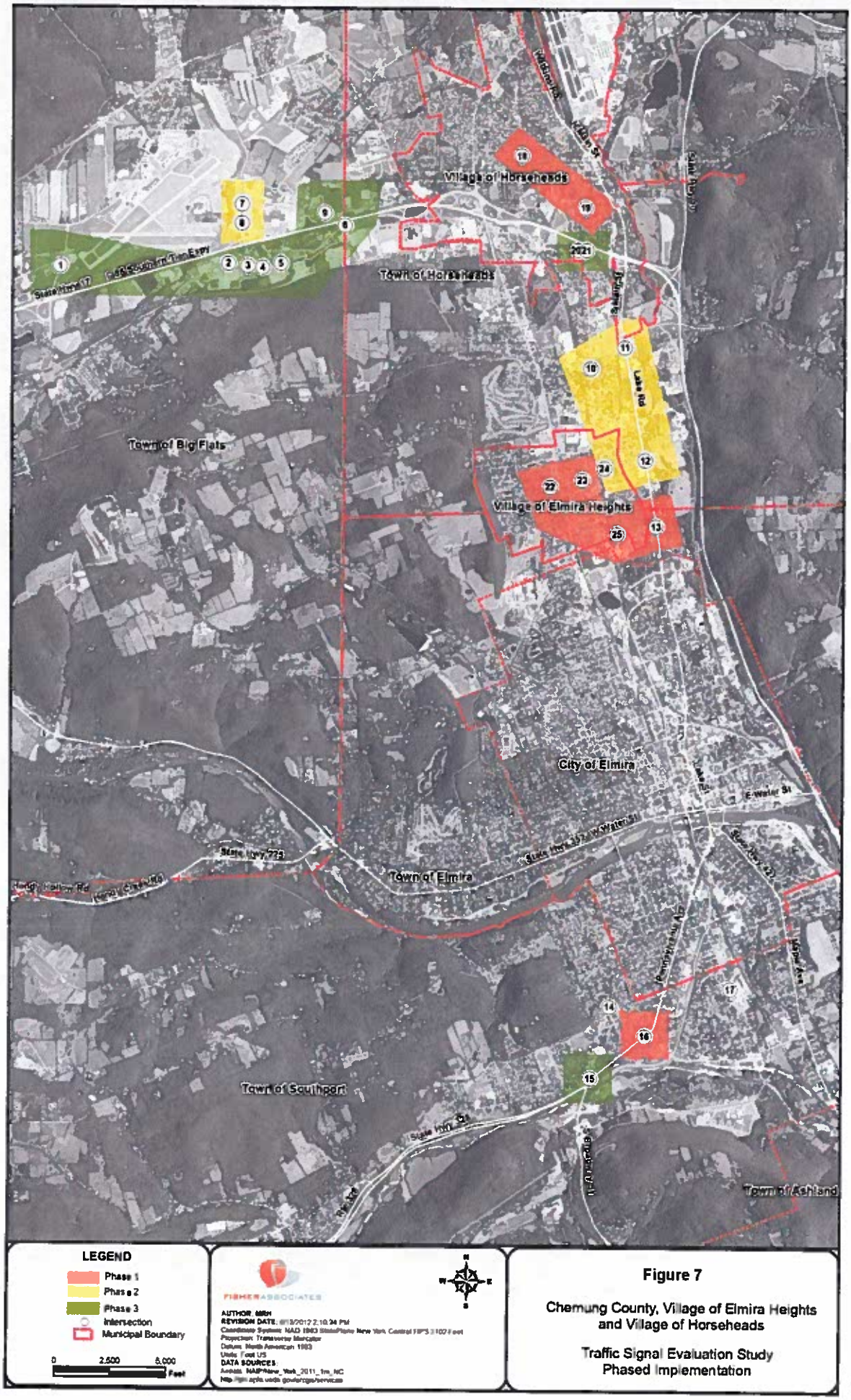


**Figure 7**

Chemung County, Village of Elmira Heights and Village of Horseheads

Traffic Signal Evaluation Study
Phased Implementation

## Table 2
### Chemung County, Village of Elmira Heights and Village of Horseheads
### Traffic Signal Evaluation Study
### Program Cost Estimate

| | | | | Phase 1 (2015) | | Phase 2 (2017) | | Phase 3 (2019) | | Standard Intersection | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Qty | Subtotal | Qty | Subtotal | Qty | Subtotal | Qty | Subtotal |
| **I. Intersection Upgrades** | | | | | | | | | | | |
| **BASE TRAFFIC SIGNAL UPGRADE** | | | | | | | | | | | |
| Cabinet/ Controller Replacement | $15,000 | Each Int | | 5 | $ 75,000 | 6 | $ 90,000 | 0 | $ - | 1 | $ 15,000 |
| Signal Poles | $9,000 | Each | | 11 | $ 99,000 | 10 | $ 90,000 | 0 | $ - | 2 | $ 18,000 |
| Signal Heads/ Signs/ Support | $15,000 | LS | | 5 | $ 75,000 | 5 | $ 75,000 | 3 | $ 45,000 | 1 | $ 15,000 |
| Ped Poles/ Heads/ Pushbuttons | $5,000 | Crossing | | 14 | $ 70,000 | 4 | $ 20,000 | 0 | $ - | 4 | $ 20,000 |
| Power Service Replacement | $1,500 | Each Int | | 5 | $ 7,500 | 6 | $ 9,000 | 0 | $ - | 1 | $ 1,500 |
| Detector Installation | $1,000 | Each | | 36 | $ 36,000 | 48 | $ 48,000 | 11 | $ 11,000 | 8 | $ 8,000 |
| Pullbox/ Conduit Crossings | $7,500 | Crossing | | 17 | $ 127,500 | 22 | $ 165,000 | 5 | $ 37,500 | 5 | $ 37,500 |
| | | | Subtotal | | $ 490,000 | | $ 497,000 | | $ 93,500 | | $ 115,000 |
| **ADDITIONAL UPGRADE WORK** | | | | | | | | | | | |
| Potential Additional Signal Poles | $9,000 | Each | | 3 | $ 27,000 | 3 | $ 27,000 | 0 | $ - | 1 | $ 9,000 |
| Removal/ Modify Equipment | $3,000 | Lump Sum | | 7 | $ 21,000 | 6 | $ 18,000 | 8 | $ 24,000 | 1 | $ 3,000 |
| Sidewalk Ramps | $3,000 | Each | | 12 | $ 36,000 | 0 | $ - | 4 | $ 12,000 | 4 | $ 12,000 |
| Milling& Resurfacing for Loops | $7,500 | Approach | | 6 | $ 45,000 | 10 | $ 75,000 | 5 | $ 37,500 | 4 | $ 30,000 |
| | | | Subtotal | | $ 129,000 | | $ 120,000 | | $ 73,500 | | $ 54,000 |
| | | | Upgrade Total | | $ 619,000 | | $ 617,000 | | $ 167,000 | | $ 169,000 |
| **II. Interconnection of Traffic Signals** | | | | | | | | | | | |
| ITS/ Interconnect/ Comm | $10,000 | Each Int | | 5 | $ 50,000 | 6 | $ 60,000 | 8 | $ 80,000 | 1 | $ 10,000 |
| Fire Preempt System | $10,000 | Each Int | | 5 | $ 50,000 | 6 | $ 60,000 | 9 | $ 90,000 | 1 | $ 10,000 |
| Timing Plan Development | $2,500 | Each Int | | | $ - | | $ - | 8 | $ 20,000 | | |
| System Upgrade of Traffic Signals | $15,000 | Each Int | | | $ - | | $ - | 8 | $ 120,000 | | |
| Central System Software Upgrade | $125,000 | Each | | | $ - | | $ - | 1 | $ 125,000 | | |
| | | | ITS Subtotal | | $ 100,000 | | $ 120,000 | | $ 435,000 | | $ 20,000 |
| | | | Program Subtotal | | $ 719,000 | | $ 737,000 | | $ 602,000 | | $ 189,000 |
| | | | Contingency | 20% | $ 143,800 | | $ 147,400 | | $ 120,400 | | |
| | | | Work Zone Traffic Control | 5% | $ 35,950 | | $ 36,850 | | $ 30,100 | | |
| | | | Scoping /Preliminary Engineering | 10% | $ 71,900 | | $ 73,700 | | $ 60,200 | | |
| | | | Final Engineering / Bid Plans | 10% | $ 71,900 | | $ 73,700 | | $ 60,200 | | |
| | | | Construction Inspection | 10% | $ 71,900 | | $ 73,700 | | $ 60,200 | | |
| | | | Total | | $ 1,114,450 | | $ 1,142,350 | | $ 933,100 | | |
| | | | Annual Escalation (2% per year) | 6% | $ 66,867 | 10% | $ 114,235 | 14% | $ 130,634 | | |
| | | | Program Total | | $ 1,181,317 | | $ 1,256,585 | | $ 1,063,734 | | |
| | | | Chemung County Share | 37.0% | $ 437,019 | 80.7% | $ 1,014,117 | 48.2% | $ 512,928 | | |
| | | | Village of Horseheads Share | 0.9% | $ 10,243 | 0.0% | $ - | 12.3% | $ 130,994 | | |
| | | | Village of Elmira Heights Share | 62.1% | $ 734,055 | 19.3% | $ 242,468 | 0.0% | $ - | | |
| | | | NYSDOT Share | 0.0% | $ - | 0.0% | $ - | 39.5% | $ 419,812 | | |
| | | | | | $ 1,181,317 | | $ 1,256,585 | | $ 1,063,734 | | |

# VII. Funding Opportunities and Follow-on Activities

## A. Federal Funding with State and Local Match

1. Surface Transportation Program (STP)
2. Hazard Elimination & Safety Program (HES)
3. Congestion Mitigation & Air Quality (CMAQ)

## B. Other Funding Sources

1. Energy Grants
2. Private Developer Share for Traffic Impact Mitigation/Incentive Zoning
3. Transportation Improvement Districts

## C. Follow-on Activities

1. Traffic Signal Warrant Studies
2. Revisit Policy for Permit Traffic Signals to NYSDOT and formalize agreements
3. Establish a policy for obtaining Permanent Easements for access to traffic signal equipment on private properties
4. Provide formal or revise current Maintenance Agreements between owning agency and operating/maintaining agency
5. Develop a standard Traffic Signal Design and Plan Review procedure for municipal and permitted traffic signals
6. Incorporation of traffic signal upgrades with other street/roadway improvement projects
7. Update standards and costs listed in this report every two years (i.e. revisit program in 2014, 2016, and 2018 to update report and program.)
8. Coordinate an ITS Incident Management plan with NYSDOT and ECTC to operate traffic signals from the Town of Big Flats to the City of Elmira to bypass incidents on I-86 between exits 51 and 56
9. Update the Traffic Signal Management Plan for the City of Elmira to include the remaining traffic signals in the County

## References

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