Continuation of the Interoperable Coordinated Signal System Deployment in White Plains, New York

Final Report

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Prepared for:

New York State Energy Research and Development Authority

Albany, NY

Joseph D. Tario, PE
Senior Project Manager

and

New York State Department of Transportation

Albany, NY

Rich Dillmann
Project Manager

Prepared by:

TransCore ITS, LLC

New York, NY

Jacques Lardoux
Ray Martinez, PE
Principal Investigators

Edward Heller
Project Team Member

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This report was funded in part through grant(s) from the Federal Highway Administration, United States Department of Transportation, under the State Planning and Research Program, Section 505 of Title 23, U.S. Code. The contents of this report do not necessarily reflect the official views or policy of the United States Department of Transportation, the Federal Highway Administration, the New York State Department of Transportation, or the New York State Energy Research and Development Authority. This report does not constitute a standard, specification, regulation, product endorsement, or an endorsement of manufacturers.

Technical Report Documentation Page

1. Report No. C-11-58	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subtitle Continuation of the Interoperable Coordinated Signal System Deployment in White Plains, New York		5. Report Date December 2015
		6. Performing Organization Code
7. Author(s) Jacques Lardoux		8. Performing Organization Report No. 15-36
9. Performing Organization Name and Address TransCore ITS, LLC 253 West 35th Street – Third Floor New York, NY 10001		10. Work Unit No. (TRAIS)
		11. Contract or Grant No. NYSERDA Contract No. 25737
12. Sponsoring Agency Name and Address New York State Department of Transportation (NYSDOT), 50 Wolf Road, Albany, NY 12232; New York State Energy Research and Development Authority (NYSERDA), 17 Columbia Circle, Albany, NY 12203		13. Type of Report and Period Covered Final Report (2012-2015)
		14. Sponsoring Agency Code
15. Supplementary Notes Project funded in part with funds from the Federal Highway Administration. Joseph D. Tario from NYSERDA and Rich Dillmann from NYSDOT Region 8 served as project managers.		

16. Abstract

The City of White Plains, NY owns and operates an advanced traffic control system (TCS) that monitors and controls over 130 intersections in real time. Its Traffic Department facility is not staffed 24 hours a day, 7 days a week, but two other centers operate 24/7: the City of White Plains Police Department (CWPPD) and the Hudson Valley Transportation Management Center (HVTMC) in Hawthorne, NY. This traffic management center (TMC) is operated by New York State Department of Transportation (NYSDOT) Region 8, which includes Westchester County and six other counties north of New York City. It monitors, collects, and sends real-time traffic information for responding to roadway incidents and taking action to minimize disruptions to travelers.

The objective of this project was to provide NYSDOT Region 8 and the CWPPD with real-time data on roadway arterials available from City of White Plains' TCS. Although the city's traffic signals are currently not monitored during nights and weekends, they would be operated and controlled from the HVTMC. All intersection controllers are monitored once-per-second in real-time, and multiple control strategies can be applied. Intersections can operate in multiple control modes including central time-of-day (CTOD), local time-of-day (LTOD), free, manual, and traffic-responsive (TR). As a result of this project, the agencies will be able to coordinate in managing incidents and monitoring the City of White Plains' signals at all times.

17. Key Words	18. Distribution Statement
ICSS, ITS, Timing Plans, TCS, TMC, TOD	No restrictions.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of	22. Price
Unclassified	Unclassified	Pages 24	

Form DOT F 1700.7 (8-72) Reproduction of completed page authorized

Abstract

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Executive Summary

S.1 Background

NYSDOT and the City of White Plains have agreed to continue the Interoperability Signal System Deployment (ICSS). As a result, this project sought funding through a research partnership between NYSERDA and NYSDOT to support programs and technology that provide pathways to energy efficiency, enhanced economics, sustainability, and improved livability throughout the State of New York. The deployed system expands the monitoring and incident response capabilities of the CWP Traffic Control System (TCS) to a true 24/7 operation. Also, it has the potential to enhance the traffic control coordination among all involved agencies in support of drivers' safety, traffic congestion mitigation, and greenhouse gas (GHG) emissions reduction.

S.2 Research Approach

At this time, over 130 signals are online in the City of White Plains' TCS software. The end-to-end network connectivity will be established between the City of White Plains Traffic Department facility and the Hudson Valley Traffic Management Center (HVTMC) to allow for the monitoring and control of these signals. The workstation deployment will accommodate for TCS access at any current workstation at two agencies: HVTMC and CWP Police Department.

S.3 Conclusions

The expansion of the TCS network enables several key benefits for the City of White Plains. The existing TCS can now be monitored on nights and weekends, thereby allowing the operators to more quickly identify traffic or maintenance issues and respond accordingly. The resulting reductions in response time would lead to reduced number of stops, delays, GHG emission, and fuel consumption for vehicles. The NYSDOT Region 8 and CWPPD will have access to real-time information on City of White Plains arterials, which they do not currently receive. This access would allow these operations centers to make better-informed decisions in terms of how they manage traffic and disseminate information to motorists. In all, the TCS network upgrade will enhance the commuters' quality of life, increase their safety, and save the City's time and resources in the long run.

1 Introduction

1.1 Original System Operations

The City of White Plains (CWP) currently owns and operates an advanced traffic control system (TCS) called TransSuite® TCS (designed by TransCore ITS LLC [TransCore]) that monitors in real time and controls intersections throughout the City's arterials. Located in City Hall, the CWP Traffic Department facility is not staffed on a 24/7 basis. CWP personnel consist of two traffic engineers and six field technicians. To date, TransSuite® TCS has been used to control only daytime traffic operations in White Plains. Nighttime on-call emergencies such as signal failures have been handled by the City of White Plains Police Department (CWPPD) without access to TCS.

TransCore met with the City and the Police Department to discuss the communication network status between the two facilities and how maintenance of field devices is handled. The impact of communication issues such as broken interconnect cables affecting intersection controllers at Elmsford and Sprain Brook Parkway was identified. Also, under the original operations, unforeseen traffic events in after-hours could not be handled in real-time. For these reasons, a solution was sought to handle both on-call emergencies affecting traffic controllers and traffic disruptions from events in a more efficient manner.

1.2 Proposed System Operations

Region 8 of the New York State Department of Transportation (NYSDOT) operates a 24/7 traffic management center in Hawthorne New York (HVTMC). Full-time operators monitor the region's transportation system by responding to incidents and taking action to minimize disruption to motorists. Therefore, a workstation that has access to White Plains TCS was proposed at the HVTMC. If HVTMC and CWPPD have access to the TCS, decisions could be made on real-time information instead of the regular venues of communications between the agencies that result in slower response. For example, a traffic incident or complaint that would be normally called in by the public could be observed more quickly through regular monitoring. Due to limited resources and personnel, the CWP traffic department's two traffic engineers cannot constantly monitor the system, even during the day.

The project team consisted of co-project managers from the New York State Energy Research and Development Agency (NYSERDA), which is the main contracting agency, and NYSDOT Region 8. The HVTMC and CWPPD will host the TCS workstations. TransCore is the prime system integrator. TransCore is a leading transportation engineering firm in the United States (U.S.) and has provided an experienced installation and integration team that has the sole focus of providing traffic control system solutions. Over the past 30 years, the firm has successfully deployed TransSuite TCS in over 30 jurisdictions throughout the nation, controlling more than 92,000 intersections at locations shown in Figure 1.

Figure 1. TransSuite® TCS Deployments in the United States

(Source: TransCore ITS, LLC)

The City of White Plains first installed the Series 2000 TCS in 1991, and just recently upgraded to TransSuite TCS Version 10.4 in 2015. The current TCS software is hybrid system that communicates with all traffic signals in real-time by polling once-per-second devices based on timing plans or patterns that are stored in each controller's local database. During this process, TCS verifies that the controllers are running the plans or patterns commanded by the operator. It is also a client-server based system, in which the server applications collect, process, and store data. The user can obtain access to the system operations and data through these client applications.

2   System Implementation

2.1   Current TCS Monitoring Area

White Plains is a city in Westchester County, NY and is the commercial hub of Westchester. White Plains DOT currently monitors and controls 132 intersections throughout the city including Main Street. The system uses 2,070 traffic controllers and communicates via hard-wired twisted pair connections with sections that use wireless technology. The City realizes that a proper monitored and maintained traffic control system is vital to the roadway management that serves a typical daytime weekday population of an estimated 250,000. Figure 2 shows the project area with each intersection communication statuses.

Figure 2. City of White Plains Project Area

(Source: TransCore ITS, LLC)
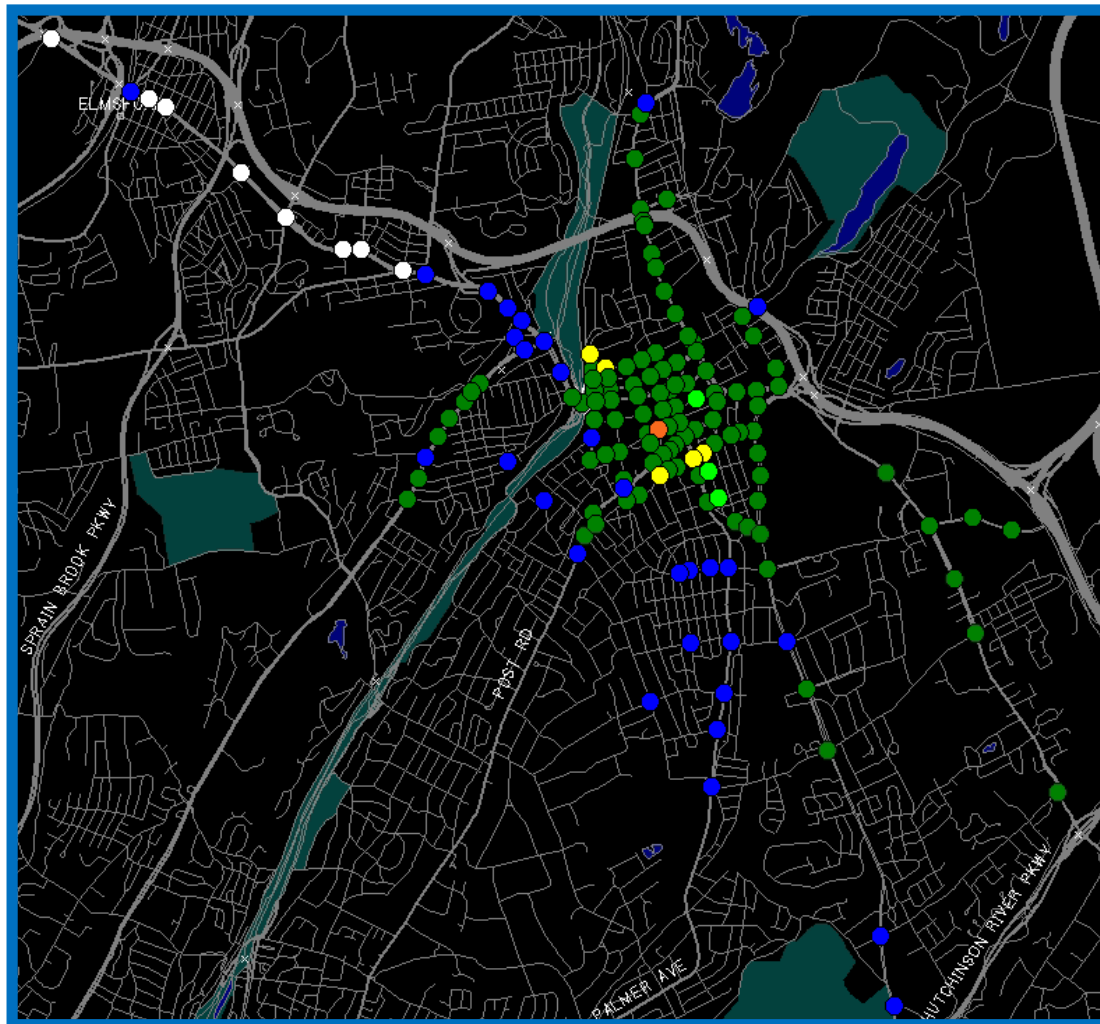
2.2   Network Design

The original network design called for fiber optic switches at HVTMC and CWP to connect one workstation. During a scoping meeting with HVTMC managers and IT personnel, access from all workstations at the HVTMC operations center for ease and convenience was requested. This approach would allow operators to perform their functions without the disruption of moving to a separate workstation. One way is to install the client software at each operator's workstation, but this approach leads to two problems. First, potential workstation incompatibles such as JAVA versions and operating system can potentially lead to conflicts. Second, a client application can't perform under a Network Address Translation (NAT) firewall scenario.

After further analysis, Transcore recommended a terminal server. One new terminal server installed in White Plains would act as a client workstation for 24/7 staff at the HVTMC (and CWPPD) for accessing City of White Plains' TCS remotely. The terminal server remote desktop licensing would allow for simultaneous connections to TCS. TransCore has prepared the specifications, procured the required equipment, and configured the terminal server.

The end-to-end network connectivity from HVTMC to White Plains was met with multiple obstacles. Similar IP schemes used by the two centers created the most difficulty for the IT managers. Also, routing from an intermediate network at Westchester County needed to be re-configured. IP address subnets and firewall rules were eventually modified to accommodate communication between the two networks. With the network connection tested and verified, any workstation could simply remote desktop to the new terminal server installed with the client application previously for TCS without being disconnected from its original network. This new access will enable the monitoring and management of traffic signals of White Plains, which is essential for improving the mobility on roadways that would not be monitored otherwise. HVTMC operators can also react to field device or communications failures and deploy White Plains maintenance personnel 24/7. Traffic detection data is available in real-time and historical report formats. The network between CWP and CWPPD already exists and would require only minor adjustment for their access. The proposed system architecture and communication design is shown in Figure 3.

Figure 3. Proposed Network Design for ICSS in White Plains

(Source: TransCore ITS, LLC)
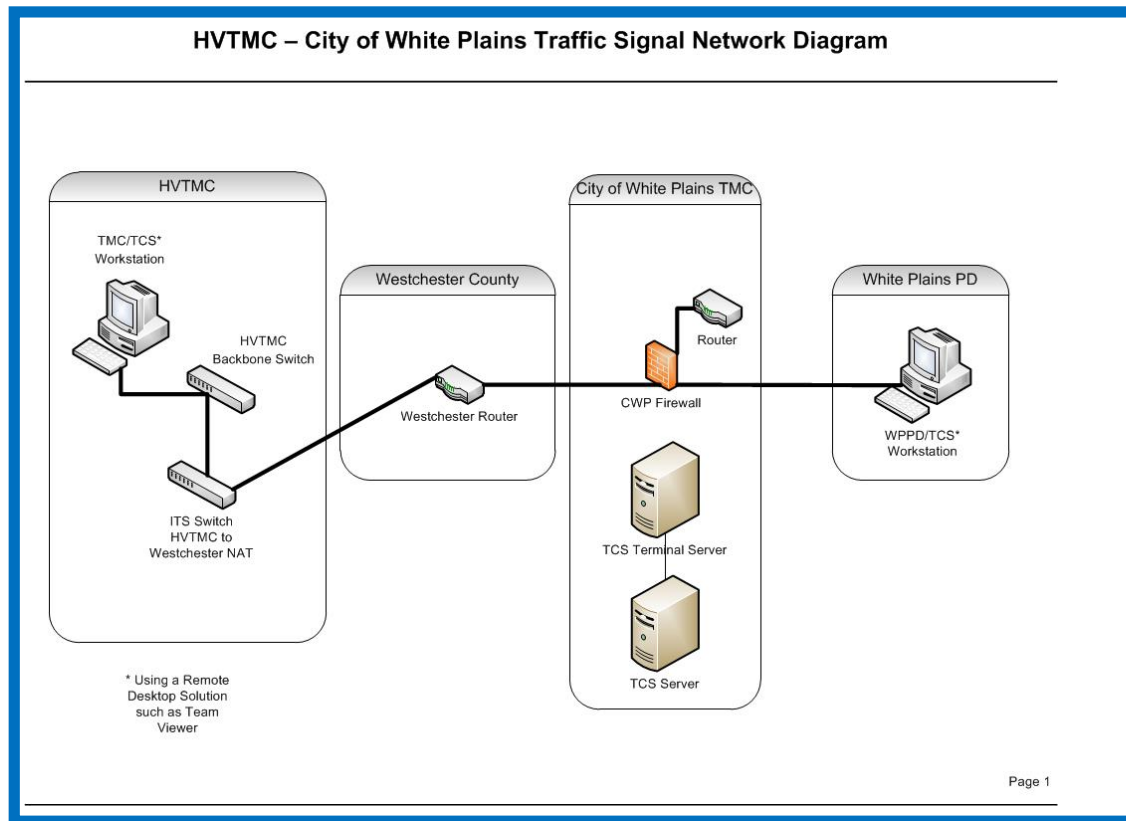
2.3　Main TCS Components

The TransSuite® software contains several key applications, including the following.

Management User Interface (MUI) is the primary application used to monitor and control the system (Figure 4). The MUI has several key features such as detailed views of real time and historical intersection controller and detector status data, extensive failure management views and command and control functions that remotely affect intersection controllers in the field. The bottom row of the MUI identifies the overall status of the intersections at a glance such as the number of communication and device failures. The Intersection Failure Details tab shows all intersection failures details and fail time. Clicking on any intersection on the device tree transfers to an intersection view where the operator can see intersection system details such as signal status, timing status, and timing plan details real-time (Figure 5). Details of any communication or operational failure can be viewed in the Failures and Alarm Flags tabs where the type and time of the failure can be determined and addressed by the maintenance personnel.

Figure 4. TransSuite® TCS Management User Interface
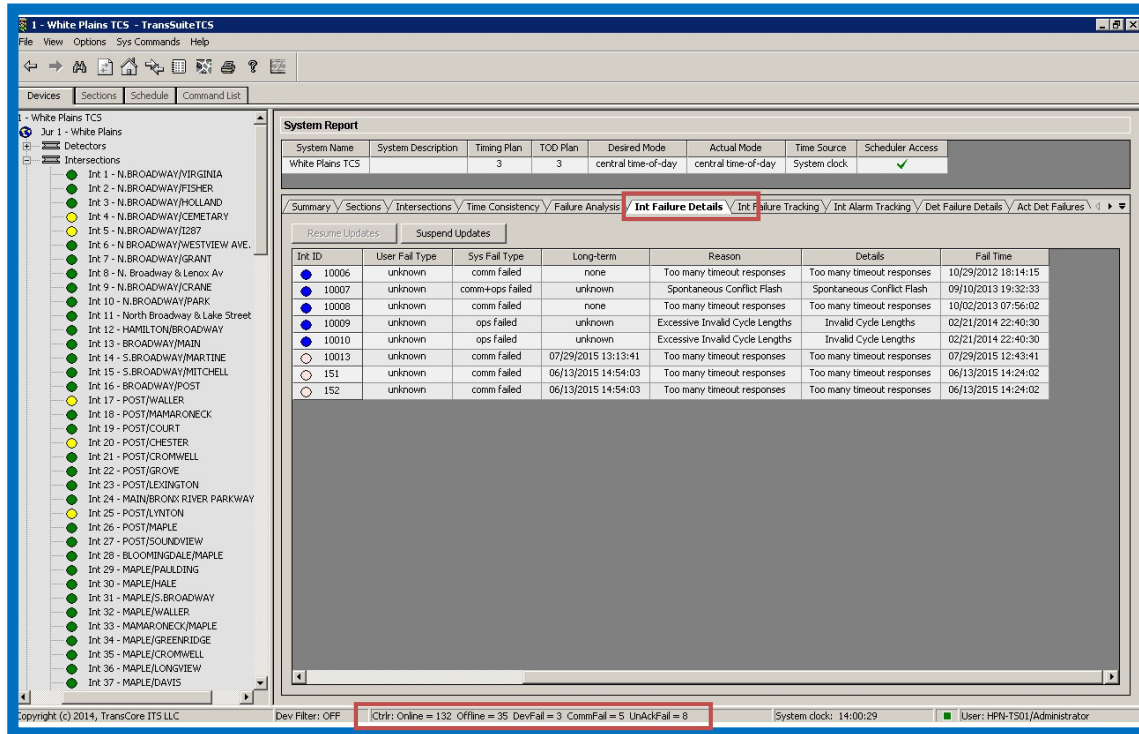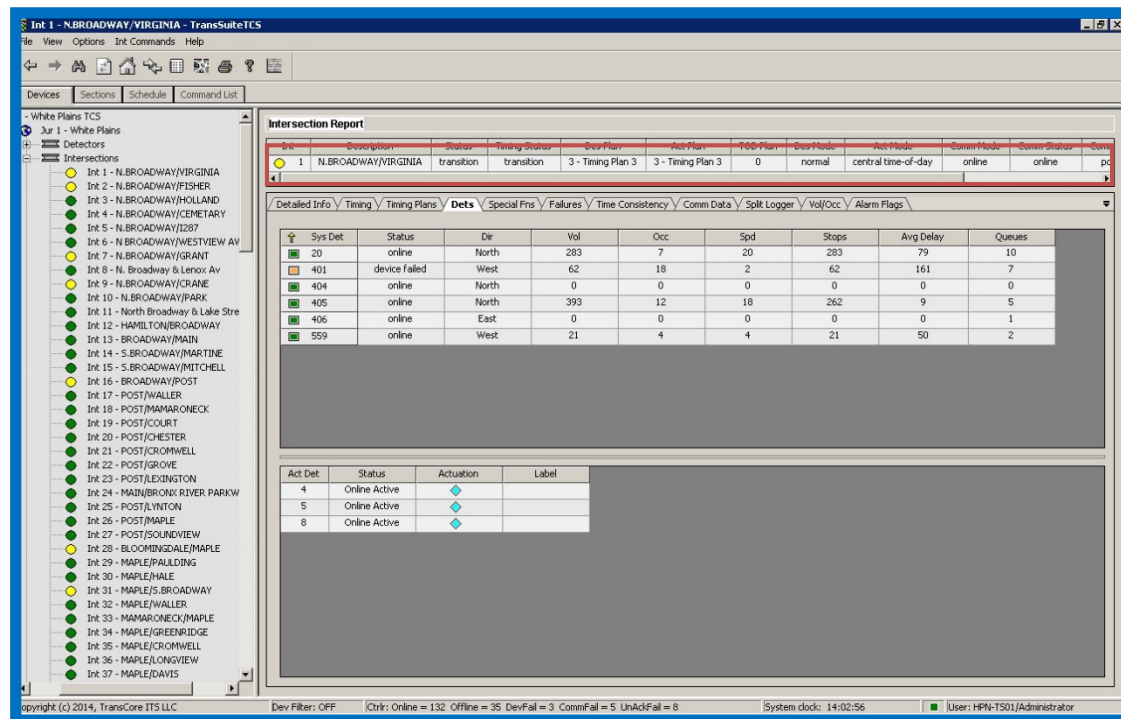
(Source: TransCore ITS, LLC)

Figure 5. TransSuite® TCS MUI – Intersection and Detector Status and Failures

(Source: TransCore ITS, LLC)

Unified Controller Manager (UCM) is for managing multiple versions of the intersection's controller database in addition to the resident database. Timing engineers can use the UCM to modify the database to download to the controller in the field. UCM is intended for advanced users only because any modifications can lead to potential field errors. User privileges are set up for read-only access to prevent unauthorized changes.

Alarm Viewer generates notifications whenever a system event such as signal failure is detected and has an ability to send out email alerts.

Log Viewers are for viewing log entries for any changes to the respective controller or system components. For example, the System Log Viewer displays all event messages from TCS applications, including warnings from intersection signal failures and is valuable to identify historical information of the controller.

Advanced Traffic Management System (ATMS) Explorer is a powerful graphics platform that can be used to build and display custom diagrams that show the status and operation of components within the system. To make monitoring the system easier, CWP uses multiple Explorer diagrams in everyday use. Figure 6 shows an Explorer map that CWP created for the main screen selection menu to show all intersections statuses with icons at a glance. HVTMC should view the main screen as the primary window because it links to other Explorer maps. Clicking on a specific intersection links to a dynamic diagram showing the operation screen with real-time traffic flow and detector data (Figure 7).

Figure 6. TransSuite® TCS Explorer Map Main Menu Screen
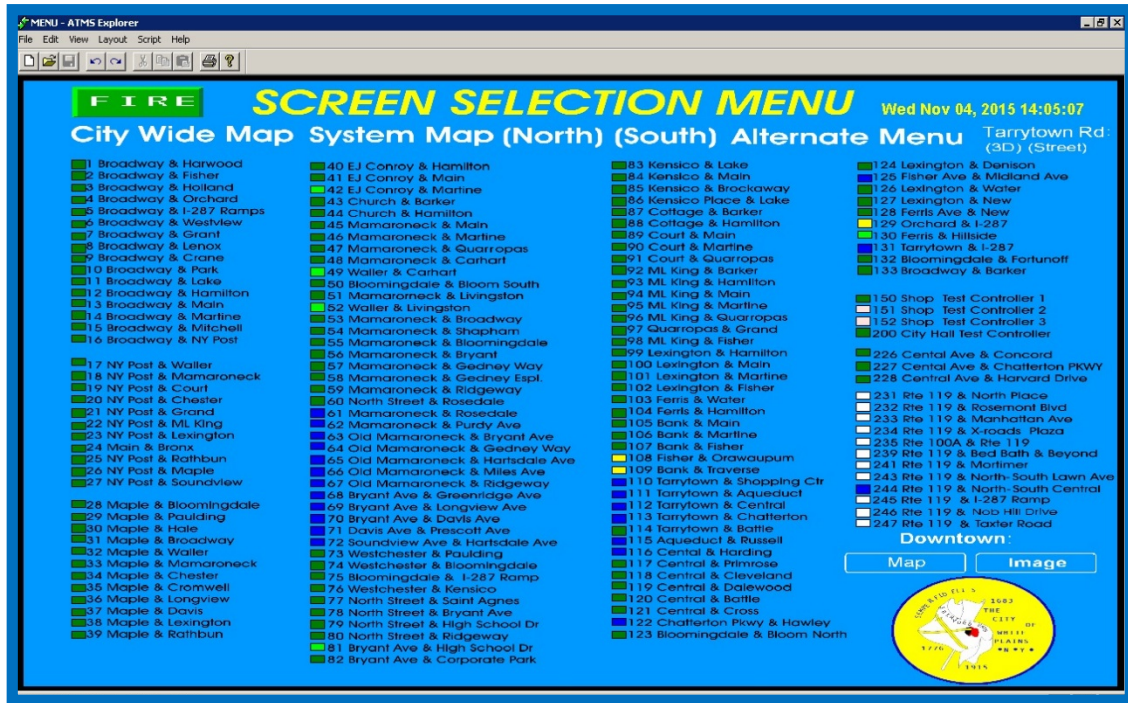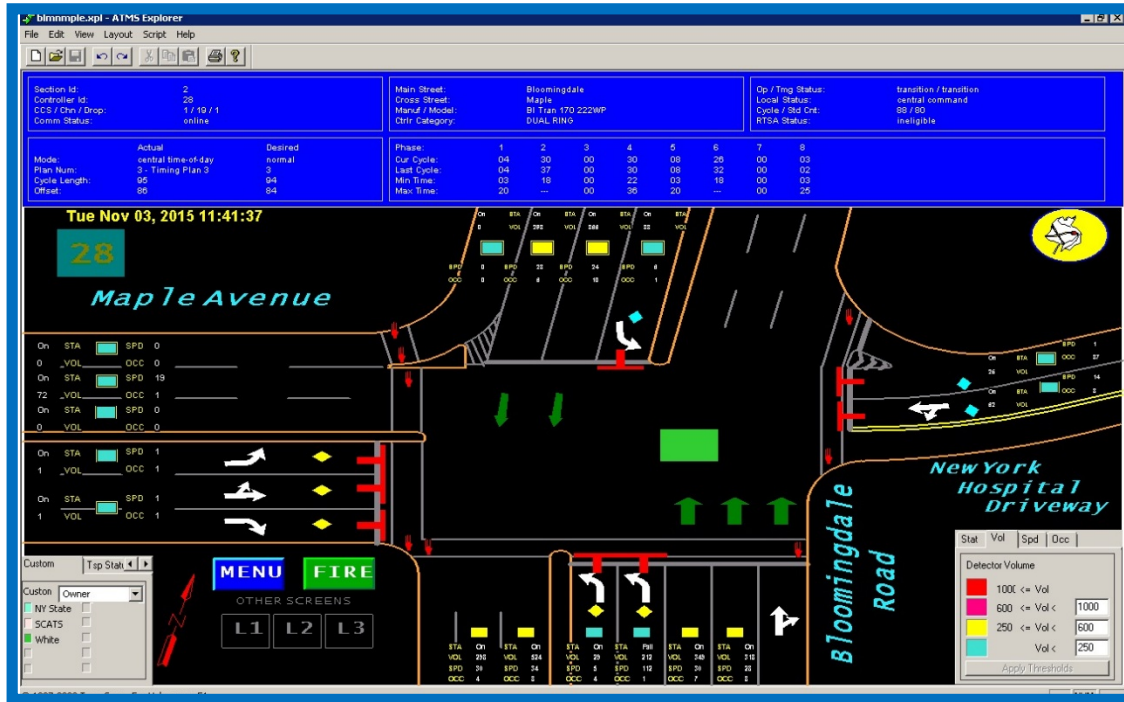
(Source: TransCore ITS, LLC)

**Figure 7. TransSuite® TCS Explorer Map Dynamic Intersection Screen**

(Source: TransCore ITS, LLC)

Multiple ATMS maps show the status of system components at their locations within the roadway network shown with dynamic icons. Maps were created for key sections of the city with timing statuses and detector information such as volume, speed, and occupancies of each location (Figure 8).

Figure 8. TransSuite® TCS Explorer Map Roadway Network Screen

(Source: TransCore ITS, LLC)
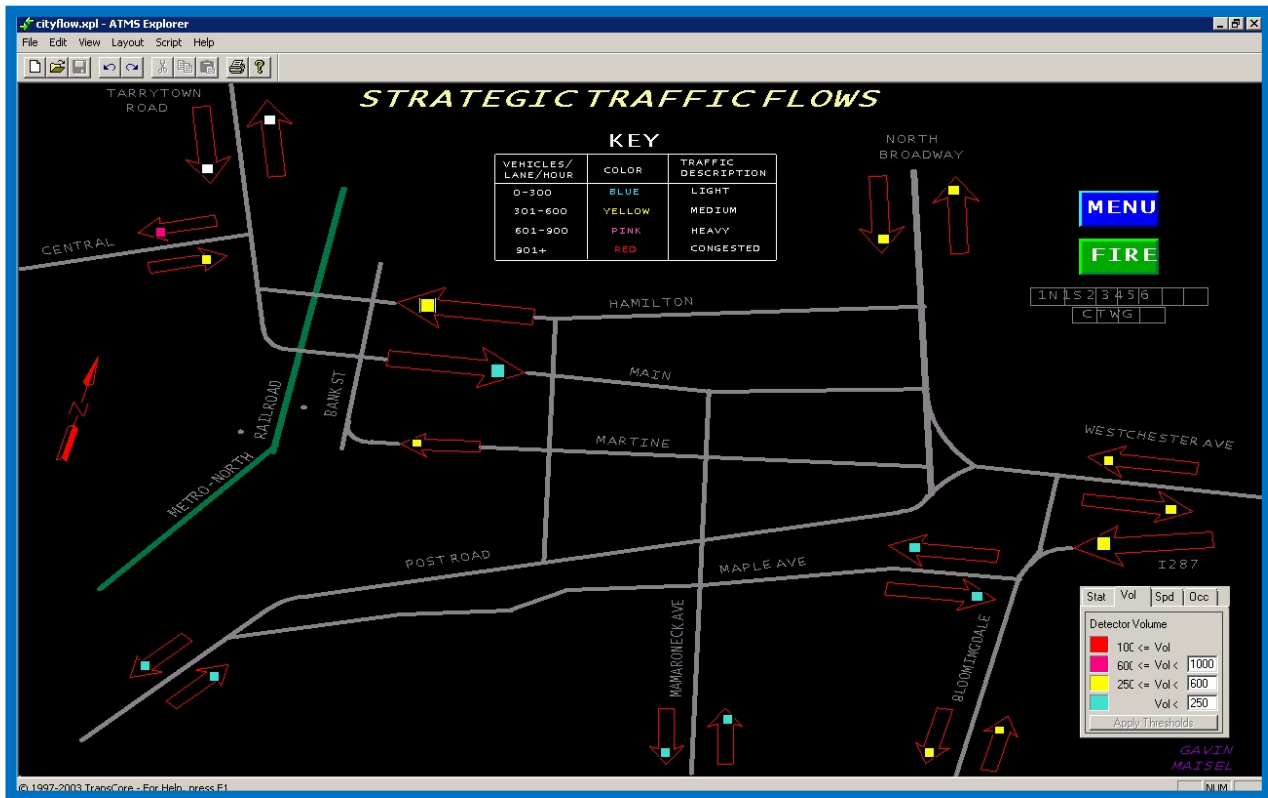
2.4   Roles of Agencies

As part of this project, a meeting with the HVTMC operation managers and White Plains Traffic engineers was held at the White Plains DOT to discuss the roles that each agency will play and to review a Standard Operation Procedure (SOP) drafted by White Plains DOT commissioner Tom Soyk (Appendix A). Based on HVTMC observations, the SOP details the monitoring and action procedures to be followed for typical responses to field conditions:

- Repairing and maintaining critical traffic control devices, which can be a result of a temporary signal failure communication failure, power failure or the whole system down.
- Implementing emergency signal timing plans and making temporary adjustments to existing plans as necessary.
- Establishing diversion routes for expediting traffic flow during disasters and other major incidents.
- Updating/ correcting signal timing plans and settings.

The Operations Managers, Adam Levine and Giselle Vagani, were provided a live demonstration of the CWP Traffic Control System upon commissioning. The screens showed real-time status of traffic

controllers and roadway conditions. Each intersection's status was shown and conditions like cabinet flash and communication failures were explained. A more extensive hands-on training for the managers and operators will be scheduled for the use of the system and its major components such as Explorer Map functions and generating reports. Training on TransSuite® Unified Controller Manager (UCM) will allow for the advanced database management of traffic plans. The SOP will be finalized after comments made by the managers and it will include detailing the intersection control rights and privileges. White Plains DOT Commissioner Tom Soyk noted that White Plains runs a concurrent adaptive traffic control system (SCATS) along nine intersections on Tarrytown Road from Interstate 287 to downtown White Plains with future deployments in planning. These intersections run independently of the other intersections that TCS monitors

3   TransSuite® TCS Evaluation

3.1   Project Benefits

Although the completed project does not include integration of additional intersections into the City of White Plains' TCS, it expands the current network access from other agencies to the existing system. If a major route such as Interstate 287 and Bronx River Parkway were to be shut down, signal operations at intersections on adjacent corridors could be monitored and multiple control strategies could be applied to affected signals. Implementing certain timing patterns during accidents, emergencies and signal failures can help deal with congestion in real time. Thus, reducing incident-related delay correlates to less fuel consumption and GHG emissions in the City of White Plains. In addition to such incident management strategies, central time-of-day (TOD) plans can be adjusted remotely from the TMC. Intersections can be operated in multiple control modes including TOD, local TOD, free, manual, and traffic congestion. Frequent site visits to local controllers for signal timing adjustments can be avoided, resulting in time savings. Increased mobility and reliability leads to the major benefit of enhancing traffic flow resulting to reduce the transportation carbon intensity.

The current staff in City of White Plains Traffic Department does not monitor its signal system after hours. It relies on receiving calls and reports from the CWPPD then dispatches the maintenance technicians. With the newly expanded TCS network, the operators from CWPPD and HVTMC will be able to access the City of White Plains TCS remotely. Furthermore, they will be able to see the problem location and failure details real-time as reported by TCS. This access will directly lead to an increased economic benefit and cost savings from reduced response time and less agency oversight for the City of White Plains from coordination with other agencies.

In addition to operations and maintenance concerns, traffic data is the foundation of highway transportation planning and is used in making numerous decisions, which can lead to construction, traffic improvements, and pavement design projects. Because accurate traffic data is a very crucial element in the transportation planning process, understanding and implementing the process accurately can lead to better design decision. Currently, automatic traffic recorders (ATR) are used to collect necessary traffic volumes for planning purposes. The deployment of this workstation will allow for the communication link to access travel volume data from over 500 system detectors that were not previously available to HVTMC. This access would be useful for future planning and reducing the use of State funds to hire contractors to collect data with ATR counting equipment. The TCS system can allow retrieval of real-time detection information.

3.2 Conclusions

The City of White Plains was interested in expanding the TCS network access to the CWPPD and HVTMC and to be more flexible in managing events and unexpected incidents. Under a proposed plan, CWPPD and HVTMC would monitor the existing signal system on nights and weekends, enabling the operators to identify traffic or maintenance issues quickly and respond accordingly. The resulting reductions in response time would result in improved safety and reduced stops and delays to motorists.

Real-time, 24/7 access to the City of White Plains' arterials would allow the agencies to make better-informed decisions on how they manage traffic and disseminate information to motorists. The project would improve the efficiency of the existing transportation system, including congestion relief, optimization of infrastructure improvements, greenhouse gas emissions reduction, safety enhancements for motorists, and less operational expenses for the City of White Plains. It also represents a unique collaboration of State and local agencies to centralize and share all regional transportation, emergency, and enforcement functions in one facility, resulting in a model of cooperation in support of public safety and efficiency.

In the current economic environment, New York State agencies are having difficulty providing funds for transportation projects and agencies are experiencing shrinking budgets, so the ability to deliver benefits to the public via low-risk, proven technology is paramount. Installing TransSuite® TCS workstation and offering the HVTMC and CWPPD with access rights will benefit motorists around the City of White Plains. Through the expanded use of TCS, the City of White Plains and NYSDOT would be using a proven system that has a demonstrated record of performance.

Appendix A. Standard Operating Procedure

To: NYSDOT / Hudson Valley Traffic Management Center (HVTMC), Hawthorne, NY

For: City of White Plains Traffic Control System (TCS) Monitoring and Action Procedures

I.   **GENERAL GUIDELINES**

The following actions are typical responses to field conditions that may involve some coordination based on TMC observations. In most cases this would involve a phone call to the Traffic Division of Parking (if 8:00 AM to 5:30 PM, Monday to Friday). Some actions could involve calling on-call personnel (see list). Some emergency actions could be initiated by TMC personnel, if on call personnel could not be reached:

A.   Repairing and maintaining critical traffic control devices.

B.   Implementing emergency signal timing plans and making temporary adjustments to existing plans as necessary.

C.   Establishing diversion routes for expediting traffic flow during disasters and other major incidents.

D.   Updating/ correcting signal timing plans and settings.

E.   Updating/ correcting adaptive cycle lengths or system plan selection (Future)

NOTE: Intersection Icons will display a blue color if they are not yet connected to the system or they are part of the Adaptive (SCATS) system.

II.   **TRAFFIC SYSTEM CONTACT INFORMATION**

A.   The priority order for contacting the City regarding observations of the traffic control system is as follows:

1.   The **White Plains System Engineer** who provides the necessary liaison activities to the computerized traffic signal system operation.

2.   The **Deputy Commissioner of Parking / City Transportation Engineer** who is responsible for the administration of the Department of Parking/Traffic Division and directs the use of its resources and personnel.

3.   **Traffic Signal & Sign Shop** XXX-XXX-XXXX (7:30 AM - 4:00 PM, M-F)

4.   **Signal Crew Cell Phone** XXX-XXX-XXXX (on-call technician during off hours)

III.   **EMERGENCY RESPONSE PROCEDURE**

The following procedure should be followed in dealing with emergencies related to traffic control equipment (signals) which appear to be malfunctioning:

A. **TRAFFIC SIGNAL PROBLEMS**

1. **For all signal "in flash"** (flashing red icon) **problems, shop personnel** can be **called at XXX-XXXX between 7:30 am and 4:00 pm** or via the following cell phone numbers or other appropriate emergency numbers on the list in **Section IV:**

    SIGNAL CREW CELL PHONE # - XXX-XXXX

    FIELD SUPERVISOR CELL PHONE # - XXX-XXXX

2. **There are some Greenburgh intersections** where the White Plains Department of Parking/Traffic Division is responsible for maintenance and repair of signal equipment. The intersections in Greenburgh that are Maintained by White Plains are:

    A.   Tarrytown Road & Aqueduct Road

    B.   Tarrytown Road & Dobbs Ferry Road

    C.   Tarrytown Road & Hillside Avenue

    B.   Tarrytown Road & I287 Exit 5 Ramp

    C.   Tarrytown Road & White Plains Bowl Driveway

    D.   Central Avenue & Concord Avenue/Dalewood Drive

    E.   Central Avenue & Chatterton Parkway

    F.   Central Avenue & Harvard Drive/Washington Avenue

3. **If the signal is in "Flash" mode,** the following signals can remain in flash **after 10:00 pm** without any maintenance action until the following morning **(7:30 am)** if no other unusual conditions exist and the overnight problem occurs **between Sunday evening and Thursday morning:**

    A.   Bank Street & Traverse Street

    B.   Bryant Avenue & Davis Avenue

    C.   Bryant Avenue & Greenridge Avenue

    D.   Bryant Avenue & High School (if school is not in session)

    E.   Bryant Avenue & Longview Avenue

    F.   Chatterton Parkway & Hawley Avenue

    G.   Dr. Martin Luther King Jr. Blvd. & Fisher Court

    H.   East Post Road & Court Street

    I.   Ferris Avenue & Hillside Terrace

    J.   Martine Avenue & City Center Garage

    K.   Martine Avenue & South Broadway

    L.   North Broadway & Crane Avenue

B. TRAFFIC SYSTEM PROBLEMS

1. Temporary Signal Failure - The signal icon will have an orange color and will still be timing correctly for a number of cycles before reverting to back up plans. In most cases the signal will repair itself but if re-try maximums have been reached, the signal can be manually repaired (right click on icon and choose "failure repair") or reported to the White Plains System Engineer.

2. Communications Failure - A signal or group of signal icons display a white color. This can be caused by either a loss of power or communications. This can be reported to the White Plains System Engineer.

3. System Down - Could be indicated by all signal icons white in color or unresponsive terminal. This can be reported to the White Plains System Engineer.

C. TRAFFIC SYSTEM ADJUSTMENTS

1. Diversion - The White Plains System Engineer can be contacted to coordinate plan or cycle length changes in the event of crash or maintenance work which has caused delays on diversion routes. Delays can be observed through high occupancies on detector screens.

2. Timing Changes - The White Plains System Engineer can be contacted to implement timing changes in response to complaints which are received at the TMC or due to video/ graphic screen observations by TMC personnel.

IV.   **PARKING/TRAFFIC DIV. EMERGENCY CONTACT INFORMATION**

(914 area code unless otherwise indicated)

Cell	**Personal Cell**	**Office**
White Plains System Engineer	XXX-XXXX	XXX-XXXX
Deputy Commissioner	XXX-XXXX	XXX-XXXX
SIGNAL CREW (CELL)	XXX-XXXX	XXX-XXXX
Field Supervisor	XXX-XXXX	XXX-XXXX
Signal Benchman	XXX-XXXX	XXX-XXXX
Signal Installer	XXX-XXXX	XXX-XXXX
Signal Installer	XXX-XXXX	XXX-XXXX
Senior Sign Installer	XXX-XXXX	XXX-XXXX
Sign Installer	XXX-XXXX	XXX-XXXX
Sign Installer	XXX-XXXX	XXX-XXXX

Department Equipment Resources (Operated by All Shop Personnel)

Bucket Trucks # 123 & 129, 35' Max Reach, 1000 lbs. Lifting Cap.

Stakebed Truck #116, 3/4 ton w/hydraulic tailgate.

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